Management Plan

Aguacaliente Wildlife Sanctuary

2009 – 2014
DRAFT

PACT
Protected Areas Conservation Trust

Wildtracks, 2008


AGUACALIENTE WILDLIFE SANCTUARY

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Plan Facilitated By:

Zoe and Paul Walker, Wildtracks, Belize
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1. Introduction

Background and Context

Belize is recognized as having some of the least impacted protected areas in the region. One of these, Aguacaliente Wildlife Sanctuary, is situated on the southern coastal plain and covers a 5,492 acres mosaic of wetlands, swamp forest and karstic hills. It was established as a Wildlife Sanctuary through Statutory Instrument 87 of 1998, under the National Parks System Act of 1981, in recognition of both its importance as a wetland floodwater sink in times of storm events, as a natural resource for local fishermen, and for its importance to waterbirds. Aguacaliente is managed under the Forest Department of the Ministry of Natural Resources, with a co-management agreement signed in 2006 between the Forest Department and Aguacliente Management Team, a community based non-governmental organization comprised of representatives from each of the stakeholder communities. The Wildlife Sanctuary is considered to be equivalent to an IUCN Category IV area – a Habitat/Species Management Area, with management targeted at conservation through management intervention (IUCN, 1994).

The Wildlife Sanctuary was highlighted as a priority area under the Directory of Belizean Protected Areas and Sites of Nature Conservation Interest (Zisman, 1996), and listed as being extremely important for wetland birds in an assessment of waterbirds in Belize (Miller and Miller: 2006). It is considered an important component of Belize's national protected areas system, ranking within the top three protected areas in the priority ranking conducted under the National Protected Area Policy and System Plan project (NPAPSP, 2005). It is the only major inland wetland in southern Belize, protecting both feeding and nesting resources of many species of wetland birds, including a nesting colony of 200 pairs of American woodstork (Meerman et. al., 2006). The Wildlife Sanctuary also protects representative examples of two ecosystems, "Swamp grassland without trees or shrubs" and "Tropical evergreen broad-leaved lowland swamp forest, Aguacaliente variant", which occur only in Aguacaliente.

Purpose and Scope of Plan

The management of Aguacaliente is guided by its categorization as a Wildlife Sanctuary (under the National Parks System Act, 1982), being set aside to:

" protect nationally significant species, biotic communities or physical features"

This is the first management plan for the Wildlife Sanctuary, and seeks to protect the resources of the reserve while exploring options for economic benefit through sustainable fishing and tourism. It has been developed with the participatory input of the Aguacaliente Management Team and the stakeholder communities adjacent to the protected area (Laguna, Jordan, Blue Creek, Yemeri Grove, Dump, Mafredi, San Antonio, Big Falls, San Marcos, and Silver Creek), through a series of meetings, workshops and interviews with community members, and input from the tourism sector. This is in line with national and international recommendations that recognize the following premises(Beltran, 2000):

> *"Protected areas will survive only if they are seen to be of value…to the nation as a whole, and to local people inparticular*

Government and protected area managers should incorporate customary resource use and indigenous land tenure, as well as control systems, as a means of enhancing biodiversity conservation

Knowledge, innovations and practices of indigenous peoples have much to contribute to to the management of protected areas"

This has led to the development of a number of key concepts, contained in the principles adopted by IUCN and WWF:

- Compatibility between protected area objectives and those of indigenous and traditional peoples
- Rights of traditional peoples to the traditional use of their lands and resources
- Recognition of the decision making institutions and mechanisms of indigenous and traditional peoples
- Access of indigenous peoples to the benefits associated with protected areas

Fernandez-Baca et. al., 2007

This management plan incorporates these concepts, seeking to increase community participation in management decisions, to promote ownership and sustainable management of the resources, whilst seeking to align this with the national framework for protected areas.

The document follows the National Management Plan Framework required by the National Protected Area Policy and System Plan (NPAPSP, 2006), and includes general information on the physical and biological attributes of the protected area, documents the current uses and management problems, defines the goals and objectives, summarizes conservation planning outputs, outlines specific management programmes, including a preliminary zoning plan, sets in place the means for measuring effectiveness of implementation, and recommends an implementation schedule.

The management plan, submitted to Forest Department, is designed to guide the management of the Wildlife Sanctuary through the next five years, providing a framework for both broad management activities as well as more specific research and monitoring activities. The management programmes are based on the best available data and scientific knowledge, with the integration of information from the Rapid Ecological Assessment, the conservation planning workshops, and community review.

Operational plans will be developed on an annual basis by the Aguacaliente Management Team, based on the framework provided by this management plan, and an annual review of implementation success will allow for adaptive management over the five year period.

2. Current Status

2.1 Location

Aguacaliente Wildlife Sanctuary is located in the Central American country of Belize - 8,867 sq. miles (22,966 sq. kilometres) of tropical forest, savannah, mangrove, and wetlands, with a population of approximately 301,270 (CIA, 2008). Belize is bordered by Mexico to the north and Guatemala to the west and south. To the east, it is bordered by the Caribbean Sea, with the Belize Barrier Reef, which runs parallel to the coastline for the entire length of the country.

Belize can be divided into two topographic areas – to the north is the flat, limestone Yucatan platform to the north, the Maya Mountains and flat coastal plain to the south. Aguacaliente Wildlife Sanctuary is situated in this low-lying southern coastal region, between the foothills of the Maya Mountains and the Bay of Honduras. It is fed by the rivers and creeks that drain the mountain slopes, via the Moho River.

Aguacaliente Wildlife Sanctuary encompasses a wetland area positioned in a low lying basin containing lagoons, swamps and creeks. This is surrounded by hills and higher ground of forests and shrubland, cut through with creeks flowing down to the central wetland area. In the northern section of the Sanctuary there is a small area of karstic hills, at the base of which are two hot springs, the features which give the Sanctuary its name.

Geopolitically, Aguacaliente Wildlife Sanctuary is located in Toledo District, the most southerly of the six administrative districts in the country. Punta Gorda, the administrative centre for this district, lies approximately 20km in a straight line from the Sanctuary. It is a multicultural town with a population of approximately 4,330 (CSO, 2000), surrounded by traditional Ketchi and Mopan Maya villages

The Wildlife Sanctuary covers an area of 5,467 acres and is located at UTM coordinates 288745 east and 1789513 north (UTM Zone 16N, NAD 1927) (Map 1). It is bounded on the eastern side by the Machaca Forest Reserve, while to the west, north and north east lie agricultural land under a combination of private and national ownership. To the south the land falls mainly under the Black Creek Indian Reservation, although in recent years leases have been secured on some areas of this land.

Statutory Instrument 87 of 1998, made under the National Parks System Act (1981), designates and describes the Sanctuary as:

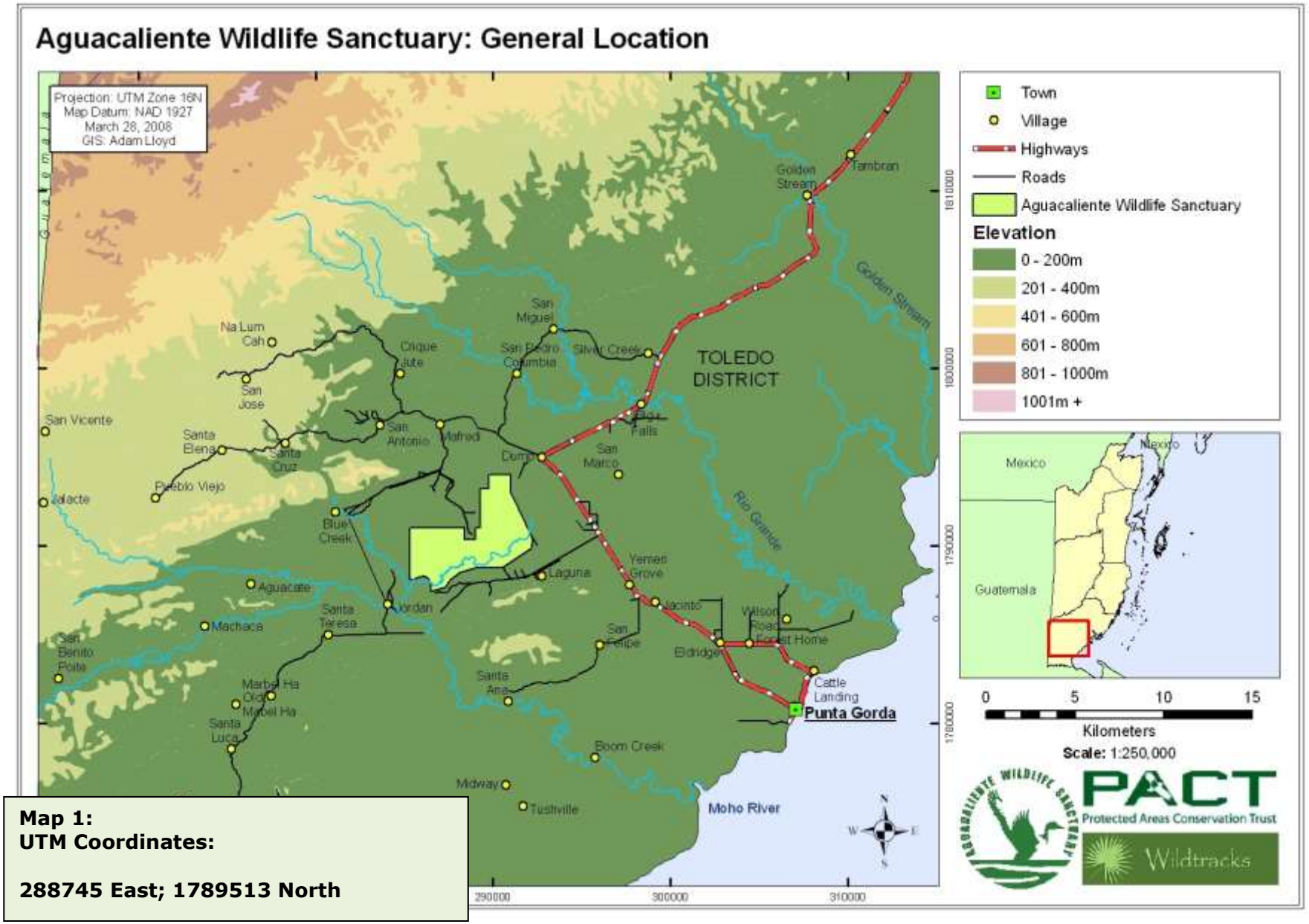
> *"ALL THAT piece or parcel of land lying in the Toledo District and being now or formerly national land and hereinafter referred to as the Aguacaliente (Lu Ha) Wildlife Sanctuary and bounded on the north by Blue Creek and Mafredi agricultural parcels; on the East by Machaca Forest Reserve, and part of the old San Antonio Road; on the South by the Black Creek Indian Reservation and Laguna agricultural parcels; and on the West by Blue Creek, National lands and Blue Creek agricultural parcels".*

The nearest communities to are Laguna and Jordan to the south, Blue Creek and Yemeri Grove to the East, Dump, Mafredi and San Antonio to the north, and Big Falls, San Marcos and Silver Creek to the north east. The Aguacaliente Management Team currently manages the Sanctuary from an office in Big Falls village.

The primary access route is from Laguna, reached by a road running south west for three miles from the Southern Highway. A raised boardwalk runs from Laguna for about a mile through agricultural lands and buffer forest, to the Visitors' Centre, located at the edge of the Sanctuary. The Wildlife Sanctuary can also be accessed from the villages lying to the north by way of a road that crosses Mafredi Creek then branches to reach the agricultural lands to the north of the Aguacaliente, and by boat via Blue Creek.

The Aguacaliente Management Team and Trekforce Expeditions have worked together on a number of projects to improve the infrastructure of the Sanctuary, including the construction of a Visitors' Centre and a raised boardwalk, approximately 4,750 feet long, providing easier access from Laguna to the Visitors' Centre and on from there to Piedra Creek, facilitating access even once the swamp forest has become inundated at the start of wet season.

Boardwalf at Aguacaliente Wildlife Sanctuary



Map 1:
UTM Coordinates:

288745 East; 1789513 North

2.2 Regional Context

Aguacaliente Wildlife Sanctuary lies within Mesoamerica, a region highlighted as a world 'hotspot for species diversity' (Conservation International, 2003), and considered critical for the preservation of the biodiversity of the Western Hemisphere. Here, the Nearctic bioregions of North America converge with the Neotropical bioregions of South America, and, in Belize in particular, also with the Greater Antillean bioregion of the Caribbean. Each of these three bring a unique assemblage of plants and animals, resulting in a particularly rich biodiversity, with components of all three regions being represented within the Central American land bridge. This area contains 8% of the world's known plant species, and 10% of its vertebrates. The bridge has also enabled the movement of species between the North and South American regions since the late Pliocene, and is still of vital importance today to migratory bird species, both as a corridor and as an over-wintering location.

The entire Central American region has suffered from an alarming rate of deforestation, with as much as two thirds of the forest having been converted within the last 50 years into agricultural land that has then often been degraded by unsustainable agricultural practices and cattle-farming. Belize, with its relatively low population, and large areas of natural vegetation still intact, plays an important role in the survival of many of the threatened species of Central America, and is an important waypoint for Nearctic and Neotropical migrants.

Until recently, Belize had escaped most of the more destructive land clearance, but in the south of the country large cattle farms are now appearing alongside the more established citrus, banana and rice farms. Meanwhile the population of the country is increasing at a rate of 2.207% per year (CIA, 2008) resulting in increasing pressure on land and natural resources.

Belize is a signatory to several international agreements concerning issues such as environmental management and development, with effective management of Aguacaliente Wildlife Sanctuary assisting with meeting these commitments (Table 1). The protection of Aguacaliente Wildlife Sanctuary within the National Protected Areas System also assists Belize in fulfilling its regional commitments under several regional agreements (Table 2).

In addition to these is PARCA – the Environmental Plan for Central America, which was established in 1999 and aims to strengthen regional environmental management through regional planning strategies and regional environmental standards.

Table 1: International agreements with relevance to Aguacaliente Wildlife Sanctuary	
International Agreement	**Ways in which AWS assists in meeting these obligations**
Convention on Biological Diversity (Rio de Janeiro, 1992) Ratified in 1993 *To conserve biological diversity to promote the sustainable use of its components, and encourage equitable sharing of benefits arising from the utilization of natural resources.*	Aguacaliente Wildlife Sanctuary (AWS) is an important part of the national protected areas system, protecting biodiversity and threatened species. The Aguacaliente Management Team (AMT) is committed to community development and to helping local people benefit from the Sanctuary through involvement in management and through developments such as tourism.
Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar, 1971) *To stem the progressive encroachment on and loss of wetlands now and in the future, recognizing the fundamental ecological function of wetlands and their economic, cultural, scientific and recreational value.*	Whilst not designated as an official RAMSAR site, AWS does protect a variety of wetland ecosystems including lakes, *Eleocharis* marsh, reed swamp and swamp forest. AWS aims to make economic use of these wetland areas through the development of tourism.
United Nations Framework Convention on Climate Change (New York, 1992) *Aims to reduce global warming and to reduce greenhouse gas emissions throughout the world.*	Belize is identified by the 1994 National Inventory as a net remover of CO_2, the high percentage of vegetation cover estimated to be absorbing 6 billion tons of CO_2 a year against a total emission estimated at 3 million tons. The protection of AWS contributes to this high national percentage of vegetation cover.

Table 2: Regional agreements with relevance to Aguacaliente Wildlife Sanctuary	
Regional Agreement	**Ways in which AWS assists in meeting these obligations**
Central American Commission for Environment and Development (CCAD) (1989) *Regional organisation composed of ministers most responsible for the environment from each Central American country.* *To develop policy on environment and development through consultation with ministers, NGOs and grassroots groups amongst others, and to encourage participation from the public.* *To improve quality of life in Central America through sustainable use of natural resources, control of pollution and reversal of environmental degradation.* *To build the capacities of institutions and to develop funding.* *CCAD implemented and manages the Mesoamerican Biological Corridors Programme which aims to establish corridors of natural vegetation throughout Central America to link protected areas. A central concept of the programme is sustainable development.*	The Aguacaliente Management Team encourages public participation and is itself composed of community members. It is involved in projects focused on development through the sustainable use of natural resources. It has been recommended for inclusion in the proposed Moho River biological corridor, linking the AWS to the sea.
Convention on the Conservation of Biodiversity and the Protection of Priority Wilderness Areas in Central America (Managua, 1992) *To conserve biological resources in Central America and to recognise their value for economic and social development.* *To recognise and preserve the knowledge held by indigenous groups in the region that contributes to conservation and the sustainable use of resources.*	The Aguacaliente Wildlife Sanctuary protects biological resources and the Aguacaliente Management Team is involved in projects which assist local communities in benefiting from these resources.
Alliance for the Sustainable Development of Central America (ALIDES) (1994) *To increase regional integration for economic, social and political development and environmental management.* *To promote the establishment of a biological corridor linking protected areas throughout Central America.*	The Aguacaliente Management Team is working with local communities on a number of sustainable development initiatives. In terms of connectivity, the National protected Area Policy and System Plan (Meerman and Wilson: 2005) suggests the designation of a corridor linking AWS to the sea via the Moho river.

2.3 National Context

2.3.1 Legal and Policy Framework

Aguacaliente Wildlife Sanctuary is a national protected area designated by Statutory Instrument 87 of 1998 under the National Parks System Act (1981), and co-managed by the Aguacaliente Management Team and the Forest Department, under a co-management agreement signed in 2006.

History of establishment

In the early 1990s Iremonger and Brokaw carried out research in the area that is today Aguacaliente Wildlife Sanctuary and recognised that it contained two unique ecosystems – 'swamp grassland' and the Aguacaliente variant of 'seasonal swamp forests of southern and central Belize' (Iremonger and Brokaw; 1995).

In 1995, the National Protected Areas Systems Plan for Belize (produced under NARMAP, the Natural Resource Management and Protection Project) recommended the protection of 35 km^2 of the Aguacaliente Swamp. It recognised the Aguacaliente Swamp as a gap in the national protected area system at that time, and discussed the importance of protection of the 'Seasonal Swamp Forests of Southern and Central Belize, Aguacaliente variant' – a unique vegetation type (Wilson, 1995).

This argument was supported by the Directory of Belizean Protected Areas and Sites of Nature Conservation Interest (Zisman, 1996), which lists the 'Aguacaliente Wetland' as a site of conservation interest, referencing the unique vegetation type and the diversity of wetland communities.

One of the major driving forces behind the establishment of the Aguacaliente Wildlife Sanctuary was the Environmental and Social Technical Assistance Project (ESTAP), funded by the Inter-American Development Bank (IDB). This project, started in 1997, aimed to produce a regional development plan for southern Belize, and ran in parallel with the paving of the Southern Highway, also funded by the IDB. It focused on sustainable development, anticipating changes brought about by the paving of the Southern Highway, and ensuring that benefits from this development were sustainable and fairly distributed, while at the same time protecting the environment from adverse effects of this growth.

As part of this project, ESTAP initiated the process of formal protection for the Aguacaliente wetlands, carrying out local consultations to ensure community support and provided assistance for the formation and development of the Aguacaliente Management Team, with representation from the identified stakeholder communities (Inter-American Development Bank, 1998). The Management Team was formally recognised as a Community Based Organisation in 2001, and instrumental in the designation of the Sanctuary through lobbying of the government.

Site Status

Aguacaliente is designated as a Wildlife Sanctuary under the National Parks System Act of 1981. This is one of five distinct categories of protected area, each of which is protected by restrictions strictly defined by law (Table 3).

Table 3: Categories of Belizean protected areas			
Category	**Legal Foundation**	**Purpose**	**Activities Permitted**
Nature Reserve	National Parks System Act, 1981	To protect biological communities or species, and maintain natural processes in an undisturbed state.	Research, education
National Park	National Parks System Act, 1981	To protect and preserve natural and scenic values of national significance for the benefit and enjoyment of the general public.	Research, education, tourism
Natural Monument	National Parks System Act, 1981	To protect and preserve natural features of national significance.	Research, education, tourism
Wildlife Sanctuary	National Parks System Act, 1981	To protect nationally significant species, biotic communities or physical features. *Aguacaliente was designated under this category.*	Research, education, tourism
Forest Reserve	Forest Protection Act, 1927 Forest Act, 1990	To protect forests for management of timber extraction and/or the conservation of soils, watersheds and wildlife resources.	Research, education, tourism, logging

The Ministry of Natural Resources is responsible for the establishment and management of all five of these categories of protected area (including Aguacaliente Wildlife Sanctuary), working through the Forest Department

The Wildlife Sanctuary designation is for the protection of nationally significant species, biotic communities or physical features, and allows for research, tourism and education but no extractive activities, though traditionally the area has been important to local communities for its native fish resources.

National planning strategies

The national objectives for conservation revolve around the protection, conservation and rational use of Belize's natural resources within the context of sustainable human development. These objectives are supported by the **National Strategy on Biodiversity**, through the National Biodiversity Strategy and Action Plan (Jacobs and Castaneda, 1998), and more recently, the **National Protected Areas Policy and System Plan (NPAPSP**) (Meerman and Wilson: 2005). These two planning frameworks fulfil two of Belize's commitments following the signing of the Convention on Biological Diversity in 1992 (later ratified by Belize in 1995). Management is theoretically guided by the National Protected Areas Policy and System Plan, although limited resources currently restrict effective management.

The overall goal of the National Biodiversity Strategy and the NPAPSP reflects the national objectives - ecological and economic sustainability over the long term, and recognizes the need to build both human and institutional capacity to effectively manage the biodiversity resources within Belize. There are also moves towards decentralisation of the management of these resources, with a strong focus on co-management partnerships, community-based participation and equitable benefit from conservation efforts.

In line with these national objectives, Aguacaliente Wildlife Sanctuary is co-managed by the Forest Department and the Aguacaliente Management Team, the latter being composed of representatives from the local stakeholder communities. The Management Team is committed to ensuring that local communities benefit from conservation. This is supported through initiatives

such as an environmental education programme for children from local schools, and hospitality and tour guide training for people from local communities, with the goal of enabling these communities to derive economic benefits from their proximity to the Sanctuary.

The Government of Belize has developed a funding mechanism to assist in management and development activities within protected areas – the Protected Areas Conservation Trust (PACT) - through a 'conservation tax' of Bz$7.50 levied on non-residents as they leave the country. Protected Area managers can apply for funding towards increased management effectiveness from this trust.

Legal Framework

The conservation framework of Belize is supported by a number of laws designed to protect wildlife and national heritage within the country. The Forest Act (1990), Wildlife Protection Act (1981), and the National Parks System Act (1981) are all administered by the Forest Department, under the Ministry of Natural Resources and the Environment. The **Environmental Protection Act** (1992), under the Department of the Environment, a department of the Ministry of Natural Resources and Environment, with the aim of ensuring that development initiatives within Belize are planned to minimize their environmental impact. These focus on protection of the environment and natural resources.

The Fisheries Act (1948) is administered by the Fisheries Department, under the Ministry of Agriculture, and is the principal governing legislation to regulate the fishing industry, being directly concerned with maintaining sustainable fish stocks and protecting the marine, brackish and freshwater environments.

Archaeological sites are protected under the **Ancient Monuments and Antiquities Act** of 1971, administered by the National Institute of Culture and History, under the Ministry of Youth, Sports and Culture.

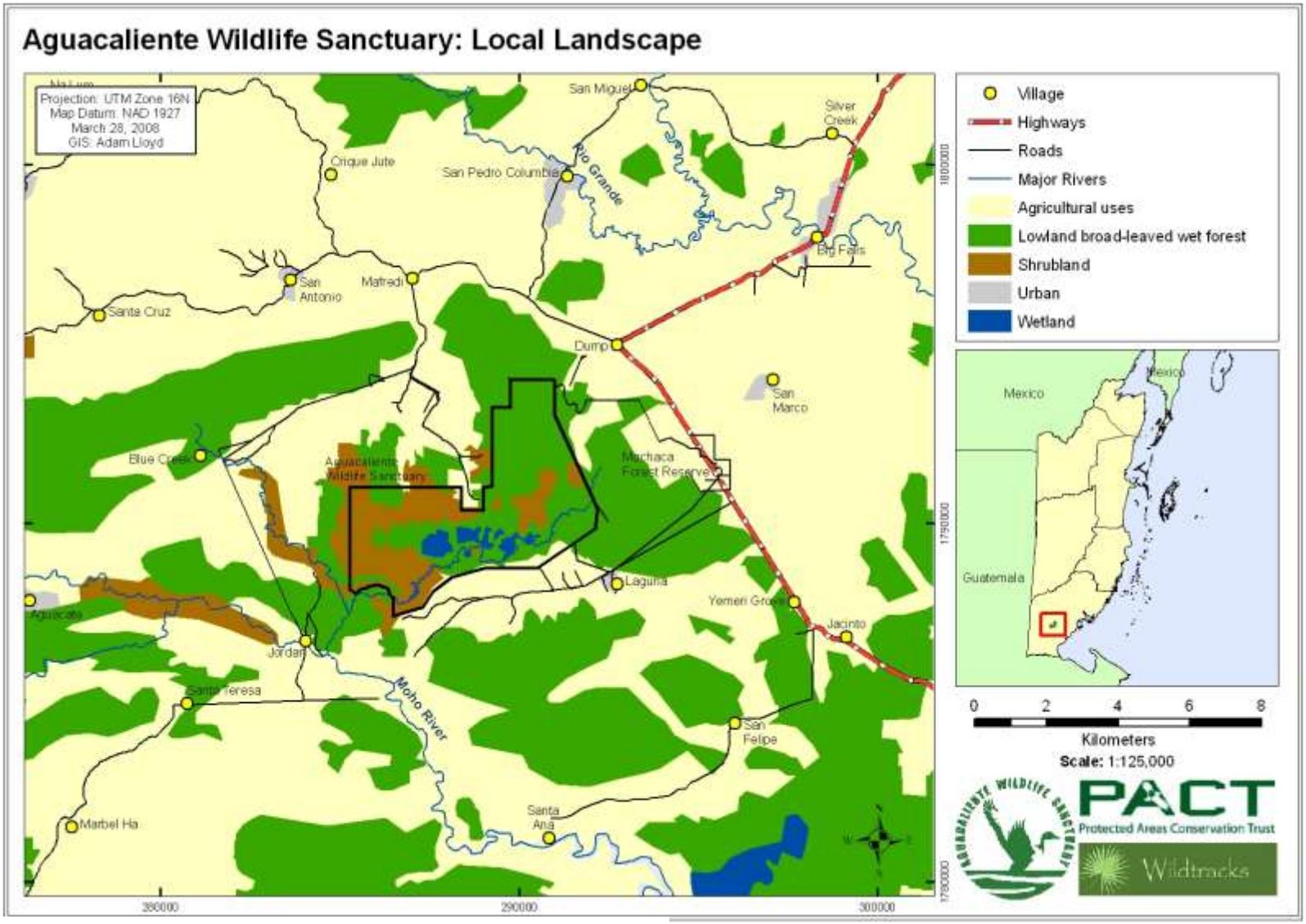
Whilst the above are the legislative Acts most relevant to the Aguacaliente Wildlife Sanctuary, there are others - such as the Mines and Minerals Act (1989) and the Petroleum Act (1991), which regulate the exploration and extraction of all non-renewable resources, governing natural resources other than wildlife. These Acts regulate activities including dredging and prospecting.

2.3.2 Land Tenure

Aguacaliente Wildlife Sanctuary is national land, designated as a protected area under the mandate of the Forest Department. Any activity within the protected area needs to be approved by both the Forest Department and the co-management organization – the Aguacaliente Management Team. Any mining activities would also require a license from the Geology & Petroleum Department.

The Wildlife Sanctuary lies within a landscape of agricultural lands and tropical broadleaf forest (Map 2). Community lands and private lands are gradually encroaching into the buffering forest that surrounds the Wildlife Sanctuary, with some incursions from mechanised rice farms south of Mafredi.

Land tenure in the adjacent villages is mostly lease land holdings with traditional village boundaries and land use practices still respected by the majority of the community members. Households generally hold 25 to 50 acre blocks, used for small scale agriculture, and any unsurveyed national lands is used for resource extraction in a communal manner, with the Alcalde and the Chairman exercising some management over them. National lands adjacent to the villages are used for hunting, fishing, and house material extraction.



Map 2: Local Landscape

2.3.3 Evaluation of Protected Area

The wetland areas of Aguacaliente are a prime focus of conservation interest in the Sanctuary. Not only are they of great importance for watershed protection, but they also contain a number of plants and animal species that are specifically adapted to the wetland conditions, and are unique to this area, including the "Swamp grassland without trees or shrubs" and "Tropical evergreen broad-leaved lowland swamp forest, Aguacaliente variant." These only occur in Aguacaliente, and the protection of the Wildlife Sanctuary is considered critical for their conservation.

The Rapid Ecological Assessment for Aguacaliente Wildlife Sanctuary (Meerman, 2006) demonstrated that the area protects six species of international concern (rated as Critically Endangered, Endangered or Vulnerable, IUCN, 2007; Table 4), including the Critically Endangered **Central American River Turtle** (*Dermatemys mawii*), locally known as 'Hickatee,' which is rapidly disappearing from its known range throughout Central America.

A rich diversity of birds make use of the wetland areas of the Wildlife Sanctuary, which is recognized as an extremely important resource for wetland birds, as the only major inland wetland in southern Belize (Miller and Miller, 2006; Meerman, 2006). Part of the reason for this diversity and high concentration of birds is the inundation of much of the Wildlife Sanctuary during the wet season. This large flooded area becomes an important breeding and feeding ground for fish, and as the water recedes at the start of the dry season, many young fish become trapped in the lagoons and rapidly drying pools, attracting a great number of waterbirds to the area to feed.

A number of colonial nesting bird species, including the nationally vulnerable woodstorks (*Mycteria americana)* make use of sites within the Wildlife Sanctuary (Meerman, 2006). The convergence of these birds in one location for nesting makes them particularly vulnerable to disturbance, which can cause the whole colony to abandon a site. The inclusion of such nesting sites within the protected area is therefore critical to the maintenance of these species in southern Belize.

As part of the National Protected Areas Policy and System Plan (NPAPSP) a protected area system site scoring analysis was used to assess the relative importance of protected areas within the system (Meerman, 2005). This focused on two components – biophysical characteristics and management issues. Aguacaliente scored very highly on biophysical characteristics, coming joint first of all protected areas in Belize, as a result of its protection of representative ecosystems, of nesting bird colonies, and critical species, and as an important resource for wildlife. In terms of management issues, it came eighteenth, still a relatively high score given that 94 protected areas were included in the analysis. Taking into account both the biophysical and management characteristics combined, Aguacaliente ranked third in relative importance within the system.

A Marxan analysis looking at the effectiveness of biodiversity coverage of the Belizean protected area system was also carried out under the NPAPSP (Meerman: 2005) and again Aguacaliente scored highly. The Wildlife Sanctuary was shown to be important for the conservation targets used for the analysis, with the central wetland area being highlighted as 'extremely important', partly a reflection of the uniqueness of two of the ecosystems found in this area, as Aguacaliente Wildlife Sanctuary is the only protected area in the country where these particular ecosystems are found.

The wetlands also protect a number of water bird species included as conservation targets, again increasing the importance of the Wildlife Sanctuary under this analysis. The areas of the Sanctuary lying to the north east and the south west, outside the central wetland area, were assessed as of less conservation importance than the wetland areas.

Table 4: Species of international and national Concern of Aguacaliente Wildlife Sanctuary			
Common Name	**Species Name**	**IUCN Status**	**Belize Status**
Species of International Concern			
Central American River Turtle Hickatee	*Dermatemys mawii*	Critically Endangered	Endangered
Mexican Black Howler Monkey	*Alouatta pigra*	Endangered	Vulnerable
Central American Tapir	*Tapirus bairdii*	Endangered	Vulnerable
	Vitex kuylenii	Endangered	
Variegated Zamia	*Zamia variegata*	Endangered	Vulnerable
Mahogany	*Swietenia macrophylla*	Vulnerable	Vulnerable
Jaguar	*Panthera onca*	Near threatened	Near threatened
Puma	*Puma concolor*	Near threatened	Near threatened
Mexican Musk Turtle	*Staurotypus triporcatus*	Near Threatened	Near Threatened
Common Slider Turtle	*Trachemys scripta*	Near Threatened	
Buff-breasted sandpiper	*Tryngites subruficollis*	Near threatened	
Morelet's Crocodile	*Crocodylus moreletii*	Conservation Dependent	Conservation Dependent
Species of National Concern			
Agami Heron	*Agamia agami*		Vulnerable
Roseate Spoonbill	*Ajaia ajaja*		Vulnerable
Great Blue Heron	*Ardea herodias*		Vulnerable
Muscovy Duck	*Cairina moschata*		Vulnerable
Black-Bellied Whistling Duck	*Dendrocygna autumnalis*		Vulnerable
Snowy Egret	*Egretta thula*		Vulnerable
Tricolored Heron	*Egretta tricolor*		Vulnerable
Jabiru	*Jabiru mycteria*		Vulnerable
Ocelot	*Leopardus pardali*		Vulnerable
Margay	*Leopardus wiedii*		Vulnerable
Neotropical River Otter	*Lontra longicaudis*	Data Deficient	Vulnerable
Wood Stork	*Mycteria americana*		Vulnerable
Black-crowned Night-Heron	*Nycticorax nycticorax*		Vulnerable
Neotropical Cormorant	*Phalacrocorax brasilianus*		Vulnerable

In terms of connectivity to other protected areas, Aguacaliente Wildlife Sanctuary lies adjacent to the Machaca Forest Reserve, but is otherwise isolated in a strongly human-influenced landscape. However, the NPAPSP highlights the section of the Moho River connecting Aguacaliente Wildlife Sanctuary to the sea as a priority site for the designation as a biological corridor, both in terms of its importance for under-represented ecosystems in the current protected area system and in terms of connectivity for Aguacaliente (Meerman and Wilson, 2005).

Aguacaliente Wildlife Sanctuary provides a number of environmental services, especially in terms of its role in flood control. At times of high water levels, the wetlands are able to store large

amounts of water from the surrounding swollen rivers, reducing flooding downstream. This is particularly important for minimizing flooding impacts from the Moho River, which has its sources in Guatemala, to the west, where much of the upper watershed has been deforested, contributing to the increased threat of flash floods. The river back up into the lowland swamps of the Wildlife Sanctuary, which act as a sponge, absorbing these waters and then gradually releasing them into the river in small portions, filtering at the same time.

These wetlands are also important for their ability to retain sediments and to remove nutrients such as phosphorus and nitrogen from agricultural run-off from upstream (RAMSAR, 2008). Other environmental services provided by Aguacaliente Wildlife Sanctuary include improved air quality, and the role of the vegetation acting as a potential carbon sink.

The communities adjacent to the Wildlife Sanctuary benefit from these environmental services, and also have the potential to benefit more directly from tourism, community outreach and development projects initiated by the Aguacaliente Management Team, and by direct, reacreational use of the Sanctuary. The Aguacaliente wetlands have been important traditionally for fishing, and are still of great importance to the local communities today. Whilst fishing is theoretically not allowed within the Sanctuary under the regulatory framework of the National Parks System Act (unless under Ministerial permission), there is an acceptance that such traditional fishing activities should be allowed to continue, though should follow a traditional sustainable fisheries plan. Fishing with hand lines is currently allowed by the Management Team, but methods such as the use of seine nets and poison are not.

The Aguacaliente Wildlife Sanctuary has also traditionally been a focus for harvesting of forest resources - firewood, construction materials and medicines, and for hunting activities. It is recognised, however, that if traditional use is to continue, there needs to be mechanisms in place to balance this with sustainability.

2.3.4 Socio-Economic Context

Belize is a country of many ethnic cultures, with Mestizo, Creole, Maya and Garifuna being the major population groups (Graph 1, CSO, 2002). The original Maya occupants of Belize are subdivided into three ethnic groups – the Yucatec Maya of the north, the Mopan Maya of the west and south, and the Ketchi of the southern regions (Figure 1). Belize has a low population currently estimated at approximately 301,270 (CIA, 2008), of which 52% are urban dwellers (CSO, 2004). Population densities are low, with just over 12 persons per sq. km., concentrated mostly within the northern plain, southern coastal plain, Belize Valley and Stann Creek Valley, with much of the remaining country being less suited in the coastal plains and steep terrain in the Maya Mountains.

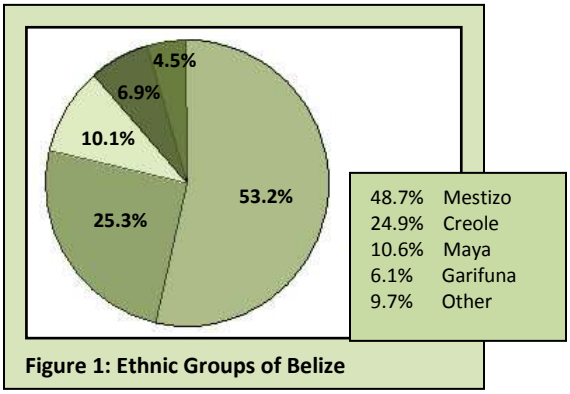


Figure 1: Ethnic Groups of Belize

There is an ongoing emigration of Belizeans to the United States – generally those from urban areas who have completed secondary school or have professional training. There is also a significant influx of Central American refugees – primarily from Guatemala and Honduras - contributing approximately 13% towards the total population of Belize and resulting in the relatively high population growth rate of 2.3%. At the present rate of immigration, it has been calculated that the population of Belize will double in twenty-six years, with much of this immigrant sector tending to be rural-based with low levels of education, placing far greater stress on the natural resources than currently exists.

Figure 2: Belize Demographic Statistics (Average)

Population estimate (2008)	301,270
Population density (2004)	12.3 /sq. km.
Annual growth rate (2000)	2.7%
Birth rate (1996)	23.2 per 1000
Mortality rate (1996)	4.3 per 1000
Fertility rate (2000)	3 children per woman
Life expectancy (2000)	76 (female); 73 (male)
Below Poverty level (2002)	33.5%
Literacy rate (2002)	94%
Unemployment rate (2004)	11.6%
GDP (bn Bz$) (2004)	2.121

Ref: CSO 2000 Census
Ministry of Health
CSO, Mid-term 2004
CSO, Poverty Assessment Report, 2002
CIA, 2008

Toledo District, within which Bladen Nature Reserve is located, is the most southerly of the six districts, and the poorest, with 79% of the population of 26,800 considered to be unable to maintain a minimum standard of living, compared with the national average of 33.5% (CSO, 2002; CSO, 2004). With limited economic and industrial activities within this southern-most district, there is little infrastructural development, nor the associated support services. Unemployment is high (16% as compared with the national average of 11.6%), and there is a high reliance on natural resources, with much of the population living at a subsistence level, dependent on milpa farming. The population is predominantly rural-based (Figure 2), with a fertility rate of 5.6 children per woman, far above the national average of 3.0, resulting in a higher population growth rate than other districts of Belize.

The economy of Belize has, in the past, been based largely on agriculture, with banana, sugar and citrus forming some of the traditional exports that contribute significantly towards the GDP, though this has recently been exceeded by revenue from oil extraction - Belize's current primary export is crude petroleum, which now exceeds the traditional exports of Belize. There is also an increasing reliance on the developing tourism industry, which is rapidly becoming the major foreign exchange earner.

Citrus, banana, shrimp and cattle are the major, large-scale agricultural industries within the southern coastal plain. They dominate not only the land use patterns, but also the economy of the area. The banana industry, the second major agricultural industry in the area, is Toledo's largest employer – and a source of about 10 per cent of total employment countrywide. It is also a major contributor to the GDP (Table 5) - however again market uncertainties and high production costs are affecting both production and marketing (Caribbean Banana Exporters Association, 2003). Large cattle farms are also starting to appear in the coastal plain.

Major Exports of Belize (2006 / 2007)		
	2006 Bz$ million	2007 Bz$ million
Marine Products	86.02	42.16
Sugar	100.07	88.14
Citrus Concentrate	108.99	117.44
Bananas	50.59	41.46
Garments	36.59	18.79
Papayas	31.01	26.07
Crude Petroleum	88.56	142.62
Other	34.58	31.20
Total	536.41	507.88
		CSO (2008)

The Belize GDP and Labour Force		
	GDP Composition by Sector (%) (2007 est.)	Labour Force (Occupation) (%) (2005 est.)
Agriculture	21.3%	22.5%
Industry	13.7%	15.2%
Services	65%	62.3%
		CIA (2007)

Table 5: Exports, GDP and Labour Force Statistics

The large agricultural developments of the Toledo coastal plain – banana and citrus in particular, are a focus for the immigration of Central American seasonal workers, attracted to the area by the employment opportunities presented by the farms. With low wages, there is a heavy incentive for these workers to supplement their diet with game meat, increasing the stress on the protected area through illegal hunting and fishing.

In the Aguacaliente area, the mechanized farming is more focused on growing rice, with some cattle farming, but the majority of community members are engaged in small-scale traditional agriculture with the clearance and burning of forest (slash and burn) as part of the practice of rotational farming, allowing the forest to regenerate over time. Using the slash-and-burn method of farming, each farmer can clear 4 acres primarily for corn, and 6-10 acres for rice. Many plantations also have small areas for beans, peppers, root crops, and plantains, planted at different times of the year. Once these crops are harvested, and the crops are sold at the market in Punta Gorda or to the rice marketing board in Big Falls village, the land is left for at least two to five years to regenerate. According to farmers interviewed from Laguna, San Marcus Blue Creek, Mafredi and Jordan, each individual farmers holds 5 to 6 plots or pieces of land where he does his farming, using these plots on a rotational basis. This system, practiced by the grandparents in the past, has been passed onto the present generation.

Agricultural development, whether large banana or citrus farms, or smaller community farmlands, is the primary cause of major land use changes around the Aguacaliente Wildlife Sanctuary, with clear felling of forest, and associated increased wildfire risks, with anthropogenic fires close to and sometimes entering the protected area on an annual basis. Based on interviews conducted within the communities, it appears that the people are well aware that Aguacaliente is a Wildlife Sanctuary, and that they cannot use the area for farming. However, the fertile soils near or along the buffer areas of the Wildlife Sanctuary are good for farming, which can create problems when farms appear along the boundary line, with the increased risk of fire.

Stakeholder Communities

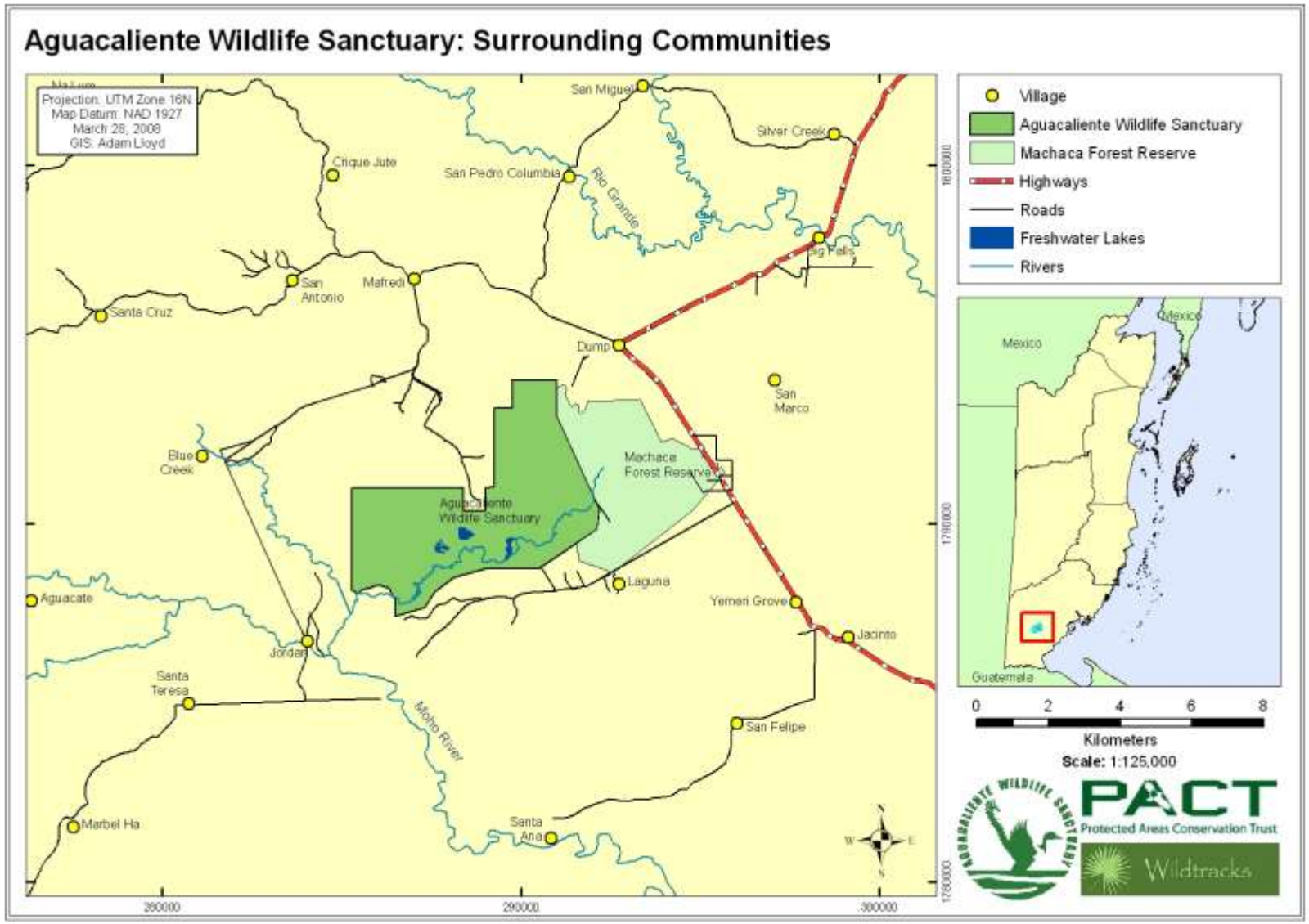
The Aguacaliente Management Team (AMT) has been working with ten stakeholder communities: Laguna, San Marcos, Dump, Big Falls, Silver Creek, San Antonio, Blue Creek, Mafredi, Jordan, and Yemeri Grove (Table 6; Map 3), all of which have been represented on the AMT since the establishment of the Wildlife Sanctuary in 1998.

Table 6: Stakeholder Communities of Aguacaliente Wildlife Sanctuary

Community	Population Estimate	Primary Occupations	Activities that impact AWS
Big Falls	1,300 (Maya - Kekchi & Mopan, Hispanic, creole & East Indian)	Farming, Shop-keeping, Teaching, Construction Work, Livestock	Fishing and recreational use (tourism)
Silver Creek	410 (Primarily Kekchi)	Farming, Construction Work, Bus operator	Fishing and medicinal plants collection
Dump	175 (Creole, East Indian, Mestizo and Maya)	Live stock, farming, Mechanic	Fishing and to a lesser extent hunting and recreational use (tourism)
San Marcos	610 (Primarily Kekchi)	Farming, construction work	Fishing and hunting
Yemeri Grove	175 (Creole, East Indian & Maya)	Livestock, farming	Fishing & hunting
Laguna	400 (Primarily Kekchi)	Farming, Livestock	Fishing and Hunting & Milpa fires
Blue Creek	360 (Primarily Mopan & Kekchi)	Farming, tour guide	Fishing
Mafredi	210 (Primarily East Indian with some Maya)	Mechanize Rice farming, livestock	Fishing & chemicals from mechanize rice farms, fires
Jordan	100 (Primarily Kekchi and some Mopan)	Farming	Fishing
San Antonio	1,600 (Primarily Maya Mopan)	Farming, shop-keeping, construction work	Fishing and to some degree hunting, recreational use

The Mopan, Q'eqchi', Mestizo, Creole and East Indian people living in these buffer communities have traditionally used the resources of the protected area in various ways for their livelihoods, although to a lesser degree than 10 years ago. These uses include recreation, food, shelter, and medicine. A number of people from San Marcus also use caves and other areas of the Wildlife Sanctuary for traditional spiritual purposes.

People interviewed during the management planning process in the ten communities indicated that they have traditionally been conscious of the importance of managing the resources found in Aguacaliente Wildlife Sanctuary, and all agree that better protection is needed. Presently the resources found in the Wildlife Sanctuary are being extracted with minimum control and there is a recognized need to improve this situation. Communities have traditionally extracted forest



Map 3: Stakeholder Communities

products such as house materials, medicinal plants, food, and game for subsistence purposes. Community perception suggests that the majority of the current environmental damage inflicted on the area is the result of over-hunting and over-fishing for commercial purposes, and the removal of traditional building materials – thatch leaves and vines – for the tourism infrastructure in Placencia. The forest is now considered to be over-exploited and natural resources are becoming scarce.

Laguna Community Guesthouse

Increasing modernization brought on by road expansion and access to the cash economy has affected the culture of the communities and has contributed to the proliferation of such things as radio, television, motorized transportation, plastics, pesticides, and chemicals. Most families now have gas stoves alongside their fire hearth. The traditional thatch homes with dirt floors are being replaced with zinc roofs and cement floors. In addition, the Government of Belize has provided potable drinking water for most villages and to some extent, electricity and community phones are also accessible. Today's youths are beginning to reflect American values in their dress, behavior, speech, food preferences, and social choices.

Community Perception of Aguacaliente Wildlife Sanctuary

During the series of participatory workshops, community stakeholders were asked for their opinions on Agucaliente Wildlife Sanctuary. There was general agreement on the requirement to keep Aguacaliente as a Wildlife Sanctuary, but with the identification of the need for much greater exchange of information between the Management Team and the communities (Table 7). There was general agreement that communities did want to be involved in the management of Aguacaliente, but that there was no mechanism for participation. During the course of the management planning process, re-elections for community representatives were held to resolve this issue, with a re-commitment to the conservation of the protected area.

Table 7: Community Perceptions and Opinions

Community Group	Opinion on Designation as Protected Area	Strongest Perceptions / Opinions
Big Falls **Silver Creek** **Dump**	Positive - supportive	▪ Agree that Aguacaliente Wildlife Sanctuary should be protected, and its potential developed ▪ Feel that AMT Board needs to be restructured, potentially with community leaders on the Board, and with community representatives elected by the community ▪ Would like greater communication and transparency between AMT, community leaders and communities
San Marcos **Yemeri Grove** **Laguna**	Positive - supportive	▪ Agree that Aguacaliente Wildlife Sanctuary should be protected, but needs stronger protection programme ▪ Would like greater communication and transparency between AMT and communities, with better identification and selection of community representatives ▪ Would like a community liaison person whose role is to communicate and educate ▪ Would like to see more meetings, to involve and motivate leaders and communities
Blue Greek **Mafredi** **Jordan** **San Antonio**	Positive - supportive	▪ Agree that Aguacaliente Wildlife Sanctuary should be protected, but needs stronger protection programme ▪ Would like to see a sustainable fisheries plan based on accurate knowledge of current fish stocks ▪ Would like to see zoning for activities (tourism, fishing, bird nesting colonies) ▪ Would like greater communication between AMT and communities, with better identification and selection of active community representatives

A Stakeholder Assessment was completed for the primary stakeholders of Aguacaliente Wildlife Sanctuary (Table 8).

Table 8: Stakeholder Analysis for Aguacaliente Wildlife Sanctuary				
Stakeholder	**Influence or Impact of AWS on Stakeholder**		**Influence or Impact of Stakeholder on AWS**	
Community Stakeholder	• Flood control function of Aguacaliente wetlands • Protection of fish and game resources, ensuring continued viability of traditional fishery, and game species in the adjacent buffer area • Recreational area • Tourism resource with potential benefits to communities • Regulation of activities within traditional fishing areas	+ + + + -	• General support of the concept of AWS • Fishing with nets within the protected area • Hunting within the protected area • Collection of non-timber forest products within the protected area for commercial gain • Clearance of agricultural land to water's edge • Agricultural incursions into the protected area • Agrochemical pollution and sediment runoff into protected area • Poor fire management in lands adjacent to the protected area boundary	+ - - - - - - -
Local Tour Guides	• Benefit from having Aguacaliente Wildlife Sanctuary as a tourism resource • Income from using AWS for tourism	+ +	• Support the conservation goals of AWS • Provide interpretation for visitors, facilitating overall visitor appreciation • If well trained, assist with visitor management within the protected areas through in-depth briefings • If poorly trained, can result in poor visitor management and increased impact on biodiversity	+ + + -
Local/National Tour Operators	• Benefit from having AWS as a major venue for natural history tourism • Income from using AWS for tour groups	+ +	• Provide marketing at a national level, and send visitors to the protected area, increasing sustainability of AWS • Support the conservation goals of AWS	+ +
BTIA	• Benefit from having AWS as a venue for natural history tourism – helps promote Belize in international press	+	• Provide marketing of AWS internationally	+
Hotels	• Benefit from having AWS as a major venue for natural history tourism, attracting visitors to area	+	• Provide marketing of AWS to clients • Support the conservation goals of AWS	+ +
Visitors: Tourists	• Enjoy AWS as a tourist destination • Benefit from AWS facilities and trail system	+ +	• Entrance fee contributes towards goal of sustainability • Provide marketing nationally and internationally by word of mouth, if happy with level of product • Presence deters illegal activities in active area • Buy crafts and use facilities on offer in local communities – support income-generating efforts in buffer communities • Impact trails, particularly in wet season • Have a negative impact on wildlife behaviour and distribution, however small • Cultural impact on local communities	+ + + + - - - +
Volunteer/Expedition Groups	▪ Benefit from worthwhile project activities	+	• Provide a volunteer labour force for construction and maintenance projects requiring unskilled labour • Large groups have often exhibited loud and anti-social behaviour to the detriment of other visitors' enjoyment	+ -

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Local Tour Guides	• Benefit from having Aguacaliente Wildlife Sanctuary as a tourism resource • Income from using AWS for tourism	+ +	• Support the conservation goals of AWS • Provide interpretation for visitors, facilitating overall visitor appreciation • If well trained, assist with visitor management within the protected areas through in-depth briefings • If poorly trained, can result in poor visitor management and increased impact on biodiversity	+ + + -
General Belize Public (excl. buffer communities)	• A venue for exploring a natural area within Belize • A venue for education activities for school trips • Environmental services (particularly flood control)	+ + +	• Extended/improved public support if visits are a positive experience • Increased foot traffic impact on trails	+ -
Government of Belize	• AWS included within National Protected Areas System • AWS assists in fulfilling commitments under CBD • Income generation - a venue that attracts visitors to Belize • Provides local employment opportunities • Environmental services • Reduces land available for local community use	+ + + + + -	• Support for surveillance and enforcement efforts • Support for payment for environmental services – a potential source of finance • Financial support through PACT • Possibility of dereservation by Ministerial Fiat • Limited financial ability to fulfill co-management responsibilities	+ + + -

2.4 Physical Environment of Management Area

2.4.1 Climate

Belize lies within the outer tropical geographical belt, with a noticeable variation in average monthly temperatures. It can be divided into two climatic regimes – subtropical in the northern lowlands and central inland areas, and tropical in the southern Stann Creek and Toledo regions. Aguacaliente Wildlife Sanctuary is situated in the latter.

Rainfall

Rainfall levels are far higher in the southern part of Belize than in the north, with the Aguacaliente Wildlife Sanctuary receiving between 2540 and 3556 mm of rain per year (100 to 140 inches) (Figure 3).

The rainfall pattern in Belize is characterised by distinct wet and dry seasons. The wet season is slightly longer in the south of the country than in the north, generally beginning in early May in Toledo, and lasting until November, bringing with it annual inundation of the swamp forest. There is a pronounced dry season stretching from January through to the end of April, with minimum monthly rainfall of as low as 47mm in April, the driest month. This is followed by a wetter season (May to December) with maximum monthly rainfalls in the region of 300 and 600mm, punctuated by a mini dry season in July/August. The majority of the rain falls within the hurricane season, associated with passing tropical storms (particularly between September and November; Figure 4).

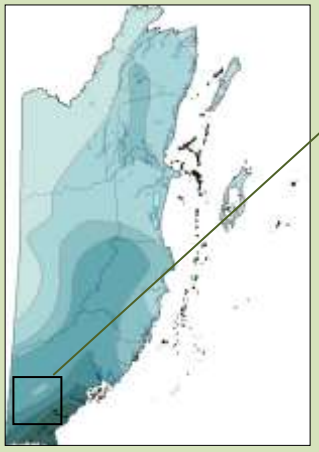


Figure 3: Rainfall belts in Belize

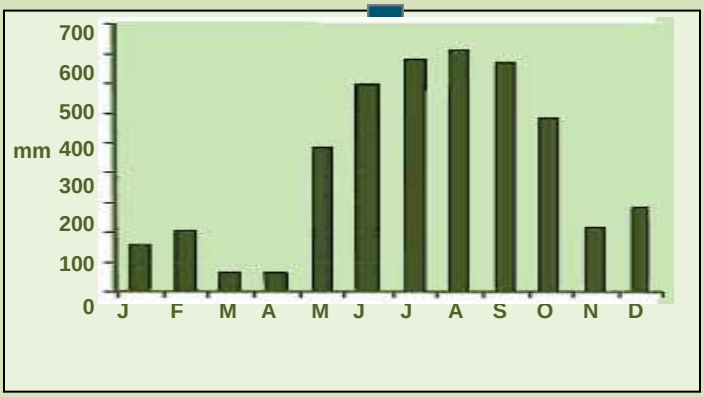


Figure 4: Rainfall

Rainfall varies throughout the year, with the highest rainfall occurring between June and December, peaking in November during the tropical storm season. The dry season has minimum rainfall levels are recorded in April.

Data Source: Fig. 3: Base Map from BERDS (Biodiversity and Environmental Resource Data System)
Fig. 4: Rainfall Data from Bladen Nature Reserve

Temperature

Temperature
Belize has an average annual temperature of approximately 25°C, with cooler temperatures between November and February associated with weather systems from the north, and warmer between April and June. The temperature in coastal areas is moderated by breezes from the sea, while inland temperatures are more extreme, with cooler average minimum temperatures and warmer average maximum temperatures (Figure 5)

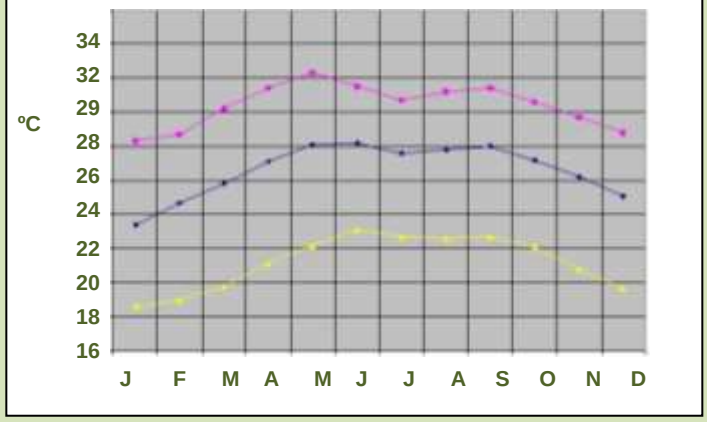


Figure 5 Temperature data from Punta Gorda (Belize National Meteorological Service: Downloaded June 2008)

There is no temperature data for the Aguacaliente Wildlife Sanctuary specifically, but temperature data is available for the coastal town of Punta Gorda, though being inland, AWS is likely to have higher maximum temperatures and lower minimum temperatures than Punta Gorda.

Weather Systems

Belize is affected by three very distinct seasonal weather systems:

Trade Winds

These are the prevailing winds of the area, blowing from the north east to east and rarely exceeding 10 to 15 knots. This wind keeps the coastal areas cooler than the inland areas.

Northers

These are cool air masses that move down from North America between November and April, bringing cooler temperatures and on occasion, heavy wind and rain.

- ***Trade Winds*** – the predominant winds, blowing from the east and north-east
- ***Northers*** - high-pressure fronts moving down from the north, occurring between October and April
- ***Tropical Cyclones*** - occurring between June and November, originating in the mid-Atlantic

Tropical Cyclones

Tropical cyclones are non-frontal low pressure systems, with organised circulations. Cyclones affecting Belize originate in the Atlantic Ocean over warm, tropical waters, moving westward towards the Caribbean and generally gathering strength until they hit land. They occur between June and November and range in scale from tropical depressions, to tropical storms with sustained winds of at least 39 mph, to hurricanes which have sustained wind speeds of at least 74 mph.

Of recent note for Aguacaliente Wildlife Sanctuary is Hurricane Iris of October 8th 2001. An overflight of the area on October 21st 2001 noted severe damage across the whole Sanctuary with most of the trees either down or with broken crowns (Meerman, 2001). After the hurricane,

the area suffered an increasing frequency of fires, which is reported to have caused more damage than the hurricane itself.

Table 9: Hurricanes Affecting Aguacalient Wildlife Sanctuary

Hurricane Iris
GOES Project, NASA-GSFC 14:45 UTC 8 October, 2001

Name	Year	Date Passed AWS
Unknown	1946	14th September
Unknown	1950	10th September
Jig (Tropical Storm)	1951	16th October
Faith	1966	1st September
Brenda (Tropical Storm)	1968	10th September
Laura	1971	November
Carrie (Tropical Storm)	1972	31st August
Dawn (Tropical Storm)	1972	10th September
Fifi	1974	18th September
Greta	1978	18th September
Josephine	1984	12th October
Daniel	1998	1st September
Mitch	1998	27th October
Keith	2000	30th October
Iris	2001	8th October
Ivan	2004	12th September

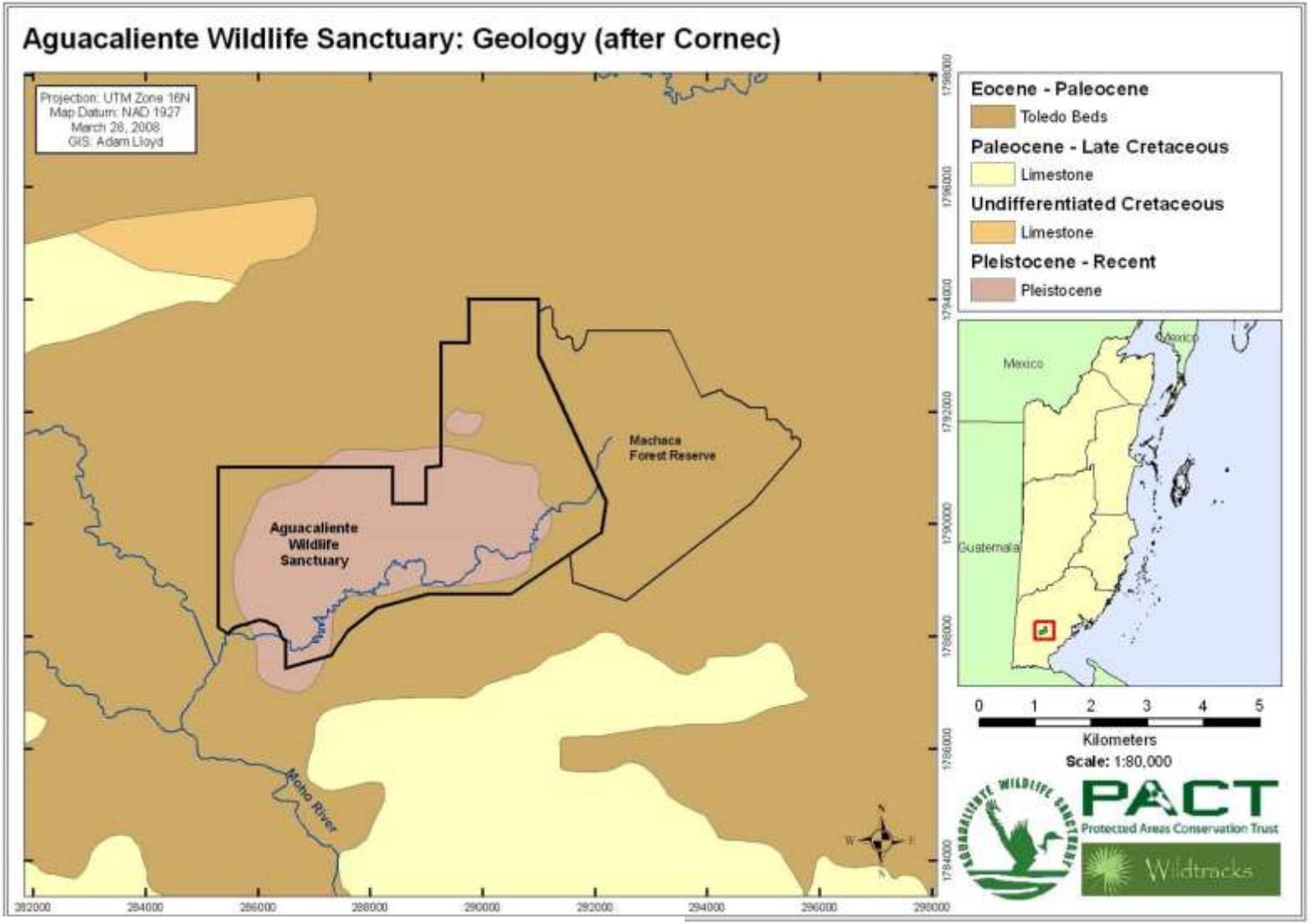
2.4.2 Geology

The geology of the Aguacaliente Wildlife Sanctuary is described in the Rapid Ecological Assessment (Meerman et. al., 2006), with the core of the protected area being located on alluvial deposits overlying Eocene-Paleocene-limestone-Toledo bed formations.

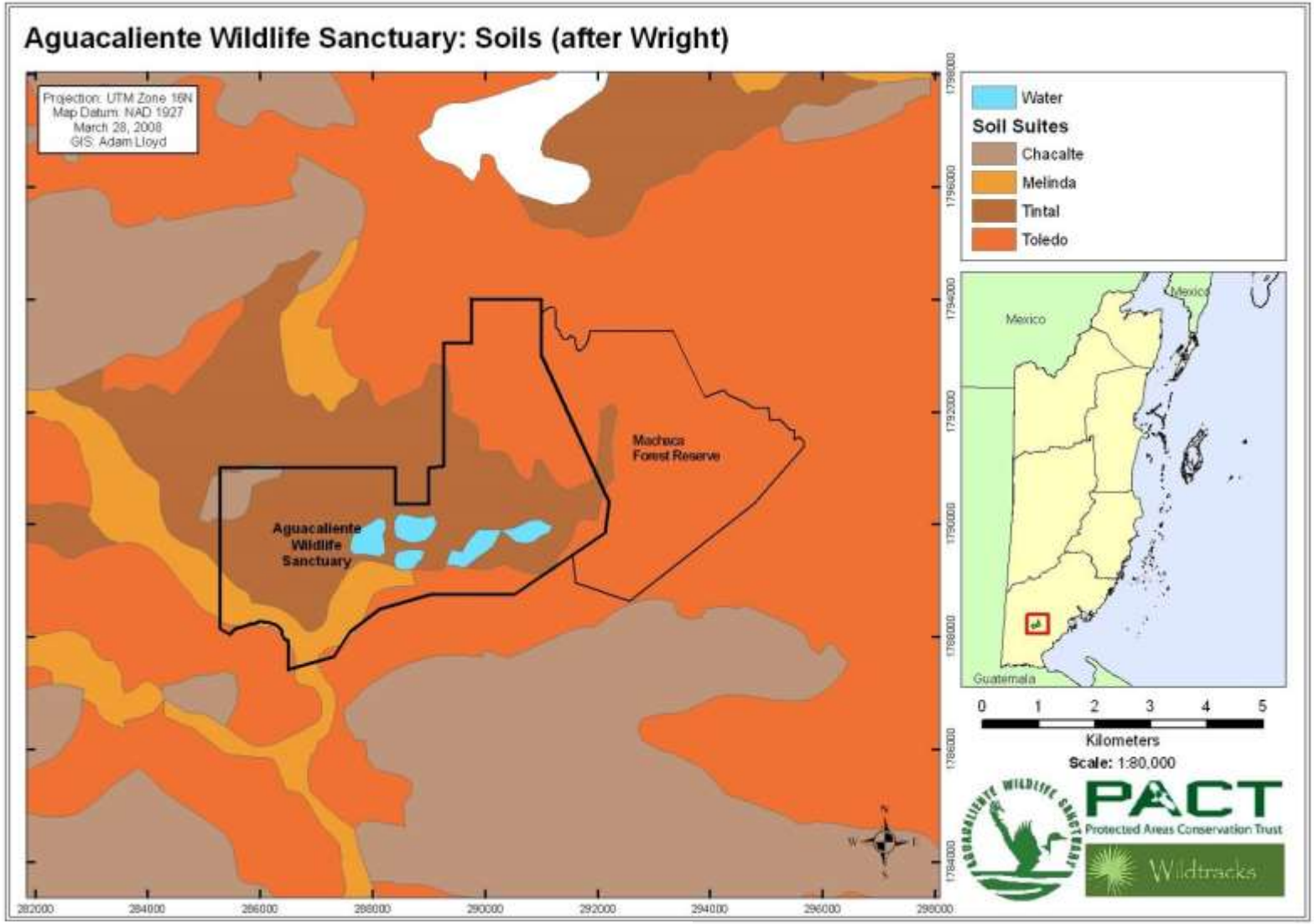
In the north of the sanctuary, there is small karstic cretaceous limestone outcropping. It is suggested that a fault line traverses the area, indicated by the presence of seepage of warm, sulphuric water - the 'hot springs' that give the area its name. Other 'hot springs', presumably along the same fault line, can be found in the Big Falls and Silver Creek vicinity (Map 4).

2.4.3 Soils

The basin of Aguacaliente Wildlife Sanctuary is located on recent alluvial soils of the Tintal Suite, added to by each subsequent flooding event (Map 5). In the better drained limestone terrain to the north / north east, this is replaced by soils of the Toledo Suite.



Map 4: Geology of the Aguacaliente Wildlife Sanctuary Area



Map 5: Soils of the Aguacaliente Wildlife Sanctuary Area

2.4.4 Hydrology

Aguacaliente Wildlife Sanctuary lies entirely within the Moho Watershed, which covers an area of approximately 198,000 acres (Meerman and Clabaugh: 2005), with the headwaters extending into Guatemala (Map 6). Before the construction of the Blue Creek road, it is thought that there may also have been inflow from the Rio Grande watershed at times of peak flooding (community consultations).

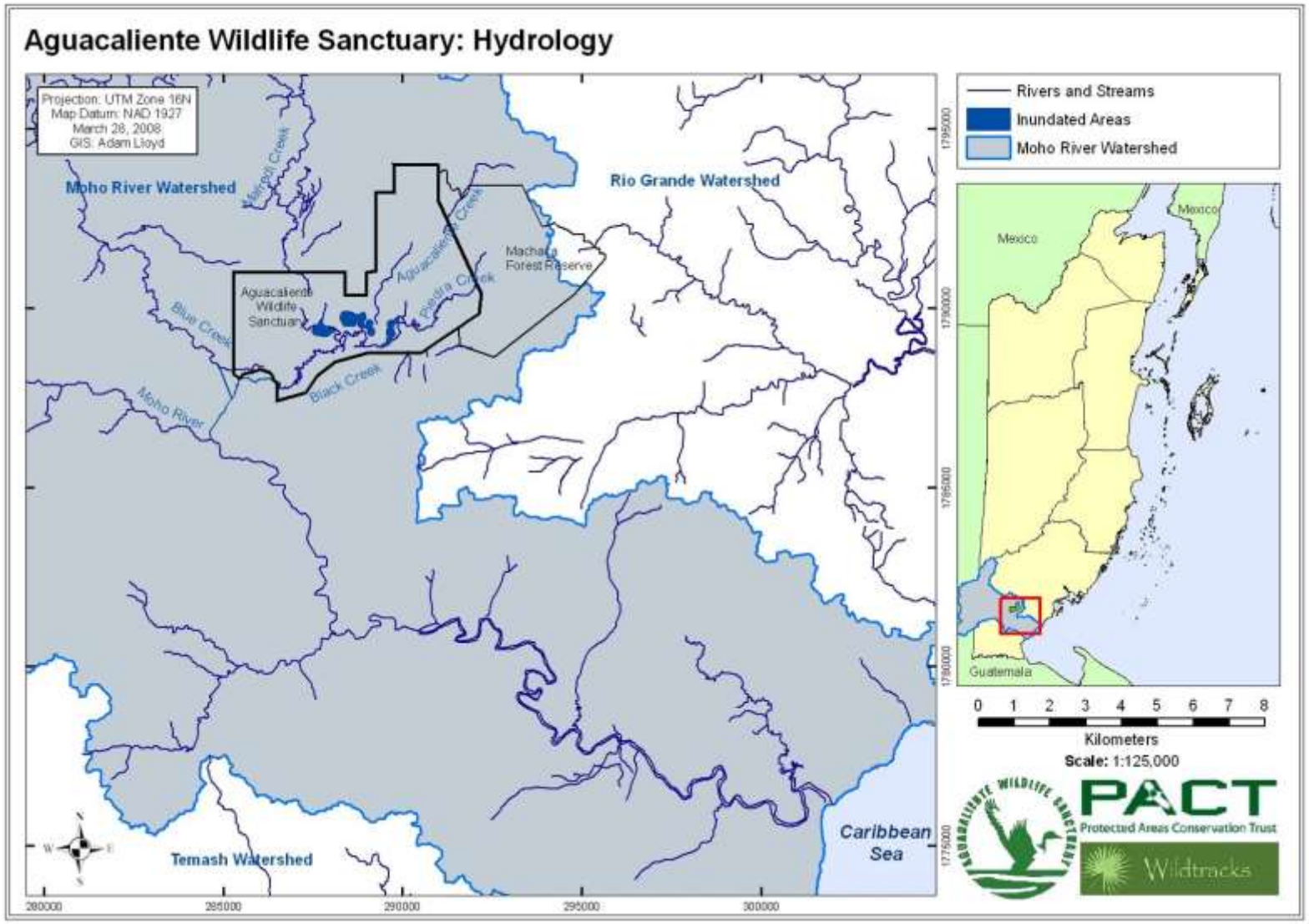
Within Belize, a dense series of tributaries enter the Moho watershed from the north, draining part of the southern Maya Mountains, including a section of the Columbia River Forest Reserve. The watershed then follows the Moho River as it continues in a south easterly direction, meeting the sea at a point roughly equidistant between Punta Gorda and Barranco.

The wetland area of Aguacaliente Wildlife Sanctuary is fed by Mafredi Creek from the north and the Aguacaliente and Piedra Creeks from the north east. These creeks form a series of lagoons at the centre of the wetland area which drain into Black Creek, which in turn drains back into Blue Creek. The central basin is almost entirely contained by higher ground; steep hills lie to the south and north west, and the ground rises gently to the east, west and north east. The only drain from the basin lies in the south west corner of the Sanctuary, where the Blue Creek exits, following a winding southerly course before joining the Moho River.

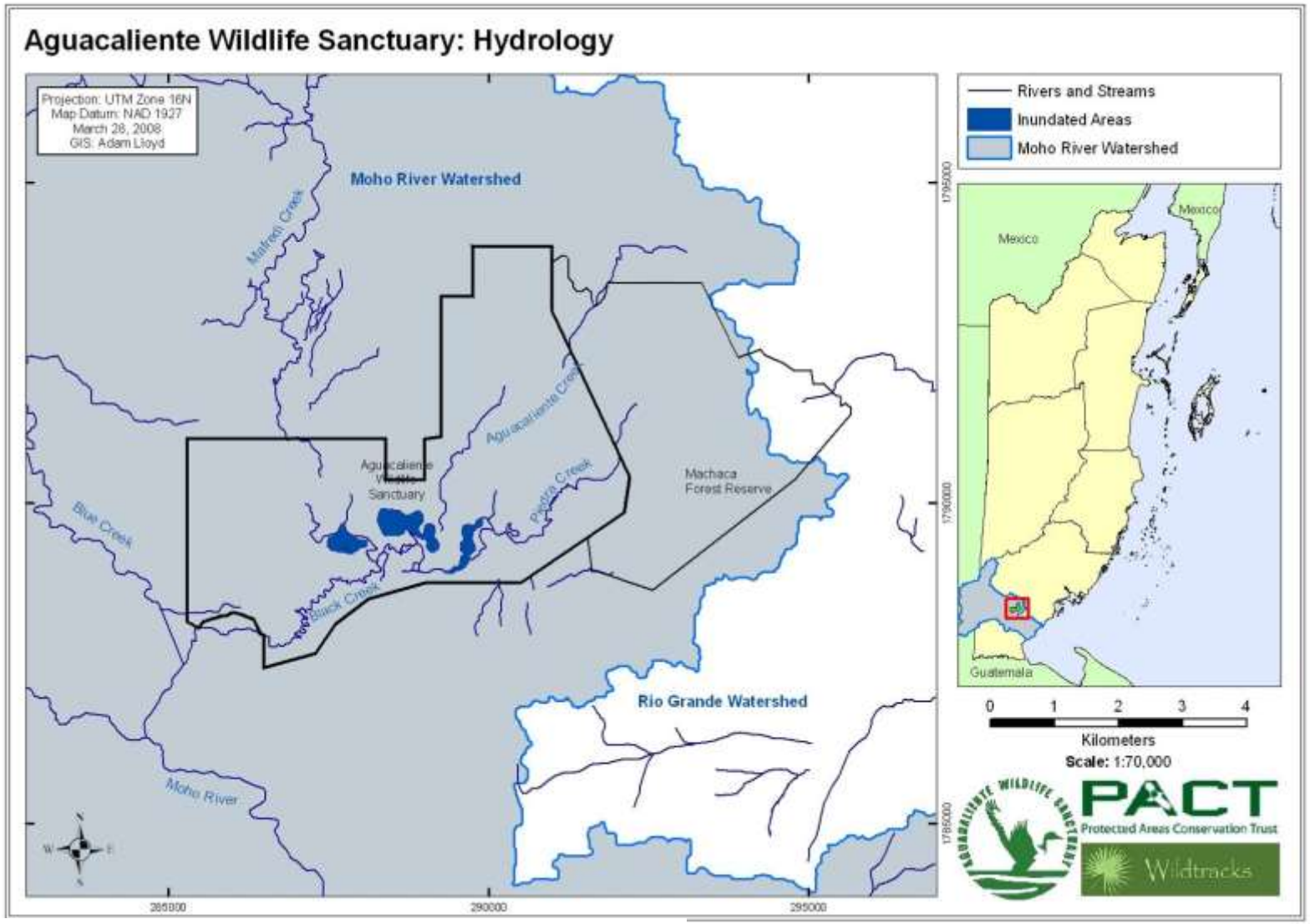
At times of high water levels the Aguacaliente basin becomes completely inundated. When the Moho River is swollen, Blue Creek cannot drain into it quickly enough, so water backs up into the Aguacaliente basin. As the only exit from the basin is Blue Creek, the wetlands become a store for all the creeks which feed them, and for the 44,600 acre Blue Creek subwatershed itself, acting as a storage buffer at times of high water levels, making them important for flood regulation in the areas downstream of Aguacaliente.

Upstream of Aguacaliente, the Moho watershed contains a large number of settlements and their associated agricultural areas, giving rise to concerns about the quality of water entering the wetlands. To the north-west of the Sanctuary in the southern foothills of the Maya Mountains lie many communities where small scale milpa agriculture is practised, while to the north and north west of the Sanctuary lie extensive areas under mechanised agriculture – principally rice cultivation.

While agricultural run-off, and the associated agrochemical contamination and sdediment load, is likely to be entering the Aguacaliente wetlands, the wetlands will be playing an important role in the purification of that water. Wetland soils and plants are very effective at removing nitrogen and phosphorus from agricultural run-off, reducing the levels of these chemicals in the groundwater and in rivers downstream and therefore improving the quality of drinking water sources downstream (RAMSAR, 2008). Furthermore, the slowing down of the water in the wetland area encourages the deposition of sediments carried in the water, preventing them from blocking waterways downstream.



Map 6: Hydrology of the Aguacaliente Wildlife Sanctuary Area



Map 7: Hydrology of the Aguacaliente Wildlife Sanctuary

2.5. Biodiversity of Management Area

2.5.1 Ecosystems

Within the 5,468 acres of the Aguacaliente Wildlife Sanctuary, lies a rich mosaic of 10 natural ecosystems (Table 10) – a diverse assemblage of terrestrial, freshwater, and seasonally inundated habitats. Two of these, the Aguacaliente swamp forest (tropical evergreen broad-leaved lowland swamp forest, Aguacaliente variant) and the grassland swamp (swamp grassland without trees or shrubs) are unique and confined entirely to the Aguacaliente Wildlife Sanctuary (Meerman, J., et. al., 2006). Four of the other ecosystems of Aguacaliente are considered significantly under-represented within the current National Protected Areas System, further emphasizing the contribution of Aguacaliente in the conservation of these habitats; they include tropical lowland reed swamp (69% below national protection target), Eleocharis marsh (47%), freshwater lake (36%) and tropical evergreen broad-leaved lowland hill forest on steep karstic hills (28%). The area of at least two of Aguacaliente's natural ecosystems has been somewhat reduced in the past by agricultural incursions, both mechanized and non-mechanized – creating management challenges that are addressed within the conservation planning section of this management plan.

Table 10: Ecosystems of Aguacaliente Wildlife Sanctuary

Ecosystem	Acres	
Agriculture: mechanized agricultural land uses	18	
Agriculture: non mechanized agricultural land uses including unimproved pasture	226	
Deciduous broad-leaved lowland disturbed shrubland	1584	
Deciduous broad-leaved lowland riparian shrubland of the plains	259	
Eleocharis marsh	12	*
Freshwater Lake (normal low water levels)	70	*
Swamp grassland without trees or shrubs	123	**
Tropical evergreen broad-leaved lowland forest on poor or sandy soils	867	
Tropical evergreen broad-leaved lowland hill forest on steep calcareous hills	119	*
Tropical evergreen broad-leaved lowland swamp forest	1738	
Tropical evergreen broad-leaved lowland swamp forest, Aguacaliente variant	328	**
Tropical lowland reed-swamp	125	*

** Ecosystems unique to Aguacaliente Wildlife Sanctuary
* Ecosystems significantly under-represented within National Protected Area System

Based on Meerman and Sabido, 2001 (revised 2004)

Aguacaliente Wildlife Sanctuary is centred on the inter-connected freshwater lakes, and surrounding wetlands, and includes a relatively small area of non-inundated broadleaf forest along the north-eastern and eastern portion of the Sanctuary. The ecosystems fall within four main groupings: freshwater lakes and surrounding herbaceous swamps, swamp forests, shrublands, and non-inundated broadleaf forests (Map 8, Map 9).

1. Freshwater lakes and surrounding herbaceous swamps

Freshwater Lake
[UNESCO Ecosystem code: S.A.1.b.(4)(b).]

The extent of the lakes of Aguacaliente change dramatically seasonally, from the core pools which may be only a few tens of metres across in peak dry season, with a maximum depth of little over a metre, to a very extensive body of water spreading over more than 1,000 acres and into the surrounding swamp forest. During peak floods, the core lake areas may have a depth in excess of 4m – and act as a catchment for a large area to the north and west. Drainage of the system is slow and westerly, into the Moho River. Because of the very slow flow through the interconnecting creeks, they are considered here as part of the lake system, rather than as a separate ecosystem. Plant species commonly occurring in the lakes include *Cabomba palaeformis, Nymphaea ampla* and *Sagittaria guyanensis.*

Freshwater lakes and surrounding herbaceous swamps

Freshwater Lake
[UNESCO Ecosystem code: S.A.1.b.(4)(b).]

Tropical lowland reed-swamp
[UNESCO Ecosystem code: VII.B.1.a.]

Eleocharis marsh
[UNESCO Ecosystem code: V.D.1.a.(1)]

Swamp grassland without trees or shrubs
[UNESCO Ecosystem code: V.A.2.c.(g).]

Creek system of Aguacaliente Wildlife Sanctuary

Tropical lowland reed-swamp
[UNESCO Ecosystem code: VII.B.1.a.]

The greatest extent of this ecosystem occurs around the westernmost lake, the reed-swamp is deeply inundated for much of the year, and remains wet through at least most of the dry season. The sedge *Cyperus articulatus* is a predominant species in this system, with *Mimosa pellita* and *Hymenachne amplexicaulis* being locally abundant. The red beds are undoubtedly important breeding grounds for many of the fish species of Aguacaliente, and support flocks of wading birds during the drier months.

Eleocharis marsh
[UNESCO Ecosystem code: V.D.1.a.(1)]

Occurring often in small stands interspersed throughout the wetlands, a sizeable tract of Eleocharis marsh has been mapped near the central lakes (Meerman, J., et. at., 2006). In Aguacaliente, *Eleocharis interstincta* occurs in almost monospecific stands, and then grades into the surrounding reed beds. The *Eleocharis* stands are generally under 0.7m in height, and are therefore deeply inundated for much of the year.

Swamp grassland without trees or shrubs
[UNESCO Ecosystem code: V.A.2.c.(g).]

The second ecosystem that is unique to Aguacaliente, the grassland swamp forms a dense, rich green sward for about 4 months each year – and is inundated by 2m or more of floodwaters or much of the rest of the year. It is dominated by the grass *Neeragrostris contrerasii,* generally growing to no more than about 20-30cm in height. In places, the grassland includes a few other herbaceous plant species, such as *Ludwigia octovalvis, Cyperus articulatus, Lippia stoechadifolia* and *Solanum campechiense.*

The grassland has generally been too humid to be threatened by fire, though in recent years anthropogenic fires have spread from the northern shrublands and have impacted at least the edge o this unique ecosystem.

2. Swamp forests

Swamp forests

Tropical evergreen broad-leaved lowland swamp forest
[UNESCO Ecosystem code:1.A.1.g.(1).(a)]

Tropical evergreen broad-leaved lowland swamp forest, Aguacaliente variant
[UNESCO Ecosystem code: I.A.2.g.(1).(a).AC]

Tropical evergreen broad-leaved lowland swamp forest
[UNESCO Ecosystem code:1.A.1.g.(1).(a)]

More extensive than the adjacent Aguacaliente swamp forest variant, this ecosystem is distinguished by its taller stature, more closed canopy, greater plant species diversity, the general absence of a grassy field-layer, and the more distinct hog-wallow relief. Typically floodwaters throughout this swamp forest rarely exceed much more than 1m or so in depth, noticeably less than the 1.5m or more that can occur through the Aguacaliente variant for extended periods. Most or all of the species occurring in the Aguacaliente variant occur in this swamp forest, amongst a suite o species often associated with somewhat less wet forests – species such as *Andira inermis, Attalea cohune, Heliconia vaginalis, Hirtella racemosa, Licania hypoleuca, Psychotria poeppigiana, Symphonia globuliera* and *Vitex kuylenii*. The gradation from this ecosystem into the Aguacaliente variant is clearly seen along the main access boardwalk north of the Ranger Station.

Tropical evergreen broad-leaved lowland swamp forest, Aguacaliente variant
[UNESCO Ecosystem code: I.A.2.g.(1).(a).AC]

This unique habitat is adapted for extremes of water reqime, from extended seasonal flooding up to 2m in depth, to significant drought conditions in the peak dry season. The canopy is 6-10m in height, quite open and often with a grassy field layer – not dissimilar in structure to logwood stands seen elsewhere in Belize. It is dominated by the tree *Eugenia aeruginea,* which forms monospecific stands in some areas. Other characteristic plant species within this ecosystem include *Lonchocarpus hondurensis, Dalbergia glabra, Pachira aquatica and Chrysobalanus icaco.* Associated species include: *Acoelorraphe wrightii, Alibertia edulis, Bactris major, Bactris mexicana, Calyptranthes chytraculia, Guadia longifolia, Lonchocarpus castlloi* and *Lonchocarpus rugosus.* Epiphytes are locally abundant in some areas, almost absent in others; common species include *Aechmea tillandsioides, Anthurium scandens, Epidendrum nocturnum,* and several species of *Tillandsia,* and *Vriesea gladioliflora*.

This is one of the two ecosystems that are entirely confined to the Aguacaliente Wildlife Sanctuary. Seasonally, it is home to a number of mammals, with tracks of tapir, white-tailed deer and collared peccary being seen during the site visits.

3. Shrublands

Shrublands

Deciduous broad-leaved lowland disturbed shrubland
[UNESCO Ecosystem code: III.B.1.b.(a).2.]

Deciduous broad-leaved lowland riparian shrubland of the plains
[UNESCO Ecosystem code: III.B.1.b.(f).P]

Deciduous broad-leaved lowland disturbed shrubland
[UNESCO Ecosystem code: III.B.1.b.(a).2.]

It appears that, in Aguacaliente, the sources of the 'disturbance' that results in a shrubland ecosystem (as opposed to a forest) are both anthropogenic and natural. Within the mapped extent of this system within Aguacaliente, seasonal water-logging appears to favour the maintenance of a shrubland with a significant herbaceous component, whereas anthropogenic fire is unquestionably the primary disturbance maintaining some of the shrubland in the northern portions of the Sanctuary. In dry season, this shrubland is criss-crossed with the tracks of 4-wheel drive vehicles that are used to illegally enter the Sanctuary by hunters, mostly hunting white-tailed deer. Whilst some of the fires might originate in nearby farmlands, the majority are clearly set deliberately by hunters, clearing thorny thickets, and encouraging new grass growth to attract deer. There is, as yet, insufficient on-the-ground data to adequately characterize this ecosystem in Aguacaliente, or to list its predominant plant species.

Deciduous broad-leaved lowland riparian shrubland of the plains
[UNESCO Ecosystem code: III.B.1.b.(f).P]

This ecosystem occurs mostly along the reaches of Black Creek and Blue Creek, southwest of the westernmost lagoon in the Sanctuary. Disturbance, maintaining the system, appears to be mostly natural here – associated with the impacts of flooding from the creeks. The habitat is a much richer mosaic than the other shrubland type (described above), with components of a riparian forest ecosystem, swamp forest, interspersed throughout the 'shrubland'. As with the other category of shrubland in Aguacaliente, there is not yet adequate information to thoroughly characterize this shrubland mosaic; common plant species include *Bactris major, Bactris Mexicana, Ficus insipida, Guadua longifolia, Gynerium sagittatum, Heliconia latispatha, Inga vera, Lonchocarpus guatemalensis* and *Schizolobium parahyba*.

4. Non-inundated broad-leaved forests

Non-inundated broad-leaved forests

Tropical evergreen broad-leaved lowland forest on poor or sandy soils
[UNESCO Ecosystem code: I.A.1.a.(1).(b).P]

Tropical evergreen broad-leaved lowland hill forest on steep calcareous hills
[UNESCO Ecosystem code: I.A.1.a.(1).(a).K-s]

Tropical evergreen broad-leaved lowland forest on poor or sandy soils
[UNESCO Ecosystem code: I.A.1.a.(1).(b).P]

Occurring on the rather poorly drained soils along the north-eastern boundary of the Sanctuary, this forest was heavily impacted by Hurricane Iris in 2001. Regeneration is occurring rapidly, though the canopy is inevitably more open than in less recently disturbed tracts of this ecosystem. Predominant tree species include *Attalea cohune, Dialium guianense, Terminalia amazonia, Vochysia hondurensis* and *Xylopia frutescens*.

Melastomataceae, and Rubiaceae are abundant in the understory, with *Psychotria poeppigiana* being especially noticeable.

This ecosystem has been impacted in the northern portion of the Sanctuary by agricultural incursions (non-mechanized), with a small number of people having illegally cleared forest on and adjacent to the colluvial soils near the base of the karstic hills. These farms appear to have been abandoned in the last 2-3 years, with young secondary growth forest already becoming established.

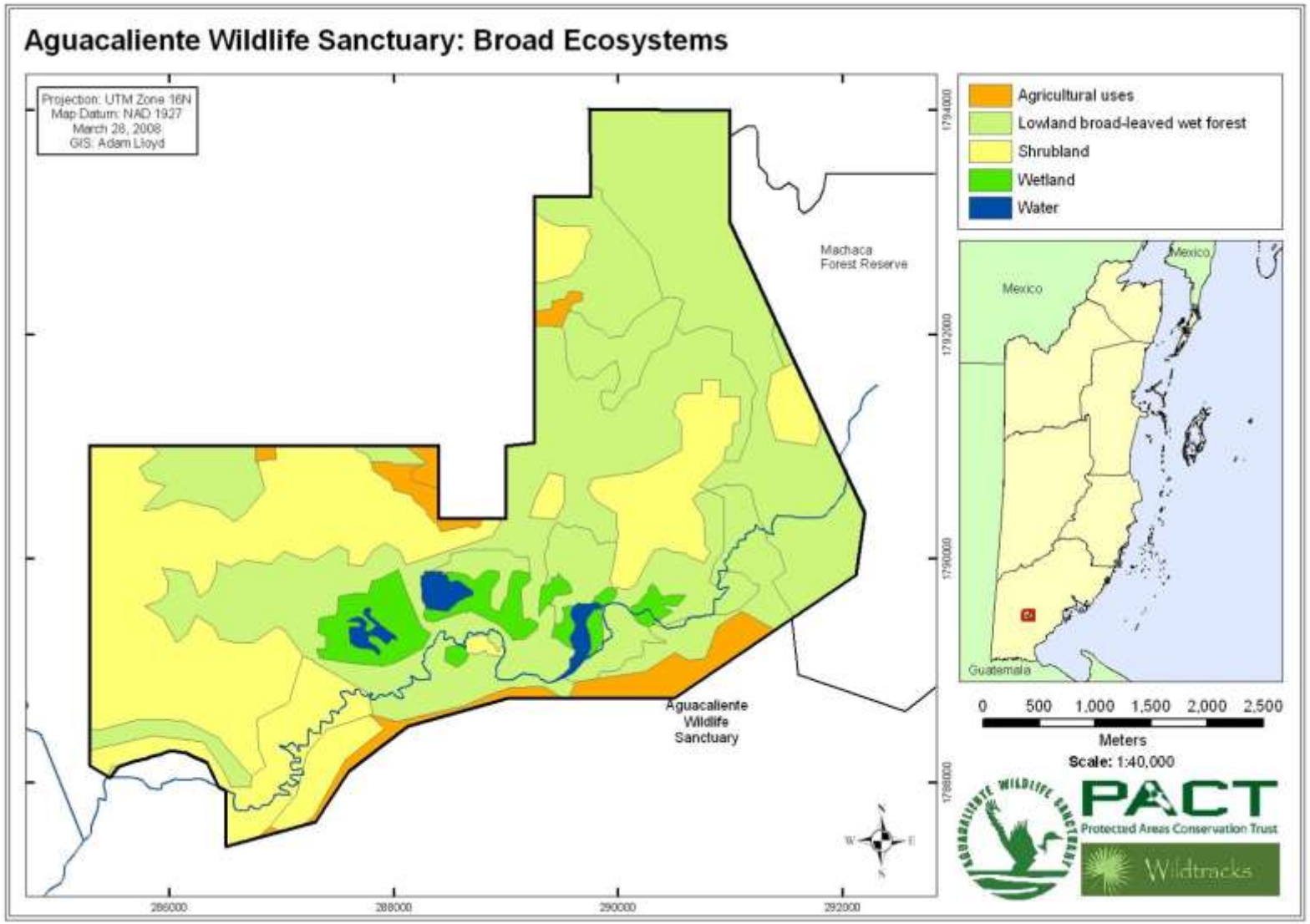
Tropical evergreen broad-leaved lowland hill forest on steep calcareous hills
[UNESCO Ecosystem code: I.A.1.a.(1).(a).K-s]

A relatively small tract of this species-rich forest occurs on and between the steep limestone hills in the north-eastern portion of the Sanctuary, surrounded by the lowland forest on poor or sandy soils. Parts of this forest have been significantly degraded by anthropogenic fire – with milpa fires escaping from farming incursions, on the colluvial soils at the foot of the steep hills, and spreading uphill on the seasonally drier slopes. On other hills the forest has escaped these impacts, and remains in very good condition – providing seed-stock for the natural regeneration on the fire-damaged hills.

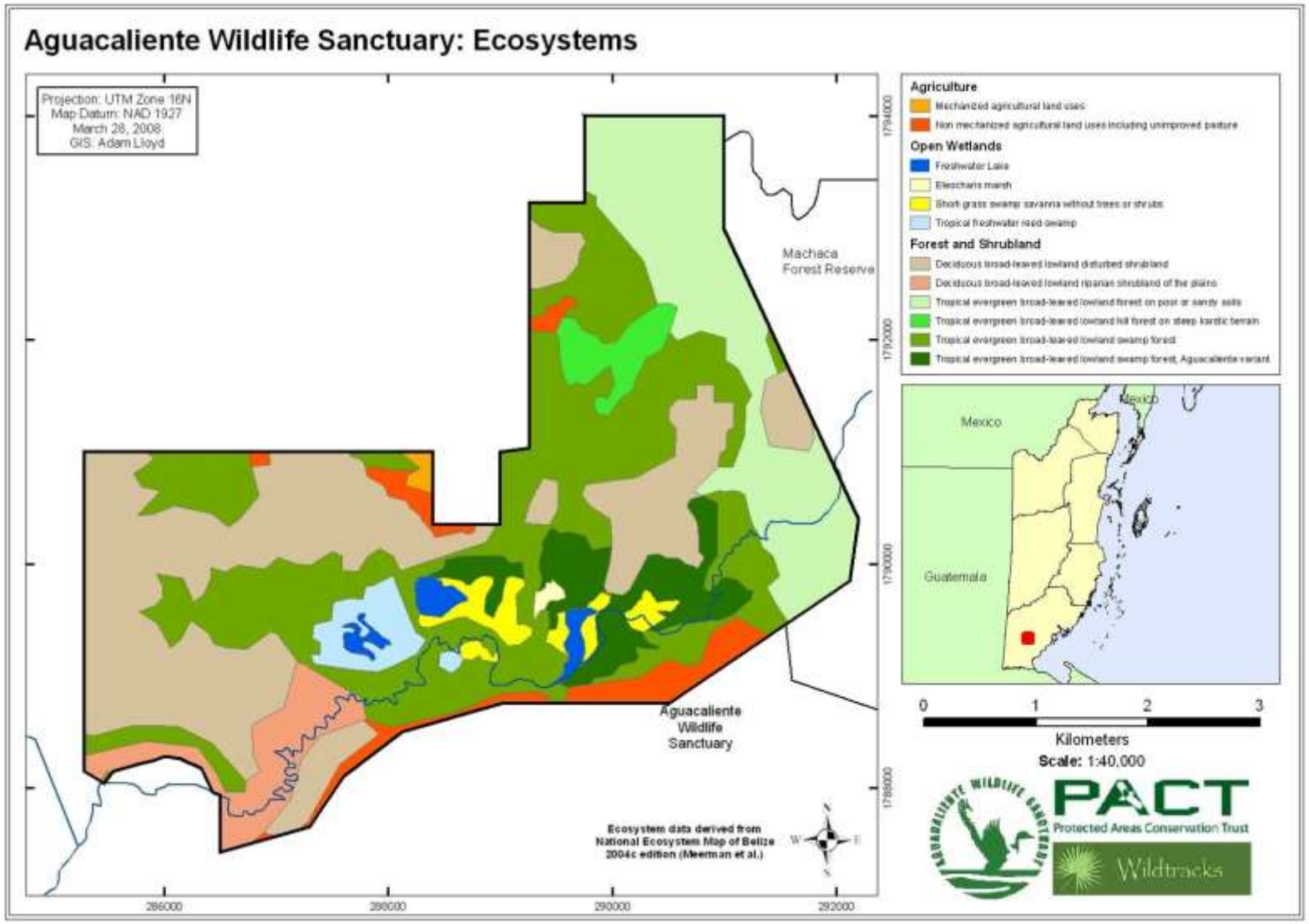
Predominant tree species within this forest include *Ceiba pentandra, Dendropanax arboreus, Pouteria campechiana* and *Sabal mauritiformis. Chamaedorea neurochlamys, Chamaedorea tepejilote* and *Crysophila staurocantha* are very visible components of the understory.

Agriculture

Both mechanized and non-mechanized agricultural incursions have impacted some of the natural ecosystems of the Sanctuary, and have recently been mapped (Meerman, J. et. al., 2006). They are not considered here as separate ecosystems, as with increasing management effectiveness, they will all be vacated and succession will then allow a gradual regeneration of natural vegetation.



Map 8: Broad Ecosystems of Aguacaliente Wildlife Sanctuary



Map 9: Ecosystems of Aguacaliente Wildlife Sanctuary

2.5.2 Flora

The range of ecosystem types found at Aguacaliente Wildlife Sanctuary – from freshwater lakes to reed swamp and evergreen broadleaf forests – has led to an array of flora adapted to these varying ecosystems, including many specialists associated with narrow ecological zones. A plant species survey was conducted under the REA for Aguacaliente Wildlife Sanctuary, during which 213 species were identified belonging to 70 families (Meerman et. al., 2006). A further 12 species were added to the list during the site visits or the development o this management plan.

This list includes three species of concern. One of these is mahogany (*Swietenia macrophylla*), found in the northern section of the Sanctuary around the karst hills and is listed as Vulnerable (IUCN). Another is Variegated Zamia (*Zamia variegata*) which is listed as Endangered (IUCN) and is found in the "Tropical evergreen broadleaf lowland forest over poor or sandy soils". Finally there is *Vitex kuylenii*, a species of tree which is listed as Endangered by the IUCN.

The REA also lists five species of plant which appear to be first records for Belize. These are *Sagittaria guyanensis*, *Trichostigma octandrum*, *Bravaisia integerrima, Ceratopteris thalictroides,* and *Marsilea sp.* which has not been identified to species level (Meerman et. al., 2006).

There are also a number of plants which are dominant for the ecosystems in which they are found: *Neeragrostis contrerasii* is the species of grass dominant in the "Swamp Grassland Without Trees or Shrubs". It is adapted to seasonal inundation by sprouting as soon as the water levels recede in February, then growing rapidly and setting seed before the water levels rise again in late May or June. (Meerman et. al., 2006). The dominant species in the "Tropical Lowland Reed Swamp" is *Hymenachne amplexicauli*, a grass which is adapted to fluctuating water levels of up to 2 metres deep (Meerman et. al., 2006).

Lonchocarpus hondurensis and *Eugenia aeruginea* are both tree species characteristic of the "Tropical evergreen broad-leaved lowland swamp forest, Aguacaliente variant". Aguacaliente Wildlife Sanctuary is the only known location in Belize where *Eugenia aeruginea* grows in nearly pure stands (Meerman: 2006). The "Tropical evergreen broadleaf lowland swamp forest" is dominated by *Amanoa guianensis*, a tree species adapted to this seasonally inundated ecosystem with stilted roots (Meerman et. al., 2006).

Interestingly, the monkey tail palm (*Asterogyne martiana*) was recorded during the REA - this species having previously only been recorded in the Davis Falls area of the Sittee River Forest Reserve. The record in Aguacaliente should be validated (*Asterogyne* can be confused with the very similar *Calyptrogyne*), if correct, it represents an important national range extension or this uncommon palm. A species list has been included as Annex 1.

2.5.3 Fauna

Herpetofauna

To date, only 11 species of amphibian and reptile have been recorded within Aguacaliente Wildlife Sanctuary – 4 amphibian and 7 reptile species (Table 11). However, based on its geographical location, its broad array o habitats, and the specific habitat requirements of Belize's herpetofauna, it can reasonably be expected that the actual species richness of the sanctuary will include at least 85 species of amphibian and reptile (Annex 2). Up to a further 22 species have ranges and habitat requirements relatively close to the Sanctuary, and could possibly occur there – so it is highly probable that more than 90 species of amphibian and

reptile occur within the Sanctuary, many of which will be largely confined to the non-inundated forest on and surrounding the karst hills in the north-east.

Table 11: Reptiles and Amphibians reported from AWS			
Family	**Species**	**English Name**	**2007 IUCN**
Leptodactylidae	*Leptodactylus melanonotus*	Sabinal Frog	LC
Bufonidae	*Bufo marinus*	Cane Toad	LC
	Bufo valliceps	Gulf Coast Toad	LC
Ranidae	*Rana vaillanti (palmipes)*	Rainforest Frog	LC
Crocodylidae	*Crocodylus moreletii*	Morelet's Crocodile	LR
Dermatemydidae	*Dermatemys mawii*	Central American River Turtle	CR
Emydidae	*Trachemys scripta*	Slider	LR
Corytophanidae	*Basilicsus vittatus*	Brown Basilisk	
Iguanidae	*Iguana iguana*	Green Iguana	
Polychrotidae	*Anolis lemurinus*	Ghost Anole	
	Anolis rodriguezii	Smooth Anole	

The diversity of habitats within the Aguacaliente Wildlife Sanctuary undoubtedly harbour a rich herpetofauna - the very limited number of species recorded there to date being a reflection of the limited extent of studies, rather than of the overall diversity of amphibian and reptile species that occur there. The complexity of habitats for amphibians and reptiles is very broad, with the diversity of water regimes - permanent pools and creeks, prolonged inundation of swamp forest and grasslands, less prolonged temporary inundation of peripheral swamp forest, non-inundated lowland forest, and the well-drained forest on the karstic hills of the north-eastern portion of the Sanctuary.

In terms of herpetofaunal species conservation, the continued presence of the hicatee (*Dermatemys mawii*) is of paramount importance. As one of only two non-marine critically endangered species in Belize (IUCN, 2008), the hicatee population has been declining sharply throughout is range in Belize in recent years, and has been largely extirpated by unsustainably hunting and habitat conversion throughout much of its range. This species occurs in very few protected areas in Belize (Aguacaliente being one of them), and limited management effectiveness in all has resulted in illegal hunting, bringing even these 'protected' populations to the brink of local extinction, and one step closer to global extinction. To prevent the eradication of this culturally important species in Belize, effective conservation must start with the complete protection of the remnant populations within the wetland protected areas where they occur, so as to allow viable populations to become re-established. Aguacaliente Wildlife Sanctuary has the potential to become a prominent stronghold for the hicatee.

As with the hicatee, Aguacaliente should play an important role in the long-term conservation of several other less endangered freshwater turtle species, including the slider (*Trachemys scripta*), the Mexican giant musk turtle (*Staurotypus triporcatus*), the narrowbridge musk turtle (*Claudius angustatus*), the Tobasco mud turtle (*Kinosternon acutum*), and the nationally uncommon snapping turtle (*Chelydra serpentina*), whose Belize distribution is limited to southern watersheds in Toledo. The hunting of any reptiles is illegal within a wildlife sanctuary in Belize, and Aguacaliente is one of the few protected areas protecting the habitats of several globally and nationally endangered turtles – their effective protection and conservation should be a core focal target of the Sanctuary's management.

Occasional sightings of Morelet's crocodiles within the Sanctuary are also important: whilst the species has largely recovered elsewhere in the Country from past commercial hunting, numbers in Toledo District remain extremely low – apparently as a result of persecution (Meerman, 2006). Aguacaliente Wildlife Sanctuary has extensive habitat that is eminently

suited to Morelet's crocodiles, and should in fact support quite a large population: effective conservation measures for this species would allow its numbers to grow, and for it to become a significant tourism focal attraction.

Aguacaliente is likely to harbour good populations of a broad suite of lowland amphibian species, though the potential for significant agrochemical pollution from the nearby mechanized rice farms is considerable. It is quite possible that the globally endangered Sabrinus Rainfrog (*Craugastor sabrinus*) could occur along the broadleaf forest creeks in the vicinity of the karst hills – which would represent the most southerly distribution of this species in Belize.

Birds

The rich diversity of ecosystems from lagoons to broadleaf forest found in Aguacaliente Wildlife Sanctuary supports a wide range of bird species. The lowland broadleaf forest and shrubland ecosystems are important for a variety of birds including hummingbirds, manakins, woodpeckers, woodcreepers, wood warblers and wrens, but the Sanctuary is most famous for its water birds which are found by the creeks, lagoons, and surrounding swamps, savannas and grasslands. The Aguacaliente swamp was described as an extremely important site, being the only major inland wetland in southern Belize and of particular importance for ducks and wood storks (Miller and Miller, 2006).

146 species of bird belonging to 48 families have been recorded so far for Aguacaliente Wildlife Sanctuary, although the actual number of species is expected to be higher (Meerman: 2006). This number is based primarily on a literature survey and supplementary fieldwork carried out for the REA, and also on opportunistic data gathered during the development of this management plan. One species expected to be recorded during the fieldwork for the REA is the grey throated chat (*Granatellus sallaei*), a local endemic which is relatively common in the north of Belize but scarce in the south. It was recorded prior to Hurricane Iris by Lee Jones, from the "Tropical evergreen seasonal broadleaf lowland swamp forest: Aguacaliente variant", but was not found during the survey work in 2006. It is possible that this bird is no longer found in the Sanctuary as a result of the habitat disturbance cause by Hurricane Iris in 2001, the ecosystem in which it was previously recorded having been severely damaged by fires following the hurricane (Meerman, 2006).

Amongst the birds found in Aguacaliente Wildlife Sanctuary are twelve species of national concern, all of which are water birds. One of these, the Buff-breasted sandpiper, has an IUCN status of Near Threatened, and the remaining eleven are listed as Vulnerable in the List of Critical Species for Belize (Meerman 2005). These eleven species and a further seven are listed in a watch list of Belizean waterbirds of conservation concern (Miller and Miller, 2005). (Table 12).

The wetlands of the Aguacaliente Wildlife Sanctuary are important to migratory water birds including the snowy egret, blue winged teal and great egret, which visit the Sanctuary between February and May. The roseate spoonbill, while resident in Belize, also appears to be a visitor to the Aguacaliente wetlands, occurring there between March and May. The buff-breasted sandpiper, a rare transient in Belize, is occasionally seen at Aguacaliente, stopping off during its migration between Arctic North America, and South America (Jones, 2003).

These birds are especially attracted to the area at this time of year as a result of the plentiful food resources, as large numbers of fish become trapped in the diminishing lagoons in the dry season, providing good feeding opportunities for both the resident and migratory birds.

A number of bird species are known to use the Aguacaliente wetlands for nesting, including several species of colonial nesting birds, highlighted as species of concern. During the bird monitoring, a colony of American wood storks was recorded in the south-west corner of the Sanctuary, near the confluence of the Black Creek and Blue Creek. In 2006, it was estimated that 200 pairs were breeding herealong with two other colonial nesters – neotropical cormorants and montezuma oropendolas. To the north east of this site on the Black Creek, a colony of boat billed herons was located with approximately 50 nests (Meerman et. al., 2006).

Table 12: Birds of Concern of AWS

Common Name	Species	Belize Status	Belize Waterbirds Watchlist?
Agami Heron	*Agamia agami*	Vulnerable	Yes
Roseate Spoonbill	*Ajaia ajaja*	Vulnerable	Yes
Anhinga	*Anhinga anhinga*		Yes
Gray-necked Woodrail	*Aramides cajanea*		Yes
Great Blue Heron	*Ardea herodias*	Vulnerable	Yes
Cattle Egret	*Bubulcus ibis var.*		Yes
Green Heron	*Butorides virescens*		Yes
Muscovy Duck	*Cairina moschata*	Vulnerable	Yes
Black-Bellied Whistling Duck	*Dendrocygna autumnalis*	Vulnerable	Yes
Great Egret	*Egretta alba*		Yes
Little Blue Heron	*Egretta caerula*		Yes
Snowy Egret	*Egretta thula*	Vulnerable	Yes
Tricolored Heron	*Egretta tricolor*	Vulnerable	Yes
Jabiru	*Jabiru mycteria*	Vulnerable	Yes
Northern Jacana	*Jacana spinosa*		Yes
American Wood Stork	*Mycteria americana*	Vulnerable	Yes
Black-crowned Night-Heron	*Nycticorax nycticorax*	Vulnerable	Yes
Neotropical Cormorant	*Phalacrocorax brasilianus*	Vulnerable	Yes
Buff-breasted sandpiper	*Tryngites subruficollis*		No

The protection of these nesting colonies is of great importance; the presence of so many nesting birds in one location means that any disturbance to these sites has the potential to impact a very large number of birds.

A monitoring programme is in place to examine the importance of the Sanctuary to the different bird species and the seasonality of their use of the Sanctuary, with monitoring activities carried out by the Aguacaliente Wildlife Sanctuary wardens, covering 6 terrestrial and 3 lagoon focused monitoring sites (Meerman et. al., 2006).

Mammals

A total of thirteen species of mammal from ten families were recorded under the REA for Aguacaliente Wildlife Sanctuary (Meerman et. al., 2006; Table 13). This low number can be attributed to a variety of factors including the limited research conducted to date (especially for

small mammal species such as bats and rodents), a lack of suitable habitat within the Sanctuary, much of the area being wetland and therefore unsuitable for a number of mammal species. Other factors are high hunting pressure, and the conversion of much of the adjacent land to agriculture, with a large number of communities surrounding the Sanctuary. This limits the connectivity between Aguacaliente Wildlife Sanctuary and other still uncleared areas and therefore limits the use of the Sanctuary by larger mammals, particularly those with wide ranges such as the White-Lipped Peccaries. Hunting pressure has decreased as a result of the management of the Sanctuary, but still remains a problem.

Having said this, Aguacaliente Wildlife Sanctuary does support a variety of species of mammal, including some which are attracted to habitats such as swamps and lagoons, for example the Neotropical River Otter and Baird's Tapir. The list of mammals also includes six or seven species of concern. It is not known whether jaguar and puma occur at the Sanctuary, or whether only one of these species occurs, only tracks having been found so far.

Table 13: Mammal species of concern found at Aguacaliente Wildlife Sanctuary

Common Name	Species	IUCN Status	Belize Status
Mexican Black Howler Monkey	*Alouatta pigra*	Endangered	Vulnerable
Ocelot	*Leopardus pardali*		Vulnerable
Margay	*Leopardus wiedii*		Vulnerable
Neotropical River Otter	*Lontra longicaudis*	Data Deficient	Vulnerable
Jaguar*	*Panthera onca*	Near threatened	Near threatened
Puma*	*Puma concolor*	Near threatened	Near threatened
Central American Tapir	*Tapirus bairdii*	Endangered	Vulnerable

*To be verified...tracks of large cats have been seen, but not identified as jaguar or puma

The presence of species such as puma and jaguar within the Sanctuary is encouraging as it demonstrates that there is still connectivity between Aguacaliente Wildlife Sanctuary and other more undisturbed areas, the size of the Sanctuary itself being insufficient to support a population of either of these species.

Two species listed as Endangered by the IUCN, the Yucatan Black Howler Monkey and the Central American Tapir, are found within the Sanctuary. The Yucatan Black Howler Monkey (*Alouatta pigra)*, restricted to broadleaf forest, is a regional endemic, being found only in a relatively small area of Belize, Mexico and Guatemala. The increasing rate of forest fragmentation, and the continued conversion of forest to agriculture, is placing this species at increased risk of local extinction. The number of Yucatan Black Howler monkeys found at Aguacaliente Wildlife Sanctuary is low, probably as a result of the impact on the forest of Hurricane Iris in 2001.

The Central American Tapir (*Tapirus bairdii*) tends to be associated with the creeks, freshwater inundation areas and riversides, where it grazes on herbaceous vegetation. It is thought to be widespread and relatively common in Belize, where it is seldom hunted, the main threat to this species being the increasing rate of habitat fragmentation and conversion to agriculture. The protection of significant tracts of unfragmented riparian vegetation and other suitable habitats is a priority for its continued survival.

Fish

Very little research has been carried out into the fish fauna of Aguacaliente Wildlife Sanctuary and therefore the number of species recorded is uncharacteristically low for the site. A total of 11 species belonging to five families were identified during the REA, but they were surveyed only on an opportunistic basis. Given the suitable habitat found at Aguacaliente Wildlife Sanctuary, the actual number of fish species that occur is probably much higher.

The inundation of large areas of land surrounding the lagoons during the rainy season forms a large area of suitable feeding and breeding habitat for fish, encouraging a high population. The receding water during the dry season forces large numbers of fish into the receding lagoons, so that at this time of year especially, many birds, particularly waders converge upon the area to feed. During the wet season, with increasing water depth, species of fish not normally resident in the Aguacaliente lagoons enter through Blue Creek, leaving the system when the water flow starts to reverse and the system starts to dry up, as is the case at Crooked Tree Wildlife Sanctuary.

The Aguacaliente lagoon is also an important resource for fishing for people from surrounding communities. The Aguacaliente Management Team is currently working on strategies to encourage more sustainable methods of fishing in the Sanctuary. These include a ban on the use of gill nets, issuing a limited number of fishing permits to local, non-commercial fishermen, and increasing awareness of the importance of sustainable fishing.

The presence of Tilapia (*Oreochromis niloticus)* in the Aguacaliente lagoons is a major cause for concern for the native fish population. This species has spread throughout Meso-America following its introduction for aquaculture, and subsequent accidental release which in Belize was primarily due to hurricane flooding. Non-native Tilapia are known to have a detrimental effect on native fish populations by eradicating underwater vegetation, destroying feeding and breeding niches, and promoting outbreaks of parasites among native fish species (Walker and Walker: in prep). The tilapia is a member of the cichlid family and is known to alter the species assemblage of native cichlids. In Nicaragua the biomass of native cichlids has been reduced by 80% as a result of the establishment of tilapia, while at Crooked Tree Wildlife Sanctuary it has been observed that 80% or more of net catch is now composed of tilapia, with huge reductions in the native cichlid species favoured by community members (Walker and Walker: in prep).

Condition of fishing resources

Fish stocks within the Aguacaliente Wildlife Sanctuary are considered to have fallen significantly since the use of nets was introduced. The general perception within the stakeholder communities is that fish stocks are still down on previous levels. A survey was conducted in 2008 to provide baseline data on resource use and perceptions for input into the management planning process, with the following outputs:

Of those who responded:

- 58% of respondents have fished in Aguacaliente Wildlife Sanctuary in the past
- 23% of respondents are still fishing in the Wildlife Sanctuary
- 98% of those who fish, do so to provide food for their household
- 86% of those who fish in Aguacaliente do so primarily during dry season
- The majority of respondents believe that over-fishing, largely caused by the use of nets, is the main reason for the decline in fish resources

Not all communities use Aguacaliente for fishing to the same degree. Respondents from Jordan, Big Falls and Silver Creek, for example, rarely if ever use the area for fishing, stating a preference for the creeks and rivers adjacent to their communities (Table 14).

Of the 157 community respondents who were engaged in fishing 10 years ago, only 63 (23%) were still using the resources. The majority of the communities have shown a significant decline in fishing activitiy.

When asked to rate the fisheries resource in 1998 and 2008, the majority (73%) of fishermen rate the fish resources as 'Very Good' in 1998, the majority (%4%) rate the same resources as 'Not Good' in 2008. This represents a decline of 70% in the number of respondents who consider the resource to be Very Good, over the intervening 10 years. (Table 15).

Table 14: Relative community use of AWS for fishing

Community	% of fishermen using AWS 1998	% of fishermen using AWS 2008
San Marcus	98%	33%
San Antonio	94%	44%
Blue Creek	50%	5%
Big Falls	11%	0%
Laguna	98%	33%
Jordan	0%	0%
Dump	45%	40%
Silver Creek	8%	0%
Mafredi	88%	87%

Table 15: Community perceptions of AWS Fish Resources

Fisheries condition	1998	2008
Very good	73%	3%
Good	23%	23%
Not good	3%	54%
Bad	1%	3%
Very bad	0%	17%

Community perception of the condition of the Aguacaliente fish stock over the last 5 years

During the conservation planning workshop, held on 2nd August, 2008, participants developed a management foal for the fish resources: ***Sustainable fishing, with restoration of native fish and reduced tilapia population*** When asked to provide possible solutions, and suggested the following strategies for achieving this:

Strategy 1: Total ban of gill net use in Aguacaliente Wildlfe Sanctuary
Strategy 2: Develop a plan for sustainable fishing
Strategy 3: Effective surveillance and enforcement, with targeted enforcement of creeks
Strategy 4: Engagement of community leaders, and enforcement through the alcaldes
Strategy 5: Preferential harvest of tilapia – netting under supervision on rotation over a pre-determined timeframe (once a month? Rotation per community?)
Strategy 6: Awareness – if people don't understand the need for sustainable fishing, they won't participate

Management strategies and actions are focused on developing a Sustainable Fisheries Plan, with the enforcement of the complete on the use of nets, to provide the stakeholder communities with a mechanism to lobby with Forest Department to allow continued traditional use of the fish resources of the lagoons and creeks.

2.5.4 Past and Present Research

In the early 1990s Iremonger and Brokaw carried out research in the Aguacaliente area and recognised that it contained two unique ecosystems, describing them as “Seasonal swamp forest of Southern and Central Belize: Aguacaliente variant” and “Swamp grassland” (Iremonger & Brokaw, 1995). In 1998, Meerman and Holt studied the ecosystems of the Aguacaliente area in more detail during a district wide vegetation assessment (Meerman, 1999).

These studies were used in the production of a 1:250,000 ecosystems map for Belize, which includes the Aguacaliente area, under the Central American Ecosystems mapping initiative (Meerman and Sabido, 2001).

In August 2001, shortly before Hurricane Iris, a Rapid Management Assessment was produced for Aguacaliente Wildlife Sanctuary by members of the Las Cuevas Consulting Team, associated with the Natural History Museum of London.

A Rapid Environmental Assessment for Aguacaliente Wildlife Sanctuary was completed in December 2006 (Meerman, 2006). This formed the basis for a bird monitoring programme, implemented by Aguacaliente Wildlife Sanctuary wardens and under the guidance of the Belize Tropical Forest Studies, is ongoing at the Sanctuary. The monitoring is focused on the importance of the Sanctuary for different bird species, primarily waterbirds, and on the seasonality of their use.

Aguacaliente Wildlife Sanctuary is suitable for biological research in a variety of fields, but most specifically is suited to wetland research – fish population studies, adaptations of wetland species, the impacts of climate change on wetlands (especially on wetland plants), carbon and methane sequestration in wetlands.

2.6 Cultural and Socio-Economic Values of Management Area

2.6.1 Community and Stakeholder Use

The Mopan, Q'eqchi', Mestizo, Creole and East Indian people living in these buffer communities have traditionally used the resources of the protected area in various ways for their livelihoods, although to a lesser degree than 10 years ago. These uses include recreation, food, shelter, and medicine. A number of people from San Marcus also use caves and other areas of the Wildlife Sanctuary for traditional spiritual purposes.

People interviewed during the management planning process in the ten communities indicated that they have traditionally been conscious of the importance of managing the resources found in Aguacaliente Wildlife Sanctuary, and all agree that better protection is needed. Presently the resources found in the Wildlife Sanctuary are being extracted with minimum control and there is a recognized need to improve this situation. Communities have traditionally extracted forest products such as house materials, medicinal plants, food, and game for subsistence purposes. Community perception suggests that the majority of the current environmental damage inflicted on the area is the result of over-hunting and over-fishing for commercial purposes, and the removal of traditional building materials – thatch leaves and vines – for the tourism infrastructure in Placencia. The forest is now considered to be over-exploited and natural resources are becoming scarce.

Increasing modernization brought on by road expansion and access to the cash economy has affected the culture of the communities and has contributed to the proliferation of such things as radio, television, motorized transportation, plastics, pesticides, and chemicals. Most families now have gas stoves alongside their fire hearth. The traditional thatch homes with dirt floors are being replaced with zinc roofs and cement floors. In addition, the Government of Belize has provided potable drinking water for most villages and to some extent, electricity and community phones are also accessible. Today's youths are beginning to reflect American values in their dress, behavior, speech, food preferences, and social choices, and move away from the traditional farming to employment.

2.6.2 Archaeological Sites

During the last five decades, archaeologically significant features have been located on the southern coastal plain of Belize, with a temporal span that extends from the Archaic (7000 – 2000 B.C.) to the Early Historic period (1500 – 1900 A.D.) (Awe, 2007). There are a number of known archaeological sites in adjacent areas (Num Li Punit to the east and Lubaantum to the north), and Aguacaliente can be assumed to have been utilized by the Maya of that period. A survey of cave sites in the area south and west of San Antonio village may have included the caves of the karstic hills within the protected area, and could shed light on the use of the wetlands by the Maya.

2.6.3 Tourism and Recreation Use

In 2007, Aguacaliente Management Team implemented a project to provide "Alternative Livelihood through Eco-Cultural Tourism for Aguacaliente Wildlife Sanctuary Indigenous

Communities", to assist stakeholder communities in effectively protecting and managing their natural and cultural resources, and to promote their cultural values and traditional, sustainable land use practices.

The project report (**Summary Document Eco-cultural Tourism Symposium for Aguacaliente Wildlife Sanctuary Indigenous Communities** - Green Grove Consultancy, 2007) provides an in-depth analysis of the context in which tourism needs to be developed, with recommended strategies and guidelines for tourism development (Annex 3). These have been integrated into the management programme strategies, particularly in the areas of Public Use and Community Benefits.

2.6.4 Other Economic Use

There is no current legal economic use other than tourism. Traditional harvesting of natural resources is allowed by the AMT for home use, using approved methods.

2.6.5 Research and Education Use

Other than the bird surveys being implemented by AMT, there is no current ongoing research studies in the Aguacaliente Wildlife Sanctuary.

AMT is trying to increase educational use of the area, and outreach to the schools of the stakeholder communities, but is limited by human resources and

3. Conservation Planning

This conservation planning section looks at the species and ecosystems of concern, at the threats that impact them, and the strategies that can be used within the management of the area to abate these threats.

3.1 Conservation Targets

Conservation targets may be species, species assemblages or ecosystems that are selected as representing the biodiversity of a protected area – such that strategic actions, taken to ensure their continued viability and reduce the pressures impacting them, will adequately address the needs of the system as a whole.

3.1.1 Identification of Conservation Targets

A conservation planning workshop was conducted on 5th August, 2008, with the participation of local community leaders, resource users of the stakeholder communities. After an overview of the concept of conservation targets, and as a first step in the Conservation Planning process, participants suggested a number of potential conservation targets - to represent and encompass the biodiversity and cultural values of the area, and to provide a basis for setting goals, developing strategies and actions, and monitoring success.

An initial list of 25 potential targets considered of biological or cultural importance was first generated (Table 1), from which the final target selection was based. These were then reviewed, combined or nested into a list of nine conservation targets (Table 2), each representing or capturing the array of ecological systems, communities and species at the Wildlife Sanctuary, including those highlighted in the preliminary list.

The nine conservation targets selected for Aguacaliente Wildlife Sanctuary can be divided into subgroups:

Ecosystem Level: Assemblages of ecological communities that occur together, share common ecological processes, and have similar characteristics. Four terrestrial ecosystems have been selected

- ***Broadleaf Forests***
- ***Grassland***
- ***Aquatic Ecosystems***
- ***Cave Systems***

Potential Conservation Targets for Aguacaliente Wildlife Sanctuary

- Broadleaf Forests (1)
- Medicinal Plants (1,6)
- Freshwater mangrove (1)
- Karst Hills (1)
- Jaguar (1)
- Spiritual values (1,7)
- Gibnut (3)
- Baird's Tapir (1)
- Scenic Beauty (1,2, 5, 7)
- Yucatan black howler monkey (1)
- Orchids (1,6)
- White tailed Deer (3)
- Native Fish (4)
- Caves (7)
- Nesting bird colonies (9)
- Birds with Touristic Value (1,5,9)
- Grassland (2)
- Warm Springs (5)
- Great Curassow (3)
- Xate (6)
- Water Birds (5)
- Turtles (including hicatee) (8)
- Crocodiles (5)
- Flood Control Functions (2,5)
- Clean Water (5)

Numbers in brackets indicate the focal conservation target(s) that represents these potential targets, listed in Table 2.

Focal Conservation Targets for Aguacaliente Wildlife Sanctuary

1. Broadleaf Forests (including swamp forest)
2. Grassland
3. Game Species
4. Native Fish
5. Aquatic Ecosystems
6. Non-timber Forest Products
7. Cave Systems
8. Turtles (including hicatee)
9. Nesting bird colonies

Species Assemblages: Groups of species that share common natural process or have similar conservation requirements:

- ***Game Species***
- ***Native Fish Species***
- ***Non-timber Forest Products***
- ***Turtles (including Hicatee)***
- ***Nesting Bird Colony Species***

The justification for Conservation Target selection, and a summary of the species, communities and ecological system represented by these targets is summarized in Table 16:

Table 16: Conservation Targets

Conservation Target	Justification for Target Selection	Species, Communities or Ecological Systems Represented by Target
Broadleaf Forest	Protection of this ecosystem provides protection for many species, including those important to local communities, and to tourism. It also protects the spiritual value of the area	Commercial timber species – including mahogany, cedar and rosewood Species that have a touristic value – orchid, bird and mammal species, including the Endangered Baird's Tapir and the regional endemic – the Yucatan black howler monkeys. Scenic values of the broadleaf forest
Grassland	The grassland has been identified as a unique ecosystem in Belize, only present in of the wetland basinAWS, where it is inundated for eight months of the year.	'Swamp grassland without trees or shrubs', dominated by the grass *Neeragrostris contrerasi.* Buff breasted sandpipers
Game Species	Species considered of cultural importance, targeted by local hunters.	Great curassow, paca (gibnut), white tailed deer, collared peccary, armadillo, agouti, tinamou
Native Fish Species	Species considered of cultural importance, targeted by local fishermen. Currently being heavily impacted by both fishing pressure and the presence of the Tilapia (*Oreochromis niloticus*)	The fish species that support the local fisheries - cichlids ('Crana', 'tuba'), catfish and dormilon, machaca and tarpon, as well as smaller species not harvested for food.
Aquatic Ecosystems	Recognized as an important component of the resources of the Park – particularly with the importance of its flood control functions. The wetlands, lagoons and creeks charactize the Wildlife Sanctuary, and support many of the species considered culturally important	Includes the waterbirds – agami heron, jabiru, wood stork, roseate spoonbill, anhinga, muscovy duck, great blue heron, and snowy egret, among others. Also represented are the Morelet's crocodile, and the amphibians and invertebrates reliant on the wetland ecosystems.

Table 16: Conservation Targets (continued)

Conservation Target	Justification for Target Selection	Species, Communities or Ecological Systems Represented by Target
Non-timber Forest Products	Non timber forest products have been traditionally harvested from the area	Medicinal plants, house construction materials (thatch leaf, tie-tie vine). Xate
Caves	Recognized as an important component of the protected area, for its spiritual values, and for the cave species	Bats and other cave dwellers. The caves are also conisder
Turtles (including Hickatee), and Green Iguana	Hunted for meat, the turtles are highlighted due to the rapid decline in numbers – particularly of the hickatee	The Critically Endangered Central American River Turtle (hickatee – *Dermatemys mawii*), and the Near Threatened bocotura (Common Slider Turtle - *Trachemys scripta*). and sambodango (Snapping turtle – *Chelyda serpentine*). Also included is the Green Iguana (*Iguana iguana*)
Nesting Colony Bird Species	One of the primary touristic values of the area, and particularly vulnerable to disturbance	Wood storks, boat billed herons, Neotropical cormorants, Montezuma's oropendola

3.1.2 Assessment of Conservation Target Viability

The Viability Assessment, as conducted under the Conservation Planning process, provides a:

- means for determining changes in the status of each focal conservation target over time, allowing the Aguacaliente Management Team to measure success of its conservation strategies, compare the status of a specific focal target with future conditions, and with other projects in Belize / Central America that focus on that target
- basis for the identification of current and potential threats to a target and identifies past impacts that require mitigation actions
- basis for strategy design and a framework for monitoring

For each conservation target, viability is assessed to give a reflection of abundance and condition within the protected area (Table 17). Community and stakeholder workshops provide input into the rating of each target as Very Good, Good, Fair, or Poor, based on site specific knowledge of the ecosystems and species selected, local knowledge and social conditions, using the viability ratings developed by TNC.

Viability Ratings

Very Good:	Requires little or no human intervention to maintain conservation target at acceptable level (e.g. healthy, breeding populations, minimally impacted ecosystems)
Good:	May require some human intervention to maintain conservation target at acceptable level (e.g. reducing / preventing hunting pressure)
Fair:	Requires human intervention - if unchecked, the conservation target will be seriously degraded
Poor:	If allowed to remain in the present status, restoration or preventing local extinction will be impossible

(Adapted from TNC 5-S System)

Justification is provided for the current viability rating, and a future viability goal is determined that is considered feasible within the 5-year term of the management plan, assuming the identified strategic actions are successfully implemented. Viability indicators are also listed, to enable the co-management agency to monitor viability on an ongoing basis.

Table 17: Conservation Target Assessment

Conservation Target	Current Rating	Goal	Justification for Rating, Goal and Indicator
Broadleaf Forest	**FAIR**	**GOOD**	***Justification:*** Increased clearance of broadleaf forest – mechanized farming, slash and burning. Limited illegal logging in buffer zone. Impacts from escaped fire from agricultural burning and hunting. Hurricane damage, causing a shift to pioneer species NB: Swamp forest is rated as 'VERY GOOD'
			Goal: GOOD: Broadleaf forest will take time to recover, but is regenerating slowly with protection. Mahogany / cedar / rosewood seedlings coming up.
			Indicators: Number of hunting fires per annum; acres of broadleaf forest cleared for agriculture within pa boundaries
Grassland	**FAIR**	**VERY GOOD**	***Justification:*** Area of grassland remains constant, but increased incidence of fire is altering the grass species composition, and thought to be resulting in increased 'prickle'. Past cattle grazing of the area (from Mafredi and Yemeri Grove) may have once kept this plant down and assisted in maintaining the grassland habitat. Hurricane Iris resulted in the removal of large trees that used to inhabit the area, and which are also thought to have prevented the growth of the invasive 'prickle'.
			Goal: VERY GOOD – with a reduced area with 'prickle' and a reduced incidence of fire
			Indicators: Number of fires, Area of 'prickle'
Game Species	**POOR**	**FAIR**	***Justification:*** Game species – deer, peccary, armadillo, agouti, curassow, tinamou and paca (gibnut) are all decreasing in numbers due to hunting pressure.
			Goal: FAIR…increased numbers of game species, providing replenishment to adjacent areas
			Indicators: Number of patrols, number of rangers, number of game species sightings
Native Fish Species	**POOR**	**FAIR**	***Justification:*** Crana, tuba,. Great reduction in native fish species. Large numbers of tilapia. Declining catfish and dormilon – used to be preferred fish. Pond has primarily tilapia. Heavy fishing pressure
			Goal: FAIR, Increased numbers of native fish species
			Indicators: Number of native fish caught, measured and released during Tilapia netting; fewer illegal fishermen recorded

Conservation Target Assessment / 2			
Conservation Target	**Current Rating**	**Goal**	**Justification for Rating, Goal and Indicator**
Aquatic Ecosystems	**GOOD**	**GOOD**	***Justification:*** Aguacaliente and Pica Piedra creeks poisoned for fishing (tie tie vine). Garbage in creek (which creek?)s, potential for agrochemical pollution from farms adjacent to water's edge. Machinery by waters edge, cattle ranching, sedimentation from land clearance at water's edge and on banks of Moho River…lagoon shallower. Blue Creek flows into Aguacaliente – people bring canoes into pa for hunting / fishing.
			Goal: GOOD. Maintain the current level as Good
			Indicators: Number of fish kills; Agricultural activity within 50metres of water's edge; water quality
Turtle Speces	**POOR**	**FAIR**	***Justification:*** Hunted throughout Aguacaliente Wildlife Snactuary, with heavy impacts on the populations
			Goal: FAIR. Increase the numbers of turtles and iguanas within the Wildlife Sanctuary
			Indicators: Number of turtles / iguanas recorded during patrols
Non-timber Forest Products	**GOOD**	**VERY GOOD**	***Justification:*** Medicinal plants are rated Good – not collected or used by too many people. Xate is rated as Fair – localized in pockets, and harvested illegally where it occurs. Building products (vines, leaves) rated as Good, however there is commercial collection of tie-tie vines for tourism infrastructure in Placencia, and these are considered to be increasingly hard to find as a result
			Goal: VERY GOOD. Sustainable harvesting; Xate resources regenerating towards natural levels & condition
			Indicators: Number of people harvesting NTFP; Number of uncut xate leaves, young plants; Reports of xatero activity
Caves	**VERY GOOD**	**VERY GOOD**	***Justification:*** Whilst there has been little focus on the caves in the past, and it is possible that there has been some looting. However, they are generally considered to currently have few impacts
			Goal: VERY GOOD**.** Condition is maintained as very good, without increased impacts
			Indicators: Number of reports of impacts on caves; Number of targeted patrols that include caves
Colony Nesting Bird Species	**VERY GOOD**	**VERY GOOD**	***Justification:*** There are thought to be few current impacts on the colony nesting birds within the Wildlife Sanctuary
			Goal: VERY GOOD**.** The current rating is maintained as very good, without increased impacts
			Indicators: Number of active Wood Stork nests; Number of reports of disturbance of bird colonies

The results of the workshop output on Conservation Target viability are summarized (Table 18), with proposed management strategies targeted at increasing viability ratings over time.

Table 18: Conservation Targets – Current Rating		
Conservation Target	**Current Rating**	**Goal**
Games Species	**Poor**	**Fair**
Native Fish Species	**Poor**	**Fair**
Turtles (incl. Hickatee) and iguana	**Poor**	**Fair**
Broadleaf Forest	**Fair**	**Good**
Grassland	**Fair**	**Good**
Aquatic Ecosystems	**Good**	**Good**
Non-timber Forest Products	**Good**	**Good**
Caves	**Very Good**	**Very Good**
Colony Nesting Birds	**Very Good**	**Very Good**

Summary of Conservation Target Viability – Prioritisation

Using the Viability Ratings, it is possible to prioritize the conservation importance of each of the Conservation Targets within the Aguacaliente Wildlife Sanctuary, to assist decision making in allocation of funding and future project targets.

Priority	Conservation Target	Viability Rating
High Priority	*Native Fish Species*	Poor
	Turtles (including Hicatee)	Poor
	Game Species	Poor
Medium Priority	*Broadlead Forest*	Fair
	Grassland	Fair
	Aquatic Ecosystems	Good
	Non-timber Forest Products	Good
Lower Priority	*Caves*	Very Good
	Colony Nesting Birds	Very Good

3.2 Threats to Biodiversity

A fully participatory threat analysis was conducted in 2008 for the biodiversity assessment process, with input from the stakeholder communities considered to have knowledge of the protected area – particularly community leaders, hunters and fishermen, and members of Aguacaliente Management Team.

3.2.1 Identifed Threats

Outputs from the threat assessment identified eight threats as impacting the Wildlife Sanctuary (Table 19). These were then assessed using a series of three criteria to allow prioritization of conservation actions and resources towards mitigating those identified as the most critical threats.

This assessment rated:

- the area affected by the threat
- the severity of the threat
- the urgency of actions needed to mitigate the threat

following the methods outlined (Figure 6).

Threats identified as impacting Aguacaliente Wildlife Sanctuary

- Unsustainable Fishing
- Unsustainable Hunting
- Unsustainable Turtles Hunting
- Agriculture – mechanized and milpa
- Fires
- Uncontrolled Visitor Impacts
- Invasive Species - Tilapia
- Unsustainable Harvesting of Non-timber Forest Products

Table 19

Figure 6: Rating Critical Threats

The critical threats are assessed by Area, Severity and Urgency, using the following criteria:

☐ **Area:** The area of the threat (how much of the conservation target area it affects)

Proportion of Area Affected (adapted from WCS)		
Criteria	**Score**	
Area	**4**	Will affect throughout >50% of the area
	3	Widespread impact, affecting 26 – 50% of the area
	2	Localized impact, affecting 11 – 25% of the area
	1	Very localized impact, affecting 1 – 10% of the area

☐ **Severity:** The severity of the threat – how intense or great the impact is

Severity Ranking (adapted from WCS)		
Criteria	**Score**	
Severity	**3**	Local eradication of target possible
	2	Substantial effect but local eradication unlikely
	1	Measurable effect on density or distribution
	0	None or positive

☐ **Urgency:** The likelihood of the threat occurring over the next five years

Urgency Ranking (adapted from WCS)		
Criteria	**Score**	
Urgency	**3**	The threat is occurring now and requires action
	2	The threat could or will happen between 1 – 3 years
	1	The threat could happen between 3 – 10 years
	0	Won't happen in > 10 years

Threats to biodiversity of the Aguacaliente Wildlife Sanctuary

Unsustainable Fishing

Status: ACTIVE

Target: NATIVE FISH SPECIES

Threats (*Direct*)*:*

- Unsustainable Fishing – spear gun, gill net, poison
- Sedimentation of the AWS pond, with decreased water depth and increase in water temperature
- Invasive species – Tilapia – with elimination of local species

Source (Indirect Threat)***:***

- Traditional food source
- For sale, as mechanism to fund medical or education costs
- Poor management and/or flooding of Tilapia farms

NB. Three commercial fishermen have been reported in 2008 - 2 commercial from San Pedro Columbia, and 1 from Jordan.. now stopped

Area	***4***	Fishing occurs thtoughout the lagoons and creeks
Severity	***3***	If unsustainable fishing continues, the native fish populations will collapse
Urgency	***3***	Fishing is an ongoing activity and requires action

Management Goal: *Sustainable fishing, with restoration of native fish and reduced tilapia population*

Management Strategies:

Strategy 1: Total ban of gill net use in Aguacaliente Wildlfe Sanctuary

Strategy 2: Develop a plan for sustainable fishing

Strategy 3: Effective surveillance and enforcement, with targeted enforcement of creeks

Strategy 4: Engagement of community leaders, and enforcement through the alcaldes

Strategy 5: Preferential harvest of tilapia – netting under supervision on rotation over a pre-determined timeframe (once a month? Rotation per community?)

Strategy 6: Awareness – if people don't understand the need for sustainable fishing, they won't participate

Threats to biodiversity of the Aguacaliente Wildlife Sanctuary

Unsustainable Hunting

Status: ACTIVE

Target: GAME SPECIES

Threats (*Direct*)*:*

- Over hunting – Outsiders with vehicles and spotlights, Overkill during dry season, hunting out of season
- Illegal weapons

Source (Indirect Threat)***:***

- Traditional diet
- Lack of alternative income
- Lack of co-operation / unsupportive stakeholders
- Sport Hunting, shooting animals for fun
- No regard for wildlife law

Area	***4***	Hunting occurs throughout the area
Severity	***3***	Hunting is considered to be having a substantial effect on the game species populations
Urgency	***3***	Hunting is an ongoing activity and requires action

Management Goal: Sustainable and seasonal hunting to improve viability of game species

Management Strategies:

Strategy 1: Lobby for extension into Machaca Forest Reserve as a sustainable use zone, with permitted hunting for traditional users

Strategy 2: Develop sustainable hunting plan and regulations for Machaca Forest Reserve extension

Strategy 3: Enforce seasonal hunting regulations and ban on all night hunting within Machaca Forest Reserve extension, with assistance from FD

Strategy 4: Awareness campaign on the benefits of AWS as a game species refuge for restocking of peripheral areas

Strategy 5: Environmental Education in primary schools

Threats to biodiversity of the Aguacaliente Wildlife Sanctuary

Hunting of Turtle Species	***Status: ACTIVE***		
	Target: TURTLE SPECIES (and iguana)		
	Threats (*Direct*)*:* ▪ Over hunting of turtles (hickatee, bocotora, 3 skeels, and sambodango) and Green Iguanas ▪ Destruction of nesting grounds ▪ Hunting out of season		
	Source (Indirect Threat)***:*** ▪ Traditional diet ▪ Source of income ▪ Easy to catch		
	Area	***4***	Will affect populations throughout more than 50% of area
	Severity	***3***	Local eradication is possible
	Urgency	***3***	It is occurring now and requires action
	Management Goal: To maintain populations of turtles and iguanas within Aguacaliente Wildlife Sanctuary, ***Management Strategies:*** ***Strategy 1:*** *Moratorium on hunting of turtles & iguanas for at least 3 years* ***Strategy 2:*** *Raise awareness locally and nationally of importance of AWS in conservation of hicatee* ***Strategy 3:*** *Hire more rangers to enforce regulations* ***Strategy 4:*** *Engage local authorities and other conservation organizations to assist in the enforcement of laws and in the outreach campaign*		

Threats to biodiversity of the Aguacaliente Wildlife Sanctuary

Poor Agricultural Practices (Agriculture – Fires and Agrochemical Contamination)

Status: ACTIVE

Target: Aquatic Ecosystems (agrochemical contamination and sedimentation)
Grasslands (escaped milpa fires)

Threats (*Direct*)*:*

- Fire impacts on grassland, with shifts in species composition
- Impacts on grassland species (eg. nesting birds)
- Increase in siltation of lagoon from erosion
- Increased water temperature

Source (Indirect Threat)***:***

- Escaped land clearance fires
- Agro-chemical runoff into the lagoon
- Farming is main source of income for stakeholder communities
- Clearance of 66' waters edge vegetation along creeks and Moho River upriver from protected area
- No visible boundary line
- Limited presence of park personnel

Area	*3*	Wide spread impact
Severity	*2*	Substantial effect
Urgency	*3*	Threat is happening now and requires action

Management Goal: *To reduce the negative impacts of agricultural activities near the protected area to improve grassland and forested areas and prevent agrochemical contamination of the lagoons and creeks.*

Management Strategies:

Strategy 1: *Clearly demarcate AWS boundary*

Strategy 2*: Assist farmers to engage in mulch farming rather than slash & burn*

Strategy 3: *Educate mechanized farmers on non-toxic herbicide to use in their farms and to leave a buffer areas along protected area boundary and water ways*

Strategy 4: *Hire more park rangers to monitor agriculture activities in boundary area*

Strategy 5: *Carry out regular water quality tests*

Strategy 6: *Engage FD and Department of Agriculture to enforce existing laws*

Strategy 7: *Fire Awareness in all buffer communities, targeted particularly at hunters and farmers*

Strategy 8: *Fire control & management training to rangers/community members*

Threats to biodiversity of the Aguacaliente Wildlife Sanctuary

Fires (Non-Agricultural in origin)	***Status: ACTIVE***		
	Target: Grasslands		
	Threats (*Direct*)*:* ▪ Destruction of unique grassland habitat ▪ Impacts on grassland species (eg. nesting birds)		
	Source (Indirect Threat)***:*** ▪ Burning by hunters - ashes and young grass shoots are attractive to deer ▪ Negligence and carelessness of fishermen/hunters ▪ Lack of co-operation with AMT management		
	Area	3	Wide spread impact of grassland area
	Severity	3	Local eradication of target possible
	Urgency	3	Threat is occurring now and requires action
	Management Goal: *Stop and control all burning within AWS and adjacent areas.* ***Management Strategies:*** ***Strategy 1:*** *Full time ranger presence* ***Strategy 2:*** *Engage FD and Department of Agriculture to enforce existing laws on agricultural fires* ***Strategy 3:*** *Fire Awareness in all buffer communities, targeted particularly at hunters and farmers* ***Strategy 4:*** *Fire control & management training to rangers/community members*		

Threats to biodiversity of the Aguacaliente Wildlife Sanctuary

Harvesting of Products (Medicinal plants, xate)	***Status: ACTIVE***		
	Target: Forest		
	Threats (*Direct*)*:* ▪ Reduced populations of traditional forest products ▪ Tie tie vines being harvested for sale in Placencia; xate being harvested unsustainably		
	Source (Indirect Threat)***:*** ▪ Market demand ▪ Traditional use		
	Area	4	Wherever these resources occur
	Severity	3	Not harvested sustainably
	Urgency	3	Occurring now
	Management Goal: Conserve non-timber forest products within Aguacaliente Wildife Sanctuary ***Management Strategies:*** ***Strategy 1:*** Increase surveillance and enforcement ***Strategy 2:*** Develop access mechanisms for local home use in Machaca buffer zone, developing ownership and community protection		

Prioritizing Threats

Once the threat assessment has been completed, it is important to prioritize threats, to indicate where financial and human resources need to be most focused. This is done through the National Management Plan Framework prioritization process.

The threats are listed, and for each threat, the scores are transferred from the previous threat assessment:

Threats	*Criteria Rankings*			*Total Ranking*
	Area	*Severity*	*Urgency*	
Unsustainable fishing	***4***	***3***	***3***	***36***
Unsustainable harvesting of turtle and iguana	***4***	***3***	***3***	***36***
Harvesting of non-timber forest products	***4***	***3***	***3***	***36***
Non-agricultural Fire	***3***	***3***	***3***	***27***
Unsustainable hunting	***4***	***2***	***3***	***24***
Poor Agricultural Practices	***3***	***2***	***3***	***18***

The threat with the highest total threat score is ranked as the highest threat. This places unsustainable harvesting – whether fishing or harvesting of turtles or non-timber forest products - as the highest priority, followed by fire impacts.

3.3 Strategies to Reduce Threats

During the threat assessment process, the primary cross cutting strategies were identified for effective management of the Gales Point Wildlife Sanctuary (Table 17).

Primary Cross Cutting Strategies	Broadleaf Forests	Grassland	Game Species	Native Fish Species	Aquatic Ecosystems	Non-timber Forest Products	Cave Systems	Turtles (including Hickatee)	Nesting Bird Colonies
Effective surveillance and enforcement									
Hire more rangers to enforce regulations									
Clearly demarcate AWS boundary									
Engage FD and Dept. of Agric. to enforce existing laws									
Engagement of community leaders, and enforcement through the alcaldes									
Increase awareness of benefits of AWS									
Environmental Education in primary schools									
Engage local authorities and conservation organizations to assist in the enforcement of laws									
Fire Awareness in all buffer communities, targeted particularly at hunters and farmers									
Fire control & management training to rangers /community members									
Educate mechanized farmers on non-toxic herbicide to use in their farms and to leave a buffer areas along protected area boundary and water ways									
Lobby for extension into Machaca Forest Reserve as a sustainable use zone									

Primary Cross Cutting Strategies	Broadleaf Forests	Grassland	Game Species	Native Fish Species	Aquatic Ecosystems	Non-timber Forest Products	Cave Systems	Turtles (including Hickatee)	Nesting Bird Colonies
Assist farmers to engage in mulch farming rather than slash & burn									
Monitor water quality									
Preferential harvest of tilapia									
Total ban of gill net use in Aguacaliente Wildlfe Sanctuary									
Development and implementation of sustainable fisheries plan and zonation									
Develop sustainable hunting plan and regulations for Machaca Forest Reserve extension									
Enforce seasonal hunting regulations and ban on all night hunting within Machaca Forest Reserve extension									
Moratorium on hunting of turtles & iguanas for at least 3 years									

4. Management Planning

4.1 Management and Organizational Background

Aguacaliente Wildlife Sanctuary is managed by the Aguacaliente Management Team (AMT), a community-based organization that was established in 1996 following the recommendations of the Environmental Social and Technical Assistance Project (ESTAP). AMT was formally registered as a Community Based Organization (CBO) in August 2001. The organization consists of ten communities: Yemery Grove, Laguna, San Marcos, Dump, Big Falls, Silver Creek, Mafredi, San Antonio, Blue Creek and Jordan. Each of these communities elects three community representatives, from which a ten-member elected Executive Committee is formed, which is in charge of administrating the daily affairs of the Wildlife Sanctuary and Management Team.
.
The Aguacaliente Management Team is tasked with the role of education, conservation, with the protection and management of the Aguacaliente Wildlife Sanctuary (AWS) as its main purpose. It is also tasked with improving the livelihood of the communities that rely on the natural resources from the area.

Mission

To ensure the conservation of the natural environment of the Aguacaliente Wildlife Sanctuary and its surroundings while promoting and maintaining the cultural heritage and economic survival of the people in the surrounding communities.

Vision

Aguacaliente Management Team will be successful in making Aguacaliente Wildlife Sanctuary a renowned protected area for biodiversity, both nationally and internationally, and in helping the communities surrounding the area to prosper whilst fostering a healthy relationship with the Sanctuary.

Philosophy of the Organization

1. That it will endeavor to provide equal opportunity for all individuals of the communities.
2. That for the organization to be effective and efficient requires that there be unity and teamwork.
3. That true success will be determined to a large degree by the degree to which the communities are empowered and their cultural heritage is maintained.
4. That as a CBO all of its affairs must be transparent.
5. That conservation and management of natural resources must be based on sound scientific research.
6. That the organization must be accountable for funds received and use such funds in an efficient manner.

Aguacaliente Management Team Strategic Plan, CARD, 2005

4.2 Review of Previous Management Effectiveness

Aguacaliente Management Team participated in a national review of management effectiveness in July, 2006, using the Management Effectiveness Tracking Tool developed under the NPAPSP. This has more recently been updated by the Forest Department (2008).

Individual Indicators*	
Indicator Category	**Average Score (out of a possible Score of 4)**
1. Resource Information	2.42
2. Resource Administration, Management and Protection	2.44
3. Participation, Education and Socio-Economic Benefit	2.46
4. Management Planning	1.00
5. Governance	2.50
6. Human Resources	2.14
7. Financial and Capital Management	1.88
Overall	**2.12**

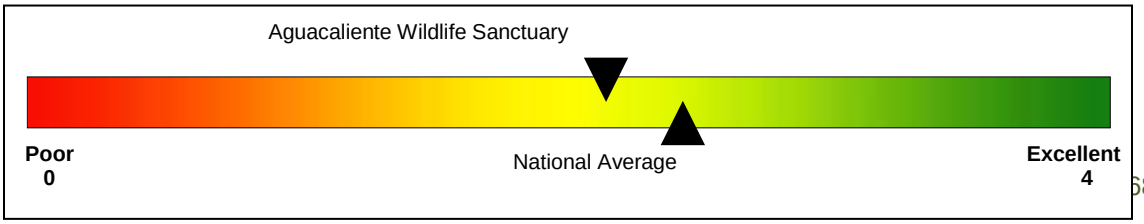
***** Indicators and Indicator categories used are from Young et. al., 2005

Table 20: Summary of outputs from the 2006 NPAPSP assessment of Management Effectiveness

Figure 7: Range of Indicator Category average scores for management effectiveness of Aguacaliente Wildlife Sanctuary (2006)

1. Resource Information
2. Resource Administration, Management and Protection
3. Participation, Education and Socio-Economic Benefit
4. Management Planning
5. Governance
6. Human Resources
7. Financial and Capital Management

Whilst this assessment is not designed to give comparisons between protected areas, it is useful to compare the performance of management of Aguacaliente Wildlife Sanctuary with the average for all protected areas assessed. Overall, the assessed protected areas score a total average of **2.51**. When averaged across the seven Indicator Categories, management of Aguacaliente Wildlife Sanctuary scored **2.12**.



Conclusions and Recommendations

With an overall rating of **MODERATE** in 2006**,** the following general conclusions and recommendations for areas requiring strengthening were made, based on the assessment results (for recommendations for more specific actions see the full management effectiveness report (Walker Z. and Walker P., 2006):

1. Resource Information

In 2006, the management of Aguacaliente Wildlife Sanctuary was assessed as being strong in having adequate baseline information on cultural and archaeological resources, and on the socio-economic context of the protected area, however it was weak in many other areas of resource information. This has been addressed through the implementation of a rapid ecological assessment – which strengthens the core baseline data available for management (except for fish). Systematic viability and threat assessments have been conducted during the management planning process.

2. Resource Administration, Management and Protection

The management of Aguacaliente Wildlife Sanctuary was assessed as being strong in its legal status, but weak in permitting processes, guidelines for best management practices, boundary demarcation and visitor monitoring activities. There was also scope to strengthen management in the areas of tenure claim conflict resolution, surveillance and enforcement and visitor management activities.

The workshops of the management planning process have acted as a catalyst to reinvigorate the Aguacaliente Management Team, with new representatives being elected

Recommendations from the 2006 Management Effectiveness Assessment for Aguacaliente Wildlife Sanctuary

- Develop strategies and actions towards the development and implementation of effective data management
- Liaise with the Forest Department to strengthen management involvement in permitting processes
- Develop and implement policies for best management practices
- Adequately demarcate boundaries, particularly in identified priority areas
- Further develop and implement visitor monitoring activities
- Strengthen surveillance and enforcement activities
- Develop and implement strategies and actions to strengthen stakeholder participation in management, and opportunities for economic benefits
- Strengthen communications within management, and with stakeholders to develop more informed management and to assist in the dissemination of information
- Determine why participation in the current volunteer programme is low, and develop and implement strategies and actions to strengthen
- Develop and implement strategies and actions to strengthen capacity building activities
- Implement protected area zoning regulations as developed under management planning
- Develop and implement strategies and actions for the establishment of an effective advisory committee
- Develop and implement strategies and actions to strengthen collaboration with other protected area managers
- Develop and implement strategies and actions to increase the availability of operational and administrative staff – either paid or volunteer
- Develop and implement strategies and actions to strengthen revenue generation and financial management.
- Prioritize equipment and infrastructure needs and prioritize financial management accordingly
- Develop strategies and actions to strengthen collaboration with other protected area managers to share technical and scientific expertise and outputs
- Conduct annual human resource assessments for adaptive management
- Develop and implement strategies and actions to increase the availability of the site manager

from each community, and a stated commitment from community leaders to the management of the area. There is, however, still a critical need for increased surveillance and enforcement.

3. Participation, Education and Socio-Economic Benefit

The management of Aguacaliente Wildlife Sanctuary was assessed as being moderately effective in areas of participation, education and socio-economic benefits. Whilst management was not considered adequate in any one field, only moderate strengthening would be necessary in the areas of communications, environmental education, dissemination of knowledge, in its volunteer programme and its capacity building strategy and socio-economic benefits. There was a need of significant strengthening in strategies to engage stakeholder communities, through improved communications, improved mechanisms for stakeholder participation in management and increased socio-economic benefits derived by local communities.

4. Management Planning

In 2006, the management of Aguacaliente Wildlife Sanctuary was assessed as being very weak in all areas of management planning. There was neither a management plan nor an operational plan, and no zoning regulations. Long-term management needs had not been identified, and no monitoring or evaluation of management programmes were in place to measure success.

The management planning process is now complete, and includes prioritized strengthening of the areas assessed as critical weaknesses.

5. Governance

The management of Aguacaliente Wildlife Sanctuary was assessed as being moderately effective in governance: it was strong in having clear protected area objectives, but had scope for significant strengthening management in the operating procedures of its board of directors and in collaboration with other protected area managers. Strengthening of the AMT was highlighted as critical during the management planning process, and the strengthening process has already started.

Site administrative autonomy could also be strengthened. Management was weak in the area of advisory committee operating procedures, and in not yet having a full co-management agreement.

6. Human Resources

Since the original assessment, the management of Aguacaliente Wildlife Sanctuary has remained weak in the area of human resources, being strong only in the experience of the site manager. It is particularly weak in the areas of availability of operational staff, technical & scientific staff, and administrative staff. Limited availability of the site manager is also a limitation to management effectiveness, as is the extent of training activities.

7. Financial and Capital Management

Considerable strengthening is needed in the areas of funding, infrastructure and equipment availability and maintenance, and signage. There is also a need to strengthen financial management. Staff accessibility around the reserve is considered very limited in wet season.

4.3 Management Goals

Under the National Protected Areas Policy and System Plan, there is a move to standardize protected area categories with those of the global conservation community, following the IUCN system. Under this, Aguacaliente Wildlife Sanctuary is designated as a Category IV protected area. This provides guidelines for activities that can take place within the protected areas, to be taken into account during the development of future goals and objectives.

Aguacaliente Wildlife Sanctuary	
CATEGORY IV	Habitat/Species Management Area: Protected area managed mainly for conservation through management intervention
Definition	Area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species
Guidance for Selection	▪ The area should play an important role in the protection of nature and the survival of species (incorporating, as appropriate, breeding areas, wetlands, grasslands, or forests). ▪ The area should be one where the protection of the habitat is essential to the well-being of nationally or locally-important flora, or to resident or migratory fauna. ▪ Conservation of these habitats and species should depend upon active intervention by the management authority ▪ The size of the area should depend on the habitat requirements of the species to be protected and may range from relatively small to very extensive.
Objectives	1. to secure and maintain the habitat conditions necessary to protect significant species, groups of species, biotic communities or physical features of the environment where these require specific human manipulation for optimum management; 2. to facilitate scientific research and environmental monitoring as primary activities associated with sustainable resource management; 3. to develop limited areas for public education and appreciation of the characteristics of the habitats concerned and of the work of wildlife management; 4. to eliminate and thereafter prevent exploitation or occupation inimical to the purposes of designation; 5. to deliver such benefits to people living within the designated area as are consistent with the other objectives of management. **IUCN Protected Area definitions**

4.4 Management Strategies

4.4.1 Regulations

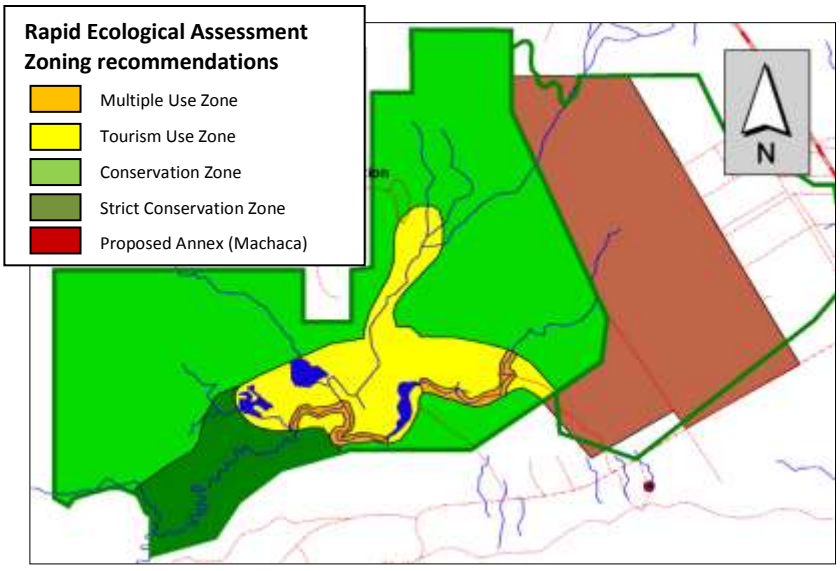
Under the Forest Department, Wildlife Sanctuaries have clearly defined regulations concerning resource use and extraction. Other laws also provide regulations on the use of natural resources (the Wildlife Protection Act, The Fisheries Act, Mines and Minerals Act, Petroleum Act).

There are no current regulations specific to the Aguacaliente Wildlife Sanctuary – their development will be undertaken during the first of the five year implementation period by the Aguacaliente Management Team, in collaboration with the Forest Department and Fisheries Department, to guide the AMT in management of the natural resources.

4.4.2 Management Zones

Initial management zones have been recommended under the Rapid Ecological Assessment (Meerman et. al., 2006; Map 10). This was based on four zones:

- **Multiple use zone:** Specifically for traditional local use (primarily line fishing). This zone overlaps with the tourism zone.
- **Tourism zone:** Provides visitors access to the prime bird watching areas (excluding the bird nesting colonies). The hot-spring area in the north has tentatively been included in this even though there is no current easy access to this area and the hot-springs themselves are at this stage not much of an attraction.
- **Conservation zone:** Those areas without tourism potent
- **Strict conservation zone:** Effectively a stricter zone within the Conservation Zone, containing the major bird nesting colonies along the Black Creek. Access should be for research and monitoring purposes only - tourism access to the colonies are deemed to be too much of a risk, considering the disturbance it might cause.



Map 10: Zoning Recommendations - Rapid Ecological Assessment (Meerman et. al.; 2006)

With the need for watershed protection, and the low management effectiveness rating for the Machaca Forest Reserve, the, Rapid Ecological Assessment (Meerman et. al., 2006) also recommends investigating annexing a portion of Machaca Forest Reserve.

These recommended management zones were discussed at the final community workshop, and agreed on in general, with the exception of which water bodies would be most appropriately zoned for 'no fishing'. In contrast to the REA recommendations, the strong opinions were voiced at the workshops that:

- the creeks and streams are the critical habitat and breeding grounds of the fish
- the creeks and streams are very easily over-exploited by fishermen
- the lagoons are now largely dominated by the exotic tilapia

With these and other actors in mind, the recommendation the community consultations was that the lagoons themselves should be within the Multiple-Use Zone, but that the creeks and streams should be within the Conservation Zone / Strict Conservation Zones. Under this zonation, controlled traditional line fishing would be permitted within the lagoons, but not within the creeks and streams.

4.4.2 Limits of Acceptable Change

With increasing visitation comes the potential for increasing impacts to the environment, presenting the ever-present dilemma of how a protected area can develop a sustainable financial income from tourism without causing significant damage to the natural resources that attract the visitors. This poses the question that, given increasing recreational use and the inevitable impact this will have on the local environment, what are the biophysical and social conditions that should be considered as acceptable to both the management organization and to visitors.

Planning for the mitigation of visitor impacts is based on the recognition of a number of specific values that are essential for both the conservation management of the area and for future appreciation by visitors.

- The quality of the environment, which forms the basis for all other human values and benefits associated with the protected area
- The dependence of recreational activities on the maintenance of near-pristine conditions
- The importance of economic and social benefits to both local stakeholders and to the Belize economy as a whole
- The value of the protected area as a recreational and educational resource

With the relative the limited tourism currently being experienced in the Aguacaliente Wildlife Sanctuary, it is suggested that the development of a full Limits of Acceptable Change programme should not be considered for at least the initial two years of plan implementation, to enable the Aguacaliente Management Team to focus on building its management capacity and increasing its community support. Some attention should be paid, however, to potential visitation impacts on the nesting birds, and on the cave systems.

4.4.3 Management Constraints and Limitations

This Management Plan has been developed with the assumption that Aguacaliente Management Team can increase community engagement and active participation. Whilst having a dedicated project coordinator, the Aguacaliente Management Team needs to build (and is in the process of rebuilding) an active Board as a matter of urgency if it wants to fulfill its co-management position, and revitalize its position within the ten stakeholder communities.

Checklist for Effective Protected Area Management

- Be clear about objectives
- Seek local support
- Build partnerships
- Plan for financial sustainability
- Don't prohibit more than necessary
- Build for the unforeseen
- Put in place structures for conflict resolution
- Establish self-enforcement as much as possible

Figure 8: Adapted from Kelleher, 1999

Current operational constraints include the lack of a dedicated, paid staff members, and equipment and capacity for effective surveillance and enforcement.

Development of the management plan has also taken into account recommendations for effective protected area management (Figure 8; Kelleher, 1999).

4.5 Management Programmes and Objectives

The Aguacaliente Management Team had been the co-management partner for Aguacaliente Wildlife Sanctuary since its establishment, and was formed from representatives from each of the stakeholder communities. It has been recognized, however, that regaining and maintaining past community support and participation needs to be a high priority within the Management Programme activities, as well as increasing communication and effective surveillance and enforcement activities.

This has to be in close collaboration with the Village Councils and Alcaldes of the stakeholder communities. Several of the management activities are specifically focused on establishing mechanisms to facilitate community participation, whilst also ensuring that the conservation planning activities are implemented effectively.

It should be borne in mind that the Programmes of a Management Plan are interconnected over space and time, supporting each other and forming a whole that is greater than the single parts. As such, Management Programmes cannot be considered individually, but must be seen in terms of a bigger picture – the integrated management of Aguacaliente Wildlife Sanctuary towards the fulfillment of the Management Objectives (Figure…).

Management Programmes

There are six programmes within the overall Management Strategy for the Aguacaliente Wildlife Sanctuary:

A. Natural Resource Management Programme
B. Research and Monitoring Programme
C. Community Participation Programme
D. Public Use Programme
E. Site and Infrastructure Management Programme
F. Administration Programme

When prioritizing activities within these programmes, the results of the Conservation Planning prioritization have been taken into account:

Priority	Conservation Target	Viability Rating	Primary Threat within AWS
High Priority	*Native Fish Species*	Poor	Unsustainable Fishing
	Turtles (including Hicatee)	Poor	Unsustainable Harvesting
	Game Species	Poor	Unsustainable Hunting
Medium Priority	*Broadleaf Forest*	Fair	Agricultural Incursions
	Grassland	Fair	Fire
	Aquatic Ecosystems	Good	Agricultural Contamination
	Non-timber Forest Products	Good	Unsustainable Harvesting
Lower Priority	*Caves*	Very Good	Uncontrolled Visitation
	Colony Nesting Birds	Very Good	Uncontrolled Visitation

The management programmes also take into account recommendations voiced during the three workshops conducted as part of the planning process (Annex 4)

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Lower Priority	*Caves*	Very Good	Uncontrolled Visitation
	Colony Nesting Birds	Very Good	Uncontrolled Visitation

A. Natural Resource Management Programme

Vision

To ensure the continued maintenance of biodiversity and hydrological processes to promote and maintain healthy, functioning ecosystems and viable populations of all species within the Aguacaliente Wildlife Sanctuary.

Management Goals:

- Sustainable fishing, with restoration of native fish and reduced tilapia population
- Sustainable and seasonal hunting to improve viability of game species
- To maintain populations of turtles and iguanas within Aguacaliente Wildlife Sanctuary
- To reduce the negative impacts of agricultural activities near the protected area to improve grassland and forested areas and prevent agrochemical contamination of the lagoons and creeks.
- Conserve non-timber forest products within Aguacaliente Wildife Sanctuary

Objective	Activity Areas	Actions
To provide the framework for effective natural resource management	▪ Reconsolidation of the institutional structure of the Aguacaliente Management Team	A1
	▪ Develop regulations for Aguacaliente Wildlife Sanctuary	A2
	▪ Finalise management zones and zone regulations	A3
	▪ Increase communication, participation and collaboration with stakeholder communities	A4
	▪ Increase communication, participation and collaboration with other conservation organizations	A5
To develop and implement measures for increasing viability of biodiversity	▪ Demarcate and maintain survey lines in areas of conflict on boundaries	A6
	▪ Ensure awareness of boundaries of conservation area and regulations	A4
	▪ Increase effectiveness of surveillance and enforcement activities	A7 – A14
	▪ Establish monitoring programme for threats	A15
Increase the viability of Conservation Targets of the Aguacaliente Wildlife Sanctuary	**Aquatic Ecosystems**	
	▪ Develop a better understanding of the hydrology of the Aguacliente Wildlife Sanctuary and impacts on water quality	A16, A18
	▪ Develop strategies to reduce agro-chemical impacts on Aguacaliente Wildlife Sanctuary	A17, A19 A20
	▪ Ban on hunting crocodiles within AWS	A21
	Native Fish Species	
	▪ Total ban of gill net use and poisons in Aguacaliente Wildlfe Sanctuary	A22
	▪ Develop and implement plan for sustainable traditional fisheries	A23

Increase the viability of Conservation Targets of the Aguacaliente Wildlife Sanctuary (continued)	**Game Species**	
	▪ Enforcement of moratorium on hunting within Aguacaliente Wildlife Sanctuary	A33
	▪ Lobby for extension into Machaca Forest Reserve as a sustainable use zone, with permitted hunting for traditional users	A34
	▪ Develop sustainable hunting plan and regulations for Machaca Forest Reserve extension	A35, A36
	▪ Investigate mechanisms for decreasing hunting impacts	A37
	Turtles and Iguanas	
	▪ Moratorium on hunting of turtles & iguanas for at least 3 years	A38. A39
	▪ Develop and implement Hicatee Recovery Plan for Aguacaliente Wildlife Sanctuary in collaboration with other conservation organizations	A40– A44
	Grasslands	
	▪ Develop and implement Fire Management strategies for Aguacaliente Wildlife Sanctuary	A45-A47
	Broadleaf Forest	
	▪ Adequate monitoring of adjacent agricultural areas to ensure incursions into Aguacaliente Wildlife Sanctuary are prevented	A48, A49
	Non-Timber Forest Products	
	▪ Develop and implement access mechanisms for local home use	A50, A51
	Colonial Nesting Birds	
	▪ Develop and implement regulations that protect nesting bird colonies within Aguacaliente Wildlife Sanctuary	A3,A4,A7
	Caves	
	▪ Develop and implement regulations that protect the caves within Aguacaliente Wildlife Sanctuary	A52
Provide policies for mitigation of future potential impacts	▪ Explore feasibility of developing a long term policy and plan in case a mining or oil exploration permit should be issued for the Aguacaliente Wildlife Sanctuary	A53
	▪ Develop and implement strategies to mitigate impacts of potential landfill site in the Machaca area	A54

A. Natural Resource Management Programme						
AWS: Aguacaliente Wildlife Sanctuary **AMT: Aguacaliente Management Team** **C Leaders: C Leaders: Village Chairman / Alcalde**			**SC Members: Community Members** **IoA: Institute of Archaeology**			
To provide the framework for effective natural resource management						
Management Actions		**Present Status**	**Desired Status**	**Year**	**Responsible Parties**	**Limitations/Requirements**
A1	Reconsolidate the Aguacaliente Management Team (AMT)	AMT needs to reconsolidate and strengthen, and build capacity to engage in co-management of AWS	Functional, active AMT with the capacity to effectively represent the communities in co-management of AWS	1st	AMT CL	Hold re-elections for re-newel of Board, Greater community participation in planning, and capacity building for management
A2	Develop regulations for Aguacaliente Wildlife Sanctuary in collaboration with traditional users	AMT has no current regulations developed in consultations with stakeholder communities for AWS	AMT has regulations developed in consultation with stakeholder communities for AWS	1st	AMT C Leaders SC Members Forest Dept. Fisheries Dept.	Community workshop with Forest and Fisheries Departments to develop and agree on regulations for AWS, based on Management Plan. Disseminate results
A3	Finalise Management Zones and Zone regulations	Management Zones proposed in REA but not yet in place. No regulations	Management Zones in place with regulations	1st	AMT C Leaders SC Members	Community workshop (combined with A2). (reviewed and advertised through signs, brochures and community meetings, demarcation and billboards installed). Needs to incorporate regulations from Sustainability Plans (Fishing, Natural Resources). See also A23
A4	Increase communication, participation and collaboration mechanisms for involvement of stakeholder communities	Need for greater communication, participation and collaboration with stakeholder communities	Strong communication, participation and collaboration developed with stakeholder communities	1st – 5th	AMT C Leaders SC Members	Mechanisms for increasing communication, participation and collaboration – see Public Use and Community Participation
A5	Increase communication, participation and collaboration with other organizations and initiatives	Need for greater collaboration with other organizations and initiatives within Toledo, and other national and international organizations and Government agencies involved in protected areas management	Strong links and collaboration developed with other organizations and initiatives within the Toledo area, and other national and international organizations and Government agencies involved in protected areas management	1st – 5th	AMT	Forest Department, Belize Fisheries Department, TIDE, Ya'axché Conservation Trust, GSW. Areas of collaboration include: Surveillance and enforcement, hicatee conservation, environmental education, watershed protection, biological corridors

A. Natural Resource Management Programme						
Management Actions		**Present Status**	**Desired Status**	**Year**	**Responsible Parties**	**Limitations/Requirements**
Develop and implement measures for increasing biodiversity protection						
A6	Demarcate and maintain survey lines in areas of conflict on boundaries of Aguacaliente Wildlife Sanctuary	Survey lines recently opened – need to be demarcated	Survey lines cleared and demarcated, and community members aware of locations in areas of conflict on boundaries of Aguacaliente Wildlife Sanctuary	1st	AMT C Leaders Forest Department	Engaging C Leaders in respecting survey lines, and promoting community awareness of location
A7	Develop Enforcement Plan to guide surveillance and enforcement activities	No Enforcement Plan	Enforcement Plan developed and implemented in collaboration with C Leaders	1st	AMT C Leaders Forest Dept Fisheries Dept.	Participation in development of Plan should also be sought from Police Department and local fishermen & hunters
A8	Ensure effective ranger team	Only one ranger – insufficient for effective surveillance and enforcement	Ranger team established, with community participation and regular, trained, coordinated and effective surveillance activities	1st	AMT Forest Dept Fisheries Dept.	Liaison with TIDE and Ya'axché Conservation Trust for potential to collaborate in surveillance and enforcement activities. Limited by finance
A9	Increase effectiveness of rangers through provision of adequate equipment	Surveillance and enforcement activities limited by limited equipment	Rangers are functional, and well equipped for task	1st	AMT	Dedicated patrol equipment, digital camera, GPS (and training in use), binoculars, maps, medical kit, radio communication throughout area, uniform, ID cards, boat
A10	Investigate possibility of rangers being trained as 'Forest Officers' and Special Constables, with legal mandate to react to illegal occurrences within area	Rangers currently have limited power to enforce	Rangers have full powers of 'Forest Officers' or Special Constable, and are therefore able to enforce	1st	AMT Forest Dept	FD Green Laws training, special constable training,
A11	Investigate potential for enforcement by alcaldes, and if viable, develop relevant policies and implement	Alcaldes and other village leaders suggested that community level enforcement of regulations under the Alcalde system may be effective	Alcaldes take on some of the responsibility for community level enforcement	1st – 5th	AMT C Leaders Forest Dept.	Self-policing, with fines going to community funds

A. Natural Resource Management Programme						
Develop and implement measures for increasing biodiversity protection						
Management Actions		**Present Status**	**Desired Status**	**Year**	**Responsible Parties**	**Limitations/Requirements**
A12	Investigate feasibility of empowering fishermen as voluntary rangers for surveillance activities as part of Sustainable Fisheries Plan	Limited effective surveillance activities currently occurring within AWS	Ongoing surveillance assisted by voluntary rangers engaged from local fishermen	1st – 5th	AMT C Leaders SC Members Forest Dept. Fisheries Dept.	Needs recognition by fishermen of the need (and advantages) for their involvement in protecting the fisheries resource and their livelihoods
A13	Implement effective surveillance and enforcement activities under Enforcement Plan	No Enforcement Plan. Limited surveillance and enforcement	Enforcement Plan developed and implemented	1st	AMT C Leaders SC Members Forest Dept. Fisheries Dept.	Participation should also be sought from Police Department and local fishermen & hunters
A14	Liaise with Forest Dept. and Belize Fisheries Dept.– Freshwater Compliance Unit for enforcement	Good liaison with Forest Dept. Limited liaison at present with Fisheries Department	AMT in constant liaison with Forest and Fisheries Departments	1st -5th	AMT Forest Dept. Fisheries Dept	Support from the Forest & Fisheries Depts. will assist community acceptance and recognition of need for enforcement
A15	Establish monitoring programme for threats	No current mechanism for monitoring threats	Threats are monitored effectively to allow for targeted patrols	1st – 5th	AMT	Potential indicators for monitoring of threats included within Conservation Planning threat assessment and summarized under the Research and Monitoring Programme
Increase the viability of Conservation Targets of Aguacaliente Wildlife Sanctuary						
Conservation Target: Aquatic Ecosystems						
A16	Increase understanding of the hydrological systems of Aguacaliente Wildlife Sanctuary	Management limited by limited knowledge of hydrological system	Increased understanding of the hydrological systems of Aguacaliente Wildlife Sanctuary	2nd – 3rd	AMT	Consultancy to expert, including recommendations for maintenance of current water flow etc.
A17	Develop and enforce regulation banning use of poison in creeks	No strong regulations in place for AWS	Regulation banning use of poison within AMT, with strict enforcement	1st – 5th	AMT C Leaders SC Members	Regulations should be created with full community consultation
A18	Map upstream impacts on water quality outside of the protected area to provide a baseline for future monitoring	No hard data on agricultural and other impacts upstream	Mapping of impacts on water quality upstream of the protected area	2nd – 3rd	AMT	Information from water quality monitoring should tie into the mapping Including agrochemicals

A. Natural Resource Management Programme						
Increase the viability of Conservation Targets of the Aguacaliente Wildlife Sanctuary						
Management Actions		**Present Status**	**Desired Status**	**Year**	**Responsible Parties**	**Limitations/Requirements**
Conservation Target: Aquatic Ecosystems						
A19	Increase awareness in landowners / farmers upstream of importance of maintaining 66' creek and river-side vegetation	Greater awareness needed in landowners / farmers upstream of AWS of the important role played by 66' creek and water-side vegetation	Collaboration with landowners / farmers of creek and river-side properties to develop and implement guidelines for maintaining 66' creek and river-side vegetation	1st-5th	AMT Agriculture Dept.	Increased awareness of benefits resulting from maintenance of the 66' buffer. Memorandum of Agreement with landowners for maintenance of 66' buffer vegetation Collaboration with other conservation organizations
A20	Raise awareness of farmers of ensuring that agrochemicals do not reach the water systems, either following application, or through washing of spray containers in water bodies	There is a need for greater local awareness of health risks (human and environmental) from chemical pollution	Community support and lobbying for maintenance of clean waters, free from chemical pollution	1st-5th	AMT C Leaders	Needs to be part of an ongoing public awareness initiative re. maintenance of environmental services
A21	Ban on hunting / disturbing crocodiles within AWS	AWS is one of the few places in Toledo where crocodiles still have the potential to do well	AWS effectively protecting crocodiles, and highlighting their presence in marketing for tourism	1st-5th	AMT C Leaders	Need to convince fishermen
A22	Introduce a total ban on use of gill nets and poison within Aguacaliente Wildlife Sanctuary	There is a ban on gill net use, but it is not adequately enforced	A ban on gill net use is agreed on by C Leaders, and is adequately enforced	1st-5th	AMT C Leaders	
Conservation Target: Native Fish Species						
A23	Finalize zonation plan for traditional fishing areas	REA recommended zonation of fishing access areas questioned in workshops, alternative presented	Zonation of controlled traditional fishing / no fishing areas finalized, protecting the biologically most important areas and allowing regulated traditional fishing where sustainable	1st	AMT C Leaders FD BFD Consultant	General agreement reached in workshops, but should be validated prior to formal adoption

A. Natural Resource Management Programme						
Increase the viability of Conservation Targets of the Aguacaliente Wildlife Sanctuary						
Management Actions		**Present Status**	**Desired Status**	**Year**	**Responsible Parties**	**Limitations/Requirements**
Conservation Target: Native Fish Species						
A24	Resolve traditional resource use issue	Local fishermen are extracting fish from AWS, in contravention of the current FD legislation (and in the case of gill nets, in contravention of Fisheries legislation)	Recognition by FD and GoB of sustainable , non-commercial, traditional use of AWS fish resources for local community members, with training towards greater sustainable use	1st	AMT C Leaders Forest Dept. Fisheries Dept.	Through discussion with Forest and Fisheries Departments , and initiation of permitting process for identified traditional fishers
A25	Develop a baseline and guidelines for sustainable , non-commercial, traditional fishing within Aguacaliente Wildlife Sanctuary	No baseline or guidelines exist	Baseline and guidelines for sustainable fishing have been developed based on sound scientific research	1st-3rd	AMT C Leaders Forest Dept. Fisheries Dept. Consultant	Requires assistance from Belize Fisheries Department and/or consultant to develop baseline , zoning, guidelines and monitoring programme Traditional fisheries Consultant
A26	Monitor fishing activity	At present there is no formalized monitoring of level of fishing activity	Guidelines in place for monitoring and reporting of fishing activity, with output of findings presented in annual report	1st – 5th	AMT	Establishment of protocol – will be needed for formal recognition of traditional fishing rights See Research and Monitoring Programme
A27	Investigate feasibility of netting of *Tilapia* for community use, with community participation, with release of native species, as a regulated, monthly AMT activity	All gill nets are banned from AWS, though enforcement needs to be strengthened. Native fish species are considered to be heavily impacted by the presence of *Tilapia*	Netting of *Tilapia* by AWS staff and community participants on a monthly basis during dry season, with release of native species	1st – 5th	AMT C Leaders Forest Dept. Dept. of Fisheries	Would need to be incorporated into Sustainable Fisheries Plan. Suggestions included monthly rotation per community, led and overseen by AWS staff.
A28	Develop and implement a Sustainable Fisheries plan	No Sustainable Fisheries or Sustainable Fisheries Plan	Sustainable Fisheries Plan developed and implemented with the input and participation of the traditional fishermen and C Leaders, and based on baseline and guidelines	1st – 3rd	AMT C Leaders Forest Dept. Fisheries Dept. Traditional fisheries Consultant	Requires assistance from Belize Fisheries Department and/or consultant to develop Plan, incorporating baseline, guidelines and monitoring programme, awareness activities in stakeholder communities

A. Natural Resource Management Programme						
Increase the viability of Conservation Targets of the Aguacaliente Wildlife Sanctuary						
Management Actions		**Present Status**	**Desired Status**	**Year**	**Responsible Parties**	**Limitations/Requirements**
Conservation Target: Native Fish						
A29	Identify critical areas and times of peak fishing pressure to increase efficiency of patrol effort	No accurate mapping of fishing activity within AWS, though knowledge is available. Limited surveillance or enforcement activities	Accurate mapping of fishing activity within AWS, using community knowledge of the area. Surveillance and enforcement activities driven by knowledge of when and where patrolling needs to be carried out	1st	AMT C Leaders	GIS mapping would facilitate development & implementation of sustainable fisheries plan. Broad cooperation with identified local traditional fishermen will assist this process.
A30	Promote greater participation in surveillance and enforcement by traditional fishermen	Very few traditional fishermen are currently fully engaged in the protection of AWS	Traditional fishermen actively protect their resources and assist AMT with surveillance activities	1st-5th	AMT C Leaders Forest Dept. Fisheries Dept. Traditional fishermen	Traditional fishermen need to take ownership of their resources, and contribute towards management – through participatory focal workshops towards development of the Sustainable Fisheries plan
A31	Liaise with Forest Dept. and Belize Fisheries Dept.– freshwater compliance unit for assistance with enforcement activities	Limited liaison at present with Forest Department and Fisheries Department towards effective enforcement	AMT in constant liaison with Forest and Fisheries Departments	1st -5th	AMT	Support from the Forest & Fisheries Depts. will assist community acceptance and recognition of need for enforcement FD BFD
A32	Monitor fish populations	No sound information on the status of fish populations	Ongoing monitoring provides up to date data on the status of fish populations and trends	1st-5th	AMT BFD	Will require adoption o monitoring protocol, acquisition of equipment, and training
Conservation Target: Game Species						
A33	Introduce a moratorium on hunting within Aguacaliente Wildlife Sanctuary	Hunting continues within AWS	A moratorium is agreed on and effectively enforced within AWS	1st – 5th	AMT C Leaders FD	Lobby with stakeholder communities for moratorium to allow recovery of game species

A. Natural Resource Management Programme						
Increase the viability of Conservation Targets of the Aguacaliente Wildlife Sanctuary						
Management Actions		**Present Status**	**Desired Status**	**Year**	**Responsible Parties**	**Limitations/Requirements**
Conservation Target: Game Species						
A34	Lobby for extension of AWS into Machaca Forest Reserve as a sustainable use zone with permitted hunting for traditional users	AMT is interested in the possibility of annexing a portion of Machaca Forest Reserve as a sustainable use area	A portion of Machaca Forest Reserve is annexed to AWS as a sustainable use area for permitted traditional , non-commercial activities, under a sustainable use plan	1st -5th	AMT C Leaders FD	
A35	Develop sustainable hunting plan and regulations for Machaca Forest Reserve extension	AMT is interested in the possibility of annexing a portion of Machaca Forest Reserve as a sustainable use area	A Sustainable Use Plan is developed for the Machahca extension, to include limited traditional hunting under permit	1st -5th	AMT C Leaders FD Consultant	Tie in with signed agreement by hunters to not hunt within AWS. Relies on annexing of Machaca Forest Reserve as a sustainable use area, and agreement by FD
A36	Introduce and enforce seasonal hunting regulations and ban on all night hunting within Machaca Forest Reserve extension	AMT is interested in the possibility of annexing a portion of Machaca Forest Reserve as a sustainable use area No current regulation of hunting	Seasonal hunting regulations and ban on all night hunting within Machaca Forest Reserve extension	2nd – 5th	AMT C Leaders FD	Tie in with signed agreement by hunters to not hunt within AWS Relies on annexing of Machaca Forest Reserve as a sustainable use area, and agreement by FD
A37	Investigate further mechanisms for decreasing pressure on game species – e.g. game farming, no-hunting areas	Depressed economy of AWS area, limited enforcement of AWS, limited employment opportunities and cultural traditions has placed severe pressure on game species	Unsustainable hunting pressure on game species alleviated by implementation of positive alternatives for hunters, and by reduction of need for wild-caught meat	1st-5th	AMT Forest Department	Paca farming pilot project already implemented
Conservation Target: Turtles and Iguana						
A38	Implement a moratorium on hunting of iguanas for at least 3 years	Iguanas are declining within AWS as a result of hunting pressure	3 year hunting moratorium for iguanas agreed on by communities	1st – 5th	AMT C Leaders SC Members	
A39	Implement a ban on hunting of turtles	Turtles are declining within AWS as a result of hunting pressure	Ban on hunting of turtles agreed on by communities	1st – 5th	AMT C Leaders SC Members	Turtles (especially the hicatee) have declined rapidly. Ban will allow AWS to act as a reservoir

A. Natural Resource Management Programme						
Increase the viability of Conservation Targets of the Aguacaliente Wildlife Sanctuary						
Management Actions		**Present Status**	**Desired Status**	**Year**	**Responsible Parties**	**Limitations/Requirements**
Conservation Target: Turtles and Iguana						
A40	Develop Hicatee Conservation Programme, in liaison with other local and national initiatives	No programme currently in place.	Programme established by end of the first year with participation from C Leaders and key community members	1st - 2nd	AMT C Leaders SC Members Wildtracks	Integrate with proposed National Hicatee Conservation Action Plan and local hicatee projects (TIDE Ya'axché). Incorporates A38, A40, A41, A42, A43
A41	Identify funding support for Hicatee Conservation Programme	No Programme currently in place	Programme has funding by end of the 1st year	1st – 5th	AMT Wildtracks	Integrate with proposed National Hicatee Conservation Action Plan
A42	Increase awareness in AWS communities of the conservation status of the Central American River Turtle (hicatee), and importance of AWS for its continued survival	Little awareness in AWS communities of global significance of the hicatee population of AWS	AMT and community members are fully aware of conservation status of hicatee, and global significance of the hicatee population of AWS	1st - 5th	AMT	Hicatee declining, but still present in AWS. Collaborate with TIDE and Ya'axché
A43	Develop awareness and support for the Hicatee Conservation Programme in AWS communities	No Programme currently in place.	Programme is supported by AWS communities by end of the 2nd year	1st – 5th	AMT	Liaise with other local and national hicatee initiatives (Collaborate with TIDE and Ya'axché)
A44	Increase awareness of national legislation protecting and regulating use of Hicatee	General awareness that there is legislation regulating hicatee use, but little awareness of specifics	Awareness (and compliance) in AWS communities of legislation regulating hicatee use	1st -5th	AMT Fisheries Dept Forest Dept	In collaboration with Belize Fisheries and Forest Departments Collaborate with TIDE and Ya'axché
Conservation Target: Grassland						
A45	Training in fire management for the AMT and communities	No trained or equipped staff for fire fighting	Trained staff and community members ready and equipped to respond to fires within AWS	1st – 5th	AMT Forest Dept Dept. of Agriculture	Liaise with Forest Dept, Dept. of Agriculture and C Leaders
A46	Support and participate in any local and national fire awareness activities	Impacts of fire within AWS are increasing	Greater awareness in the stakeholder communities of the fire hazard during the dry season and the effect it has on natural resources of the country. Reduction of man-made fires.	1st – 5th	AMT Dept. of Agriculture	Increased liaison and collaboration with other NGOs, Forest Dept and Dept of Agriculture

A. Natural Resource Management Programme						
Increase the viability of other biodiversity of the Aguacaliente Wildlife Sanctuary						
Management Actions		**Present Status**	**Desired Status**	**Year**	**Responsible Parties**	**Limitations/Requirements**
Conservation Target: Grassland						
A47	Increase awareness among hunters of the problems associated with the increasing frequency of fires, and seek support for a fire management programme	No awareness activities in stakeholder communities	AWS stakeholder communities aware of problems of increased fires, and cooperative in trying to prevent further fires	1st – 5th	AMT Dept. of Agriculture	Liaise with Forest Dept., C Leaders and other local conservation organizations (TIDE, Ya'axché Conservation Trust)
A48	Baseline map of current extent of broadleaf forest, and annual overflight / patrols to monitor further incursions	No current, up-to-date mapping of agricultural incursions and/or active farms	Knowledge and mapping of agricultural incursions into AWS, with information used to guide enforcement activities	2nd-5th	AMT	Also highlighted under Research and Monitoring Programme (B
A49	Identify and map essential broadleaf forest corridor areas that maintain connectivity of AWS broadleaf forest	Connectivity is recognized as important, with identification of forest along the Moho river as the primary connectivity link	AMT has identified forest corridors relevant to the AWS and is developing strategies and collaborative partnerships for their continued maintenance	1st-5th	AMT C Leaders	In collaboration with other initiatives focused on the Moho River. Also highlighted under Research and Monitoring Programme (B
Conservation Target: Non-timber Forest Products						
A50	Lobby for extension of AWS into Machaca Forest Reserve as a sustainable use zone with permits for traditional users	AMT is interested in the possibility of annexing a portion of Machaca Forest Reserve as a sustainable use area	A portion of Machaca Forest Reserve is annexed to AWS as a sustainable use area for permitted traditional , non-commercial activities, under a sustainable use plan	1st -5th	AMT C Leaders FD	See Also Conservation Target: Game Species
A51	Develop sustainable harvesting plan and regulations for Machaca Forest Reserve extension	AMT is interested in the possibility of annexing a portion of Machaca Forest Reserve as a sustainable use area	A Sustainable Use Plan is developed for the Machahca extension, to include limited and controlled resource extraction under permit	1st -5th	AMT C Leaders FD Consultant	See Also Conservation Target: Game Species
A52	Develop regulations that protect the caves within Aguacaliente Wildlife Sanctuary	Caves are currently not mapped or well explored, and no regulations guide access and use	Caves within AWS are mapped, with regulations developed and enforced by targeted patrols	1st -5th	AMT C Leaders IoA	Require collaboration with, and input from, IoA

Conservation Target: Caves						
A. Natural Resource Management Programme						
Increase the viability of other biodiversity of the Wildlife Sanctuary						
Management Actions		**Present Status**	**Desired Status**	**Year**	**Responsible Parties**	**Limitations/Requirements**
Provide policies for mitigation of future potential impacts						
A53	Explore feasibility of developing a long term policy and contingency plan in case a mining or oil exploration permit should be issued	No long term policy or plan exists at present to be enacted should a mining permit be issued	Advanced planning of strategies to put into place should a permit be issued	1st	AMT Forest Dept.	Ensure knowledge of legal aspects of situation, to allow proactive rather than reactive response
A54	Develop strategies to mitigate impacts of potential landfill site in the Machaca area	Mahcahca has been highlighted as a potential landfill site for garbage. This falls within the watershed of AWS	Advanced planning of strategies to put into place should a permit be issued	1st	AMT C Leaders Forest Dept.	

B. Research and Monitoring Programme

Vision

To increase management effectiveness and biodiversity conservation through targeted research and monitoring

Objective	Activity Areas	Activities
To provide the framework for effective research and monitoring	▪ Develop Research Programme for Aguacaliente Wildlife Sanctuary ▪ Ensure good data collection and management protocols	B1 – B7 B8, B9
Conduct targeted assessments and mapping necessary for the implementation of management actions	▪ Increase baseline data on biodiversity within the Aguacaliente Wildlife Sanctuary ▪ Improve knowledge of water flow/drainage of the Aguacaliente Wildlife Sanctuary ▪ Research and monitoring for effective management of conservation targets ▪ Fire risk assessment of ecosystems and critical areas within Aguacaliente Wildlife Sanctuary	B10 – B16 B17-B21 B22 – B25 B26

B. Research and Monitoring Programme

AWS: Aguacaliente Wildlife Sanctuary
AMT: Aguacaliente Management Team
C Leaders: Community Leaders: Village Chairman / Alcalde
SC Members: Stakeholder Community Members
IoA: Institute of Archaeology
TIDE: Toledo Institute for Development and Environment
Ya'axche: Ya'axche Conservation Trust

Management Actions		Present Status	Desired Status	Year	Responsible Parties	Limitations/Requirements
To provide the framework for effective research and monitoring						
B1	Produce a Research and Monitoring Development Plan to provide guidelines for developing an effective Research Programme	No formal Research Programme in place to guide research activities, and limited experience of research and monitoring requirements within AMT	A Research Development Plan exists to guide AMT in the development of an effective Research and Monitoring Programme	$1^{st} - 3^{rd}$	AMT Forest Dept. Consultant	Should include infrastructure requirements, identification of high priority research and monitoring requirements and protocols, guidelines for data collection and management (B4), for community participation (B5) and for marketing (B6). Timeline and Budget
B2	Develop and implement Research and Monitoring Programme for Aguacaliente Wildlife Sanctuary	No formal Research and Monitoring Programme in place to guide research activities	Formal Research and Monitoring Programme in place to guide research activities, for effective management of conservation targets and other biodiversity of AWS	$2^{nd} - 5^{th}$	AMT Forest Dept.	Developed following Research and Monitoring Development Plan, and identified research and monitoring needs highlighted during management planning and REA processes, and. Should include B4, B5 and B6
B3	Strengthen cross linkages with other research and conservation initiatives	AMT lacks research and monitoring expertise, and would benefit from cross linkages and collaborations with other conservation initiatives in the area of research and monitoring	Research and monitoring within AWS is strengthened through collaboration with other conservation partners	$1^{st} - 5^{th}$	AMT Forest Dept.	Increased communication with other local research initiatives, local and national NGOs and government agencies to seek collaborative relationships and synergies in research and monitoring

B. Research and Monitoring Programme						
Management Actions		**Present Status**	**Desired Status**	**Year**	**Responsible Parties**	**Limitations/Requirements**
To provide the framework for effective research and monitoring						
B4	Incorporate community participation mechanisms into Research and Monitoring activities	Limited research and monitoring activity at present, with limited community participation Some ongoing bird monitoring following protocols developed under REA, with community participation	Increase community opportunities for participation in research and monitoring activities	1st – 5th	AMT	
B5	Promote AWS as a research site, to fill highlighted research requirements	No marketing of AWS as a potential research location	AWS marketed as a potential location for targeted research	1st – 5th	AMT	Identify and target researchers in freshwater ecology, sustainable fisheries management, bird monitoring, for assistance in developing strong protocols and baseline data for the Research and Monitoring programme. Encourage long term research
B6	Develop and implement Monitoring Plan for Conservation Target Indicators	Conservation target indicators have been developed, but there is no system in place for monitoring them	Monitoring plan developed for conservation target indicators, integrated into Research and Monitoring Programme	1st – 5th	AMT	Indicators summarized in Table…. Annex One: Monitoring data collection form
B7	Incorporate research and monitoring activities into annual Operational Plan	Limited research and monitoring, with limited incorporation into AWS management activities	Research and monitoring activities are an integral part of the annual Operational Plan	1st – 5th	AMT	
B8	Establish good data collection and management system and protocols	No formal Research Programme or guidelines in place	Research guidelines and regulations developed to ensure good data collection and management protocols	1st – 2nd	AMT Forest Dept.	Computer-based data storage
B9	Ensure dissemination of research and monitoring results	Limited research and monitoring, and limited access to research and monitoring results	Research and monitoring results are widely disseminated, both within stakeholder communities and nationally	1st – 5th	AMT	Important to provide feedback to stakeholder communities, to keep them informed. Dissemination through BERDS[1]

[1] BERDS – Biodiversity and Environment Resource Data System for Belize

B. Research and Monitoring Programme						
Management Actions		**Present Status**	**Desired Status**	**Year**	**Responsible Parties**	**Limitations/Requirements**
Improve Baseline Knowledge of Conservation Targets and other Biodiversity of AWS						
B10	Increase baseline data on fish species within the Aguacaliente Wildlife Sanctuary	AMT has an REA, providing much of the baseline required for effective management. However, fish are an identified gap	AMT has filled the baseline information gap identified for fish, with data feeding into sustainable fisheries plan	$1^{st} – 5^{th}$	AMT	Dry season survey - encourage targeted research and assessment initiatives within the area Locate technical assistance
B11	Increase baseline data on reptile and amphibian species within the Aguacaliente Wildlife Sanctuary through	AMT has an REA, providing much of the background information required for effective management. However, reptiles and amphibians are an identified information gap	AMT has filled the baseline information gap identified for reptiles and amphibians	$1^{st} – 5^{th}$	AMT	Wet and dry season survey - encourage targeted research and assessment initiatives within the area Locate technical assistance See also B12 – B14
B12	Increase baseline data on hicatee populations within AWS	A breeding population of hicatee is present in AWS, and that numbers are declining, but there is no sound data on population distribution and density	Good baseline knowledge on current hicatee population, with mapping of areas where present breeding sites, and targeted protection based on this info.	$1^{st} – 5^{th}$	AMT	Seek support and collaboration from other conservation organizations focused on hicatee - Wildtracks TIDE / Ya'axche
B13	Increase baseline data on other turtle species within AWS	Little data on other species of turtle present in AWS	Good baseline knowledge on current turtle populations - species with mapping of areas where recorded, and targeted protection based on this information	$1^{st} – 5^{th}$	AMT	
B14	Increase baseline data on green iguana populations within AWS	Little data on green iguana populations within AWS	Good baseline knowledge on current green iguana populations, with mapping of areas where recorded, and targeted protection based on this information	$1^{st} – 5^{th}$	AMT	
B15	Develop baseline data on game species population distributions and densities within AWS	No baseline information available on game species – only anecdotal information during conservation planning process	Baseline data available on game species for future monitoring	$2^{nd} – 3^{rd}$	AMT	Some data can be gathered during patrols and bird monitoring activities. Camera traps or other survey techniques may be needed during dry season. Should involve community participation

B. Research and Monitoring Programme						
Management Actions		**Present Status**	**Desired Status**	**Year**	**Responsible Parties**	**Limitations/Requirements**
Improve Baseline Knowledge of Conservation Targets and other Biodiversity of AWS						
B16	Increase baseline data on crocodile populations within AWS	Crocodiles are present in AWS, but limited data on where or how many	Mapping of areas used by crocodiles, and data on numbers guiding targeted monitoring and enforcement activities,	$1^{st} – 5^{th}$	AMT	Can be gathered during patrols and bird monitoring activities
Conduct targeted assessments and mapping necessary for effective management of Conservation Targets						
B17	Accurately map dry season / wet season water levels for lagoons and creeks of provide baseline for future impact mapping, and for biodiversity monitoring activities	No accurate baseline map currently exist for monitoring purposes	Accurate baseline map developed and used for monitoring purposes	$1^{st} – 5^{th}$	AMT	Collaboration for GIS input (Wildtracks, TIDE)
B18	Improve knowledge of water flow/drainage of the Aguacaliente Wildlife Sanctuary	Limited in-depth knowledge of water flow/drainage dynamics of the Aguacaliente Wildlife Sanctuary	Understanding of water flow/drainage dynamics of the Aguacaliente Wildlife Sanctuary for effective management	1^{st} - 5^{th}	AMT Forest Dept. Fisheries Dept. Consultant	Targeted Research, mapping, development of monitoring protocols for incorporation into Research and Monitoring Prog.
B19	Improve knowledge of impacts on water flow/drainage of the Aguacaliente Wildlife Sanctuary	Limited in-depth knowledge of impacts on water flow/drainage dynamics of the Aguacaliente Wildlife Sanctuary	Understanding of impacts on water flow/drainage dynamics of the AWS for effective management, and development of suitable strategies	1^{st} - 5^{th}	AMT Forest Dept. Fisheries Dept. Consultant	Consultant Targeted Research with feedback into management Linked to B10
B20	Develop and implement water quality monitoring within AWS, in main lagoons, streams and creeks	No water quality monitoring within the AWS. No equipment	Monitoring of water quality at specific target points within AWS	$1^{st} – 5^{th}$	AMT	Main lagoons, creeks at entry /exit points to/from AWS. Tie in with mapping of upstream impacts. Should include monitoring of agrochemicals - high cost involved
B21	Monitor river and creek banks upstream of AWS for clearance,	No monitoring of clearance of creek / river banks upstream of AWS	Monitoring and enforcement 66' for creek and river banks outside AWS, draining in	1^{st}-5^{th}	AMT	Needs to be part of ongoing surveillance and monitoring, needs a baseline map
B22	Improve knowledge of interaction between *Tilapia* and native fish species	Limited in depth knowledge of impacts of *Tilapia* on native fish species within the Aguacaliente Wildlife Sanctuary	Understanding of impacts of *Tilapia* on native fish species within the Aguacaliente Wildlife Sanctuary	1^{st} - 5^{th}	AMT Fisheries Dept. Consultant	

B. Research and Monitoring Programme						
Management Actions		**Present Status**	**Desired Status**	**Year**	**Responsible Parties**	**Limitations/Requirements**
Conduct targeted assessments and mapping necessary for the implementation of management actions						
B23	Baseline map of current extent and condition of broadleaf forest	No current, up-to-date mapping of agricultural incursions and/or active farms	Accurate baseline map developed and used for monitoring purposes	2nd-5th	AMT	Also highlighted under Natural Resource Management Programme Should include mapping of condition Collaboration for GIS input (Wildtracks, TIDE)
B24	Annual overflight / patrols to monitor further farming incursions into protected area	No annual monitoring activity to update map		2nd-5th	AMT	Lighthawk Collaboration for GIS input (Wildtracks, TIDE)
B25	Identify and map essential broadleaf forest corridor areas that maintain connectivity of AWS broadleaf forest	Connectivity is recognized as important, with identification of forest along the Moho River as the primary connectivity link	AMT has identified forest corridors relevant to the AWS and is developing strategies and collaborative partnerships for their continued maintenance	1st-5th	AMT C Leaders	In collaboration with other initiatives focused on the Moho River.
B26	Baseline map of fire risk to assist in fire management	Patrols are not currently guided by fire risk management requirements	Areas of high fire risk are mapped, and patrols targeted at reducing risk. Feeds into Fire Management Plan	1st - 5th	AMT	

Monitoring Programme for Conservation Target Viability			
Indicator	**Conservation Target**	**Baseline**	**Methods**
Number of hunting fires per annum	Broadleaf Forest	Number of hunting fires recorded for 2009 (if 2008 data is not available)	Patrol Log kept – includes reported fires, with suspected source
Acres of broadleaf forest cleared within protected area boundary	Broadleaf Forest	Number of acres of farmland within AWS at end of 2008	Aerial photography; ground patrols and GPS plotting of farm margins; GIS mapping of data
Number of fires	Grassland	Number of non-hunting fires recorded for 2009 (if 2008 data is not available)	Patrol Log kept – includes reported fires, with suspected source
Area (km^2) of grassland with invasive plants	Grassland	Mapping of area of grassland with / without invasive plants	Aerial photography; ground patrols and GPS plotting of total grassland area, and mapping of invasive plant patches; GIS mapping of data
Number of patrols per annum	Game Species	Number of patrols in 2008	Patrol log
Number of rangers	Game Species	Average number of rangers per day in 2008	Patrol log
Number of individuals per game species sighted during patrols and monitoring activities per annum	Game Species	Baseline developed over 2009	Information on key species (white tailed deer, curassow, guan, collared and white-lipped peccary, paca, armadillo) collected during patrols using patrol form (Annex One)
Number and size of individual native fish per species caught and released per *Tilapia* netting	Native Fish Species	Baseline developed over 2009	Data collected once *Tilapia* netting is approved and started, under supervision. Native species identified, counted, measured (mm) and released
Number of illegal fishermen / illegal fishing incidents recorded per annum	Native Fish Species	Number of illegal fishermen reported in 2009	Patrol Log kept – includes reports of illegal fishermen, and community of origin, and type of incident
		Number of illegal fishing incidents recorded in 2009	Patrol Log kept – includes reports of illegal fishermen, and community of origin, and type of incident
Number of fish kills per annum	Aquatic Ecosystems	Baseline developed over 2009	All fish kill incidences logged

Indicator	Conservation Target	Baseline	Methods
Number of m/km of agricultural land within 50 meters of water's edge within AWS	Aquatic Ecosystems	Baseline developed over 2009	Aerial photography; ground patrols and GPS plotting of farm margins; GIS mapping of data
Number of m/km of agricultural land within 50 meters of water's edge on creeks / rivers draining into AWS	Aquatic Ecosystems	Baseline developed over 2009	
Annual results of water quality monitoring programme	Aquatic Ecosystems	Baseline developed over 2009	Establish water quality monitoring for pH, dissolved oxygen, phosphate, nitrate.
Average number of turtles recorded per patrol per annum	Turtles /Iguanas	Baseline developed over 2009	Information on key species (hickatee, other turtle species, green iguana) collected during patrols using patrol form (Annex One)
Average number of iguanas recorded per patrol per annum	Turtles /Iguanas	Baseline developed over 2009	
Number of people harvesting NTFP within AWS	Non-Timber Forest Products	Baseline developed over 2009	Patrol Log kept – includes reports of people illegally harvesting non-timber forest products, community of origin, and type of incident
			List of people permitted to harvest non-timber forest products ones permit process is approved and in place
Ratio of untouched to harvested xate plants recorded during patrols	Non-Timber Forest Products	Baseline developed over 2009	Patrol Log kept – includes reports on status of xate encountered
Number of reports per annum of xatero activity within AWS	Non-Timber Forest Products	Baseline developed over 2009	Patrol Log kept – includes reports of xatero activity, community/country of origin, and type of incident
Number of reports per annum of impacts on caves within AWS	Caves	Baseline developed over 2009	Patrol Log kept – includes reports of negative impacts on caves, community of origin, and type of incident
Number of targeted patrols per annum that include caves within AWS	Caves	Baseline developed over 2009	Patrol Log
Number of active Wood Stork nests per annum	Colony Nesting Birds	Baseline developed over 2009	Monitoring activities
Number of reports of disturbance to Wood Stork nests per annum	Colony Nesting Birds	Baseline developed over 2009	

Indicators from Summary Document - Eco-cultural Tourism Symposium for Aguacaliente Wildlife Sanctuary Indigenous Communities (2007)	
Indicators	**Primary Related Activities**
Measurable increase in biodiversity within the AWS within a determined period	A1 – A54 B1 – B20
At least 10 rangers and community members involved in monitoring and research throughout the project.	A8, A10 – A13 B4
Increase in community awareness of the value of research and monitoring in protecting biodiversity and terrestrial ecosystems and recognition of the threats to the resource by end of a determined period.	D23 – D26
Education of over 500 residents through Outreach and Education Program within one year.	C16 D23 – D26
Increased professionalism and effectiveness of staff through training within one year.	D15 – D18 F19
Increase in the number of convictions for illegal activities within one year.	A6 – A15 F9
Reduction in the amount of illegal encroachment in AWS within one year.	A48
Increased protection of endangered species	A16 – A52
Better understanding of biodiversity population in AWS and the institution of relevant protection measures within one year.	B10 – B26
Quantifiable progress in developing financial sustainability of AWS.	F27 – F30
Production of annual report or “Report Card” distributed to stakeholders. A report card, published in an easy to read and visually appealing style, to convey AMT progress to communities, partner organizations, and funding agencies.	F40

C. Community Participation and Awareness Programme

Vision

Integrated community participation in the conservation management of the Aguacaliente Wildlife Sanctuary by key stakeholders, with increased awareness of the environmental services and biodiversity values of the protected area

Objective	Activity Areas	
To provide the framework for integrated community participation in management of Aguacaliente Wildlife Sanctuary	▪ Develop and implement mechanisms for community participation in management activities ▪ Develop and implement mechanisms for increased engagement and participation of Community Leaders in management of Aguacaliente Wildlife Sanctuary	C1- C5 C6 –C9
To provide the framework for socio-economic benefits from Aguacaliente Wildlife Sanctuary	▪ Establish Development Sub-Program ▪ Promote Alternative Liveihood options for stakeholder communities ▪ Increase direct economic benefit for the stakeholder communities	C10 – C11 C12 – C16 C17
To increase awareness of Aguacaliente Wildlife Sanctuary	▪ Develop and implement a community awareness programme to increase awareness of conservation issues and biodiversity value of the area ▪ Develop and implement an environmental education programme to reach all schools within the stakeholder communities ▪ Provide access to educational scholarships linked to increasing awareness of importance and benefits of AWS	C18 – C19 – C20 C21

C. Community Participation and Benefit						
AWS: Aguacaliente Wildlife Sanctuary **AMT: Aguacaliente Management Team** **C Leaders: Community Leaders: Village Chairman / Alcalde** **SC Members: Stakeholder Community Members** **IoA: Institute of Archaeology** **TIDE: Toledo Institute for Development and Environment** **Ya'axche: Ya'axche Conservation Trust**						
Management Actions		**Present Status**	**Desired Status**	**Quarter**	**People**	**Limitations/Requirements**
To provide the framework for integrated community participation in management of Aguacaliente Wildlife Sanctuary						
C1	Reconsolidate the Aguacaliente Management Team (AMT)	AMT needs to reconsolidate and strengthen, and build capacity to engage in co-management of AWS	Functional, active AMT with the capacity to effectively represent the communities in co-management of AWS	1st	AMT C Leaders	See A1; F1-F3
C2	Reconsolidate Local Advisory Committee within stakeholder communities	Community participation in management decisions has been limited despite system of community representatives	Community representatives are established as Local Advisory Committees, to provide input into decision making and transparency	1st	AMT SC Members	See F4-F5
C3	Capacity building for empowerment and institutional strengthening.	Recognized requirement for capacity building for empowerment and institutional strengthening	AMT builds it capacity and strengthens the organization through annual assessment andimplementation of training requirements	1st – 5th	AMT	Identified as one of the main priority areas, this was seen to be relevant for AMT's Board and younger members, as well as community members including village leaders and teachers
C4	Determine the criteria for defining which communities are considered stakeholders of AWS.	Not all communities currently considered stakeholders are actively using or affecting AWS	Community consultations recommend that stakeholder communities should be those actively participating in management of the Wildlife Sanctuary, and using the natural resources.	1st	AMT C Leaders	Currently ten stakeholder communities. Criteria for inclusion as a stakeholder could be set based on distance, use, level of commitment and level of participation in management activities
C5	Investigate whether San Pedro Columbia should be included as a stakeholder community in AMT	San Pedro Columbia is currently not considered a stakeholder community	A decision is made as to whether San pedro Columbia fulfills the criteria as a stakeholder community	1st	AMT C Leaders	It was noted that many people from San pedro Columbia fish illegally with nets in the AMT lagoons.

C. Community Participation and Benefit						
Management Actions		**Present Status**	**Desired Status**	**Quarter**	**People**	**Limitations/Requirements**
To provide the framework for integrated community participation in management of Aguacaliente Wildlife Sanctuary						
C6	Encourage community participation in development and implementation of sustainability plans	Sustainable resource use plans not yet developed and approved	Sustainable Traditional Fisheries Plan and Non-timber forest products plan developed through community consultations, with assistance of consultant	2nd – 5th	AMT C Leaders SC Members Consultants	Plans to be developed for sustainable traditional fisheries and ntfp in collaboration with Fisheries and Forest Depts. Communities taking on responsibility for sustainability of natural resources. Recovery of local fish species for sustainable home use. (See A24, A25,A28, A35, A36, B10)
C7	Develop and implement a Communication Plan to keep communities informed of management activities	No Communication Plan in place. This is highlighted as a major weakness of AMT	Communication Plan implemented, keeping communities informed of management activities	1st – 5th	AMT Community Liaison Officer	See A4, F6
C8	Investigate feasibility of community level enforcement of some AWS regulations through Acalde system	Alcaldes and other village leaders suggested that community level enforcement of regulations under the Alcalde system may be effective	Alcaldes take on some of the responsibility for community level enforcement	1st – 5th	AMT C Leaders Forest Dept.	See A11
C9	Investigate feasibility of monthly netting of *Tilapia* as a community participation mechanism	All gill nets are banned from AWS, though enforcement needs to be strengthened. Native fish species are considered to be heavily impacted by the presence of *Tilapia*	Netting of *Tilapia* by AWS staff and community participants on a monthly basis during dry season, with release of native species	1st – 5th	AMT C Leaders Forest Dept. Dept. of Fisheries	Tied into Sustainable fisheries plan. Under strict supervision by AMT. Native species need to be released. See A27
To provide the framework for socio-economic benefits from Aguacaliente Wildlife Sanctuary						
C10	Establish a Development Sub Programme within the Community Participation and Benefit Programme	No current Development Sub-Programme	Development Sub-Programme established, with a Development Officer, as recommended by the AMT Eco-cultural Tourism Symposium Summary Document (2007)	2nd – 5th	AMT Development Officer	To improve community benefits through increased prioritization of training and sustainable development initiatives – communities need to see the connection between themselves and the protected area

C. Community Participation and Benefit						
Management Actions		**Present Status**	**Desired Status**	**Quarter**	**People**	**Limitations/Requirements**
To provide the framework for socio-economic benefits from Aguacaliente Wildlife Sanctuary						
C11	Develop and implement a structured action plan for alternative livelihood development initiatives within stakeholder communities	No structured action plan for alternative livelihood development initiatives	Structured action plan for alternative livelihood development initiatives within stakeholder communities	2nd – 5th	AMT Development Officer	Under Development Officer tasked to implement AMTs Alternative Livelihood Initiative, to include AMT Eco-Cultural Tourism Guided Tours (AMTECT) service
C12	Establish an AMT Eco-Cultural Tourism Guided Tours (AMTECT) service	AMT Eco-Cultural Tourism Guided Tours (AMTECT) service not yet established	AMT Eco-Cultural Tourism Guided Tours (AMTECT) service established	2nd – 5th	AMT Development Officer	See.D11. Recommended under the AMT Eco-cultural Tourism Symposium Summary Document (2007)
C13	Training of tour guides/site guides for the AWS, and employment of more local rangers.	AMT Eco-cultural Tourism Symposium Summary Document (2007) suggests there is the need for a further 30 community tour guides	30 further community tour guides are trained and licensed for guiding in AWS	2nd – 5th	AMT Development Officer	See D17
C14	Engage, assist and encourage young adults to establish tourism initiatives within the community	Tourism is seen as a potential mechanism for encouraging community development	Young people are encouraged to invest in tourism initiatives in their communities	2nd – 5th	AMT Development Officer	It is recognized that the young adults have the capacity and ability to borrow finances to establish tourism businesses to utilize the Wildlife Sanctuary. See D20
C15	Increase the tourism potential of AWS through effective marketing	AWS not currently effectively marketed	Effective marketing of Aguacaliente as a tourism resource	2nd – 5th	AMT	
C16	Facilitate opportunities for community development through liaison with Government agencies and NGOs	Little lobbying by AMT on behalf of the communities	AMT Development Sub-Programme will be well placed to open dialogue with Government ministries to lobby on behalf of the stakeholder communities for community development	2nd – 5th	AMT Development Officer Community Liaison Officer	Based on assessment of community development needs

C. Community Participation and Benefit						
Management Actions		**Present Status**	**Desired Status**	**Quarter**	**People**	**Limitations/Requirements**
To provide the framework for socio-economic benefits from Aguacaliente Wildlife Sanctuary						
C17	Ensure preferential employment opportunities for communities, for positions within Aguacliente Wildlife Sanctuary	Direct economic benefit is seen in some communities where there is employment by AMT for rangers etc.	Continued preferential employment for members of stakeholder communities, where feasible	1st – 5th	AMT	Feasibility is dependent on applicants having the skills and capacity for the task for which they are appling
To increase awareness of Aguacaliente Wildlife Sanctuary						
C18	Develop and implement 5 year Educational and Awareness Plan to strengthen educational activities associated with AWS	Limited educational activities associated with AWS	5 year Educational and Awareness Plan developed and implemented, guiding activities designed to strengthen conservation awareness and awareness of the environmental and economic benefits of the Wildlife Sanctuary	1st – 5th	AMT	Education and Outreach to provide communities / schools with information (meetings, posters, brochures about AMT's activities, conservation and AWS regulations, educational visits and activities). With participation of local teachers See D24
C19	Greater, ongoing effort on increasing awareness within the community of the benefits of the Wildlife Sanctuary,	Limited awareness within the community of the environmental and economic benefits of the Wildlife Sanctuary	Communities have a high level of awareness of environmental and economic benefits of the Wildlife Sanctuary, following implementation of Education and Awareness activities	1st – 5th	AMT Community Liaison Officer Development Officer	To develop appreciation and support, through slideshows, events, meetings and workshops Tied to C18
C20	Engage students of the Technical High School through structured visits to the Wildlife Sanctuary	Limited educational activities targeting the Technical High School	Students from the Technical High School are engaged through structured visits to the Wildlife Sanctuary, guided by the year Educational and Awareness Plan	1st – 5th	AMT Community Liaison Officer Development Officer	Focus on ensuring young people recognize the value of their natural resources Tied to C18
C21	Provide access to educational scholarships linked to increasing awareness of importance and benefits of AWS	Scholarships have been demonstrated to be successful in raising awareness and support for protected areas and conservation	Educational scholarships are provided, linked to increasing awareness of importance and benefits of AWS	2nd – 5th	AMT Community Liaison Officer	

D. Public Use Programme

Vision

Providing opportunities for integrated use of Aguacaliente Wildlife Sanctuary, increasing awareness of the conservation value of the area, developing broad-scale public support, and providing economic sustainability

Objective	Activity Areas	
To facilitate access for stakeholder communities to Aguacaliente Wildlife Sanctuary	▪ Provide guidance on community uses of Aguacliente Wildlife Sanctuary	D1 - D3
To develop and implement plans for management of sustainable resource use	▪ Develop and implement plans for community-based sustainable use of natural resources	D4 –D9
To provide the framework for tourism activities	▪ Demarcate tourism zone ▪ Establish AMT Eco-Cultural Tours ▪ Provide training, improved access and interpretive facilities to increase visitor awareness and satisfaction ▪ Effectively market Aguacaliente Wildlife Sanctuary as a tourism resource ▪ Enforce visitor regulations ▪ Develop baseline and monitoring programme for environmental and socio-economic impacts of public use	D10 D11 D13 – D18 D19 – D20 D21 D22 – D23
To provide the framework for educational activities	▪ Increase the number of educational activities associated with AWS	D24 – D29
To enforce against illegal use of Aguacaliente Wildlife Sanctuary	▪ Develop baseline and monitoring programme for illegal activities within the Aguacaliente Wildlife Sanctuary	D30 – D32

D. Public Use Programme						
Management Actions		**Present Status**	**Desired Status**	**Quarter**	**People**	**Limitations/Requirements**
To facilitate access for stakeholder communities to Aguacaliente Wildlife Sanctuary						
D1	Promotion of awareness of access rights and policies to AWS for communities	There is a perception among some community members that they are not permitted to enter AWS	Community members are aware that they can use AWS as a recreational area	1st – 5th	AMT Community Liaison Officer	Poster / leaflet campaign in local communities highlighting how people can use the area, activities allowed, and regulations. Linked to community liaison activities
D2	Increase awareness of clearly defined rules and regulations governing public use of AWS	AMT has no current, clearly defined rules and regulations developed in consultation with the Forest Department and stakeholder communities for AWS	Community members are aware of clearly defined rules and regulations that govern public use of AWS, and participated in their development	1st – 5th	AMT Community Liaison Officer	Poster / leaflet campaign in local communities highlighting how people can use the area, activities allowed, and regulations. Linked to community liaison activities and to Activity A2
D3	Investigate potential for increasing access to trails for local community recreation and tourism	Facilities for community recreation within AWS are currently limited	Development of self guided, clearly labeled community trail highlighting community values of AWS	1st – 5th	AMT	Need to ensure this is confined to public use zone
To develop and implement plans for management of traditional sustainable resource use						
D4	Develop and implement plan for a community-based sustainable traditional fishery	Traditional fishing is continuing in AWS, in conflict with PA regulations, and with no planning or management for sustainability	Traditional fishing continues in AWS, and is regulated through a sustainable traditional fisheries plan, developed in collaboration with the fishermen and Fisheries and Forest Departments	1st – 5th	AMT Consultant Fisheries Dept Forest Dept.	Aquaculture and Inland Fisheries Unit Has to be a community-driven process See also: A24, A25, A28, B10
D5	Ensure community participation in the development of the sustainable fisheries plan	No sustainable fisheries plan currently exists	Local fishermen are fully engaged in the development and implementation of a sustainable traditional fishery	1st – 3rd	AMT Consultant Fisheries Dept Forest Dept Local fishermen	Has to be a community-driven process
D6	Ensure adequate prioritization of monitoring and enforcement of sustainable traditional fishery plan	Sustainable use has to be carefully monitored, and rules and regulations enforced if it is to succeed	Adequate prioritization of monitoring and enforcement of sustainable traditional fishery plan	1st – 5th	AMT Local fishermen	Limited human resources

D. Public Use Programme						
Management Actions		**Present Status**	**Desired Status**	**Quarter**	**People**	**Limitations/Requirements**
To develop and implement plans for management and traditional use of sustainable resource use						
D7	Develop and implement plan for sustainable use of non-timber forest products	Harvesting of non-timber forest products is continuing in AWS, in conflict with PA regulations, and with no planning for sustainability	Traditional harvesting of non-timber forest products continues, and is regulated through a sustainable use plan, developed in collaboration with the Forest Department	1st – 5th	AMT Consultant Forest Dept	Reliant on being able to access annex into Machaca Forest Reserve for this purpose See also: A24, A50, A51
D8	Ensure community participation in the development of the plan for sustainable use of non-timber forest products	No plan exists for the regulation of sustainable use of non-timber forest products	Community members are fully engaged in the development and implementation of a sustainable use plan for non-timber forest resources	1st – 3rd	AMT Consultant Forest Dept Community members	Has to be a community-driven process
D9	Ensure adequate prioritization of monitoring and enforcement of sustainable use of non-timber forest products	Sustainable use has to be carefully monitored, and rules and regulations enforced if it is to succeed	Adequate prioritization of monitoring and enforcement of sustainable use of non-timber forest products	1st – 5th	AMT Community Members	Limited human resources
To provide the framework for environmentally sustainable tourism activities						
D10	Demarcate tourism zone	Zones are not yet finalized or implemented	Tourism zone is demarcated, with tour guides aware of areas open for tourism activities and regulations	1st Year	AMT	Safeguards against disturbance of bird nesting colonies
D11	Establish AMT Eco-Cultural Tourism Guided Tours (AMTECT)	No organization is established to provide a structure for the tour guides – this is recommended under the AMT Eco-cultural Tourism Symposium Summary Document (2007)	AMT Eco-Cultural Tourism Guided Tours (AMTECT) is established as a profitable eco-cultural tourism and adventure tourism provider under the Aguacaliente Alternative Livelihood initiative	2nd year	AMT	Use AMT Eco-Cultural Tours to promote alternate livelihoods through training and employment, and promote economic development in the AWS region.

D. Public Use Programme						
Management Actions		**Present Status**	**Desired Status**	**Quarter**	**People**	**Limitations/Requirements**
To provide the framework for environmentally sustainable tourism activities						
D12	Establish Interpretive Centre in Rangers Station, and develop interpretive exhibits	Facility for visitors and local community members to learn more about the biodiversity of AWS and stakeholder communities, and local culture	Interpretive Centre providing additional information for visitors	1st – 5th	AMT	Interpretive information in Rangers Station with library of essential wildlife identification guides
D13	Identify essential facilities and equipment required for facilitating local tour guide use of the area	No AMT facilities or equipment currently exist to facilitate local tour guide use of the area	Facilities and equipment are identified and located for facilitate local tour guide use of the area	1st – 5th	AMT	Interpretive trail network highlighting medicinal plants, nurseries, and botanical gardens, etc. Continued expansion, maintenance, and improvement to existing trails and boardwalks Access to canoes See F
D14	Develop Best Practices guidelines for tour guides using AWS	No Best Practices have been developed for tour guiding within AWS	Tour guides are guided by Best Practices guidelines	2nd	AMT Tour Guides	Developed in collaboration with the local tour guides
D15	Work with tour guides to ensure best practices within Aguacaliente Wildlife Sanctuary	Little liaison between AMT and tour guides. No best practices guidelines in place	Tour guides work with AMT, and follow best practices guidelines within AWS.	1st – 5th	AMT Tour Guides	Include local tour guides, tour operators and hotels/lodges within the assessment / best practices strategy development process
D16	Provide training for site level guiding for local tour guides	Tour guides have had some training in guiding within AWS, but would benefit from more	All local tour guides using AWS have training to build capacity in interpretation and best practices for guiding in AWS	2nd – 5th	AMT	AMT needs to train approximately 30 new community guides (AMT Eco-cultural Tourism Symposium Summary Document (2007))
D17	Provide training for AWS rangers and tour guides in visitor services and customer care	Rangers and tour guides not trained in visitor services and customer care	Rangers and tour guides provide good visitor services and customer care	2nd – 5th	AMT Development Officer	In conjunction with the AMT Eco-Cultural Tours office staff

D. Public Use Programme						
Management Actions		**Present Status**	**Desired Status**	**Quarter**	**People**	**Limitations/Requirements**
To provide the framework for environmentally sustainable tourism activities						
D18	Promote AWS as a local tourism destination for people of Punta Gorda and associated communities	People living in Punta Gorda do not see AWS as a recreational destination	Increased use of AWS for local tourism / recreation	1st – 5th	AMT	
D19	Promote AWS as an international tourism destination	AWS is not effectively promoted, despite the potential to attract international visitors	AWS is effectively promoted, despite the potential to attract international visitors	1st – 5th	AMT	Promotion strengthened under AMT Eco-Cultural Tourism Guided Tours (AMTECT)
D20	Ensure all tourism facilities and infrastructure are kept well maintained	Limited finance for facility and equipment maintenance	Tourism facilities and equipment are well maintained	1st – 5th	AMT	Safety of raised boardwalk and liability issues See E
D21	Develop and enforce regulations regarding visitor and tour guide behavior (e.g. noise pollution etc.)	No best practices guidelines developed for visitor and guide behaviour expectations	Written Best Practices guidelines provide clear guidelines on acceptable visitor and guide behaviour	1st – 5th	AMT Tour Guides	Clear guidelines will help reduce impact on biodiversity (e.g. no disturbance of birds, no noise when watching howler monkeys.)
D22	Develop baseline and monitoring programme for public use	No monitoring programme for public use	Monitoring programme developed, with annual monitoring of public use and public use impacts	1st – 5th	AMT	
D23	Ensure that data on visitation and public use is available to assist in management decisions, and maintained in a database	Some information is available for assessing visitor flow, activities and visitor satisfaction. Not complete, and not integrated into monitoring programme.	Continued use of the log-in book, but collecting more detailed information on visitor Interests, flow, activities and visitor satisfaction. Summarized information is made available in quarterly and annual reports	1st – 5th	AMT Tour Guides	Develop a visitor satisfaction questionnaire – ('Visitor' also includes VIPs, researchers, students etc. Information entered into a central database, which can be sorted by name, date of contact, place of origin, and interests

D. Public Use Programme						
Management Actions		**Present Status**	**Desired Status**	**Quarter**	**People**	**Limitations/Requirements**
To provide the framework for education activities within Aguacaliente Wildlife Sanctuary						
D24	Develop and implement 5 year Educational and Awareness Plan to strengthen educational activities associated with AWS	Limited educational activities associated with AWS	5 year Educational and Awareness Plan developed and implemented, guiding activities designed to strengthen conservation awareness and awareness of the environmental and economic benefits of the Wildlife Sanctuary	$1^{st} – 5^{th}$	AMT	See C18
D25	Increase the number of educational visits to AWS by local schools	Limited educational visits to AWS by local schools	Increase the number of educational visits by local schools, with structured educational field activities	$1^{st} – 5^{th}$	AWS Community Liaison Officer	Tie into conservation targets Raising awareness amongst students and teachers of biodiversity and local conservation issues
D26	Increase number of educational activities in local schools bringing awareness of AWS	Limited educational visits by AMT staff to local schools	Increase the number of educational visits to local schools, with structured activities raising awareness of students and teachers of biodiversity and local conservation issues	$1^{st} – 5^{th}$	AWS Community Liaison Officer	Tie into conservation targets
D27	Increase number of educational activities in local schools bringing awareness of AWS	Limited educational visits by AMT staff to local schools	Increase the number of educational visits to local schools, with structured activities raising awareness of students and teachers of biodiversity and local conservation issues	$1^{st} – 5^{th}$	AWS Community Liaison Officer	Tie into conservation targets
D28	Engage students of the Technical High School through structured visits to the Wildlife Sanctuary	Recognized requirement for greater engagement of Technical High School students in AWS	Increase the number of Technical High School students who have visited AWS		AWS Community Liaison Officer	With an overall focus on ensuring young people recognize the value of their natural resources

D. Public Use Programme						
Management Actions		**Present Status**	**Desired Status**	**Quarter**	**People**	**Limitations/Requirements**
To provide the framework for education activities within Aguacaliente Wildlife Sanctuary						
D29	Highlight AWS through an annual Community Day, with conservation awareness activities	Communities not yet fully engaged	Annual AWS Community Day with fun educational and awareness activities, and to highlight each community	1st – 5th	AMT Community Leaders	Tie in with *Tilapia* harvesting, arts and crafts marketing
To enforce against illegal use of Aguacaliente Wildlife Sanctuary						
D30	Monitor illegal activities within Aguacaliente Wildlife Sanctuary to inform management	No formal monitoring programme in place and implemented for measuring illegal hunting, land clearance , fishing activities over time	Formal monitoring programme in place for measuring illegal hunting, land clearance and fishing activities over time	1st – 5th	AMT Rangers	Patrol forms to collect the required information. Monthly report summarizes patrol form information
D31	Effective surveillance and enforcement implemented within AWS	Surveillance and enforcement within AWS is limited by limited human and financial resources	Effective surveillance and enforcement implemented within AWS	1st – 5th	AMT Rangers Forest Dept.	See also Natural Resource Management Programme
D32	Ensure legal and illegal activities are clearly defined for communities	Confusion among stakeholder communities as to which activities are allowed and which are illegal within AWS	Clear distinction between allowed vs. illegal activities within AWS	1st – 5th	AMT Community Liaison Officer Forest Dept.	Need to clarify traditional use conflict first (A24)

E. Infrastructure Programme

Vision

Infrastructure for effective management of Aguacaliente Wildlife Sanctuary.

Objective	Activity Areas	Activities
To provide the infrastructural framework for the effective management of Aguacaliente Wildlife Sanctuary	▪ Identify essential infrastructure requirements for management of the conservation area ▪ Ensure that on-site infrastructure is adequately maintained ▪ Solid waste disposal	E1 – E7 E8 – E10 E11 – E12

E. Infrastructure Programme						
Management Actions		**Present Status**	**Desired Status**	**Quarter**	**People**	**Limitations/Requirements**
Facilities and Infrastructure						
E1	Identify critical facility and equipment gaps for administration of the conservation area	Limited facilities and equipment currently exist for administration of AWS	Critical facilities and equipment are identified and located for administration of AWS	1st – 5th	AMT	
E2	Investigate optimum location for AMT Office	Currently situated in Big Falls	AMT Office is located in the optimum location for effective management of AWS	1st	AMT C Leaders SC Members	Recommendations include Punta Gorda and Laguna
E3	Investigat multiple access options from other communities	Accessis currently concentrated on Laguna	Multiple access available through other communities	1st – 5th	AMT C Leaders SC Members	Increases problem of monitoring illegal entry and activities
E4	Identify critical facility and equipment gaps for surveillance and enforcement activities for the conservation area	Limited facilities or equipment currently exist for surveillance and enforcement activities for AWS	Essential facilities and equipment are identified and located for surveillance and enforcement activities for AWS	1st – 5th	AMT	Equipment for surveillance and enforcement, eg cameras, binoculars, gps, camping gear, back-packs, Canoes etc. May need to include a ranger station / fire-lookout base north of the lagoons. May need to acquire an ATV, and open a management-only trail from Rangers Station to northern portion of Sanctuary.
E5	Identify essential facilities and equipment required for research and monitoring	No AMT facilities or equipment currently exist for research and monitoring	Essential facilities and equipment are identified and located for research and monitoring	1st – 5th	AMT	Canoes Research and monitoring equipment – identification keys and books, binoculars, scientific equipment identified during Research and Monitoring planning
E6	Identify essential facilities and equipment required for education and awareness activities	Limited equipment currently exist for education and awareness activities	Equipment requirements are identified and located for education and awareness activities	1st – 5th	AMT	
E7	Post AWS signage at each major entry point, on the boundaries of AWS	A few signs at some entry points	AWS signs posted and maintained at each major entry point, on the boundaries of AWS	1st – 5th	AMT	

E. Infrastructure Programme						
Management Actions		**Present Status**	**Desired Status**	**Quarter**	**People**	**Limitations/Requirements**
Facilities and Infrastructure						
E8	Ensure all facilities and infrastructure are kept well maintained	Limited finance for facility and equipment maintenance	Facilities and equipment are well maintained	1st – 5th	AMT	Requires twice-yearly inspections,
E9	Assess safety of raised boardwalk and liability issues, and develop strategies to improve situation	Safety issues associated with the boardwalk were raised during the community workshops	Boardwalk is repaired and maintained in a safe condition	1st – 5th	AMT	Include local tour guides, tour operators and hotels/lodges within the assessment / strategy development process
E10	Ensure that infrastructure meets visitation safety needs, and that signage (including liability disclaimer) is posted as appropriate	Current condition of boardwalk would not meet international safety standards – potentially a significant liability risk to AMT. No signage re. use of facilities / equipment, responsibility for own risk, etc.	All facilities and infrastructure meet reasonable safety standards. Clear signage at key points re. risks & liability	1st-5th	AMT	Signage needed at entrance to Sanctuary, ant start of boardwalk, and at main visitor access point to lagoon and/or creeks
Solid Waste Disposal						
E11	Post signs requesting tour guides and visitors to take their garbage with them	No signs request visitors to take garbage with them	Signs are posted requesting tour guides and visitors to take their garbage with them	1st to 5th	AMT	
E12	Monthly community cleanup during dry season	Garbage cleanups are not conducted regularly	Garbage cleanups conducted on a monthly basis during dry season, linked to *Tilapia* harvesting	1st to 5th	AMT C Leaders SC Members	Investigate feasibility of tying into fajina system

F. Administration Programme

Vision

The Aguacaliente Management Team, as the management body of the Aguacaliente Wildlife Sanctuary, has the administrative structure and capacity to effectively manage the protected area.

Objective	Activity Areas	Activity
To provide the administrative framework for the effective management of the Aguacaliente Wildlife Sanctuary	▪ Strengthen the General Administrative Structure of the Aguacaliente Management Team	F1 - F11
	▪ Improve human resources and human resource management	F12 – F22
	▪ Improve Financial Administration and Sustainability	F23-F26
	▪ Strengthen General Administrative Structure of AMT	F27 – F30
	▪ Improve Health and Safety	F31 – F32
	▪ Establish structure for measuring success	F33 – F40

F. Administrative Programme	
AWS: Aguacaliente Wildlife Sanctuary AMT: Aguacaliente Management Team C Leaders: Community Leaders: Village Chairman / Alcalde SC Members: Stakeholder Community Members (Including LAC)	IoA: Institute of Archaeology TIDE: Toledo Institute for Development and Environment

Management Actions		Present Status	Desired Status	Year	Responsible Parties	Limitations/Requirements
Strengthen the General Administrative Structure of the Aguacaliente Management Team						
F1	Reconsolidate the Aguacaliente Management Team	AMT has recently reconsolidated and strengthened its Board, and needs to build capacity to effectively co-manage AWS	Functional, active AMT Board with the capacity implement co-management role for AWS	1st	AMT SC Members	Re-elections held for new Board. Greater community participation in planning, and capacity building for management. Important to ensure that Board members are not politically appointed, but do represent the communities
F2	Develop clear Terms of Reference for Board Members	AMT Board Members have no clear roles or responsibilities, or regular meetings	AMT Board Members have clear roles and responsibilities, and meet once a quarter	1st to 5th	AMT	Elected from the Local Advisory Committee of thirty community representatives. ToR should include greater interface with communities and C Leaders with two way flow of information. Board members to be held accountable through the ToR
F3	Promote continuity in Board, with capacity development and retention of people with good management capacity	No mechanisms or incentives for retaining Board Members with good management capacity	Mechanisms or incentives for retaining Board Members with good management capacity	1st to 5th	AMT	
F4	Reconsolidate Local Advisory Committee within stakeholder communities	Community participation in management decisions has been limited despite system of community representatives	Community representatives are formally established as Local Advisory Committees, to provide input into decision making and transparency, for increased communication between the communities and the AMT Board, and to ensure a more active AMT community presence	1st	AMT SC Members	Local Advisory Committee comprised of the thirty representatives of the stakeholder communities elected through open elections within each community to elect active representatives suited for the role of community representation Need to work closely with the Community Liaison Officer
F5	Develop clear Terms of Reference for Local Advisory Committee	Community representatives have no clear roles or responsibilities, or regular meetings	Community representatives have clear roles and responsibilities, and meet once a quarter	1st to 5th	AMT	Needs to include working closely with the Community Liaison Officer

F. Administrative Programme						
Management Actions		**Present Status**	**Desired Status**	**Quarter**	**People**	**Limitations/Requirements**
Strengthen the General Administrative Structure of the Aguacaliente Management Team						
F6	Develop Community Communication Plan, with improved reporting to communities	No current Community Communication Plan. Reporting to communities is highlighted as very weak	Community Communication Plan being implemented with strategies to update communities once month. Increased community awareness of benefits provided by the Wildlife Sanctuary (e.g. for flood control and as a tourism resource), and to encourage cooperation and collaboration towards protection and management of AWS.	1st to 5th	AMT Community Liaison Officer	Community bulletin board, Monthly report on activities, posted in each community for public access; submission of quarterly reports to C Leaders for dissemination (including surveillance and enforcement reports).
F7	Develop Operations Plan in November for AMT for forthcoming year	Planning is budget-based	Operational Plan is prepared in November for each forthcoming year	1st to 5th	AMT	
F8	Conduct annual management effectiveness assessment and submit to FD	First Management Effectiveness assessment conducted in July 2006	Annual management effectiveness assessment and submitted to PA administration authority	1^{st} to 5^{th}	AMT	Should include input from Community Leaders, Local Advisory Committee and Stakeholder communities
F9	Establish administration structure for managing surveillance and measures of success data	No structure exists	A structure exists for storing surveillance and measures of success data , patrol reports etc. and producing quarterly and annual reports	1^{st} – 5^{th}	AMT	
F10	Continue daily log of activities for AWS, and prepare monthly and quarterly reports for presentation to Board, LAC, stakeholder communities and Forest Dept.	Limited surveillance and enforcement activities, but activities are logged	Daily log is completed, and summarized in monthly and quarterly reports of surveillance and enforcement activities	1^{st} to 5^{th}	AMT	Monthly and quarterly reports include enforcement activities, maintenance activities, research and monitoring outputs, number of visitors, entrance fees, accounts and a general situation report.
F11	Prepare annual report for presentation to Board, LAC, stakeholder communities and Forest Dept	Reports prepared on an annual basis	Reports prepared on an annual basis and submitted to Forest Department	1^{st} to 5^{th}	AMT	Following Forest Department format. Include summary of enforcement activities, maintenance activities, research and monitoring outputs, number of visitors, entrance fees, accounts and a general situation report.

F. Administrative Programme						
Management Actions		**Present Status**	**Desired Status**	**Quarter**	**People**	**Limitations/Requirements**
Improve human resources and human resource management						
F12	Employ AMT Coordinator to coordinate AWS activities	Project Coordinator is voluntary	AMT Coordinator is employed to provide overall coordination of AWS activities	1st to 5th	AMT	Requires location and allocation of funds for salary
F13	Employ AMT Community Liaison Officer	AMT Community Liaison Officer post is recognized as important, and included in current funding proposals	AMT Community Liaison Officer is employed to maintain active communication with the communities, with a dual role as an educator	1st to 5th	AMT	Requires location and allocation of funds for salary. Should liaise and work closely with Local Advisory Committee members within communities
F14	Employ Community Development Officer	No AMT Community Development Officer is employed at the moment to oversee Alternative Livelihood intiatives	AMT Community Development Officer is employed at the moment to oversee Alternative Livelihood intiatives	2nd – 5th	AMT	Recommended under the AMT Eco-cultural Tourism Symposium Summary Document (2007)) Requires location and allocation of funds for salaries
F15	Employ Manager for AMT Eco-Cultural Tours	AMT Eco-Cultural Tours not yet established	Manager is employed for AMT Eco-Cultural Tours as part of the Alternative Livelihood intiatives	2nd - 5th	AMT	Recommended under the AMT Eco-cultural Tourism Symposium Summary Document (2007). Requires location and allocation of funds for salaries
F16	Ensure adequate number of rangers for effective surveillance, enforcement and monitoring activities	One ranger is currently employed by AMT- recognized as inadequate	AMT Ranger Team of four rangers, employed from the stakeholder communities	1st - 5th	AMT	Requires location and allocation of funds for salaries
F17	Employment of part-time Office Manager for administration	Voluntary Project Coordinator currently fills this role	AMT has Office Manager focused on office administration / accounting	2nd to 5th	AMT	Requires location and allocation of funds for salary. Could be part time
F18	Identify and fill other priority staffing requirements as they occur	Staffing limitations are identified as a major constraint on effective management	Priority staff employed for effective management	1st – 2nd	AMT	Including volunteer staff members – e.g. Peace Corps
F19	Staff / community training in areas highlighted as requiring capacity building within the Summary Document - Eco-cultural Tourism Symposium for Aguacaliente Wildlife Sanctuary Indigenous Communities (2007)	Some staff /community training activities have been conducted, but further capacity building is required	Staff / community training is an on-going activity	1st to 5th	AMT	Tour Guiding, birding, special constable, Spanish language, law Enforcement (green laws / special constable), team building and leadership Liaise with larger NGOs to facilitate team-building exercises.

F. Administrative Programme						
Management Actions		**Present Status**	**Desired Status**	**Quarter**	**People**	**Limitations/Requirements**
Improve human resources and human resource management						
F20	Develop an employee handbook covering topics such as job duties, policies, transport policy, and a staff appraisal process	No employee handbook or policies	An employee handbook is developed covering topics such as job duties, policies, transport policy, and a staff appraisal process	1st to 5th	AMT	Input may be available from other NGOs
F21	Develop a volunteer policy covering topics such as race and gender issues, expected behavior, health and safety	No volunteer policy in place	A volunteer policy is developed covering topics such as race and gender issues, expected behavior, health and safety	1st to 5th	AMT	
F22	Ensure accurate staff records are maintained	Staff records are maintained, primarily on a project basis	Accurate staff records are maintained	1st to 5th	AMT	
Improve Financial Administration and Sustainability						
F23	Develop financial and Business plans for AWS for next five years to set course for economic sustainability	No financial planning / business planning	Good Financial and Business Plans developed and implemented to guide future financing and expenditure	3rd	AMT Consultant	
F24	Secure grant funding for the management of the AWS	Funding is through short term grant funding	AMT has funding to implement management activities in the short term	1st – 5th	AMT	Grant funding secured; explore opportunities for continued grant funding via PACT and other funding agencies
F25	Establish a membership and fundraising program targeting visitors to the AWSand the clients of AMT Eco-Cultural Tours, participants in special events, and visitors to Toledo District.	Limited fundraising outside of grant funding	A membership and fundraising program is estab lished targeting visitors to the AWSand the clients of AMT Eco-Cultural Tours, participants in special events, and visitors to Toledo District.	1st – 5th	AMT	AMT's membership will serve as a conglomeration of small donors as well as a valuable advocacy group.
F26	Develop structure for AMT Eco-Cultural Tours	A recommended funding strategy under the AMT Eco-cultural Tourism Symposium Summary Document (2007) – not yet implemented	Structure for AMT Eco-Cultural Tours is established, with funding for Development Officer and Office Assistant	2nd – 5th	AMT	Overall cost estimate for full implementation of this strategy is approximately $1.2 million (including one-time investments, all capacity building, infrastructure development, and operations). Ongoing annual operational costs estimated at approx. $110,000

F. Administrative Programme						
Management Actions		**Present Status**	**Desired Status**	**Quarter**	**People**	**Limitations/Requirements**
Strengthen the General Administrative Structure of the Aguacaliente Management Team						
F27	Strengthen administration structure for record keeping, accounting etc. for management of the conservation area	Administrative structure currently in place for record keeping, reporting, accounting etc., but would benefit from strengthening and increased transparency	A strong, transparent administrative structure in place for the conservation area for record keeping, accounting etc.	1st -2nd	AMT	
F28	Develop and implement mechanisms for increased transparency, keeping communities closely informed on project budgets and expenditures with a quarterly financial report	Concern of need for increased transparency	Greater organizational accountability, through a more formalized structure and more active administration.	1st to 5th	AMT	Particularly important to keep Community Leaders informed
F29	Prepare timely financial and management accounts and submit monthly	Report prepared for funding agencies	Reports prepared on a monthly basis and forwarded for review by AMT and LAC	1st to 5th	AMT	Incorporate into monthly, quarterly and annual report, for submission to communities and Forest Dept.
F30	Prepare financial reports as needed for funding agencies	Report prepared for funding agencies	Financial reports continue to be prepared and submitted in time to funding agencies	1st to 5th	AMT	
Improve Health and Safety						
F31	Develop Health and Safety at work policies	No health and safety policies are currently in place	Effective Health and Safety at work policies are in place, and all staff are aware and guided by them	1st to 5th	AMT	Especially Health and Safety policies for educational activities
F32	Ensure an effective Hurricane Plan is in place, and staff trained in implementation	No Hurricane Plan is in place	An effective Hurricane Plan is in place, and staff trained in implementation	1st to 5th	AMT	
Establish structure for measuring success						
F33	Annual review of measures of success	No review system at present in place for success of management strategies	Annual review of measures of success of strategies and implementation prior to developing annual work plan	1st to 5th	AMT LAC	Using Measures of Success evaluation matrix
F34	Annual evaluation of operational plan	No Operational Plan	Review operational plan in October and use successes/ failures to input into new Operational Plan	1st to 5th	AMT LAC	Review goals and measure success of implementation on scale of "achieved, in progress, planned, not done"

F. Administrative Programme						
Management Actions		**Present Status**	**Desired Status**	**Quarter**	**People**	**Limitations/Requirements**
Establish structure for measuring success						
F35	Annual evaluation of surveillance and enforcement activities	No review system for surveillance and enforcement activities	Evaluate success / failures of surveillance and enforcement activities	1st to 5th	AMT LAC	Review goals and measure success of implementation on scale of "achieved, in progress, planned, not done"
F32	Annual review of education activities	Review of education activities over the past year before developing new operational plan	Develop new operational plan with input on successes/failures of education activities in old workplan	1st to 5th	AMT LAC	Review goals and measure success of implementation on scale of "achieved, in progress, planned, not done"
F37	Annual review of community participation activities	Review of community participation activities over the past year before developing new operational plan	Develop new operational plan with input on successes/failures of community participation activities in old workplan	1st to 5th	AMT LAC	Review goals and measure success of implementation on scale of "achieved, in progress, planned, not done"
F38	Re-evaluate management plan after 2½ years	No previous management plan	Update and re-evaluate information in all sections of Management Plan - including Environmental Assessment	3rd year	AMT LAC	Review goals and measure success of implementation on scale of "achieved, in progress, planned, not done"
F39	Re-evaluate management plan after 5 years	No standardized re-evaluation of management plan currently takes place	Update information in all sections of Management Plan - including Environmental Assessment	5th year	AMT LAC	Review goals and measure success of implementation on scale of "achieved, in progress, planned, not done"
F40	Distribute Annual Report Card to communities	No reporting to communities	Annual Report Card distributed to communities	1st to 5th	AMT	Highlighting outcomes of Measures of Success monitoring

4.6 Monitoring and Review

Monitoring and evaluation are integral components of any management system and annual evaluations of reserve management are recommended. In the development of this management plan, the action areas are relatively specific, simplifying the process of monitoring success of implementation, and providing a mechanism for continual tracking of management activities, through annual review by AMT, the Forest Department, and the Local Advisory Committee of community representatives.

Management evaluation is also achieved by an assessment of management effectiveness. An initial management effectiveness evaluation was conducted in 2006 (Walker and Walker, 2006), to provide a baseline for assessment.

It is suggested that a monitoring and evaluation tracking matrix be developed for the activities under the management programme, following the outline example (Table 21).

Tracking of Management Action Implementation								
Management Actions		Present Status	1st Year	2nd Year	3rd Year	4th Year	5th Year	Desired Status
A1	Reconsolidate the Aguacaliente Management Team (AMT)	AMT needs to reconsolidate and strengthen, and build capacity to engage in co-management of AWS						Functional, active AMT with the capacity to effectively represent the communities in co-management of AWS
A2	Develop regulations for Aguacaliente Wildlife Sanctuary in collaboration with traditional users	AMT has no current regulations developed in consultations with stakeholder communities for AWS						AMT has regulations developed in consultation with stakeholder communities for AWS
A3	Finalise Management Zones and Zone regulations	Management Zones proposed in REA but not yet in place. No regulations						Management Zones in place with regulations
A4	Increase communication, participation and collaboration mechanisms for involvement of stakeholder communities	Need for greater communication, participation and collaboration with stakeholder communities						Strong communication, participation and collaboration developed with stakeholder communities

Table 21: Management Tracking Matrix (Layout Example)

4.7 Timeline

A timeline should be developed for management activities by the new AMT Board, once established. However, a proposed timeline is included here for priority cross cutting strategies highlighted by Conservation Planning (Table 22).

Primary Cross Cutting Strategies	1st Year	2nd Year	3rd Year	4th Year	5th Year
Effective surveillance and enforcement					
Hire more rangers to enforce regulations					
Clearly demarcate AWS boundary					
Engage FD and Dept. of Agric. to enforce existing laws					
Engagement of community leaders, and enforcement through the alcaldes					
Increase awareness of benefits of AWS					
Environmental Education in primary schools					
Engage local authorities and conservation organizations to assist in the enforcement of laws					
Fire Awareness in all buffer communities, targeted particularly at hunters and farmers					
Fire control & management training to rangers /community members					
Educate mechanized farmers on non-toxic herbicide to use in their farms and to leave a buffer areas along protected area boundary and water ways					
Lobby for extension into Machaca Forest Reserve as a sustainable use zone					
Assist farmers to engage in mulch farming rather than slash & burn					
Monitor water quality					
Preferential harvest of tilapia					
Total ban of gill net use in Aguacaliente Wildlfe Sanctuary					
Development and implementation of sustainable fisheries plan and zonation					
Develop sustainable hunting plan and regulations for Machaca Forest Reserve extension					

Primary Cross Cutting Strategies	1st Year	2nd Year	3rd Year	4th Year	5th Year
Enforce seasonal hunting regulations and ban on all night hunting within Machaca Forest Reserve extension					
Moratorium on hunting of turtles & iguanas for at least 3 years					

Table 22: Timeline for Priority Cross Cutting Stratgies

4.8 Financing

Aguacaliente Management Team is currently funded solely through grant funding, and needs to focus on building its capacity for financial planning and financial management.

Entrance Fees

Under a co-management agreement, entrance fees can be charged by the Aguacaliente Management Team, with a percentage of these fees being retained by the AMT towards management costs.

Donor Contributions

A major source of past funding for Aguacaliente Wildlife Sanctuary has been from grants from both national and international agencies, sourced through agencies such as PACT.

Accessing international donor funds is becoming more and more competitive and the AMT will need to demonstrate effective management to be able to successfully compete. Proposals can be submitted to both national and international donors, though it needs to be taken into account that many proposals will take time to be processed and approved.

Cost sharing mechanisms

In an effort to reduce costs and yet achieve good management, the AMT should explore possibilities of sharing certain management responsibilities with stakeholder groups such as traditional fishermen and tour guides, involving them in enforcement, visitor monitoring (in the case of tour guides) and in catch data collection (in the case of fishermen). This type of sharing of responsibility also fosters a greater sense of ownership by the users of the reserve. Collaboration with other conservation organizations within the area – Ya'axché Conservation Trust, SATTIM and TIDE – for joint patrols, combined training and project implementation of overlapping themes (such as awareness of hickatee) also provides more effective local conservation effectiveness, reducing overlap in effort.

Financial Sustainability Plan

AMT needs to develop a variety of funding sources in order to achieve sustainable financing to cover its expenses. In Belize, these sources have traditionally primarily been based on entrance fees and grants from national and international donors. However, in the future, other innovative sources and mechanisms for revenue generation will become essential to maintaining and increasing management effectiveness.

The establishment of the AMT Eco-Cultural Tourism Guided Tours (AMTECT), was recommended during the AMT Eco-cultural Tourism Symposium Summary (2007) as a funding mechanism for sustainability of the AMT. and for development projects within the stakeholder communities, under the Development Sub-Programme.

To provide justification for the financing of the Aguacaliente Wildlife Sanctuary, a Business Plan - an economic or cost/benefit analysis of the protected area - should be conducted once management is in place, to determine the direct and indirect (environmental service) values of the reserve and compare these to the costs of management, to identify funding gaps. Demonstrating that the economic value of the Wildlife Sanctuary can be clearly shown to

outweigh the management costs is a powerful argument to justify the expenditures made in protecting the reserve area, and also in providing benefits for local people who have had to modify use of the area to some extent through the establishment of the Wildlife Sanctuary.

Current Funding

Current funding is through a Protected Areas Conservation Trust (PACT) grant, focused at strengthening management effectiveness (Table 23).

PACT BUDGET (2008)

Distribution of Funds				
Specific Items per Activity	**Total ($)**	**PACT Contribution**	**Counterpart Contribution**	**In- Kind Contribution**
Activity 1: Boardwalk Construction/Repair; Construction of Gravel Vehicle Turnabout; Construction of AWS Latrine and Water Facilities				
Item 1.1: Labor for Boardwalk/Vehicle Turnabout Construction	8,550.00	7,950.00	600.00	0.00
Item 1.2: Materials for Boardwalk/Vehicle Turnabout Construction	24,237.50	3,605.00	19,807.50	825.00
Item 1.3: Labor for Boardwalk Repair	4,000.00	0.00	3,800.00	200.00
Item 1.4: Materials for Boardwalk Repair	8,350.00	7,150.00	1,200.00	0.00
Item 1.5: Transportation of Latrine and Water Facilities Materials	610.00	610.00	0.00	0.00
Item 1.6: Labor for Latrine and Water Facilities Construction	820.00	820.00	0.00	0.00
Item 1.7: Materials for Latrine and Water Facilities Construction	2,971.50	2,971.50	0.00	0.00
Sub-Total	**49,539.00**	**23,106.50**	**25,407.50**	**1,025.00**
Activity 2: Improvement of AMT Communications Infrastructure				
Item 2.1: Communications Equipment	3,680.00	3,680.00	0.00	0.00
Item 2.2: Website/Service Costs	8,770.00	7,490.00	1,280.00	0.00
Sub-Total	**12,450.00**	**11,170.00**	**1,280.00**	**0.00**

Table 23: PACT Budget (2008)

Distribution of Funds				
Specific Items per Activity	**Total ($)**	**PACT Contribution**	**Counterpart Contribution**	**In- Kind Contribution**
Activity 3: Maintenance of AMT Rangers' Patrol, Infrastructure Maintenance, and Ecological Monitoring Work				
Item 3.1: Ranger Salaries	3,675.00	3,675.00	0.00	0.00
Sub-total	**3,675.00**	**3,675.00**	**0.00**	**0.00**
Activity 4: Project Administration				
Item 4.1: AMT Coordinator	10,800.00	0.00	0.00	10,800.00
Item 4.2: Peace Corps Volunteer	9,600.00	0.00	9,600.00	0.00
Sub-total	**20,400.00**	**0.00**	**9,600.00**	**10,800.00**
Contingency	***2,000.00***	**2,000.00**	**0.00**	**0.00**
Total (Bz$)	**88,064.00**	**39,951.50**	**36,287.50**	**11,825.00**

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Annex One: Plant Species List

Family	Species	Common name	Survey	EIA
Acanthaceae				
	Aphelandra aurantiaca			1
	Aphelandra scabra			1
	Bravaisia integerrima			1
	Odontonema callistachyum			1
Adiantaceae				
	Vittaria sp.		1	1
Alismataceae				
	Sagittaria lancifolia	White-flowered water plantain	1	
	Sagittaria guyanensis			1
Anacardiaceae				
	Spondias mombin	Hogplum		1
	Spondias radlkoferi	Hogplum	1	1
Apocynaceae				
	Odontadenia macrantha			1
	Stemmadenia donnell-smithii	Horse's balls	1	1
	Thevetia ahouai	Dog balls, Cojon de mico	1	1
	Thevetia gaumeri	Willow		1
Araceae				
	Anthurium scandens			1
	Anthurium schlechtenalii			1
	Anthurium sp.	Birds' nest 'fern'	1	
	Philodendron radiatum	Common philodendron	1	1
	Philodendron sp.	Philodendron	1	
	Syngonium sp.		1	
Araliaceae				
	Dendropanax arboreus	Mano de leon		1
	Oreopanax obtusifolius	Matapalo		1
Arecaceae				
	Acoelorraphe wrightii	Tasiste		1
	Asterogyne martiana	Monkey tail palm		1
	Astrocaryum mexicanum	Warree cohune		1
	Attalea cohune	Cohune	1	1
	Bactris major			1
	Bactris mexicana	Pokenoboy -red fruit	1	1
	Calypterogyne gheisbreghtiana	San Miguel palm		1

Family	Species	Common name	Survey	EIA
Arecaceae	Chamaedorea ernesti-augustii	Xate		1
	Chamaedorea neurochlamys			1
	Chamaedorea tepejilote	Pacaya		1
	Crysophila stauracantha	Escoba, Give-&-take		1
	Sabal mauritiformis			1
Aristolochiaceae				
	Aristolochia grandiflora			1
Asteraceae				
	Neurolaena lobata	Jackass bitters	1	
Begoniaceae				
	Begonia sericoneura			1
Bignoniaceae				
	Mussatia hyacinthina			1
	Tabebuia chrysantha	Cortez		1
	Tabebuia rosea	Mayflower		1
Bombacaceae				
	Ceiba pentandra	Cotton tree		1
	Pachira aquatica	Provision bark, Santo domingo	1	1
	Quararibea funebris			1
Boraginaceae				
	Cordia stellifera	Riverside kaway		1
	Heliotropium procumbens			1
Bromeliaceae				
	Aechmea bracteata	Bromeliad (red-flowering)	1	1
	Aechmea tillandsioides			1
	Androlepis skinneri			1
	Bromelia pinguin			1
	Catpsis berteroniana			1
	Guzmania scherzeriana			1
	Tillandsia balbisiana			1
	Tillandsia juncea			1
	Tillandsia limbata			1
	Tillandsia spp.	Air-plants	1	
	Tillandsia streptophylla			1
	Tillandsia utriculata			1
	Vriesea gladioliflora			1
Cabombaceae				
	Cabomba palaeformis		1	1

Family	Species	Common name	Survey	EIA
Cactaceae	Epiphyllum phyllanthus			1
	Rhipsalis baccifera			1
	Selenicereus testudo	Devil's gut cactus		1
Campanulaceae				
	Hippobroma longiflora	Bethlehem star		1
Caricaceae				
	Carica papaya	Wild papaya		1
Cecropiaceae				
	Cecropia obtusifolia			1
	Cecropia peltata	Trumpet, Warumo	1	
Celastraceae				
	Maytenus schippii			1
Chrysobalanaceae				
	Chrysobalanus icaco	Cocoplum	1	1
	Hirtella racemosa			1
	Licania hypoleuca			1
Clusiaceae				
	Calophyllum brasiliense	Santa maria	1	1
	Garcinia intermedia			1
	Symphonia globulifera	Waika chew-stick	1	1
	Vismia macrophylla	Ringworm tree	1	
Combretaceae				
	Bucida buceras	Bullet Tree, Pucte	1	1
	Terminalia amazonia	Nargusta		1
Commelinaceae				
	Tradescantia zanonia			1
Connaraceae				
	Connarus lambertii	Can-xul		1
Costaceae				
	Costus sp.	Costus	1	
Cucerbitaceae				
	Gurania makoyana			1
Cyperaceae				
	Cyperus articulatus			1
	Eleocharis interstincta			1
	Scleria bracteata	Cutting grass	1	1
Davalliaceae				
	Nephrolepis cordifolia	Fern		1
Dilleniaceae				
	Davilla sp.		1	

Family	Species	Common name	Survey	EIA
Dracaenaceae				
	Dracaena americana	Dracaena		1
Euphorbiaceae				
	Acalypha diversifolia	Costillo del danto		1
	Amanoa guianensis	Swamp icaco		1
	Croton billbergianus	Wild spice		1
Fabaceae				
Caesalpinioideae				
	Dialium guianense	Ironwood		1
	Hymenaea coubaril	Broken ridge locust		1
	Schizolobium parahyba	Quamwood		1
	Senna undulata	John crow bead		1
Mimosoideae				
	Cojoba graciflora	Frijolillo		1
	Inga cocleensis			1
	Inga vera	Bri-bri	1	1
	Mimosa pellita	Sensitive weed	1	1
	Zgia sp.			1
Papilionoideae				
	Acosmium panamense	Billy webb		1
	Andira inermis	Cabbage bark, carbon		1
	Dalbergia cubiluitzensis	Rosewood		1
	Dalbergia glabra	Kibix	1	1
	Lonchocarpus castilloi	Cabbage Bark, machich	1	1
	Lonchocarpus guatemalensis	Dogwood		1
	Lonchocarpus hondurensis	Turtle-bone, Swamp dogwood	1	1
	Lonchocarpus rugosus	Black cabbage bark, canasin		1
	Machaerium cirrhiferum	Tiger claw		1
	Platymiscium dimorphandrum			1
	Pterocarpus officinalis	Swamp kaway	1	1
	Vatairea lundellii	Bitterwood		1
Flacourtiaceae				
	Casearia aculeata	Limoncillo		1
Gesneriacea				
	Codonanthe macradenia			1
	Columnea sulfurea			1

Family	Species	Common name	Survey	EIA
Heliconiaceae	Heliconia aurantiaca			1
	Heliconia bourgaeana			1
	Heliconia latispatha			1
	Heliconia vaginalis			1
	Heliconia wagneriana			1
Hippocrateaceae				
	Cheiloclinium belizense			1
Lecythidaceae				
	Grias cauliflora	Bombowood		1
Lentibulariaceae				
	Utricularia foliosa			1
Loganiaceae				
	Spigelia polystachya			1
Loranthaceae				
	Psittacanthus rhyncanthus	Scorn de earth	1	1
Olacaceae				
	Heisteria media	Wild cinnamon		1
Malvaceae			1	
Marantaceae				
	Calathea inocephala			1
Melastomataceae			1	
	Clidemia dentata			1
	Miconia impetiolaris			1
	Miconia sp.	Miconia	1	
	Mouriri exilis		1	1
	Mouriri myrtilloides	Wild guava		1
Meliaceae				
	Guarea glabra	Cramante		1
	Swietenia macrophylla	Mahogany		1
	Trichilia havanensis	Bastard lime	1	
Moraceae				
	Catilla elastica			1
	Ficus insipida			1
	Ficus nymphaeifolia			1
	Ficus sp.	Fig	1	
	Poulsenia armata			1
	Pseudolmedia spuria	Cherry		1
Myrtaceae				
	Calyptranthes chytraculia			1

Family	Species	Common name	Survey	EIA
	Eugenia aeruginea	Aguacaliente Eugenia	1	1
	Eugenia capuli			1
	Psidium guajava	Guayaba		1
Nyctaginaceae				
	Pisonia aculeata	Tiger claw	1	
Nymphaeaceae				
	Nymphaea ampla	Water lilly		1
Onagraceae				
	Ludwigia octovalvis	Clavos	1	1
Orchidaceae				
	Epidendrum imatophyllum			1
	Epidendrum nocturnum	Butterfly orchid	1	1
	Epidendrum rigidum			1
	Lepanthes disticha			1
	Nidemia boothii			1
Passifloraceae				
	Passiflora biflora			1
	Passilora choconiana			1
	Passilora ciliata			1
Phytolaccacaeae				
	Phytolacca rivinoides	Pigeon berry		1
	Trichostigma octandrum			1
Piperaceae				
	Piper amalgo	Cordonzillo		1
Poaceae				
	Echinochloa crus-pavonis			1
	Eragrostris contrerasii			1
	Guadua longifolia	Riparian bamboo		1
	Gynerium sagittatum	Wild cane		1
	Hymenanchne amplexicaulis			1
	Neeragrostris conterasii			1
	Rottboellia cochinchinensis			1
Polygalaceae				
	Securidaca sylvestris	Man vine		1
Polygonaceae				
	Coccoloba belizensis	Bob	1	1
	Coccoloba hirtella			1
	Polygonum acuminatum			1

Family	Species	Common name	Survey	EIA
Rubiaceae	Alibertia edulis	Wild guava	1	1
	Chiococca alba	Skunk root		1
	Faramea occidentalis	Wild coffee		1
	Guettarda combsii	Glassy wood		1
	Hamelia rovirosae			1
	Morinda panamensis	Yellow wood		1
	Palicourea crocea			1
	Psychotria glomerulata			1
	Psychotria poeppigiana	Hot lips	1	1
	Randia sp.			1
	Simira salvadorensis	Redwood		1
	Uncaria tomentosa			1
Salviniaceae				
	Salvinia minima		1	1
Sapotaceae				
	Chrysophyllum mexicanum			1
	Pouteria campechiana			1
Schizaeaceae				
	Lygodium venustum	Wire whisk		1
Simaroubaceae				
	Picramnia antidesma			1
Smilacaceae				
	Smilax sp	Chinee yam, Chinee root	1	
Solanaceae				
	Cestrum nocturnum	Dama de noche		1
	Solanum campechiense			1
Sphenocleaceae				
	Sphenoclea zeylanica			1
Sterculiaceae				
	Guazuma ulmifolia	Bay cedar		1
Theophrastaceae				
	Jacquinia paludicola	Bastard lime		1
Ulmaceae				
	Ampelocera hottlei	Luin		1
	Trema macrantha	Wild bay cedar		1
Urticaceae				
	Urera baccifera	Cow-itch		1
Verbenaceae				
	Citharexylum caudatum	Pigeon berry		1

Family	Species	Common name	Survey	EIA
Verbenaceae	Citharexylum hirtellum			1
	Lippia stoechadifolia			1
	Stachytarpheta jamaicensis	Stachytarpheta	1	
	Vitex kuylenii	Fiddlewood		1
Violaceae				
	Corynostylis arborea	Monkey apple		1
Vochysiaceae				
	Vochysia hondurensis	Yemeri, San Juan	1	1
Zamiaceae				
	Zamia variegata			1

Annex 2: Reptile and Amphibians						
Family	**Species**	**English Name**	**2007 IUCN**	Recorded	Likely	Possible
Plethodontidae	*Bolitoglossa mexicana*	Mexican Mushroomtongue Salamander	LC			
	Bolitoglossa rufescens	Northern Banana Salamander	LC			
Rhinophrynidae	*Rhinophrynus dorsalis*	Burrowing Toad	LC			
Leptodactylidae	*Craugastor sabrinus*	Sabrinus Rainfrog	EN			
	Eleutherodactylus leprus	Leprus Chirping Rainfrog	VU			
	Leptodactylus fragilis (labialis)	White-lipped Frog	LC			
	Leptodactylus melanonotus	Sabinal Frog	LC			
Bufonidae	*Bufo marinus*	Cane Toad	LC			
	Bufo valliceps	Gulf Coast Toad	LC			
Hylidae	*Agalychnis callidryas*	Red-eyed Treefrog	LC			
	Dendropsophus ebraccata	Hourglass Treefrog	LC			
	Dendropsophus microcephala	Yellow Treefrog	LC			
	Scinax staufferi	Stauffer's Treefrog	LC			
	Smilisca baudinii	Common Mexican Treefrog	LC			
	Smilisca cyanosticta	Blue-spotted Mexican Treefrog	NT			
	Tlalohyla loquax	Mahogany Treefrog	LC			
	Tlalohyla picta	Painted Treefrog	LC			
	Trachycephalus venulosus	Veined Treefrog	LC			
Centrolenidae	*Hyalinobatrachium fleischmanni*	Fleischmann'sGlass Frog	LC			
Microhylidae	*Gastrophryne elegans*	Elegant Narrowmouth Frog	LC			
	Hypopachus variolosus	Sheep Frog	LC			
Ranidae	*Rana berlandieri*	Rio Grande Leopard Frog	LC			
	Rana vaillanti (palmipes)	Rainforest Frog	LC			
Crocodylidae	*Crocodylus moreletii*	Morelet's Crocodile	LR			
Dermatemydidae	*Dermatemys mawii*	Central American River Turtle	CR			
Chelydridae	*Chelydra serpentina*	Snapping Turtle				
Kinosternidae	*Claudius angustatus*	Narrowbridge Musk Turtle	LR			

Family	Species	English Name	2007 IUCN	Recorded	Likely	Possible
Kinosternidae	*Staurotypus triporcatus*	Mexican Giant Musk Turtle	LR			
	Kinosternon acutum	Tabasco Mud turtle	LR			
	Kinosternon leucostomum	White-lipped Mud Turtle				
	Kinosternon scorpiodes	Scorpion Mud Turtle				
Emydidae	*Rhinoclemmys areolata*	Furrowed Turtle	NT			
	Trachemys scripta	Slider	LR			
Eublepharidae	*Coleonyx elegans*	Yucatan Banded Gecko				
Gekkonidae	*Sphaerodactylus glaucus*	Dwarf Gecko				
	Sphaerodactylus millepunctatus	Spotted Dwarf Gecko				
	Thecadactylus rapicauda	Turnip Tail Gecko				
Corytophanidae	*Basilicsus vittatus*	Brown Basilisk				
	Corytophanes cristatus	Smoothhead Helmeted Basilisk				
	Corytophanes hernandezii	Hernandez's Helmeted Basilisk				
	Laemanctus longipes	Eastern Casquehead Iguana				
Iguanidae	*Ctenosaura similis*	Black Iguana				
	Iguana iguana	Green Iguana				
Phrynosomatidae	*Sceloporus variablis*	Rosebelly Lizard				
Polychrotidae	*Anolis biporcatus*	Neotropical Green Anole				
	Anolis capito	Bighead Anole				
	Anolis lemurinus	Ghost Anole				
	Anolis pentaprion	Lichen Anole				
	Anolis rodriguezii	Smooth Anole				
	Anolis sagrei	Brown Anole				
	Anolis sericeus	Silky Anole				
	Anolis uniformis	Lesser Scaly Anole				
Scincidae	*Eumeces sumichrasti*	Sumichrast's Skink				
	Mabuya unimarginata	Central American Mabuya				
	Sphenomorphus cherriei	Brown Forest Skink				

Family	Species	English Name	2007 IUCN	Recorded	Likely	Possible
Teiidae	*Ameiva festiva*	Middle American Ameiva				
	Ameiva undulata	Rainbow Ameiva				
Xantusiidae	*Lepidophyma flavimaculatum*	Yellow-spotted Night Lizard				
	Lepidophyma mayae	Maya Night Lizard				
Boidae	*Boa constrictor*	Boa Constrictor				
Colubridae	*Adelphicus quadrivirgatus*	Middle American Earth Snake	DD			
	Amastridium veliferum	Rustyhead Snake				
	Clelia clelia	Mussurana				
	Coniophanes bipunctatus	Two-spotted Snake				
	Coniophanes fissidens	White-lipped Spotbelly Snake				
	Coniophanes imperialis	Black-striped Snake	LC			
	Conophis lineatus	Road Guarder	LC			
	Dendrophidion nuchale	Black-naped Forest Racer				
	Dryadophis melanolomus	Lizard Eater	LC			
	Drymarchon corais	Indigo Snake	LC			
	Drymobius margaritiferus	Speckled Racer				
	Elaphe flavirufa	Tropical Rat Snake				
	Imantodes cenchoa	Blunthead Tree Snake				
	Lampropeltis triangulum	Milk Snake				
	Leptodeira frenata	Rain Forest Cat-eyed Snake	LC			
	Leptodeira septentrionalis	Northern Cat-eyed Snake				
	Leptophis ahaetulla	Parrot Snake				
	Leptophis mexicanus	Mexican Parrot Snake				
	Masticophis mentovarius	Neotropical Whipsnake				
	Ninia diademata	Ringneck Coffee Snake	LC			
	Ninia sebae	Redback Coffee Snake				
	Oxybelis aeneus	Mexican Vine Snake				
	Oxybelis fulgidus	Green Vine Snake				
	Oxyrhopus petola	Calico False Coral Snake				
	Pseustes poecilonotus	Puffing Snake	LC			

Family	Species	English Name	2007 IUCN	Recorded	Likely	Possible
Colubridae (cont.)	*Rhadinaea decorata*	Adorned Graceful Brown Snake				
	Scaphiodontophis annulatus	Guatemalan Neckband Snake				
	Senticolis triaspis	Peninsular Rat Snake				
	Sibon dimidiata	Slender Snail Sucker	LC			
	Sibon nebulata	Cloudy Snail Sucker				
	Sibon sanniola	Pygmy Snail Sucker	LC			
	Sibon sartorii	Terrestrial Snail Sucker				
	Spilotes pullatus	Tiger Tree Snake				
	Stenorrhina degenhardtii	Degenhardt's Scorpion-eating Snake				
	Tantilla schistosa	Red Earth Centipede Snake				
	Tantillita canula	Yucatan Dwarf Short-tailed Snake	LC			
	Tantillita lintoni	Linton's Dwarf Short-Tailed Snake	LC			
	Thamnophis proximus	Western Ribbon Snake				
	Tretanorhinus nigroluteus	Orangebelly Swamp Snake				
	Urotheca elapoides	False Coral Snake	LC			
	Xenodon rhabdocephalus	False Fer-De-Lance				
Elapidae	*Micrurus diastema*	Variable Coral Snake	LC			
	Micrurus hippocrepis	Maya Coral Snake				
Viperidae	*Atropoides nummifer*	Jumping Pitviper				
	Bothriechis schlegelii	Eyelash Palm-Pitviper				
	Bothrops asper	Fer-de-Lance				
	Crotalus durissus	Neotropical Rattlesnake				
Total No. Species				**11**	**74**	**22**

Annex One: Patrol Monitoring Data Collection Form

Aguacaliente Wildlife Sanctuary - Patrol Data Form

Date:	***Rangers:***		
Species	**No. of groups**	**No. of Individuals per group**	**GPS Location / Notes**
Collared Peccary			
White lipped Peccary			
Great Curassow			
Guan			
Paca			
White tailed Deer			
Other game species			
Green Iguana			
Hickatee			
Other turtle species			