STRATEGIC ENVIRONMENTAL

AND

SOCIAL IMPACT ASSESSMENT

REPORT



MOSI-OA-TUNYA/ VICTORIA FALLS WORLD HERITAGE PROPERTY (MOT/VFWHP)

2021 – 2030

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August, 2021

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APPROVAL PAGE

This Strategic Environmental and Social Impact Assessment Report has been approved by the Honourable Minister of Environment, Climate, Tourism and Hospitality Industry, Zimbabwe and Honourable Minister of Tourism, Zambia.

1st December, 2021

……..	……..
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FOREWORD

The State Parties of Zambia and Zimbabwe, through their respective lead agencies, the National Heritage Conservation Commission (NHCC) and the Zimbabwe Parks and Wildlife Management Authority (ZPWMA) are pleased to present the outcome of the joint Zambia/Zimbabwe Strategic Environmental and Social Assessment (SESA) of developments around the Mosi-Oa-Tunya/Victoria Falls World Heritage Property (MoT/VFWHP) for the period 2021 to 2030. The MoT/VFWHP remains one of the largest and most beautiful waterfalls in the World.

In 1989, the two States Parties submitted a joint application to UNESCO WHC, to request the international body to consider enlisting the Site on the World Heritage List. UNESCO favourably considered the application and the site was declared a World Heritage Property based on the two (2) criteria; that of containing superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance (criterion vii) and being an outstanding example representing significant on-going geological processes in the development of landforms or significant geomorphic or physiographic features (criterion viii). In addition, the property is one of the 7th natural wonders of the world.

In 2017, the States Parties of Zambia and Zimbabwe prepared a joint application to the African World Heritage Fund (AWHF) for funding to conduct the Strategic Environmental and Social Assessment (SESA) for the Victoria Falls Area, for the period 2021 to 2030. This was after the realization that the first Strategic Environmental Assessment (SEA) for the area which was conducted in 1995, 26 years ago was outdated due to time lapse. It was realized that since 1995, when the first SEA was conducted, the area has experienced rapid increase in population, climate change, rapid urbanization, increase in energy demand, rapid tourism development, increase in land-use practices, biodiversity loss to mention, but a few. For this reason, the two States Parties of Zambia and Zimbabwe realized the need for an updated Strategic Environmental and Social Assessment (SESA) for the area to take stock of the various issues already mentioned and assess their likely cumulative impacts on the Outstanding Universal Values and integrity of the Mosi-Oa-Tunya/Victoria Falls World Heritage Property.

The initial request for funding from AWHF was US$52,700.20. However, in September 2020, the AWHF released US$19,000.00, while a US$1,000 would be released at a later stage for report compilation. In April 2021, the two States Parties made an attempt to hire and engage the consultancy to conduct the SESA. However, due to low funds, this attempt failed. A decision was made thereafter that the two States Parties should conduct the SESA using their own professional expertise. The NHCC in Zambia and the ZIMPARKS in Zimbabwe spearheaded the process.

The study process commenced in April 2021. The relevant topics for detailed studies were identified. Thereafter the professionals qualified in the relevant fields were appointed to carry out both the archival/desktop, research and field surveys. The study team consisted of eight (8) experts from Zambia and nine (9) experts from Zimbabwe.

In April 2021, a Coordinator for the SESA programme was appointed. From May 2021 to July 2021, the study team was conducting research to gather data after which they drafted their reports and submitted to the coordinator for compilation.

In conclusion, I would like to thank the AWHF for supporting the study of the Strategic Environmental and Social Assessment for developments around the Mosi-Oa-Tunya/Victoria Falls World Heritage Property (MoT/VFWHP). I would also like to thank the Coordinator for the SESA Programme for providing technical advice and guidance to the study team. Finally, I would like to thank all those who have been involved and supported the programme; the study team, the institutions and tour operators and the participants in the scoping meetings and the interview respondents.

_____

MUYUMBWA NDIYOI
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The study team for the Strategic Environmental and Social Assessment of developments around the Victoria Falls Area would like to thank all those who assisted them in the course of the study. This includes the Executive Director and staff of the National Heritage Conservation Commission (NHCC) and the Director General and staff of Zimbabwe Parks and Wildlife Management Authority (ZPWMA).

Special thanks go to the coordinator Professor Imasiku Nyambe for compiling the reports. The list of people who participated and supported the process is extensive. Those who participated in the stakeholder scoping meeting in Zambia and Zimbabwe are thanked and acknowledged. Those who were consulted by the Study team during the course of the study are also thanked. We would like to thank all of them for sparing their time most willingly and helpfully.

In Zambia, we would like to acknowledge the assistance rendered by the Minor Hotels' Limited for providing a venue for the scoping meeting, the Tongabezi Lodge, Chrismar Hotel, Livingstone adventures and Nick Safari and Tours for providing refreshments and logistics for the scoping meeting. Last but not least, the team would like also to thank Livingstone City Council, Livingstone Museum and Water Resources Management Authority (WARMA) for providing transport logistics to the study team.

In Zimbabwe, our sincere gratitude goes to all Victoria Falls stakeholders for their unwavering support to this important exercise. We acknowledge Chief Shana and Chief Mvutu, who made time to meet and discuss the experts and share knowledge on the history of the Mwange district. The local communities have been supportive to the end, and we appreciate the commitment.

ABBREVIATIONS AND ACRONYMS

COVID 19	Coronavirus
CRM	Cultural Resources Management
CSO	Central Statistics Office
ECZ	Electoral Commission of Zambia
ECZ	Environmental Council of Zambia
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
EPB	Environmental Project Brief
EPPCA	Environmental Protection and Pollution Control
ERB	Energy Regulation Board
GIS	Geographic Information Systems
HEP	Hydro Electrical Power
HIV/AIDS	Human Immune Virus/Acquired Immune Deficiency Syndrome
IAS	Invasive Alien Species
IATA	International Air Transport Association
IBA	Important Bird Area
ICAO	International Civil Aviation Organization
IDP	Integrated Development Plan
JMC	Joint Ministerial Committee
JSMC	Joint Site Management Committee
JTC	Joint Technical Committee
LCC	Livingstone City Council
LSA	Late Stone Age
MSA	Middle Stone Age
NCS	National Conservation Strategy
NHCC	National Heritage Conservation Commission
OUV	Outstanding Universal Values
SEA	Strategic Environmental Assessment
SESA	Strategic Environmental and Social Assessment
STI	Sexual Transmitted Infection
TB	Tuberculosis
WARMA	Water Resources Management Authority
ZEMA	Zambia Environmental Management Agency
ZICA	Zambia Institute of Chartered Accountant
ZTA	Zambia Tourism Agency
ZNBC	Zambia National Broadcasting Corporation

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1.0 INTRODUCTION

The area being considered for the SESA covers a 30 km radius from the Victoria Falls and straddles the Zambezi River in southern Zambia and northwest Zimbabwe, part of which is designated as a World Heritage Property (WHP) (Figure 1.1). Mosi-Oa-Tunya National Park in Zambia follows the north bank from the Sinde River to Songwe River Gorge below the falls; all islands up to Kandahar Island are within the park. The national border runs in the deepest stream. It covers Livingstone and parts of Kazungula districts of Zambia. On the south bank Victoria Falls National Park in Zimbabwe runs from 6 km above the falls to Batoka Gorge, 12 km below the gorge. It adjoins the City of Victoria Falls on the west; the national parks of Zambezi and Victoria Falls; part of Matetsi Safari Area; State Forest, the Hwange District communal land under Chief Mvutu and Chief Shana, and private land. Within the site, a riverine strip of Zambezi National Park extends 9 km upstream along the bank of the Zambezi. The site's centre point is 17° 56' S and 25° 51' E (UNESCO and IUCN, 2014).

The WHP is a natural component made up of the outstanding universal and wilderness value that attracts tourists. On the other hand, the cultural diversity history, archeology and hospitality enhance the visitor experience. The tourism industry has continued to grow generating more benefits to national economies of Zambia and Zimbabwe. The Victoria Falls has been a main tourist hub for both countries. The industry has become a very attractive business to both domestic and international tourists and investors. This growth in tourism has also seen the emergence and increase in the impact of environmental conservation issues and challenges that existed in 1996.

A well-managed heritage is the key foundation of tourism. Zambia and Zimbabwe subscribe to the concept of sustainable development. There are four dimensions pertinent to sustainable development – society, environment, culture and economy – which are not separated from each other and make the Victoria Falls what it is. Sustainability is a future in which environmental, societal and economic considerations are balanced in the pursuit of an improved quality of life. The prosperity of a society relies on a healthy environment to provide ecosystem goods and services. The processes and pathways to sustainable development require that the past, present and future scenarios be taken into account to achieve sustainability (Sustainable Development (unesco.org)) which we require the WHP to be for future generations.

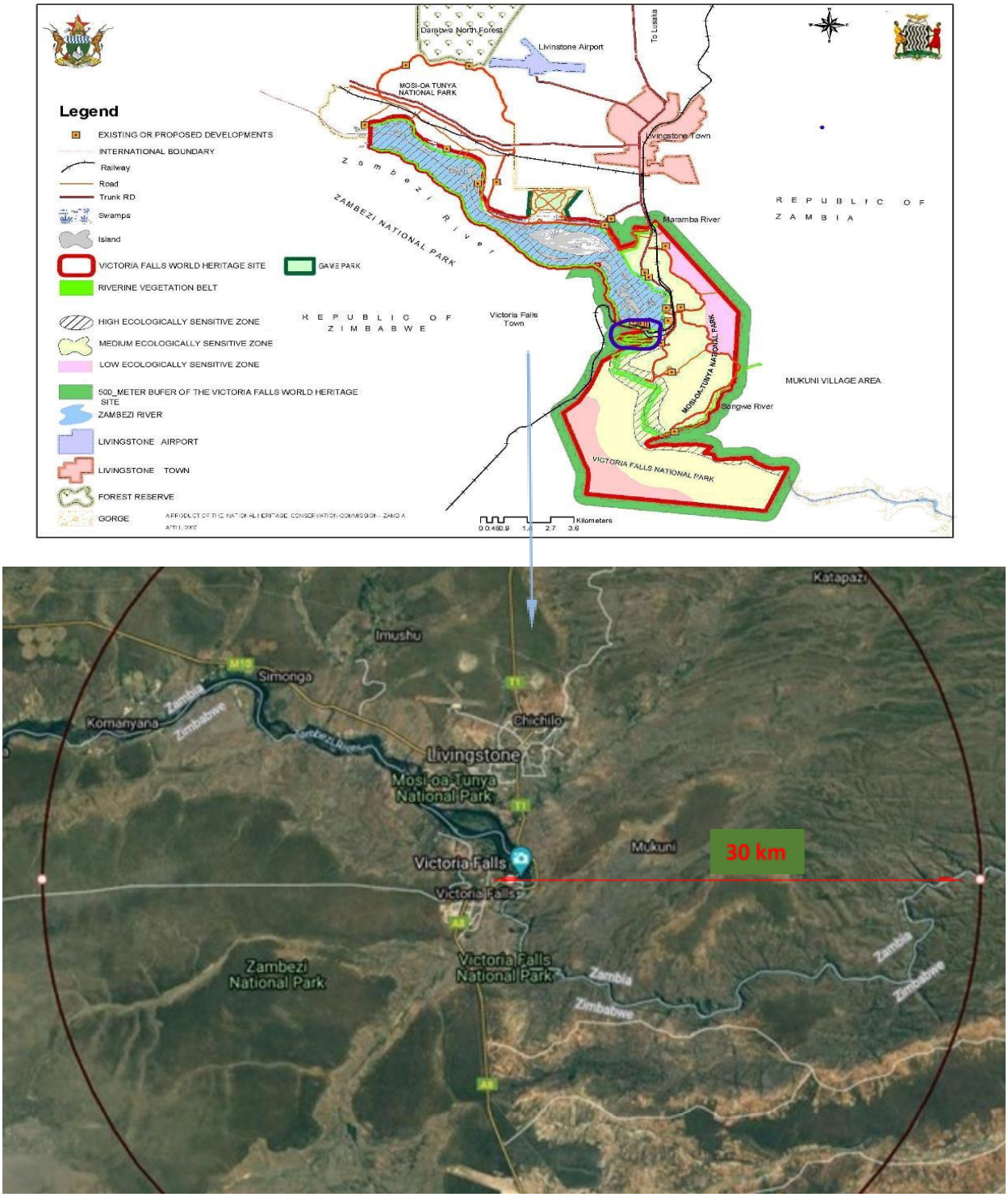


Figure 1.1: Satellite map (June 2021) showing center of 30 km radius study area and boundary map showing development zones of World Heritage Site (Zambia-Zimbabwe Joint Site Management Committee, 2016)

1.1 Background 2021 SESA in Relation to the 1995 SEA

The Victoria Falls and its surrounding areas are one of the Seven Natural Wonders of the World and were declared a World Heritage Site by UNESCO in 1989 at the joint request of the Zambian and Zimbabwean governments. The Site has superlative natural features and presents an example of significant on-going geological and geomorphological processes (IUCN, 1989; Goriup and Harvey, 1997). Due to its status, the site has undergone, endured or in some cases succumbed to the many development pressures that resonate with industrial and tourism development. This, if unchecked, can be to the detriment of the Outstanding Universal Value of the Property. Both governments are however mindful of their responsibilities regarding the Falls, and of the need to maintain or expand the economic benefits of tourism whilst maintaining the quality of the resource and its environment, which attracts tourists to the area.

The first joint Zambia/Zimbabwe Strategic Environmental Assessment (SEA) of the developments around the Victoria Falls was undertaken in 1995. The 1995 SEA provided information upon which the authorities in both countries based their policy decisions to regulate, control and manage tourism and other developments in the area following the declaration of the Victoria Falls as a UNESCO World Heritage Site in 1989.

However, there has been a time lapse since the last SEA was conducted in 1995, which is 26 years ago. The area has over the years experienced rapid tourism development, rapid urbanization, population increase, high energy demand, environmental degradation, climate change and communicable diseases such as COVID-19 pandemic. Thus, results of the 1995 SEA have been overtaken by time and events and can no longer be relied upon to inform policy making and management planning. This scenario justifies the need for an updated Strategic Environmental and Social Assessment (SESA) for the area for the period 2021-2030.

While the 1995 SEA primarily focused on the analysis of tourism development and environment, the 2021-2030 SESA goes beyond by analyzing the impacts of socio-economic issues (i.e. urbanization, increase in population, employment, energy demand, health) as well as climate change, ecology, geology, land use and hydrological issues. The anthropology and history of the people and developments in the area is also analyzed. This report also highlights the impacts of changes, predicted scenarios and makes strategic recommendations to sustain the integrity of the Property.

1.2 Purpose and Objectives of the Study

The purpose and objective of the study is to carry out critical analysis and assess the likely cumulative impacts of tourism development, urbanization, energy demand, population dynamics, biodiversity loss, climate change and invasive alien species on the integrity of the Property and the society in the Area with the following specific objectives:

1. To provide information on the history, historical trends and development of the Area;
2. To conduct a survey and provide information on the current tourism development in terms of tourism establishments, tourism activities and visitor numbers, and assess their impact on the integrity of the Property;
3. To carry out research and conduct a survey to provide information on the current socio-economic dynamics in terms of population growth, energy demand, urbanization, and other social issues, and assess their impact on the integrity of the Property;

4. To carry out a field survey to identify ecological resources and their conservation issues and assess whether or not their conservation status has impacted on the integrity of the Property;
5. To conduct a survey and provide information on all water obstruction projects/ activities from the Zambezi River upstream and downstream and assess their impact on the integrity of the Property;
6. To conduct a survey and provide information on all water related tourist activities and assess their impact on water quality, river bank erosions and integrity of the Property;
7. To conduct a survey on the various land use practices in the Area and assess their impact on the integrity of the Property;
8. To conduct a survey on the geological and geomorphological features in the Area and assess how their state of preservation have impacted on the integrity of the Property;
9. To conduct both archival and field research to provide an inventory of archaeological resources in the Area;
10. To analyse and assess how the preservation of traditional/ anthropological heritage of the local communities have affected the integrity of the property;
11. To spatially represent all major developmental, natural features including some historical, archaeological and anthropological sites; and
12. To craft practical lasting solutions to the mounting environmental and social pressures that may affect the OUV of the WHP.

2.0 LEGISLATION, REGULATIONS AND POLICY BACKGROUND

2.1 Zambia

2.1.1 Policies

The overall policy on environmental management in Zambia is largely based on the 1982 National Conservation Strategy Report and the 1992 National Environment Action Plan (NEAP). The National Conservation Strategy (NCS) was adopted as a policy document by the government in 1985 and led to the enactment of environmental legislation such as the Environmental Protection and Pollution Control Act (EPPCA) number 12 of 1990 and the establishment of the Environmental Council of Zambia (ECZ). The NCS was updated by the government through the NEAP with the overall objective of integrating environmental concerns into the social and economic development process of the country.

2.1.2 Acts

The Zambia Environmental Management Act, No. 12 of 2011

The Environmental Management Act (EMA) was signed into law in April 2011 thereby replacing and repealing the former Environmental Protection and Pollution Control Act (EPPCA) Cap 204 of 1990. The Act continues the existence of the Environmental Council of Zambia which has been renamed as the Zambia Environmental Management Agency (ZEMA). The Act is the superior legislation on matters relating to environmental protection and management, it sets out a framework for Environmental Impact Assessments.

National Heritage Conservation Commission Act, Cap 173 of 1989

The National Heritage Conservation Commission (NHCC) Act is the principal Act that deals with the conservation, management and protection of the cultural and natural heritage resources in Zambia. The

NHCC Act provides for the conservation of ancient, cultural and natural heritage, relics and objects of aesthetic, historical, prehistoric, archaeological or scientific interest by preservation, restoration, rehabilitation, reconstruction, adaptive use and good management.

Water Resources Management Act, 2011

This Act establishes the Water Resources Management Authority (WARMA). The Act provides for the management, development, conservation, protection and preservation of the water resource and its ecosystems. It provides for the equitable, reasonable and sustainable utilization of the water resources and ensures the right to draw or take water.

The Zambia Wildlife Act No. 14 of 2015

The Zambia Wildlife Act No. 14 of 2015 is responsible for the control and management of national park, bird and wildlife sanctuaries and for the conservation and enhancement of wildlife eco-systems, biological diversity and object of aesthetic prehistoric and historical, geological archaeological and scientific interest in National Parks.

Zambia Development Agency Act, 2006

The Act provides a legal framework for investment in Zambia and recognizes the role of other agencies, including those responsible for environmental protection in authorizing specific projects.

The Urban and Regional Planning Act of 2015

The Act provides for development, planning and administration principles, standards and requirements for urban and regional planning processes and systems. It also provides a framework for administering and managing urban and regional planning guidelines, systems and processes for the Republic.

Public Health Act No. 22, Cap 295 of 1995

The Act provides for the prevention and suppression of diseases and to generally regulate all matters related to Public Health in Zambia.

The Energy Regulation Act No. 12 of 2019

The Energy Regulation Act No. 12 of 2019 repealed the Energy Regulation Act of 1995. The Act provides for the licensing of enterprises in the energy sector; continue the existence of the Energy Regulation Board and re-defines its functions; re-constitute and revise the functions of the Board and provide for matters connected with, or incidental to, the foregoing.

Forestry Act No. 7 of 2015

The Act administered by the Forestry Department, provides for the establishment and management of National and Local Forests, conservation and protection of forests and trees, and the licensing and sale of forest produce.

Tourism and Hospitality Act No 13 of 2015

The Act provides for sustainable development in the tourism industry through effective tourism planning, management, promotion and coordination to ensure sustainable tourism. To provide for and enabling environment for the growth of the tourism industry by ensuring that Zambia responds to changing tourism trends in the macro and competitive tourism environment as well as regulate tourism enterprises, tourism related services and enforce standards of operation and service.

Lands Act of 1995

The Act provides for the different land tenures systems in the Zambia and the processes and procedures for land alienation and conversion.

2.2 Zimbabwe

2.2.1 Policies

Wildlife Based Land Reform Policy 2006

The policy aims to facilitate wildlife-based land reform to ensure profitable, equitable, and sustainable use of wildlife resources, particularly in areas where agricultural potential is limited. The policy highlights the important principle that wildlife management responsibility and authority must be devolved to the most appropriate level for efficient resource management, and production incentives must be maximized for the landholders.

Forest Based Land Reform Policy 2004

The policy ensures that forest development plans are integrated with overall land use plans, and supports the development of environmentally sustainable small-scale industries including furniture manufacturing and wood carving. It also ensures strict control of invasive alien species encroaching from plantations into natural forests, cultural heritage sites and protected biodiversity zones.

Zimbabwe Policy on Wildlife 1992

The policy aims to, amongst other things, maintain the Parks and Wild Life Estate for the conservation of the nation's wild resources and biological diversity; ensure the adequate protection of major ecosystems or key species and habitats; encourage the conservation of wild animals and their habitats outside the Parks and Wild Life Estate; insist upon environmental impact assessments for all developments that threaten to affect wild life and protected land adversely; use the Parks and Wild Life Estate to promote a rural-based wildlife industry; harmonize the management of the Parks and Wild Life Estate with efforts of neighbouring communities that are developing wildlife as a sustainable form of land use; and transform land use in the remote communal lands of Zimbabwe through CAMPFIRE, where rural peoples have the authority to manage their wildlife and other natural resources and benefit directly.

2.2.2 Acts

Constitution of Zimbabwe Amendment (No. 20) Act, 2013

The Constitution outlines the role of the State to ensure that local communities benefit from resources in their areas. Among other things, the State and all institutions and agencies must take practical measures to ensure that all local communities have equitable access to resources to promote their development, as well as the preservation of traditions and knowledge. Moreover, the Constitution provides for environmental rights that aim at promoting conservation and securing ecologically sustainable development and use of natural resources while promoting economic and social development.

Parks and Wildlife Act (Chapter 20:14) 1975 (Amended In 2001)

This is the key legislative framework for wildlife heritage conservation and management in Zimbabwe. The Act provides for the establishment and management of gazetted protected areas and conservation and management of the wildlife resources and landscape therein. The Act confers privileges on owners or

occupiers of alienated land as custodians of wildlife. It gives the Appropriate Authority over wildlife to Rural District Councils for communal lands on behalf of local communities.

Forestry Act (Chapter 19:05) 1949 (As Amended 2002)
The Act provides for the protection and management of both indigenous non-commercial and commercial vegetation on both alienated and unalienated land. The Act provides for demarcating forests and nature reserves, conserving timber resources, regulating trade in forest produce, and regulating the burning of vegetation.

Environmental Management Act [Chapter 20:27] 2002 (Amended 2005)
The Act's objective is to provide for sustainable management of natural resources and the environment, prevention of pollution and environmental degradation and the preparation of a National Environmental Plan and other plans for the management and protection of the environment. The management plan also prioritizes enforcement of environmental assessment policy, as well as the control of invasive alien species. Administration of this Act is done by the Environmental Agency.

Tourism Act (Chapter 14:20) 1996 (Amended 2001)
The Act established the Zimbabwe Tourism Authority. The authority is controlled by the board. The functions of the authority are principally to promote Zimbabwe as a destination for tourists, and to promote the tourism industry in overseas, regional and domestic markets. In the performance of the authority's functions, it is the board's responsibility to safeguard against negative impacts on the environment by any tourism related activity, social and physical impact to any activity.

Water Act (Chapter 20:24) of 1998 (Amended 2002)
The Act monitors and manages all surface and underground water resources. It provides for the development and utilization of water resources of Zimbabwe, to provide for the establishment, power and procedures of catchment councils and sub-catchment councils.

Communal Land Act (Chapter 20:04) 1982(Amended 2002)
The Act provides for the classification of land in Zimbabwe as communal land and for the alteration of such classification. It seeks to alter and regulate the occupation and use of communal Land.

Traditional Leaders Act (Chapter 29:17) Amendment 2001
The Act provides for the management of natural resources by traditional leaders. Section 5(1) states that traditional chiefs have the responsibility to ensure land and natural resources are used and exploited according to the law, to control: (i) over cultivation; (ii) overgrazing; (iii) the indiscriminate destruction of flora and fauna; and (iv) illegal settlements; and generally preventing the degradation, abuse or misuse of land and natural resources.

Trapping of Animal (Control) Act (Chapter 20:21) 1996
The Act prohibits making, possessing, or using certain types of traps, and specifies the purposes for which animal trapping is permitted.

National Museums and Monuments Act (Chapter 25:11) of 2001
The Minister may declare National Monuments under this Act. The discovery of any ancient monument or relic must be declared to the National Museums and Monuments Board by the discoverer or the owner or

occupier where the relic occurs. The state can acquire the land on which the monument or relic occurs for its preservation or analysis.

Urban Councils Act 1984 (Cap. 29:15)

Is an Act solely meant to provide for the establishment of cities, municipalities and towns and the administration of cities, municipalities and towns by local boards, municipal and town councils; to provide for the conferring of town and city status on growth points, municipalities and towns; to provide for the declaration of local government areas and the administration of local government areas by local boards; to confer functions and powers and impose duties upon municipal and town councils and local boards; to provide for the establishment of the Local Government Board and to provide for the functions thereof; and to provide for matters connected with or incidental to the foregoing.

Housing Standards and Control Act [Chapter 29:08] 1972

Is an Act meant to establish housing courts and to confer upon them certain powers and functions; to provide for the repair, demolition or closure of buildings of an unsatisfactory standard; to provide for the abatement of overcrowding of dwellings; to control the harmful use or occupation of premises.

Rural District Councils Act [Chapter 29:13] 1988 (Amended 2002)

This Act provides for the declaration of districts and establishment of rural district councils which fall under the Ministry of Local Government. Furthermore, the Act confers and imposes functions upon rural district councils and provides for administration of their areas. The Victoria Falls World Heritage Site falls in the Hwange District. The district council administers Hwange's CAMPFIRE programme which facilitates flow of benefits from the district's natural resources to the communities. Benefits are derived from safari hunting, rafting and photographic safaris.

Regional Town and Country Planning Act (Chapter 29:12) of 1976

The Act provides for the planning of regions, districts, and local areas, with the object of conserving and improving the physical environment, in particular promoting health, safety, order, amenity, convenience, and general welfare, and efficiency and economy in the process of development. It also designates local planning authorities.

Bees Act (Chapter 19:02) 1973 (Amended 2002)

This Act provides for the control of disease in bees and the conservation of bees found in the wild; to regulate bee-keeping; and to provide for matters incidental to or connected to the foregoing.

Prevention of Cruelty to Animals Act (1960, Chapter 19:09)

The Act prohibits activities considered cruel to animals.

Communal Land Forest Produce Act Chapter 19:04 Of 1987

The Act provides for the regulation, the exploitation of and to protect forest produce within Communal Land; regulate and encourage the establishment of plantations within Communal Land; and to provide for matters connected with or incidental to the foregoing.

Environmental Management (Environmental Impact Assessments and Ecosystems Protection) Regulations, Statutory Instrument No. 7 of 2007

This is concerned with the regulation of the Environmental Impact Assessment (EIA) process and protection of ecosystems. Part 11 of the Act highlights that no industrial project shall be implemented without an EIA.

2.3 International and Regional Context

Convention on Biological Diversity (CBD) of 1992

The Convention has three principal objectives:

1. Conservation of biological diversity;
2. Sustainable use of components; and
3. Fair and equitable sharing of the benefits arising out of utilization of generic resources.

The convention advocates for the need to ensure public participation for successful conservation.

Convention on the Conservation of Migratory Species of Wild Animals (CMS) of 1979

The Convention on Migratory Species is a Multilateral Environmental Agreement (MEA), signed in 1979 and in force since 1983. This treaty of the United Nations Environment Programme (UNEP) aims to facilitate close cooperation on the conservation of migratory species between the countries through which these animals travel on their annual journeys. The species are grouped into migratory species that are vulnerable, and into species of unfavourable conservation status (Appendix 2.1). These species include mammals, birds, fish and reptiles.

The Ramsar Convention on wetlands of 1975

The Ramsar Convention on Wetlands provides a framework for wetland conservation and asks that nations promote the sustainable utilization and conservation of wetlands. Zimbabwe became a signatory to the Ramsar Convention in 2011. Victoria Falls is a Ramsar site. Its' protection and management are guided by the national environmental legal frameworks.

World Heritage Convention of 1972.

This convention seeks to establish an international system for the protection of outstanding cultural and natural heritage sites for all humanity and to ensure their protection through a closer cooperation among nations. It establishes a list of such site's world heritage sites through a set of criteria. The Zambezi National Park is part of the Mosi-Oa-Tunya/Victoria Falls World Heritage Site. The convention provides an operational guideline for World Heritage Sites (WHS). The international body that works with member and state parties in achieving conservation goals at global level is the International Union for the Conservation of Nature (IUCN). IUCN encourages the study of species and ecosystems, and how they interact.

3.0 PROGRESS ON IMPLEMENTATION OF THE STRATEGIC RECOMMENDATIONS OF THE 1995 STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA)

The 1995 SEA suggested 15 strategic recommendations for implementation within the Area (Table 3.1)

Table 3.1: Suggested recommendations and the action taken

No	Recommendations	Action Taken
1	The steps taken to limit the visitor accommodation facilities in line with the medium growth scenario as a maximum for the Victoria Falls area	1. All major tourism projects are subjected to an Environmental Impact Assessment (EIA), 2. Other tourism activities are subjected to an Environmental Project Brief (EPB), 3. A Joint Management Plan was developed to regulate, control and guide tourism developments in the area
2	Continue to promote the policies for low volume, high value tourism in both countries, with emphasis on the continuing high wilderness value in the area	1. The Joint Management Plan (2007-2012) outlined the type of tourism developments permitted in the different zones. This has led to the development of eco-friendly low volume, high value tourism facilities
3	Provide facilities which cater for low spending visitors	2. The Zambian Government prioritized tourism as an economic sector attracting local and international investment in high volume, low value tourism facilities
4	Consider the World Heritage Site as a shared resource	3. A Joint Management Plan was developed by the two States Parties
5	Prepare a statutory Master Plan for Victoria Falls Town	4. A Master Plan for Victoria Falls Town was developed
6	Take steps towards granting Victoria Falls Municipality status	5. Victoria Falls Town has been granted municipality status and later a city status
7	Take steps to encourage the rehabilitation of the industrial sector in Livingstone	6. The rehabilitation of the industrial sector has not been done. However, government policies to attract investors into the city have led to the establishment of new industries by the private sector
8	Promote hotel and lodge development in the Livingstone area	7. The declaration of tourism as an economic sector led to foreign and local investors in hotel and lodge developments 8. Livingstone has also been declared the Tourist Capital of Zambia, this boosted tourism investment in the city
9	Strengthen the capacity of Livingstone Municipal Council	1. The upgrading of Livingstone town to city status has been done. This has strengthened the capacity of the city council in service delivery
10	Ensure compatibility of land use	2. The preparation of strategic development documents by the City Council has ensured the coordinated management of land resources

11	Encourage all tourist developments and activities to develop links with local communities	3.	Tour operators have been encouraged to employ local people and undertake corporate social responsibilities such as building of schools, clinics, sinking bole holes and cultural tourism
12	Set up institutional mechanisms for coordinating the planning and management of development in the area	4.	A three-tier management system (Joint Ministerial committee, Joint Technical Committee and the Joint Site Management Committee) has been established to regulate development control in the area
13	All proposals for the river regulation and water abstraction should be subjected to environmental assessment	5.	Regulatory bodies (WARMA, ZARA, ZEMA, ZINWA, EMA etc.) are in place to ensure compliance to the set guidelines in water resource management
14	Carry out a detailed study on the effects of water diversion for hydro-power generation at the Victoria Falls North Bank	6.	Studies have been undertaken and the observations are that during the dry season (September to December of every year) there is low volume of water over the falls on the Zambian side resulting from the diversion of water
15	Strengthen local cultural traditions	7.	Local communities are allowed access to perform their cultural and traditional rituals in the area

1. STRATEGIC ENVIRONMENTAL AND SOCIAL ASSESSMENT APPROACH

4.1 General Comments

The management of the natural resources, such as the Victoria Falls World Heritage Property, are faced with accelerating transformation. Advances in science and technology, shifting consumption patterns, continuing population growth, trade globalization, climate change, and now the impacts of COVID-19 pandemic are leading to new and serious risks to sustainable management of these resources.

This therefore, necessitates integrated and community-based approaches as well as prudent policy making to ensure the conservation and the sustainable development of the natural resources. The last SEA for the Victoria Falls Area was conducted in 1995. This is 26 years ago and it is obvious that the results obtained then have since been overtaken by time and events and can no longer be relied upon to inform policy making and management planning with regard to the Property.

The 2021 Strategic Assessment and Social Assessment (SESA) for the Victoria Falls area is to provide information on all the current and expected developments as well as:

1. information on history, historical trends and developments in the Area;
2. information on historic buildings and historic sites in the Area;
3. information on traditional/anthropological heritage practiced by communities living in the Area;
4. archaeological information in the Area;
5. information on geology, palaeontology and landforms;

6. provide visitation trends in the Area during the period under review, as well as visitor's experiences in the Area;
7. information on various land use practices and their impact on their Area and spatially represent the developments and natural features in the Area;
8. information on the current socio-economic dynamics in the Area;
9. information on all water related tourist activities undertaken in the Area;
10. information on the state of water quality;
11. the current state of river bank erosion along the Zambezi River in the Area; and
12. information on tourism developments in relation to tourism facilities.

4.2 Specific Limitation

In order to focus the effort of the study team, it was resolved that the approach used in the 1995 SEA be adopted as follows:

4.2.1 The extent of the study area

The extent of the study area is a radius of 30km around the Victoria Falls. This is going by the decision of the 1995 study for SEA. At that time, it was realized that most of the pressures from tourism development and urban expansion exerted upon the site come from outside the site.

4.2.2 The nine-year time horizon (2021-2030)

A nine-year time horizon, 2021 to 2030 was adopted for the SESA.

4.2.3 Scenarios

In order to predict future trends in the Area, the 2021 SESA analysed information gathered in the past 26 years. It was generally observed that visitation trends in the Area improved due to factors such as favourable government policies on tourism, which resulted in increased tourism developments, improved tourism services and products.

4.3 The SESA Study Team and Detailed Topics for Study

The two States Parties, Zambia and Zimbabwe, identified research fields to be investigated in detail for the 2021-2030 SESA. The study was led by a Coordinator whose roles were to oversee, guide the study team and receive specialist reports from the professionals, and edit, integrate them into one document.
The Study Team consisted of eight persons from Zambia and nine from Zimbabwe as illustrated in Table 4.1.

Table 4.1: The study team of experts for the SESA strategy

No	Name	Position	State Party	Topic For Detailed Study
1	Mr. Oliver H. Kandyata (Team Leader)	Regional Director	Zambia	History
2	Ms. Musawa M. Hamusonde	Senior Conservation Officer – Natural Heritage	Zambia	Ecology
3	Mr. Richard Mbewe	Senior Conservation Officer – Cultural Heritage	Zambia	Archaeology
4	Mr. John Zulu	Conservation Officer – Anthropology/Site Manager – Victoria Falls World Heritage Site	Zambia	Anthropology
5	Mr. Chifunilo T. Willima	Socio-Economic Planner	Zambia	Socio Economics
6	Ms. Yetambuyu Imasiku	Town Planner	Zambia	Land Use Planning and GIS
7	Mr. Gilpin K. Sikate	Tourism Development and Research Officer	Zambia	Tourism Development
8	Prof. Imasiku A. Nyambe	Professor of Geology Department and Coordinator University of Zambia Integrated Water Resources Management Centre	Zambia	Hydrology, Geology and Palaeontology
9	Mrs. Amanda Vambe (Team Leader)	Ecologist – Zambezi National Park	Zimbabwe	Ecology
10	Mr. Mukululi Ndlovu	Ecologist -Matetsi Safari Area	Zimbabwe	Ecology
11	Mr. Courage Mutema (Team Leader)	Principal Planning Officer/ GIS and RS Expert ZPWMA, Head Office. Focal Point, WHC (Nature)	Zimbabwe	Land Use Planning and GIS
12	Dr. T. Mukwende (Project Leader)	Resident Archaeologist/ Senior Researcher at the Research and Conservation Centre, Great Zimbabwe World Heritage Site, Focal Point WHC (Culture)	Zimbabwe	History Archaeology Anthropology
13	Ruth K. Zisadza	World Heritage Site Management. Matopos National Park, ZPWMA	Zimbabwe	History and Archaeology

14	Mr. Brian M. Nyabuno	Urban Planning Expert (Victoria Falls Enviro Watch)	Zimbabwe	Land Use Planning
15	Mr. Clapperton Gutu	Heritage Conservation Specialist. Regional Manager National Museums & Monuments of Zimbabwe	Zimbabwe	Socio-Economics
16	Dr. Darlington Munyikwa	Geologist, palaeontologist Deputy Executive Director National Museums and Monuments of Zimbabwe	Zimbabwe	Geology
17	Mr. W. Gumindoga	Quantity Survey Lecturer, University of Zimbabwe	Zimbabwe	Hydrology, Water Resources and Climate Change

The following topics were identified for detailed study:

1. History;
2. Tourism Development;
3. Socio-Economics;
4. Ecology;
5. GIS and Land Use Planning;
6. Archaeology;
7. Anthropology;
8. Hydrology; and
9. Geology/Geomorphology.

These studies were carried out in a period of five months as phase one, from 2nd May to 30th September, 2021 mainly due to financial limitations. During this phase, the study team described the existing situation, made strategic recommendations and predicted some scenarios. It is hoped that further detailed studies will be conducted during phase two subject to funding.

5.0 STUDY METHODOLOGY

5.1 Public Consultation Program

In order to have informed decisions, stakeholder consultations were undertaken to provide the needed information.

5.1.1 Scoping Meetings

The preparations, organization and holding of scoping stakeholder meetings marked the commencement of the SESA programme. Two (2) scoping stakeholder meetings were held; one in Livingstone City and the other in Victoria Falls City. The State Party of Zambia held its scoping stakeholder meeting on 27th April 2021 while the State Party of Zimbabwe held its scoping stakeholder meeting on 28th April 2021.

The objective of the scoping meetings was for stakeholders to share their opinions, experiences and concerns over many issues that have affected the Property over the past 26 years. The list of stakeholders that attended the scoping meetings are highlighted in (Appendix 5.1)

The Stakeholders raised a number of issues in thematic areas including tourism development, sources of energy and alternatives, employment levels in the Area, human-wildlife conflicts and others (Table 5.1).

Table 5.1: Issues raised during the stakeholder scoping meeting

Thematic Area	**Changes in the Past 20 Years (Existing Situation)**	**Impact**	
		Positive	**Negative**
Tourism Development	1. Change in policies 2. Increased employment 3. Increased participation of Zambians in the Tourism sector Improved infrastructure 4. Increased revenue 5. Increase in human – animal conflict 6. Encroachment into wildlife areas 7. Over fishing	8. Job creation 9. Incoming investment 10. Improvement of services and supply lines to all in the city	1. Expansion of city into sensitive areas 2. Opportunists breaking the rules (e.g. Ferris wheel) 3. Increased noise (helicopters) 4. Over loading facilities (EG; sewerage system) as the population expands
	5. Deforestation 6. Increase in crime 7. Increase in rates 8. Though the capital moved to Choma, Livingstone lost the higher earning civil servants who contributed to the local economy	9. Improved communication networks 10. Alternative renewable power sources 11. Opportunity to promote other tourism locations in Zambia	12. Drying up of the falls because of water extraction September to January to produce power 13. Blocking of elephant corridors 14. Cutting of trees for curios for increasing tourist numbers and charcoal for an expanding local population 15. Badly controlled waste disposal system causing pollution on a grand scale

Sources of energy and alternatives	16. HEP has stayed the same as a source of energy. However, there has been increased connectivity. 17. Continued water abstraction at the Falls. 18. The demand for electricity has gone up, with a current energy demand of 32MW. 19. Production is shut down in the months of Sept to Dec to allow for continuous flow of water over the falls 20. Diesel generators as an alternative source of electricity at lodges 21. Solar energy e. g, boreholes, solar geysers, domestic solar sources 22. Coverage of electricity will need to be verified. 23. Currently 14 turbines and two offtake channels 48MW and 60MW 24. Sources of energy include HEP, Diesel, solar. 25. HEP generation still stands at 108MW 26. the proposed construction of the Batoka Gorge HEP along the Zambezi River in six years' time 27. Subdivision of the ZESCO site within the Area, to be given to a private investor 28. Proposed biofuel production from the hyacinth weed and fuel bricks by private developer (confirm with Mukuni Royal Establishment) 29. Biogas production on a limited scale in the district. Requires to be revamped.		1. The water abstraction affects the flow of water over the falls from August to December. 2. An increase in energy sources pricing
Cost of energy	1. Hydro Electric Power still remains the cheapest form of generation of power, followed by solar, charcoal and diesel.		2. Charcoal production and burning has a negative impact on the environment
Factors and effects of rural-urban migration	1. Increased both types of migration (rural-urban and intra-urban migration)	2. It has increased the number of housing units in areas that have been planned.	3. It has led to an increase of the growth unplanned settlements moving

and intra-urban migration. Causes: high unemployment levels, increased retail trading, criminology, availability of social amenities in city.			towards the WHS or sensitive areas such as the NP and Local Forests 4. Led to low productivity in the rural areas as the productive youth are moving into urban areas in search of employment 5. Camping of migrants in areas they shouldn't be e.g. Tandabale market in Dambwa Central 6. Social vices such as prostitution, pollution (litter), increased crime 7. led to overcrowding in the urban areas and multi-household units
Employment levels in the Area	After 1995 there has been Closure of factories and companies led to high unemployment i.e., Zambia textiles, Livingstone motor assemblies, supersonic, continental factory, Zambezi sawmills. Some of these products were for export purposes. (Under land use this has led to vacant structures)		1. high unemployment levels 2. loss of revenue to the Councils, Government institutions
Major diseases in the Area	High rate of Malaria (the rate is reduced), Corona Virus, HIV/AIDS, STIs, TB, elephantiasis, diabetes, hypertension,		1. reduced workforce, loss of life
Economic activities	1. Past: manufacturing industries, retail cross border traders, agriculture (crops and livestock), 2. Present: retail cross border traders, agriculture (crops and livestock), food production, leisure-based industries (food and hospitality), financial institutions, increased flow of public transportation (increased flights and use of public transport)		3. the public transportation industry has been affected negatively by the unforeseen pandemic (COVID-19)

Urban patterns in the Area	1. expansion of the urban settlement both planned and unplanned 2. increased number of lodges and not enough hotels		1. most of the expansion is unplanned 2. this has led to problems in these areas such as flooding 3. little to no revenue collection in unplanned areas 4. the unplanned areas near the hospitality services have led to increased crimes and chaos 5. reduced accessibility in the district due to the unplanned nature of the settlements 3. lack of services in unplanned areas such as drainages, poor solid waste management
Human-wildlife conflicts	1. Increased human wildlife conflict e.g., elephants and buffaloes 4. reduced presence of animals in the area such as velvet monkeys		1. the urban area has encroached into the natural territory of the wildlife 2. the animals in the National Park have reduced 5. animals have been electrocuted due to the presence electricity in the Area
Zoning for new tourism developments	1. tourism development has increased 2. increase tourism developments in the Southern part of the Falls e.g., the development of the Ferris wheel, the ZICA convention centre, Mosi Oa Tunya Resort Hotel 3. increased accommodation (lodges & guest hotels)	1. creation of jobs 4. anticipate attraction of more tourists to the site	
Urban population, population dynamics and housing	1. Population increase 1. housing demand has increased		2. increased unplanned settlements

Agriculture	1. Farmers have not been well supported. 2. the existing feeder roads are bad. Making the distances far 3. Seasonal farming techniques. Need for reservoirs 4. Aqua fish farming is inhibited by lack of water 5. Supply of inputs is limited, limiting the number of cooperatives that have access to inputs. 6. a lot of pests that are affecting the crops 7. Infrequent weather patterns causing inconsistency in farming. Need for dams 8. need for value addition agricultural produce		
Public transportation	1. Introduction of a code of conduct to discipline drivers		
State of conservation	2. Pollution has increased in the last 20 years in all forms of pollution		1. Affects aesthetic value 2. Loss of biodiversity 3. Increase in diseases both human and animals 4. Water quality is compromised
	5. The effects of climate change have increased as compared to 1995		1. Water shortage, decreased water quality 2. Paste outbreak 3. Poor crop yield 4. Loss of species 5. Increased invasive species
	1. Habitat has been reduced due to infrastructure development		1. Reduced number of wildlife species 2. Loss of OUV (outstanding universal Value) 3. Limited facilities on offer 4. Reduced in species biodiversity
	5. Invasive alien species	1. More indigenous plants have come out (restoration of ecological integrity)	2. Chemicals destroying the land; as it is used to get rid of the invasive species 3. Compromised soil quality

	6. There has been an increase on the solid waste due to the population increase leading to increased methods of management of waste	1. Increased job creation	2. Increased in diseases 3. Pollution (air, water and soil)
	7. The state of conservation has improved for the past 20 years due to cleanness, more signage, trees are healthier within the fenced area and more secure	1. OUV maintained 2. Increased revenue 3. More tourists result in more revenue correction	4. Tourism pollution 5. Development pressure 6. Human – animal conflicts has increased
	8. Increased water abstraction due to increased energy demand, increased water consumption for both domestic use and farming activities	1. more people have access to power 2. Increased food supply due to increased farming activity 3. Increase in irrigation farming resulting in increased food supply to meet the demand	4. Water shortage for both ground and surface water 5. Increased animal mortality 6. Loss of aesthetics for the falls 7. Poor water quality
	9. The soil quality has reduced due to erosion	1. Invasive alien species may fail to strive	2. Poor crop yield 3. Insects reduced 4. Loss of aesthetic value 5. Loss of geological value 6. The gorges may be disturbed

The study team prepared and distributed questionnaires to relevant stakeholders to gather their views on tourism development, the state of conservation of the Property and the impacts affecting the World Heritage Property.

5.2 Secondary Data Collection

The study team conducted archival research, reviewed administrative data and other publications relevant to the study including unpublished material – maps, photographs, books, journals on the area under consideration. In geology, for example, analysis of the geological collections and records at Natural History Museum, Bulawayo for any previously collected voucher specimen from the study area was done. The secondary data was analyzed using content analysis in line with the impacts of socio-economic dynamics around the Victoria Falls Area. In hydrology, satellite rainfall and evapotranspiration estimates were employed for this study as most data were not available. Rain gauge rainfall for the period 1981-2013 was obtained for the stations: Livingstone, Victoria Falls, Pandametanga, Senanga, Kalabo, Mongu, Zambezi, Kabompo, Kaoma, Mwinilunga and Solwezi. CHIRPS satellite rainfall was obtained from https://data.chc.ucsb.edu/products/CHIRPS-2.0/ for the period 1981-2020 to fill gaps extend the time series of the above-mentioned stations. Bias in CHIRPS satellite rainfall estimate was

corrected using data from seven rain gauges and a space and time varying bias correction approach that was successfully applied for the Zambezi Basin (Gumindoga et al., 2019). Potential Evapotranspiration was obtained from the Global Aridity Index (Global-Aridity_ET0) and Global Reference Evapotranspiration (Global-ET0) climate grid data for the 1970-2000 period based upon the WorldClim 2.0: http://worldclim.org/version2 Aridity Index website. The flow at Victoria Falls is influenced by the rainfall and evapotranspiration activities upstream of the Rainforest. Rainfall activities in countries such as Angola, Zambia and partly Botswana and Zimbabwe directly influence flows at the Victoria Falls.

5.3 Observations

The study team made observations of the existing developments, cultural trends and the environment in the Area. The degree of changes and their impacts were noted and recorded accordingly.

5.4 Field surveys

The study team conducted field surveys relevant to their respective study. Field walking involves systematic coverage of the proposed area and its environs noting exposed rocks and landforms as well as assessing the envisaged impact of future developments on identified material. Other data collection methods included key informant interviews and interviews with curio traders around the Mukuni Village area (Appendix 5.2). Selected tour operators and relevant tourism stakeholders were interviewed while others were required to fill structured questionnaires. Focus Group Discussions (FDG) were also used in data collection and focused on institutional case studies in the area of socio-economic activities, energy mix and population dynamics. The collected data was analyzed using comparative analysis with the last SEA. Statistical Package for the Social Sciences (SPSS) was also applied to analyze the data.

6.0 DESCRIPTION OF PRESENT ENVIRONMENTAL SITUATION

6.1 Location and Area

The Victoria Falls are located at 17°56' South and 25° 55' East. They are on the Zambezi River along the border between Zambia and Zimbabwe in the districts of Livingstone in Southern Provinces of Zambia and in Hwange District of Matabeleland North of Zimbabwe. The Study area is having a radius of 30km on each side of the Victoria Falls encompassing an Area of 2800Km^2. It ranges from downstream of the Katombora rapids in the west to the fourteenth (14) gorge in the south of the Zambezi River. The Area includes Livingstone City, part of Kazungula District and Victoria Falls town; as well as three national Parks namely – Mosi-Oa-Tunya National Park, Zambezi National Park and the Victoria Falls National Park. It also includes traditional land in Zambia of Chief Mukuni, Musokotwane and Sekute and the communal lands of Hwange Rural District. There is also significant forest land on both sides.

6.2 Geographic and Habitat Classification

The area surrounding the Victoria Falls is classified as tropical dry or deciduous forest and woodland in the afro-tropical realm. The predominant woodland type is kalahari woodland, which grows on the overlying Kalahari sands. The Zambezi River runs through the middle of the area and creates its own special riverine biome which is distinct from the general biome classification. Upstream, this forms a wide, shallow river valley with riverine forest and many islands. At the Victoria Falls itself the Zambezi River has cut the underlying basalt rock to form a series of gorges over 100 meters deep from the main level of the land. The river becomes narrow and confined within the steep cliffs. The narrow rocky banks, feeder streams and gorges also have a distinctive habitat.

6.3 Conservation Status

The Victoria Falls are of unique geology, geomorphological and aesthetic value. They are one of the most spectacular waterfalls in the world with a curtain of falling water 1708m wide and 108m deep. The zig-zig course of the gorge downstream, caused by successive erosion through the weakest faults in the basalt, enable viewers to see the Falls for their complete length from the opposite bank at a distance of less than 100m. The surrounding national parks contain flora and fauna representative of the area but by no means unique. The woodland types surrounding the area are very characteristic, but the riverine forest above the Falls is unique, especially the area kept moist by the spray from the Falls, also known as the "rain forest". It is for this reason that in 1989 UNESCO, at the request of the governments of Zambia and Zimbabwe, declared the Victoria Falls, upstream river, its banks and islands and the downstream gorges as a World Heritage Site. It was considered to be still in a natural condition only partially affected by man. It met the natural criterion (iii) now criterion (vii) for the "status of the World Heritage Sites of superlative natural features" and criterion (iv) now criterion (viii) of being an important habitat for rare or endangered species (IUCN, 1989; Goriup and Harvey, 1997).
The area enclosed by the World Heritage Site falls within the boundaries of the three national parks: Zambezi National Park, Victoria Falls National Park in Zimbabwe and Mosi-Oa-Tunya National Park in Zambia. It is therefore entirely in public ownership and protected under the Zambia National Heritage Conservation Commission Act No. 173 of 1989 and the Zimbabwe Parks and Wildlife Act (Chapter 20:14) of 1975.

The three National Parks cover a wider area than the World Heritage Site and the legal protection in these areas is the same. This prohibits any permanent development but allows access with minimum management interventions. Hunting, cutting of trees, stone cropping or removal of dead wood is strictly prohibited. On both the Zambian and Zimbabwean sides there are forest areas managed for the indigenous hardwood cropping – usually through timber concessions led by the forest department and forest commission respectively. In Zimbabwe some hunting and photographic safaris are also permitted in these forestry areas.

6.4 Protected Area and Forest Land in the Victoria Falls Area

The trans-boundary property extends over 6,860ha which is considered relatively intact and adequately sized to maintain the diverse natural processes, functions and interactions including the waterfall, gorges, riverine ecosystem, breeding ground, habitat or landing base for migratory endangered bird species making it an Important Bird Area (IBA), lava flows, ancient stone artefacts and tools for hunter gatherers. It comprises 3779 ha of the Mosi-Oa-Tunya National Park (Zambia), 2340ha of Victoria Falls National Park (Zimbabwe), 741ha of the riverine strip of Zambezi National Park, including the Island Systems (Zimbabwe).

In Zambia, the boundary also includes the riverine strip upstream of the point of entry of Maramba River, as far as Canary Island, thus including Canary Island, Lwando Island and Kakunka Island. The width of the strip is determined by the riverside road. The boundary includes areas of the Zambezi River upstream of the waterfall both in Zimbabwe and in Zambia. The remaining area of these protected areas is considered as the buffer zone on either side of the Zambezi River in Southern Zambia and North-Western Zimbabwe. The Mosi-Oa-Tunya National Park boundary follows the left bank between the Sinde River and Songwe Gorge, bounded in the North by Dambwa Forest Reserve. On the right bank the Victoria Falls National Park is bounded by the river from 6km above to 12km below the falls and by the city of Victoria Falls on the West. Sprays from this giant waterfall can be seen from a distance of 30km from the Lusaka Road, Zambia and 50km from Bulawayo Road, Zimbabwe. The system is directly bordered by 3 protected areas which serve as buffering system (JIMP, 2016-2021).

6.5 Regional Context and Access

The Zambezi River and the Victoria Falls are of great regional importance for water resources, hydro-electricity generation and tourism. These extend beyond the two countries of Zambia and Zimbabwe.

6.5.1 Regional Water resources:

Angola, Zambia, Botswana, Zimbabwe, Mozambique, Malawi, Namibia and Tanzania. The river can be divided into two main segments:

1. the upper Zambezi - from the source down to the Victoria Falls with water draining from parts of south-eastern Angola and western Zambia and subsidiary areas in Botswana and Namibia. The main flow over the falls comes from the head water region which has the highest rainfall.
2. The middle Zambezi – stretching from the Falls to Cabora Bassa and receiving water from the Kafue and Luangwa Rivers and the confluent streams in the northern Zimbabwe.
3. The lower Zambezi below Cabora Bassa to the Indian Ocean, receiving water from Lake Malawi and the Shire River and the eastern parts of Zimbabwe.

A complete map of the drainage of the Zambezi River is in a region prone to drought, The river represents valuable water resources. Water abstraction upstream of the Falls, could have serious impact upon the Falls themselves and the area as a whole especially during the low flow period. The proposed construction of the Batoka Dam also has potential effects on the immediate downstream of the falls with back flows from the dam which could have potential impacts on the aesthetic beauty and river activities such as rafting and kayaking.

6.5.2 Regional Hydropower Resources:

The Zambezi River also represents significant energy resources from the hydropower potential, which is only partially realized as yet. The main existing hydroelectric generating stations are at:

1. Victoria Falls north bank;
2. Kariba; and
3. Cabora Bassa.

The energy generated is distributed not only within the countries of Zambia and Zimbabwe but also to neighbouring countries such as Namibia and Botswana. For Zambia, the energy is exported, which earns the country significant foreign exchange earnings. Zimbabwe suffers shortage of electricity and imports some from Zambia. The Zambezi River Authority is mandated to manage the hydroelectric resources of the Zambezi River on behalf of the two countries.

6.5.3 Regional tourism:

The Victoria Falls is the flagship of tourist attractions from both Zambia and Zimbabwe and is the number one attraction for all international visitors to the whole of the southern African region. Most international tourists spend at least one day at the Falls during their stay in the region, whether their focus is Zambia, Zimbabwe, Botswana or Namibia.

The strategic position of the Falls between Zambia and Zimbabwe and its proximity to important wildlife areas in Botswana and Namibia make it an essential component of tours in the whole region. Overland tours coming from the north to Southern Africa almost invariably pass through the Victoria Falls since it lies in the main north-south route. Regional visitors, especially from the Republic of South Africa drive through Zimbabwe or Botswana in increasing numbers to visit the Falls into Zambia. The importance of the Falls to regional tourism cannot be underestimated. The integrity and sustainable development of the area are critically linked to successful tourism development in the whole region.

6.5.4 Access:

The main road routes into the area include:
From the South Africa: RSA to Beit bridge to Bulawayo –to Hwange
From the West: Botswana to Victoria Falls via Kazungula; Botswana to Livingstone via Kazungula

From the North: Lusaka to Mazabuka to Livingstone

The bridge across the Zambezi is the main road linkage between north and south and carries both tourist traffic and road freight. The newly commissioned Kazungula Bridge linking Zambia and Botswana has become both a tourist attraction and a more convenient and efficient means for both tourist traffic and freight. The bridge has a provision of a railway line which is yet to be completed by the two States Parties.

The railway from Bulawayo to the Victoria Falls and from there to Livingstone and the rest of Zambia is also an important access to the area. The Victoria Falls Bridge is the only rail crossing of the Zambezi River between Zambia and Zimbabwe. This carries both passengers and freight. Train services from South Africa including occasional blue trains have Victoria Falls as a destination. The two airports in the area, Livingstone and Victoria Falls, have been upgraded to provide international services to bigger planes and a large number of tourists. Scheduled flights from Johannesburg, Nairobi, Addis Ababa, Gaborone and Windhoek fly directly using either of the two airports while intercontinental scheduled flights land either at the Lusaka or Harare international Airports.

6.5.5 Local Access:

Access into the national park and world heritage site is readily available. The Falls are viewed from rainforest walks on either side. Statutory fees for both local and international tourists are charged to access the rainforest in both countries. Separate fees are paid for tourists to access the national parks in both countries.

6.6 Physical Features (Geology)

6.6.1 Geology

The nature of the geology, palaeontology and landforms are generally dependent on the type of the rocks and geomorphological processes, which are influenced largely by climate and anthropogenic activities. The effects of these parameters require considerable time for them to be discernible hence negligible changes took place since the last SEA. The construction of museum whose main purpose was to educate the public on the cultural and natural heritage including geology and fossils was shelved because of resource constraints. The breakup of the Gondwana supercontinent into southern hemisphere continents (Africa, South America) during the Jurassic Period about 180 million years ago brought an opportunity for the formation of basaltic rocks of the Karoo basalts (Bond 1973; 1990; Stagman 1978). The basalts brought to an end the Karoo sedimentation and initially extended at least 1,300 km in southern Africa.

At the Falls, the basalt stretches 200 km from Kazungula on the Botswana Border to the Matetsi River confluence in the Batoka Gorge. The basalts are a succession of lava flows in a limited interval which resulted in a plateau on which several gorges were incised by rivers including the Zambezi River. At the Batoka proposed Dam, 13 nearly horizontal lava flows with thickness

varying between 10 to 80 m were recorded (Bond 1973). The thickness of the basalts at Victoria Falls is not known since the bottom has not been exposed, but it is estimated to be more than 300 m (Bond 1990).

The eruption of the basaltic lava was estimated to be over a short interval thereby minimizing the possibilities of sedimentary deposits between the basaltic successions. Several giant cracks or joints however developed on the surfaces of the basaltic lavas as they cooled down. Some of the cracks were interconnected. The joints were further developed by faulting due to effects of the East African Rift Valley system. The resultant fissures (faults and joints) were filled by sediments which consolidated into soft sandstone as compared to the hard basalt. The sandstone within the joints was later eroded by rivers leading to the formation of rapids and gorges along the Zambezi valley including at Victoria Falls (Bond 1990).

There are two distinct types of basalts at Victoria Falls. Type one is fine-grained dark bluish rock (Bond 1973; Bond 1990; Stagman 1978). Second type is purplish red rock with almond shaped inclusions of white minerals often coated with a green skin. Type one forms bare cliffs with strong vertical jointing in the walls of the gorges while type two forms bands of up to 6 m thick between the thicker type one outcrops (Bond 1990).

The basalt is overlain by 1 or 2 m thick chalcedony, which was the source of stone tools for the early inhabitants (Stagman 1978). Piped sandstone which is perforated by round pipe or holes overlies the chalcedony layer. Beds of the Kalahari Sands which are a mass of red unconsolidated wind-blown sand form the top most layer. The thickness of the Kalahari beds is not known but from boreholes along the Victoria Falls-Bulawayo Road they exceed 100 m (Stagman 1978).

In summary, the falls is known for its geological exposure of basalt rock formation of Early Jurassic in age (about 180 - 200 million years ago) when hot magma (lava) oozed out of the earth's interior to form layered basalts, which in places are massive (Figure 6.1).



Figure 6.1: Batoka Basalt Formation of the Victoria Falls. To the right close-up pictures showing faulting and fractures over the dry Victoria Falls on September 5, 2008.

6.6.2 Local geology

There are two main rock formations namely Karoo basalts and Kalahari Sands in the Victoria Falls Area (Figure 6.2). Basalts are well exposed along the Zambezi River and its tributaries. Thick succession layers of the flows of the basalts are clearly exposed on the banks of Zambezi River at the Victoria Falls Bridge (Figure 6.1). The rocks are easily distinguished by the dark brown to black colour as well as the gorges they form. There are many joints and fault lines and water springs developed on some of them. The basalt rock weathers into black clay soil which is the dominant soil in the several streams in the area. Further up away from gorges and rivers the basalt is overlain largely by the Kalahari Sand (Personnel observation during the survey).

Pebbles of chilled piped sandstone and chalcedony are not uncommon above basalt rocks. This implies that at some areas the basalt was once overlain by chalcedony and piped sandstone. The basalts are overlain by Kalahari Sands. Kalahari Sands consist of fine-grained clean and well-rounded quartz particles. The Kalahari Sands occupy most of the flat area above the gorges and form most of the ridges in the area. There is distinct scarp at the contact of Kalahari Sands and basalts as a result of the retreat of the former due to erosion. The sands are conspicuous by their colour which varies from brown to red (Personnel observation).

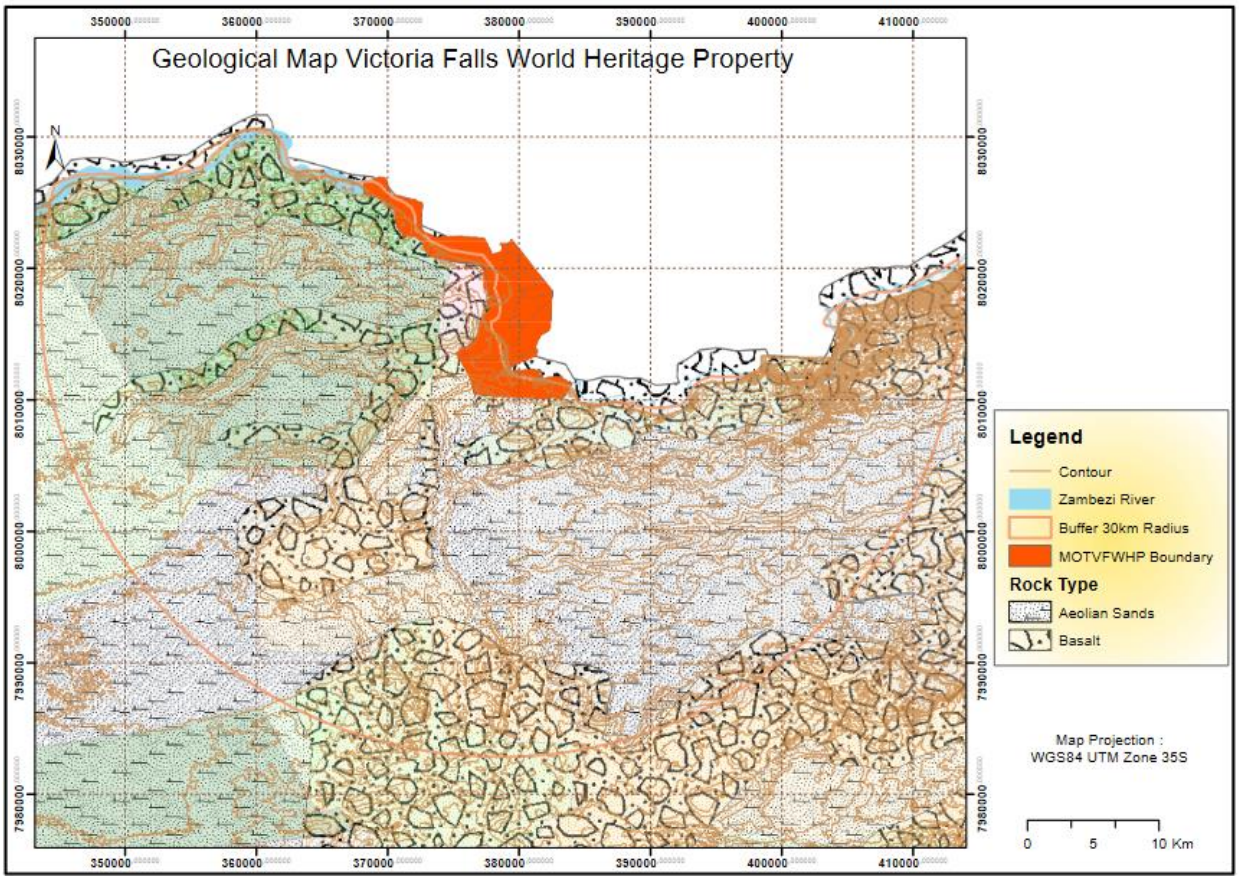


Figure 6.2: Geological map of Victoria Falls World Heritage Site (In house production by GIS Dept, Zimbabwe Parks and Wildlife Management Authority)

6.6.3 Palaeontology

Victoria Falls lies within the Karoo Basin in the Zambezi Valley. Karoo rocks are world famous for a continuous fossil record (Bond 1973; Munyikwa 1997). In addition, post Karoo rocks and sediments in the Zambezi Valley have also yielded fossil remains. The rock formations in the Zambezi Valley that have the potential of yielding fossils are the Ecca and Coal Group, Madumabisa Mudstones, Pebly Arkose, Forest Sandstone, Gokwe, Kadzi, Makanga, Kalahari Sands and alluvial deposits (Bond 1973; Cooke and Clark 1940; Munyikwa 2001; Oesterlen 1990, 1991; Raath 1969, 1972; Stagman 1978). Recent studies on the islands and shores of Lake Kariba, and Mbire District have recorded a commendable number of fossil sites of dinosaurs and their contemporaries (early crocodiles, phytosaurs, lung fish, rhychosaurs) and plants (Barret et al 2020, Scicio 2020; Viglietti 2018). The studies revealed that the dinosaur sites so far recorded lie in Forest Sandstone Formation not in sandstone layers sandwiched between basalt layers as was previously reported (Raath 1972). Gastropod (snails) fossil remains were recorded along a path from Victoria Falls Hotel to the fifth Gorge at the base of Kalahari Sands (Bond 1973; Dixey 1945).

Fossils that have been recovered from the Zambezi Valley are mammals, gastropods, plants, dinosaurs, fish and mammal-like reptiles and are kept at the Natural History Museum, Geology Department, University of Zimbabwe and the Geological Survey, Harare (Bond 1973; D Munyikwa pers communication.

In summary, Karoo basalts, piped sandstone and Kalahari Sands are the only rock formations that are present within the 30 km radius of the Victoria Falls. Fossil were not recorded from all the rock formations found in the study area.

6.6.4 Landforms

Victoria Falls lies in the Zambezi Valley in the south-west of Zambia and north-west of Zimbabwe. The terrain is dominated and shaped by the mighty Zambezi River which flows about 2,700km from its source in the Mwinilunga District of north-western Zambia to the Indian Ocean passing through Angola, Botswana, Zambia, Zimbabwe and Mozambique (Key et al 2015; Phillipson 1990). As the river flows down to the ocean it sculptures the landscape into flat valleys and gorges. The main landform features therefore within the 30 km radius of Victoria Falls are waterfalls, gorges, islands, drainage system (rivers and their tributaries), hills, ridges, springs and flat ground. The mighty Victoria Falls and the subsequent gorges are the prominent features of the study area. The falls and the gorges which were formed as a result of erosion of weak sand beds within the basalt rocks are awesome both from the land and air. There are a number of Zambezi tributaries below the Victoria Falls and they form gorges where they meet the Zambezi River. The distribution of the tributaries was largely controlled by faults within the basalts.

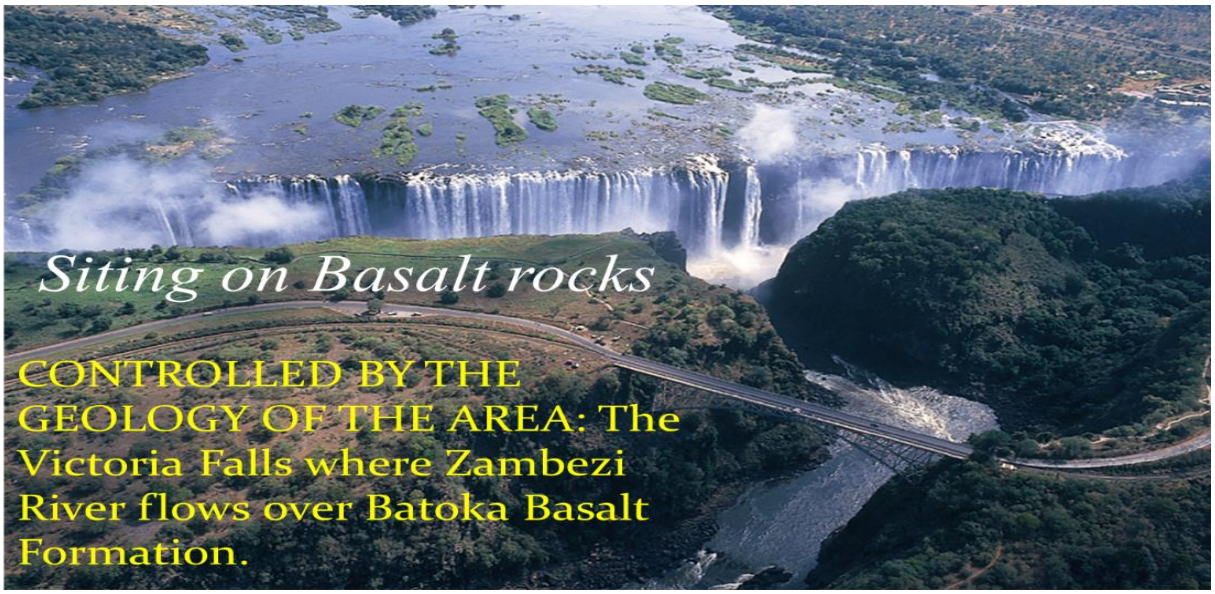


Figure 6.3: The resultant Victoria Falls controlled by the faulting in the Batoka Basalt Formation

As a result of the geological history of the area, the Zambezi River flow was captured, creating a site that contains superlative natural phenomena of exceptional natural beauty and aesthetic importance. One of such was a creation of the largest curtain of naturally falling waters in the world forming a spray of water that forms a cloud visible up to 30 to 50 kilometers away making it one of the 7 natural wonders of the world (Figure 6.3).

As indicated earlier, there is a distinct scarp at the boundary between basalts and Kalahari Sands. These scarps form ridges which are common in the area. Further up from the boundary there is a flat ground composed of loose Kalahari Sands as depicted along the Kazungula Road.

Low lying hills composed of either basalts or Kalahari Sands are present within the 30 km radius. These are remnants of gully erosion which is ongoing in the area. Erosion is enhanced by various streams which develop on fault lines or shrinking cracks of the basaltic magma. A spring is located along one of fault line which lies in a stream (Figure 3 above)

Rapids

Rapids are formed where the river flows across basalt rock. As the river flows over the resistant basalt rock which cuts across the river channel there will be more erosion of weak sandstone lenses sandwiched between basaltic layers thereby creating rapids. There are therefore several rapids along the river as the river encounters basalt rocks in several places (Phillipson 1990).

The basalt is faulted with numerous fractures (Figure 6.4) that has led to gorges (Kagosi M., and Nyambe I.A, 2020) and islands as features of outstanding international geological heritage and universal values of the mighty Zambezi River, which resulted into changing positions of the waterfall after an average period of 40 thousand years as the falls retreated (Figure 2). These outstanding universal values led to the Victoria Falls declared as a World Heritage Site in 1989.

The gorges below the falls are dramatic and scenic landscape features themselves forming a zig-zag scar of the landscape (Bond, 1990; Phillipson, 1990).

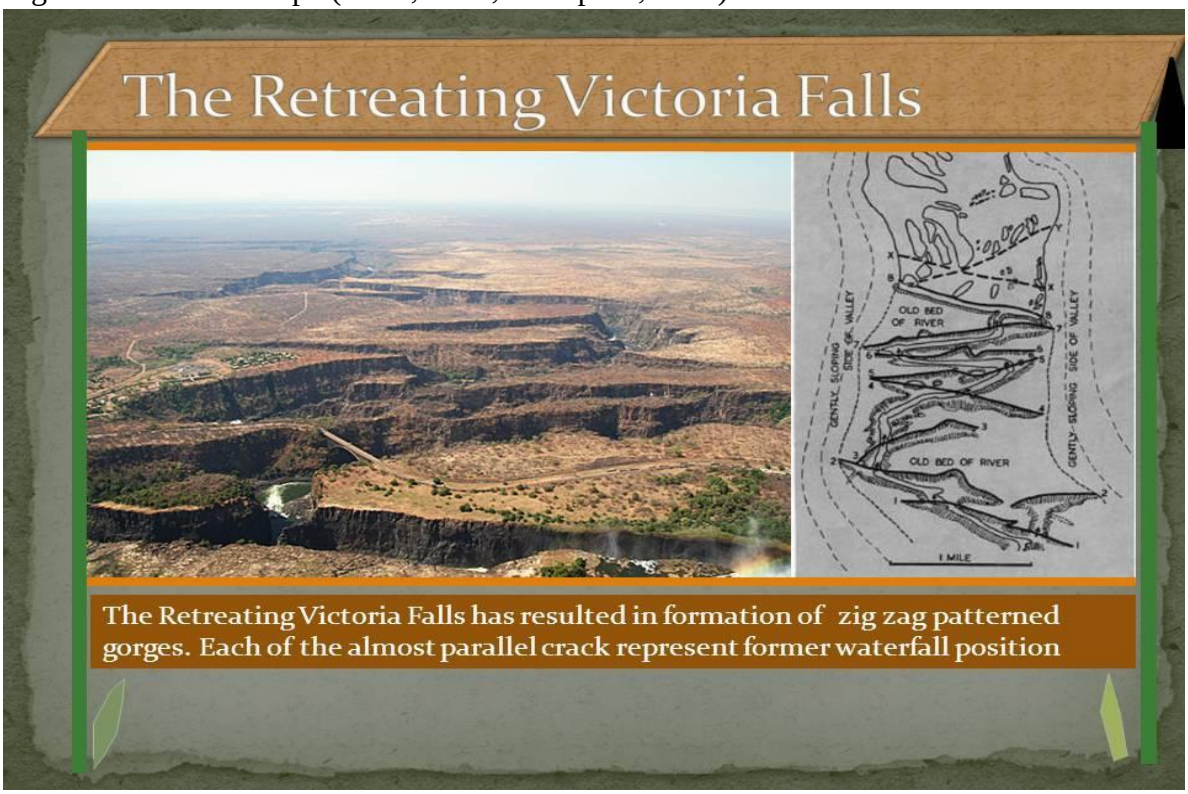


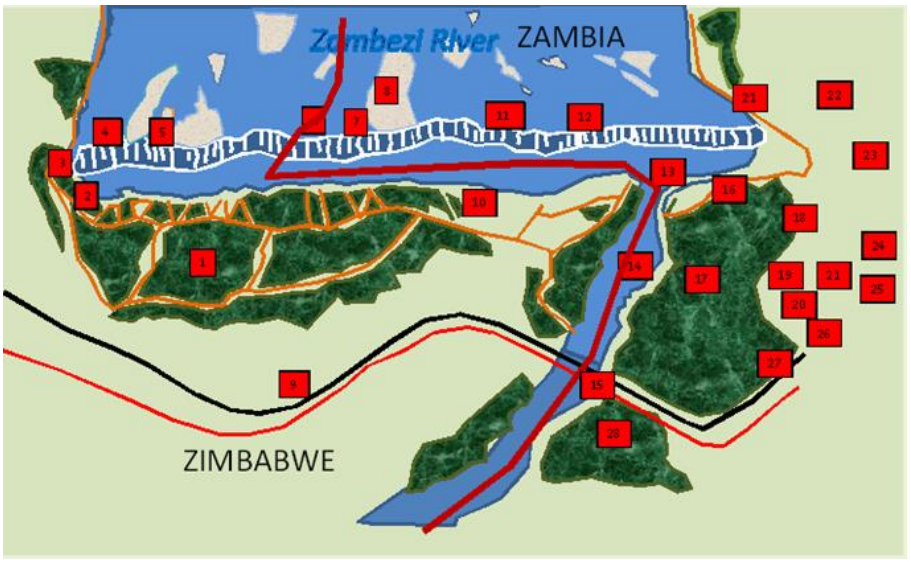
Figure 6.4: Series of zigzag patterned u-shaped gorges which formed previous seven waterfalls (see also Kagosi M., and Nyambe I.A, 2020) with an illustration at the right of the picture

Islands

Islands are found above the Victoria Falls. Basalt outcrops or sand dunes form islands e.g., Kandahar Island which is covered by vegetation. Sandy islands have more vegetation cover than the basaltic ones (Phillipson, 1990; personal observation).

Victoria Falls and Gorges

The Victoria Falls and gorges are the most prominent features in the area. The waterfall forms a cloud which is visible from about 50 kilometers. The gorges below the falls are dramatic and scenic landscape features themselves forming a zig-zag scar of the landscape (Bond 1990; Phillipson 1990). The formation of the Victoria Falls and gorges in general was a result of the combination of the development of the Zambezi River and the morphology of the basalt. The presence of joints aided by faults in the basalt rock facilitated the formation of Victoria Falls. Predatory waters of the combined Lower and Upper Zambezi River eroded sandstone layers which had been deposited in the joints and faults of the basaltic rocks. As erosion progressed basaltic blocks were removed resulting in nexus of joints causing river retreat as well as development of gorges and waterfalls. The process is still ongoing (Bond, 1990). Over the thousands of years, the river has created the scouring, erosive and depositional characteristics that are of geological significance and of scenic value for geoheritage tourism (Figure 6.5).



Location No.	Name of Location
1	Heart of the Zimbwean Rainforest
2	Chain Walk
3	Livingstone Statue - Zimbabwe
4	Devils Cataract
5	Boaruka (Cataract Island)
6	Main Falls
7	Arm Chair Falls
8	Livingstone Island
9	Victoria Falls Border Post (Zimbabwe)
10	End of Rainforest
11	Horse Shoe Falls
12	Eastern Cataract
13	Danger Point
14	Boiling Pot
15	Historic Victoria Bridge (Bunji Jump Adventure)
16	Knife Edge Bridge
17	Palm Grove
18	Livingstone's Statue - Zambia
19	Victoria Falls Sovegnier Shop
20	World War Memorial Cenotaph
21	Falls Small Access (Inner) Gate
22	Sun Hotel Gate
23	Archaeological Heritage Field Museum
24	The Shop that Thunders
25	Craft Market
26	Victoria Falls Main Entrance (Zambia)
27	Livingstone Border Post (Zambia)
28	Bunji Cafe

Figure 6.5: Geological features, geo-tourism and locales for the management of the Victoria – Mosi-Oa-Tunya Falls, Zambia – Zimbabwe

It is important to note that out of the 28 locations, fourteen (14) are as a result of the geological characteristics of the Victoria Falls Territory. These include Devils Cataract, Heart of the Zimbabwean Rainforest, Boaruka (Cataract Island), Main Falls, Arm Chair Falls, Livingstone Island, End of Rainforest, Horse Shoe Falls, Eastern Cataract, Danger Point, Historic Victoria Bridge (Bunji Jump Adventure), Knife Edge Bridge, Palm Grove and Boiling Pot. The Boiling pot is a spot where water swirls due to resistance of rocks to the erosive power of water thereby producing a backflow and upsurge of water as is the case with boiling water in a hot pot. On the upper part of the falls, through the erosive power of the water swimming pools have being formed. Boiling Pot and a Swimming pool are given in Figure 6.6.





Figure 6.6: Examples of the erosive features, the Boiling Pot at the left and Swimming Pool at the right

Overbank features

The flat landscape above the Zambezi River is interrupted by ridges and low hills which are bisected by its tributaries and subsequent streams. The low hills are either aeolian deposits (sand dunes) or basalt outcrops. Their visibility is however obscured by prominent vegetation. Ridges are scarps formed where Kalahari Sands meet the basalt rocks. There are prominent valleys on the tributaries of the Zambezi River (particularly towards the Zambezi River) whose banks are covered

by Kalahari Sands and the floors are on basalt rocks. Gullies in the Kalahari Sands are also not uncommon particularly towards the Zambezi River. The gullies are formed by active erosion as the river cuts back into the poorly consolidated Kalahari Sands.

6.6.5 Impacts on the geology, palaeontology and landforms

The impacts to the **geology and palaeontology** fall under the scenario of infrastructure development (hotel, housing, roads, water and sewer reticulation system} as they relate to the strength of the rocks and minerals available in the area as well as the structure of the rocks.

Victoria Falls lies within the Zambezi Mobile Belt which is associated with the East African Rift System. The area has been subjected to faulting resulting in several fault lines and joints leading to seismic activities in the Victoria Falls and 30km radius (Figure 6.7) (Nyambe, undated). Some of the weak lines are not easily visible since they have been blanketed over by Kalahari Sands. The faults and joints can induce structure failure (fracturing) along geological weak areas. The primary weak geological features can be further dilated by load bearing through compaction. Kalahari Sands are geomechanically not known to satisfactorily bear load because of groundwater disturbances (Personal experience). Fossils on the other hand were not recorded in the 30 km radius of Victoria Falls. The basalt rock formations have no sandstone layers known to host fossils. No gastropod fossils were observed in the Kalahari Sands and alluvial deposits were not recorded in the study area.

On the **landforms**, the major issues are erosion and visibility. Gully erosion is not uncommon in the Victoria Falls area as have been the case in Victoria Falls City area where some underground sewerage pipes and manholes were once being exposed after heavy erosion activities. This was largely because of the loose Kalahari Sands, which easily erode away. Erosion is active on sloping ground, rivers, streams and exposed surfaces. Loose sand from construction areas can produce dust as well as causing siltation of the rivers and visual intrusion caused by tall buildings.

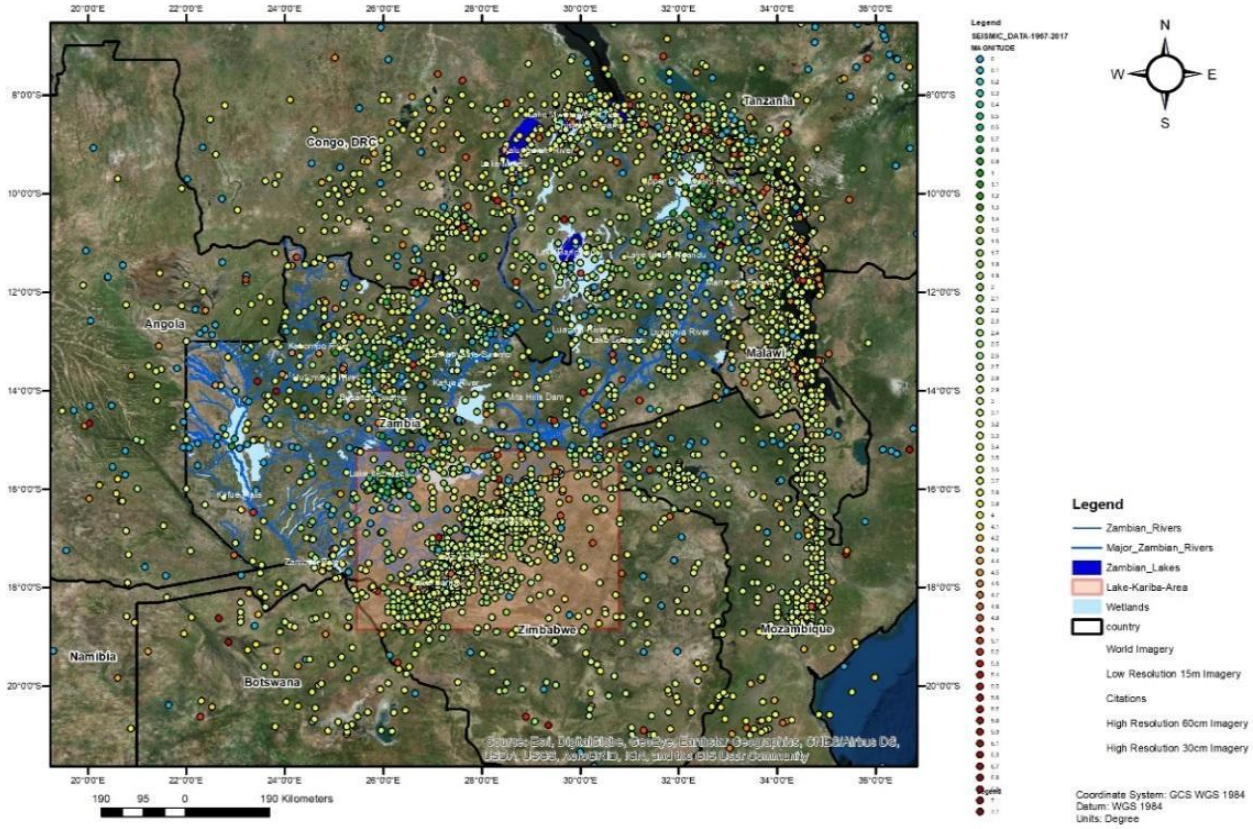


Figure 6.7: Seismic activities in and around Victoria Fall Area as from 1967 to 2017

6.6.6 Geological Strategic Recommendations

In line with infrastructural development (e.g., hotel, housing and road) in the Area, the following recommendations are presented on the three aspects; on geology:

(i) All weakened areas (major fault lines or joints) should be mapped in order to avoid them during construction;

(ii) Where unavoidable weakened areas should be stabilized before construction; and

(iii) Construction designs on Kalahari Sands areas should include stabilized foundations e.g., through using concrete cores.

On palaeontology: Any exposure of sandstone layers and alluvial deposits during earth moving activities such as hotel, housing and road construction within basalt rock formation should be undertaken with care as these could host fossils; and **Landforms:**

(i) Construction, agricultural activities and cutting down of vegetation on areas, which are prone to erosion should be discouraged;

(ii) Gullies reclamation using soil waste from ground disturbances such as construction of roads and buildings;

(iii) Paving and landscaping of exposed surfaces as a result of infrastructural development activities as is the case of the road opposite the Stanley Livingstone Lodge (Figure 6);

(iv) Construction on ridges and hills should be discouraged. The same applies to construction of tall buildings such double story building as they create visual intrusion; and

(v) Take advantage of gorges and valleys to construct subsurface building structures such as stadia and shopping malls.

In summary, a brief geological evolution of the Victoria – Mosi-Oa-Tunya Falls is given in Table 6.1.

Table 6.1: Brief geological evolution of the Victoria – Mosi -Oa- Tunya Falls, Zambia-Zimbabwe

200 million years ago (mya)	Desert-like conditions prevail in Victoria Falls area with absence of rivers at this point but dinosaurs roam the area
180 mya	Layered the basalts produced by volcanic eruptions in the Victoria Falls Region
150 mya	Deserts replaced by tropical vegetation
110 mya	Gondwanaland break-up of results into giant cracks in the basalt, which eventually developed into a series of waterfalls when river capture takes place
15 mya	Formation of gigantic lake, Makgadikgadi Pans due megauplift of central Zimbabwe. Upper Zambezi was at this point is part of Limpopo River system
5 mya	Big spill of Makgadikgadi lake causing the upper and lower Zambezi rivers to be connected and a resultant formation of first Victoria Falls waterfall around this caused by earth movements
1,5 mya	Stone Age humans emerged in Victoria Falls area
250 000 years ago –100 000 years ago	Probable age of the today's Victoria Falls

6.6 Hydrology of the Victoria Falls through Upper Zambezi River Basin

In this study, flow data was obtained from Zambia's Water Resources Management Authority (WARMA) as well as the Zimbabwe National Water Authority (ZINWA) for the Victoria Falls Big Tree runoff station. Gauge data were obtained from the 7 stations highlighted in Figure 6.8.



Figure 6.8: Victoria Falls catchment and rain gauge stations that were used to analyze historical and predicted changes in meteorological data

The results show that the mean annual rainfall (Figure 6.9) is approximately 660 mm/year for the Victoria Falls Rainforest. The minimum observed rainfall near the rainforest is 530 mm/year. However, the Victoria Falls area is characterized by high annual potential evapotranspiration rates with the maximum being 2540 /year and minimum annual potential evapotranspiration of 2240 /year (Figure 6.10).

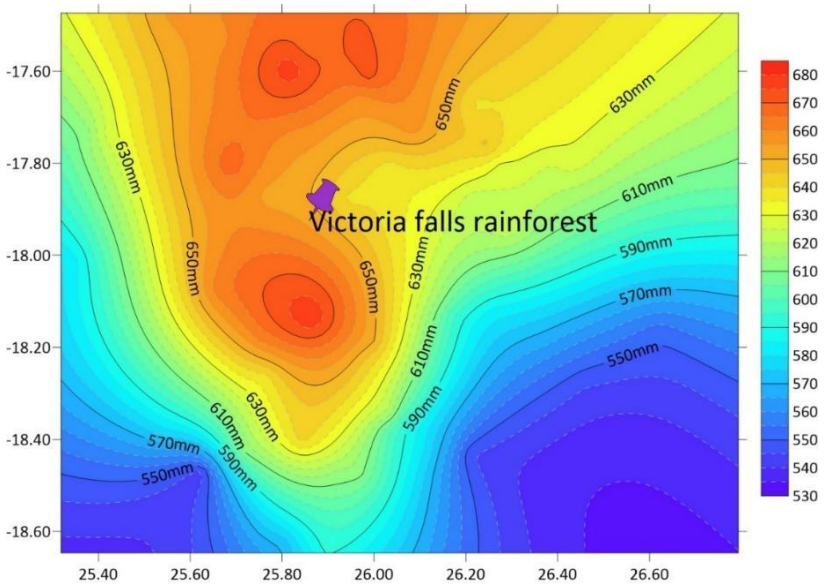


Figure 6.9: Mean annual rainfall for the period 1981-2020

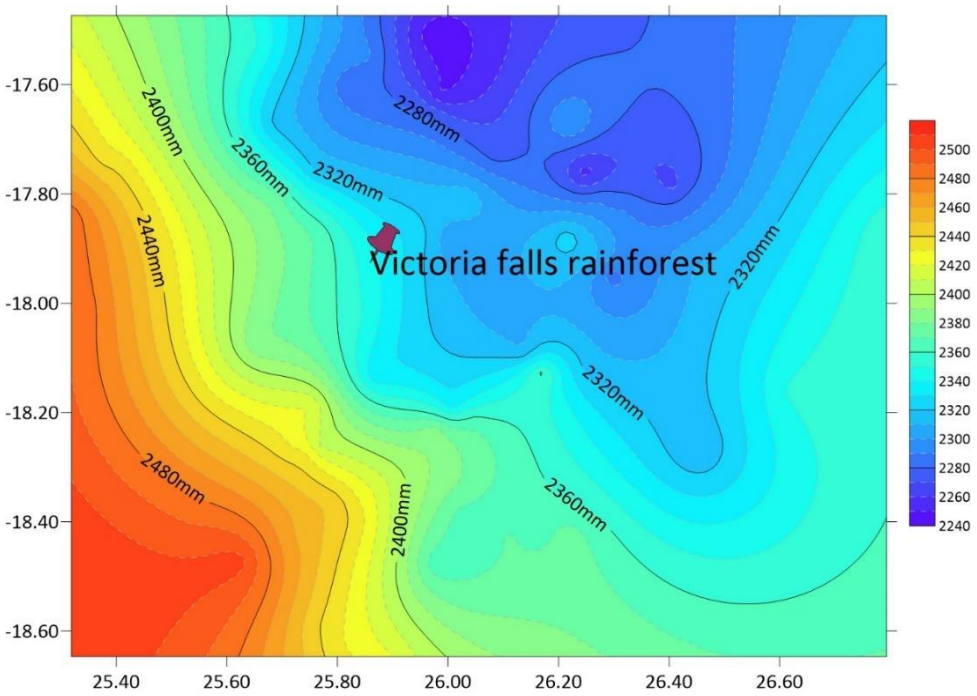


Figure 6.10: Potential evapotranspiration in Victoria Falls area

On average Victoria Falls is characterized by maximum temperatures of 29.36°C and minimum temperatures of 14.3°C**.** The amount of sunshine in the Victoria Falls is very good from April to October, which is the dry season, while it is acceptable in the rainy season.

6.7.1 Rainfall trends in the Upper Zambezi Basin from 1981-2020

Historically, extreme events such as droughts and floods have been recorded in Southern Africa (Hirji, 2002). For example, in 1967-1973, there was a 6-year drought streak. In the 1981/82,

1991/92, 1994/95 and 2019/20 season, there was a drought in most parts of Southern Africa. The rainfall and runoff activities at Victoria Falls rainforest are affected by hydrometeorological activities at the Upper Zambezi Basin. For example, the 2019 Cyclone Idai hit parts of Zimbabwe and Mozambique in 2019 destroying property and livelihoods.

The wet season (November-March) is showing an increase in rainfall over the years. However, an increase in trend for all the stations is not statistically significant since the obtained p-values are greater than the alpha level of 0.05. Since observed increasing rainfall trends are statistically insignificant, they are less likely to have a positive impact on the rainforest and on tourism. Processes such as evapotranspiration also reduce the impact of such increases in rainfall. The magnitudes of the trends > 0.28 mm/month however are large even though the trends are insignificant.

The dry season rainfall trend is characterized by significant decreasing trends for the majority of the stations (Pandametanga, Kalabo, Senanga, Kabompo and Livingstone/Victoria Falls). The dry season's significant decrease of magnitude < - 0.21 mm/month in rainfall has a negative impact on tourism numbers since tourists come to see the high flows and the magnificent waterfalls. In the 2019/2020 season there was a lot of negative publicity about the Victoria Falls decrease in flows and this negatively impacted on the number of tourists that visited the town during the April to September season. In the 2019/2020 season there was a significant decrease in rainfall in the rest of Southern Africa. The Zambezi basin was not spared. This caused a decrease in flow at Victoria Falls, thus impacting the potential of the tourism site.

6.7.2 Predicted Yearly Rainfall Trends from Climate Data 2021 to 2050

Future predicted rainfall trends (Table 6.2) are showing an increase in rainfall for the relatively majority of stations in the catchment namely Rukomechi, Senanga, Kalabo, Mongu, Zambezi, Kabompo, Kaoma and Mwinilunga. Only two stations are showing a significant decrease in rainfall from 2021 to 2050 and these are Livingstone/Victoria Falls and Pandametanga. The magnitudes of decreasing rainfall are -22mm and -5mm respectively for Livingstone/Victoria Falls and Pandametanga. This surely implies the rainforest is at risk of experiencing water stress.

Table 6.2: Predicted rainfall trends in the catchment from 2021 to 2050

Station	Kendall's tau	Sen's slope	Magnitude (mm/year)	alpha	p-value (Two-tailed)	Period
Senanga	0.112	49.01	1.00	0.05	0.39	2021-2050
Kalabo	8.97	3.9	0.08	0.05	0.49	2021-2050
Mongu	9.89	4.3	0.09	0.05	0.45	2021-2050
Zambezi	0.18	77	1.57	0.05	0.18	2021-2050
Kapombo	8.05	3.5	0.07	0.05	0.54	2021-2050
Kaoma	0.12	51	1.04	0.05	0.37	2021-2050
Mwinilunga	0.14	63	1.29	0.05	0.27	2021-2050
Pandamatenga	-0.01	-5	-0.10	0.05	0.02	2021-2050
Livingstone/ Victoria Falls	-0.05	-22	-0.45	0.05	0.04	2021-2050

Figure 6.11 shows the spatial variation of mean annual precipitation (MAP) for 1996-2020 and the predicted rainfall for 2020 to 2040 period. The mean annual rainfall ranges from 703 mm to 1274 mm per year of which the highest rainfall is being received in Democratic Republic of Congo. The lower part of the basin (Zambia, Botswana and Zimbabwe) has a relatively low amount of rainfall of (650 mm/year). Predicted mean annual rainfall for 2020-2040 is showing a minimum of 1044mm per year and a high of 1362mm per year. Compared with the previous mean annual rainfall of the period starting 1996-2020, there will be an increase in rainfall in the Zambezi Basin. Changes in precipitation amount and intensity are more important in the estimation of groundwater recharge relative to changes in temperature (Holman, 2006). Figure 6.12 shows the graphical representation of predicted rainfall trends from 2021 to 2050 (RCP 8.5).

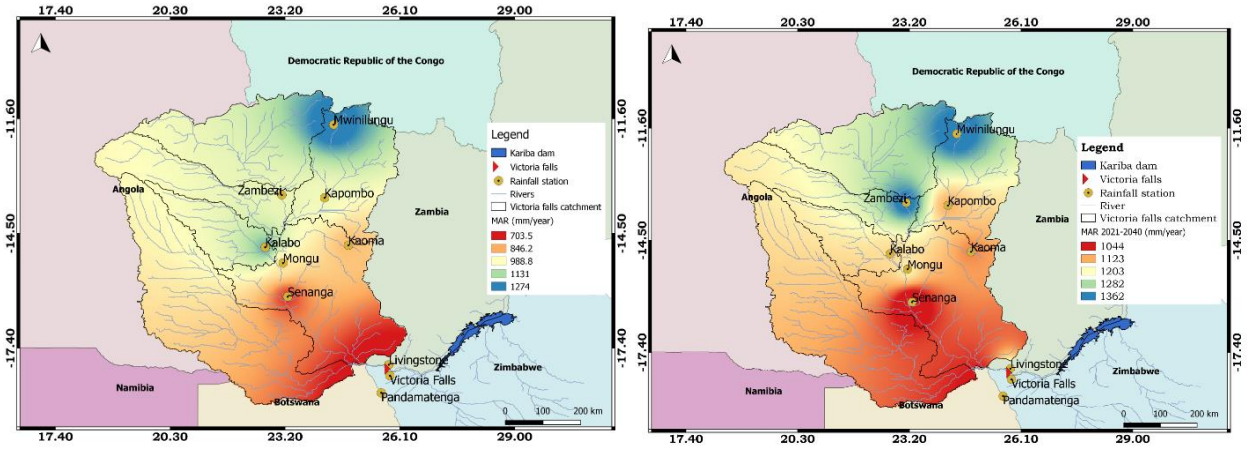


Figure 6.11: Spatial variation of Mean Annual Rainfall for a) 1996-2020) and b) RCP8.5 estimated for 2020 to 2040

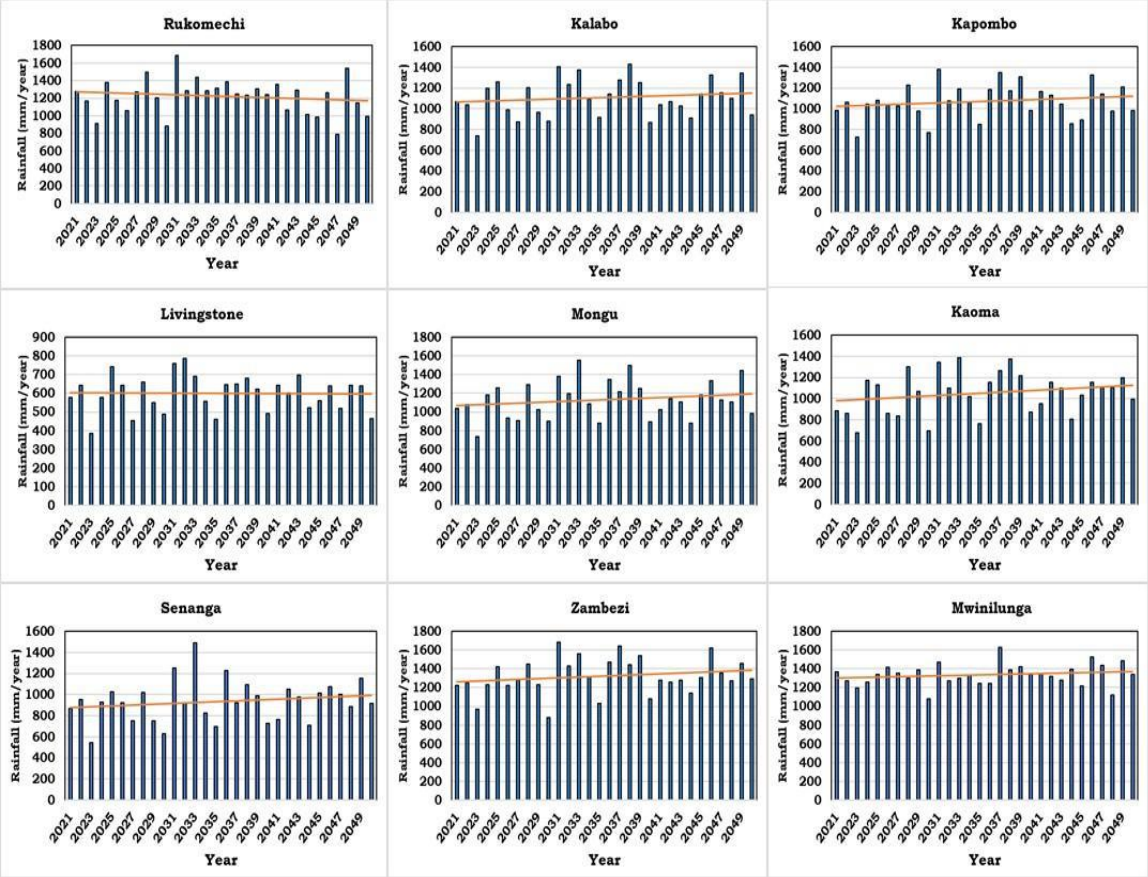


Figure 6.12: Graphical representation of predicted rainfall trends from 2021 to 2050 (RCP 8.5)

6.7.3 Runoff Trends

Observed as well as simulated stream flow hydrographs indicate that the Upper Zambezi Basin at the Victoria Falls Big Tree runoff station is a slow responding system by lack of rapid changes in stream flow over short periods by high rainfall. The Mann-Kendall trend in Figure 6.13 for the Victoria Falls Big Tree (1966-2020) and Nana Farm (1990-2020) shows that there is a positive trend (increase) in runoff as shown by a Kendall tau value of 6.95. Observed magnitudes were 5 m^3/s and 7.93 m^3/s for Nana Farm and Big Tree runoff stations respectively. The obtained p-value in both cases is greater than the alpha level of 0.05 and this implies the increase in runoff is not statistically significant. Further studies and data are needed to make a conclusion on the insignificant trends and the impacts to tourists and the Victoria Rainforest community at large.

Figure 6.13: Historical runoff trends at Nana Farm and Big Tree runoff gauges

6.7.4 Predicted Runoff Trends

Predicted runoff trend at the Victoria Falls Big Tree station are also showing an increasing trend from 2021 to 2040 (Figure 6.14). However, the trend is not statistically significant since the obtained p-value is greater than the significance level of 0.05. Observed magnitudes were as high as 8.6 m^3/s Big Tree runoff station. Predicted runoff trend at Nana Farm runoff gauge shows a negative value of -0.05 up to 2040. However, the declining trend at this gauging station is not

statistically significant since the obtained p-value of 0.70 is greater than the significance level of 0.05. Observed magnitudes were however as high as 5.8 m^3/s for Nana Farm.

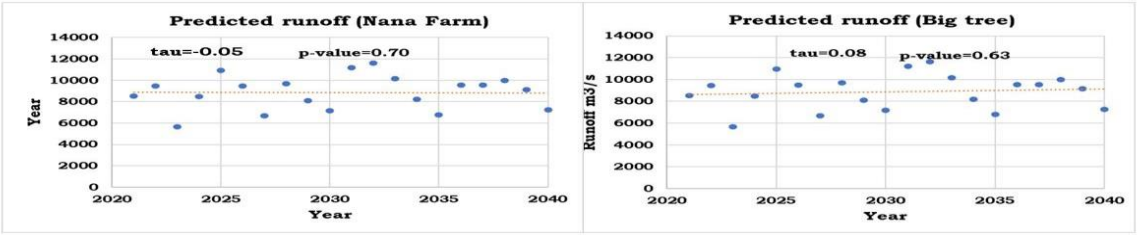


Figure 6.14: Predicted runoff trends up to 2040

6.7.5 Groundwater

The Zimbabwean side of the study area is characterized by unconsolidated sedimentary, sedimentary Kalahari Basin and Igneous (Upper Karoo Basalt) aquifer types resulting in aquifers classified into high and medium productivity. The Zambian side of the rainforest is characterized by Karoo basalts and Tertiary Kalahari Group aquifer types which are categorized into low productivity and low to medium productivity respectively (Figure 6.15). Unconsolidated sedimentary aquifers within the 30km radius are characterized by intergranular flow. Aquifers classified as high (h) productivity, yield 5-20L/s, those classified as medium have a productivity of 2-5 liters L/s whilst those classified as low productive aquifer have a yield of 0.1-0.5 L/s (Dochartaigh & Brighid, 2019).

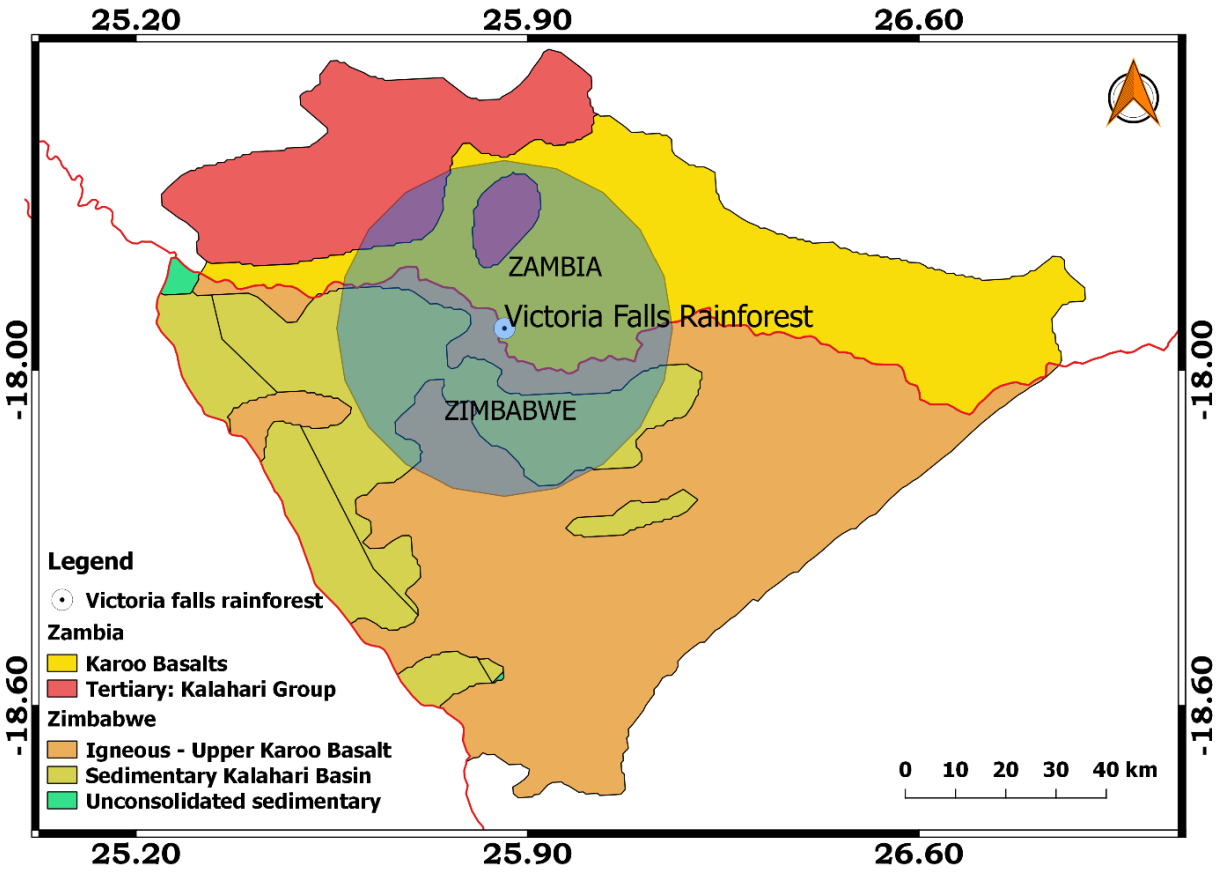


Figure 6.15: Aquifer types

Groundwater potential within the 30km radius of the study area is characterized by areas of high, moderate and low groundwater potential as shown in Figure 6.16. Relatively, the area is dominated by low to moderate groundwater potential (Dochartaigh et al., 2019) this implies there is need to avoid over-abstraction, initiate managed aquifer recharge and promote health soils in the area.

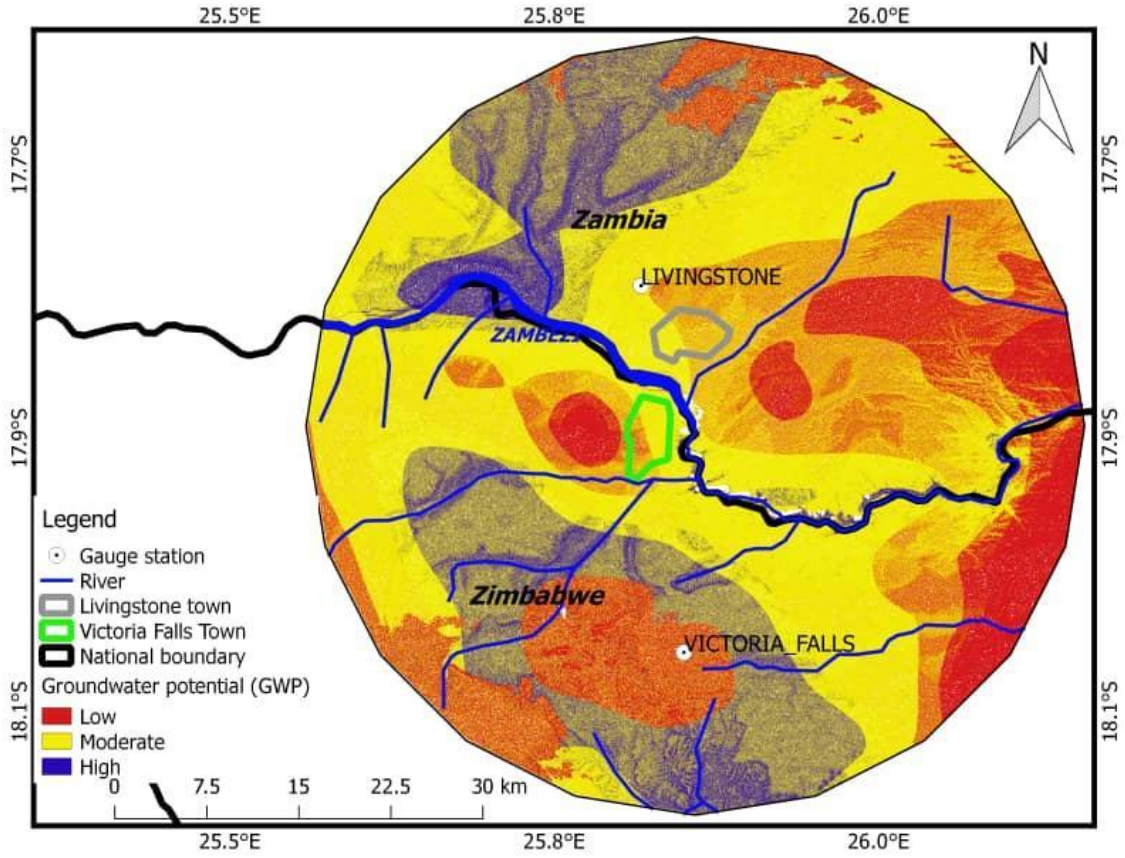


Figure 6.16: Groundwater potential within the 30km radius of the rainforest

Figure 6.17 shows that groundwater will decrease by an average of -5mm/year for Victoria Falls City due to climate change based on the output of a multi-model ensemble encompassing eight global hydrological GHMs, each forced by the bias-adjusted output of four GCMs under three different representative concentration pathways (RCPs). The above decrease means that the recharge of water to the falls and rainforest particularly in the dry season is reduced. Most perennial rivers such as the Zambezi are fed by groundwater in the dry season. It is also interesting to note that the geology of the Upper Zambezi is predominantly Kalahari Sands. It has a high infiltration rate of at least 10 mm/sec. As such groundwater potential and development within the area is limited. The predicted changes in recharge are validated by another approach which shows the ensemble mean change in Groundwater recharge (mm yr−1) between conditions of present-day warming of 1∘C GW and at 3∘C GW (Figure 6.17).

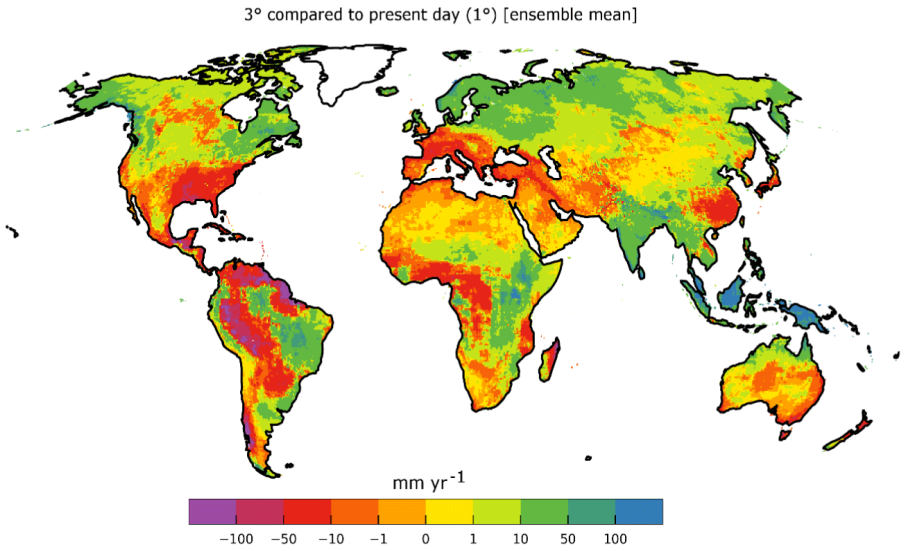


Figure 6.17: Ensemble mean change in Groundwater recharge (mm yr−1) between conditions of present-day warming of 1◦C GW and at 3◦C GW (Reinecke et.al 2021)

6.7.6 Water Quality Pollution

Preliminary results show that sewage plant and dumping sites are the main factors affecting water quality in the study area (Figure 6.18). The deposition of raw and partially treated sewage as observed in the 2021 May field trip is a setup which was not there in 1995. The above has limitations on the beauty and aesthetics of the Falls and the Rainforest. If the situation continues, we will witness a smelling and stinky Victoria Falls thus pushing away international tourists.



Figure 6.18: a) Direct discharge of sewage into Masuwe river upstream of the Victoria Falls Rainforest b) Dumping site close to the sewage plant

In Zimbabwe, the water quality tests were not done and therefore no results to present. However, in Zambia water quality assessment for middle Zambezi River sub-catchment at Livingstone Pump House on the Zambezi River in March 2020 were all satisfactory with pH of 6.62. For registered groundwater boreholes in Livingstone for March 2020 and 2021, were satisfactory except for three

that showed some total coliforms. The three have been put under monitoring. The pH ranged from 6.58 to 8.2.

6.7.7 Water Demand

Figure 6.19 shows a map of all current water demand sites. The current situation as compared to the 1995 SESA, shows that there are more water demand areas such as hotels, lodges. More water demand sites means that they put more pressure in the surface water and groundwater resources in the Victoria Falls Catchment and this can possibly lead to water stress as well as reduced flow in the Zambezi River.

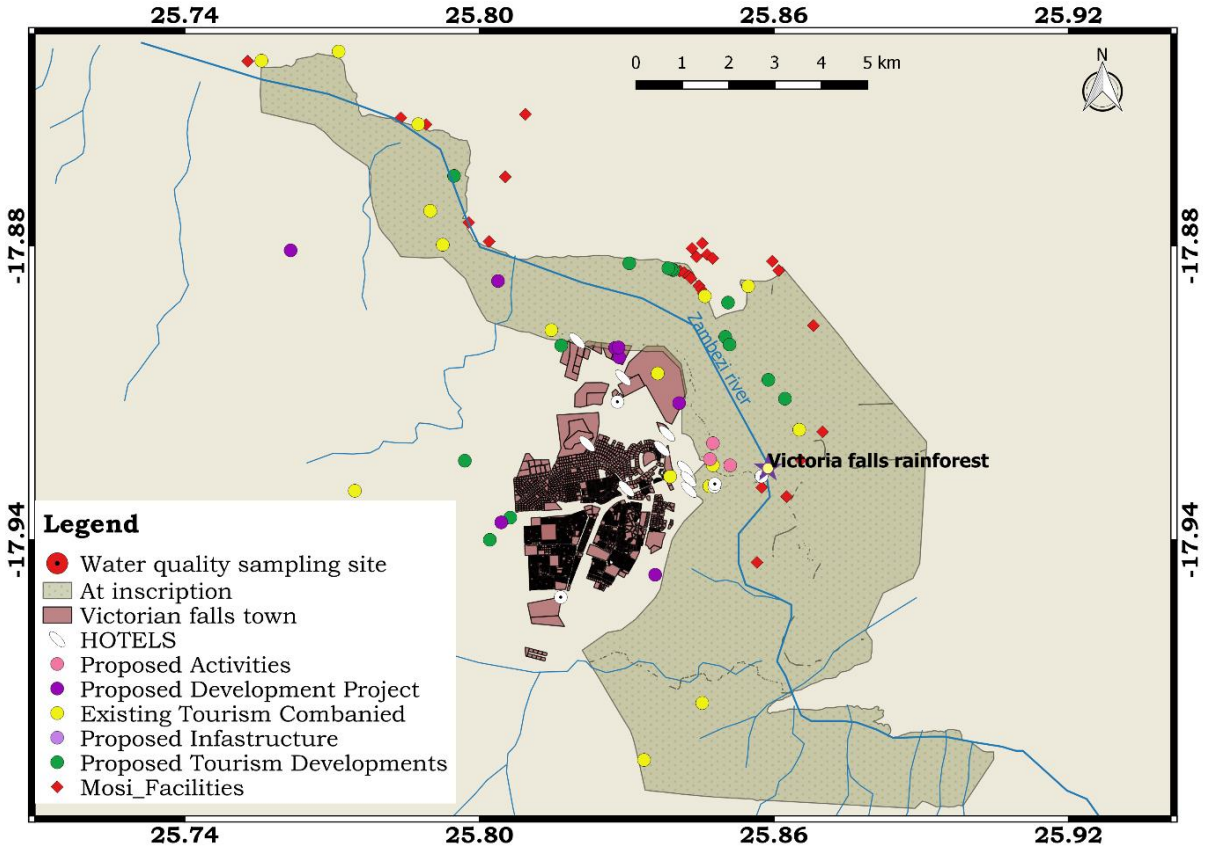


Figure 6.19: The spatial variation of water demand sites for 2021

6.7.8 Hydrological Strategic Recommendations

Strategically responsible authorities can implement a wide range of activities in an effort to promote water security in the basin upstream of the Victoria Falls. These include introduction of managed aquifer recharge, avoid sealed surfaces, improve infiltration, and promoting more infiltration through healthy permeable soils. Managed aquifer recharge can be achieved in several ways namely development of infiltration basins, galleries for rainwater, storm water and reclaimed water mains water. Rainwater harvesting will ease the pressure on groundwater and surface runoff.

6.8 Socio-Economics Features

Livingstone District consists of one (1) constituency and twenty (20) wards. The population of the district was estimated at 139, 509 as at the 2010 Census of Population and estimated at 190,419 in 2020 with a growth rate of 2.7% of which 75% of the population is estimated to be under the age of 30. Households are estimated at 39, 670 at an average size of four (4) persons. The district has a population of 0.17% of persons with disabilities. Two (2) special needs institutions cater for individuals with special needs (Holy Cross and David Livingstone). The Tourism Sector, which includes Arts and Culture, is the leading sector for fostering socio-economic development in the district. The tourism potential is drawn from the district's natural environment of the beautiful and transcendental Victoria Falls which is one of the renowned Seven Natural Wonders of the World (Livingstone City Council, 2021).

6.8.1 Demographic Characteristics

The demographic characteristics are important in understanding the living conditions of the people through the impact they have on the prevailing socio-economic situation. Furthermore, data on the demographic characteristics provide background information and the framework necessary for understanding other aspects of population, economic activities and poverty [Central Statistics Office (CSO), 2014].

6.8.2 Population Size

Statistics (Table 6.3) show that the population in Livingstone District is continually rising, leading to increased demand for tourism related activities, schools, medical facilities and houses. The population increase carries with it an increased number of street children, unemployment, and high demand for land, deforestation and basic social services. The population increase is due to tourism activity. Table 6.3 further shows that, there was a decline in annual average population growth rate in the district from 1990 (2.6%) to 2000 (2.1%) followed by an increase to 3.1% in 2010.

Table 6.3: Population Characteristics in the past three decades in Livingstone, Zambia 1990 to 2010 (Central Statistics Office, 2010)

Census Year	**Population**			**Annual Growth Rate %**
	Male	**Female**	**Total**	
1990	42,866	41,741	84,607	2.6
2000	51,828	31,460	103,288	2.1
2010	68,763	70,746	139,509	3.1

In Zimbabwe, the population estimates were derived from the following: Stand Count from the physical planning layouts and occupancy levels guided by Local Government Guidelines; Victoria Falls City's Revenue Department; Information from Billing Records; 2012 Population Census (Table 6.4).

Table 6.4: 2013 Population Statistics for Victoria Falls City (ZINWA 2014)

1	City Area	17 000
2	*Low Density*	*10 000*
3	*Chinotimba*	*30 000*
4	*Mkosana*	*35 000*
5	*Airport*	*3 000*
6	*Other Areas*	*5 000*
7	***Total***	***100 000***

The population is very important for the sustainable management of the MoT/VFWHP because it affects infrastructure and the development of infrastructure such as water supply, sewer systems, waste management and electricity supply. Poor solid waste and effluent management around the World Heritage Site causes pollution. Strain on electricity is already affecting the forests around the Falls considering that people are accessing wood energy causing serious loss of vegetation affecting biodiversity. The Zimbabwe National Statistical Authority forecasted a growth rate of 4.31%. The estimate results in a targeted population of 152,496 and 232,550 by the years 2022 and 2032 respectively. The Victoria Falls City has very limited landscape to accommodate these developments caused by population growth rate, accordingly there are also serious challenges on resources coupled with unemployment and poverty forcing residents to cultivate everywhere, again causing deforestation. The current population growth rate is therefore a likely threat to the values and outstanding universal value of Mosi-Oa-Tunya/Victoria Falls- World Heritage Site.

Estimate of Population for Base Year 2020

Livingstone District has had a projected population growth rate of 2.7% for the past ten (10) years. The same is expected to continue for the next ten (10) years. At this rate of growth, the estimated population of the district in 2020, the base year was 190,419 compared to the 2010 population which stood at 139, 509 and approximated to be 142,034 (CSO, 2010). In accordance with the 2010 census report, Livingstone has a low population density of 200.7 persons per square kilometre over a land area of 695 square kilometres.

Ward Size and Population Distribution by Ward

The breakdown of the distribution of the population of Livingstone District by ward as recorded in the 2010 census report is given in Table 6.5. As at 2010 census of population and housing, the district had seventeen (17) wards, however, with the delimitation exercise conducted in 2016, the number of wards in district increased from seventeen (17) to twenty (20) wards in 2020 [Electoral Commission of Zambia (ECZ), 2019].

Kasiya Ward has the largest surface area in the district. On the other hand, Mulungushi Ward has the smallest surface area. Zambezi Ward has the largest population despite not being the largest. Lizuma Ward has the smallest population in the district because part of it encompasses the graveyard (CSO, 2013a). Population density differs significantly between wards. The ward with the highest population density per km^2 is Mulungushi at 24,670 per km^2. The next highest is Mwalibonena with a population density of 16,186 persons per km^2. These two wards have four (4)

unplanned settlements, namely Burton, Zecco, Mbita and Malota areas. The wards with the lowest population density are Simonga, Shungu, Dr Mubitana and Kasiya. These wards have specific zones such as protected areas (national parks and local forests) agriculture and graveyard, thus restricting settlement patterns in the wards (CSO, 2010).

Table 6.5: Population and Population Density for Wards in Livingstone in 2010 (Central Statistics Office, 2010)

Ward	Size (km^2)	No. of House Holds (HH)	2010 Population			Pop 18 yrs. +	Pop density per sq km
			Male	Female	Total		
Freedom	19.102	2,408	7.699	7,875	15,574	9,417	815.3
Musi Oa Tunya	3.523	1,930	4,434	4,370	8,804	4,749	2499
Dr. Mubitana	139.469	1,443	3,326	3,343	6,669	3,770	47.8
Namatama	1.941	2,789	5,694	5,621	11,315	6,046	5829.5
Kasiya	242.064	1,901	4,501	4,474	9,075	4,499	37.5
Libuyu	4.021	1,510	3,930	3,859	7,789	4,097	1937
Mwalibonena	0.597	2,351	4,760	4,903	9,663	5,276	16185.9
Mulungushi	0.333	2,121	3,938	4,277	8,215	4,471	24669.7
Maramba	2.113	1,831	4,926	4,892	9,818	5,631	4646.5
Akapelwa	2.546	781	1,512	1,821	3,333	2,105	1309.1
Lizuma	0.922	558	1,267	1,437	2,704	1,578	2932.8
Simonga	211.724	3,003	6,320	6,362	12,682	6,861	59.9
Dambwa Central	1.798	1,430	2,893	3,147	6,040	3,496	3359.3
Zambezi	9.981	3,871	7,691	8,021	15,712	8,856	1574.2
Kariba	0.489	964	2,163	2,233	4,396	2,493	8989.8
Nansanzu	7.887	1,465	3,391	3,413	6,804	3,679	862.67
Shungu	69.885	821	1,764	1,677	3,441	1,806	49.3
Total		31,177	70,209	71,825	142,034	78,830	204.4

Table 6.5 above further shows that of the total population, 70,209 are male and 71,825 are female. Thus, there are relatively more females than males in the district as at the 2010 census. Of all the districts of Southern Province, Livingstone District has the fifth highest Population in the Province. From Table 6.5 above, Zambezi Ward, which houses the Victoria Falls, is 9.981km^2 in size with 3,871 households and a population of 15,712 representing 11.06% of the total district population. Zambezi Ward, therefore, has the highest number of households, which is attributed to unplanned settlements within the ward such as Dambwa Site Extension and Dambwa Site View (CSO, 2010).

Population Growth Trends and Projections

The population growth is expected to increase at an average annual growth rate of 2.7 %. The CSO projects that by 2030, the population of the district will have increased to 249,872 (Table 6.6). This is an increase of 59,453 persons equating to a total increase in population of 31.2%. Therefore, in next ten (10) years, it follows that there is likely to be an increased demand on the Victoria Falls, Hotel and tourism related activities and other economic activities such as curio business, retails business, agriculture and restaurants (CSO, 2013b). However, with coronavirus pandemic, it poses a serious threat on the tourism industry especially for foreign tourists.

Table 6.6: Population Projections in Livingstone District, Zambia (CSO, 2010)

Age group	Number in Age Group 2020	Number in Age Group 2025	Number in Age Group 2030
Totals	190,419	218,786	249,872
0-4	26,490	28,550	31,093
5-9	23,080	25,063	27,013
10-14	21,708	24,879	27,012
15-19	21,156	26,219	30,079
20-24	21,933	23,797	29,552
25-29	21,592	24,150	26,252
30-34	15,581	20,019	22,539
35-39	11,160	12,723	16,562
40-44	8,482	9,715	11,161
45-49	6,248	7,400	8,543
50-54	4,356	5,896	7,032
55-59	3,318	3,915	5,342
60-64	2,163	2,642	3,132
65-69	1,034	1,482	1,804
70-74	720	730	1,044
75-79	560	626	625
80+	837	980	1,086

Population Distribution by Age and Sex

The majority of the age structure in Livingstone District is the young youthful population (Table 6.7). About 75 percent of the population is under the age of 30 years. The median age is 19.9 years as of 2010, this means 50% of the population were above that age and 50% were below that age. The life expectancy at birth has improved in both sexes in the last decade, mainly due to the enhanced accessibility of health care and services. The following are the life expectancy at birth by sex segregated respectively, males 56.7 years and female 60.3 years (CSO, 2010).

Table 6.7: Projected population distribution by age in Livingstone, Zambia (CSO, 2010)

Age Groups		Number in Age Group 2020	Number in Age Group 2025	Number in Age Group 2030	Overall Percentage Growth 2020 to 2030
0 to 15	Number	71,278	78,492	85,118	19.4%
	% of Total Pop	37.4%	35.9%	34.1%	
5 to 14 years	Number	44,788	49,942	54,025	20.6%
	% of Total Pop	23.5%	22.8%	21.6%	
15 to 19 years	Number	21,156	26,219	30,079	42.2%
	% of Total Pop	11.1%	12.0%	12.0%	
19 to 64 years	Number	115,989	136,476	160,194	38.1%
	% of Total Pop	60.9%	62.4%	64.1%	
Youth Population (15 to 35)	Number	80,262	94,185	108,422	35.1%
	% of Total Pop	42.2%	43.0%	43.4%	
64 plus	Number	3151	3818	4559	44.7%
	% of Total Pop	1.7%	1.7%	1.8%	
Total		190,419	218,786	249,872	31.2%

The total population for Livingstone District stood at 139,509 as at the 2010 census of housing and population. Male population was 68,763 representing 49% and the female population was 70,746 representing 51% (Table 6.8). Sex ratio is the number of males per 100 females. A value above 100 indicates excess of males over females; while a value below 100 indicates a deficit of males over females. Livingstone has fewer males than females (Figure 6.8), with a sex ratio of 97 males per 100 females. In rural areas the sex ratio is 108 males per 100 females showing an excess of males over female whereas in urban area the sex ratio is 97 per 100 females indicating a deficit of males (CSO, 2010).

Table 6.8: Population Distribution by Sex in Livingstone, Zambia (CSO, 2010)

S/N	**Sex**	**Population**	**Percentage (%)**
1	Male	68,763	49.3
2	Female	70,746	50.7

Figure 6.20 further depicts the population distribution by age and sex in Livingstone District.

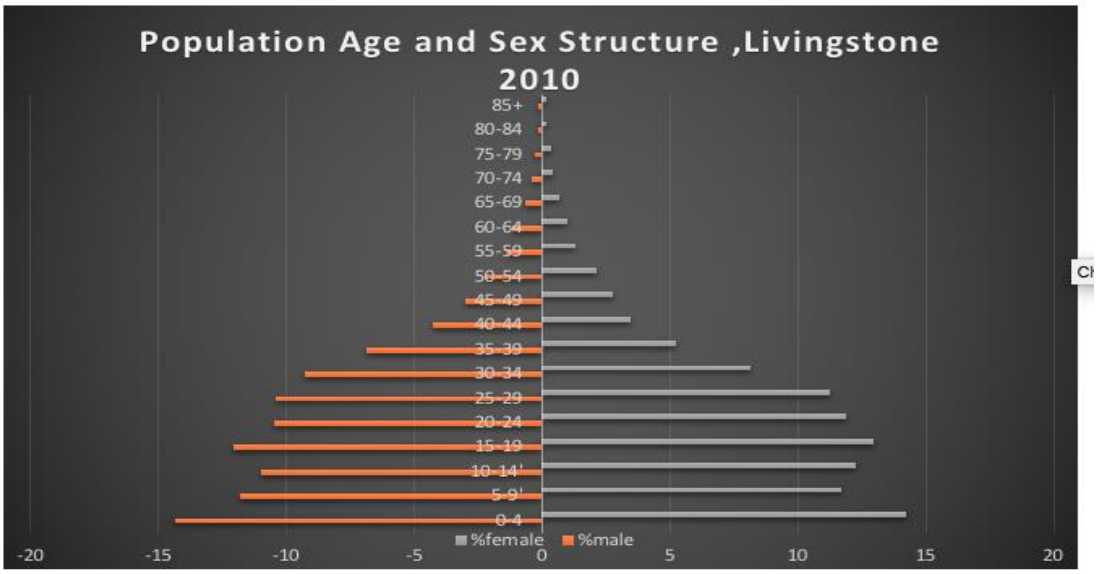


Figure 6.20: Population Structure by Age and Sex in Urban Livingstone, Zambia in 2010 (CSO, 2010)

The population distribution by age and sex in the rural part of Livingstone as recorded in the 2010 is given in Figure 6.21.

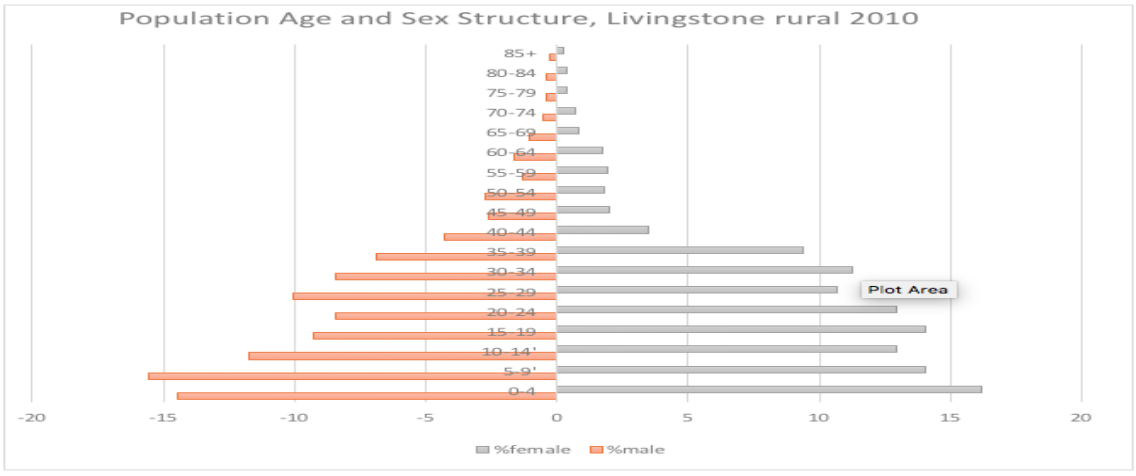


Figure 6.21: Population Age and sex structure in rural Livingstone, Zambia in 2010 (CSO, 2010)

Urban and Rural Population and Growth Rates

Livingstone City is the tourist capital of Zambia. Tourism is the engine of the district's economy. In 2010, 96% of the population was categorized as living in an urban area (Figure 6.22). This compared to 94.4% in 2000. The proportion of the population classified as being rural declined from 5.6% in 2000 to 4% in 2010.

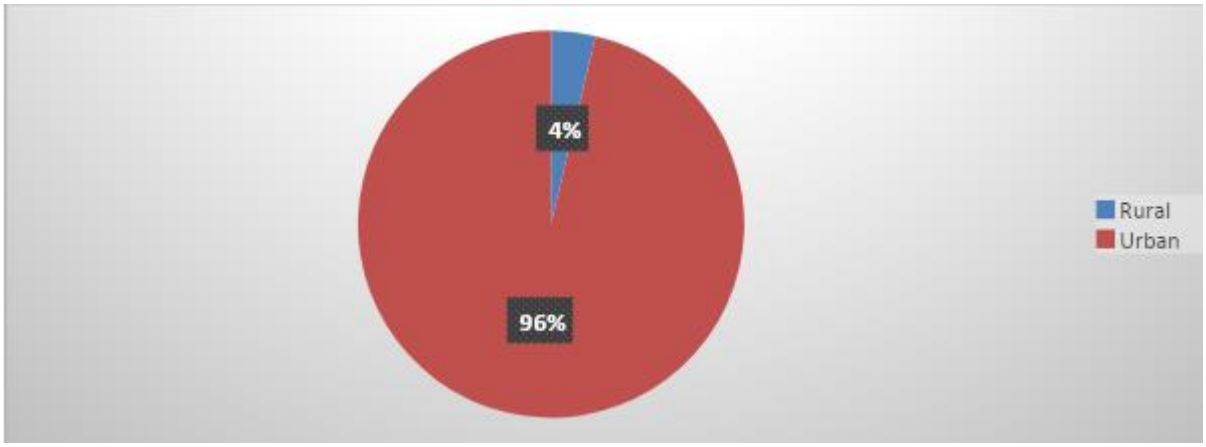


Figure 6.22: Population distributions by Urban and Rural Livingstone, Zambia (CSO, 2010)

While the population of the district as a whole grew by 3.1% per annum between 2000 and 2010 this growth was not evenly distributed (Table 6.9). The urban population grew by an average annual growth rate of 3.3% whereas the rural declined by 1.2 % (CSO, 2010).

Table 6.9: Urban and Rural Population Growth Rates, Livingstone, Zambia (CSO, 2010)

Year	Urban	Rural	Total	Urban Growth Rate 2000 to 2010	Rural Growth Rate 2000 to 2010	Total Growth Rate 2000 to 2010
2000	97,488	5,800	103,288	3.3%	-1.2%	3.1%
2010	134,349	5,160	139,509			

The major contributing factors to different rates of growth for urban and rural areas have been:

1. Rural urban migration from within and surrounding district;
2. Reclassification of areas previously defined as rural areas; and
3. Natural urban population growth.

6.8.3 Migration

This section analyses migration flows based on internal migration. Internal migration refers to changes of residence within a nation and is defined in terms of residential movements across boundaries in a country such as provinces and districts. Internal migration arises primarily for economic reasons. People migrate to improve their economic well-being. The 2010 Census identified that approximately half of the population of the district was born outside of Livingstone, i.e., they were migrants. This is the highest rate for all districts in Southern Province and is attributed to the movement of individuals from other places seeking economic opportunities in the tourism industry in Livingstone. CSO, (2014) indicates that when compared to other districts in Southern Province, Livingstone had the highest level of in-migration at 66,814 persons identified as internal migrants and comprising 50.6% of the population. Between 1996 and 2000 during

privatization of the Mines, some people came from the Copperbelt to Livingstone. The district also had extremely high levels of out-migration with the second highest level in the province of -159,851 persons and overall had a gross migration of -93,037 persons. This means that more people have left the district than have moved to the district and suggest a pattern of rural to urban migration while also a pattern of inter-urban migration especially due to creation of new settlements such as Mulala Settlement. Migration out of the district has also been influenced by the movement of the Provincial Capital to Choma in 2012 (Livingstone City Council, 2021).

6.8.4 Economic Activities

The wellbeing of both individuals and households in a society largely depends on their participation in gainful economic activities. The desire to attain and sustain a certain acceptable level of consumption of goods and services leads individuals to engage in various economic activities (CSO, 2014).

6.8.5 Local Economy

Tourism which includes heritage, history, natural arts and cultural products is the major economic driver of Livingstone District, singled out by government as one of the priority sectors for investment because of its labour intensive and numerous linkages to other sectors of the economy. The Victoria Falls in Livingstone serves as a growth point for development activities in the district. Sites with attractive natural settings are also readily available in national parks and game management areas (GMA). With the tourism potential around the Victoria Falls, curio trading, retail business and tourism related activities are anticipated to increase thereby putting more demand to the Victoria Falls Heritage Site. Investments in hotels has also increased with the number of hotels increasing from two (2) in SEA 1996 to ten (10) hotels as at the SESA 2021 with the number of lodges and guest houses standing at one hundred and twenty-two (122) from ten (10) lodges and guest houses in 1996. Bed spaces have also increased from five hundred and seventy-seven (577) to five thousand, two hundred and forty-three (5,243) and fourteen (14) conference facilities as at 2021. The numbers of rooms have also increased from three hundred and sixty-seven (367) in 1996 to two thousand, four hundred and eight two (2,482) in 2021. These recent developments in hotels, lodges, guest houses and campsites have a positive impact on the local economy because of the income which comes with it. However, these developments around the Victoria Falls area also have a negative impact, for example curio trade increase leads to increased demand for the timber, which is used for making curios as well as demand for basic services. Therefore, sustainable ways of harvesting timber are encouraged in order to maintain the natural vegetation and beauty around the Victoria Falls Site (Livingstone City Council, 2020).

6.8.6 Local Trade

Following the collapse of the industrial sector through liquidation and privatization in the third republic between 1990 and 2000, Livingstone experienced a decline in economic activities. This resulted in growth in trading activities more especially cross border trading. These activities have improved at a steady pace over the past few years, but they are limited to urban areas. The people

in the rural part of Livingstone are engaged in agriculture subsistence farming with a few small-medium scale and commercial farmers engaged in poultry, piggery, dairy and fish framing (Livingstone City Council, 2021). The district has a total of seventeen (17) markets and one (01) 80% complete modern market in the Central Business District, which will increase the trading space in the district when completed. Additionally, the district has three (3) curio markets namely: Victoria Falls World Heritage Site, Maramba Cultural Village and Mukuni Park that support income generation for marginalized communities in support of government efforts to eradicate poverty (Livingstone City Council, 2021). With increases in trading and the promotion of local tourism by the Zambia Tourism Agency, demand for visiting the Victoria Falls will increase and thereby putting more pressure on maintaining the natural beauty of the heritage site (Livingstone City Council, 2021).

In Zimbabwe, the main industry in Victoria Falls is tourism with most tourists coming to see the Victoria Falls and the wildlife within the surrounding National Parks like the Hwange and the Zambezi National Parks. This again drives the line of business with most businesses being hinged around tourism and this include tour operators, hotels, souvenir shops, curios, lodges, festivals and related service providers. There are 14 hotels and 62 lodges. Major hotels in the city include the Kingdom hotel, A 'Zambezi hotel, the Elephant Hills, Victoria Falls Hotel, Victoria Falls Safari Lodge and many high profile guest houses and lodges. The tourism industry is now also being supported by a fairly growing retail and light industrial sector that contributes to numbers of formal employment statistics and these include supermarkets, construction industries and hardware shops. There are no manufacturing and or smelting industries. According to the City of Victoria falls policies no plant or machinery is to be installed, constructed or utilized within the city and residential or industrial sites; in the opinion of the City such industries give rise to excessive pollution. The city always makes sure that appropriate measures are always undertaken to ensure that any emissions or pollution are minimized and maintained at acceptable levels. There is also a significant fraction of the city that thrives on cross border trading (plying Botswana, Zambia and Namibia route) and informal trading for livelihood. Most of those engaged in informal trade are mainly in the home industry, producing wares and works of art that support the main economic activity of the city and that finds a ready market.

6.8.7 Urban Facilities and Amenities

With population growth, urban facilities and social amenities have also increased in the Livingstone and Victoria Cities area.

Health Facilities

Health facilities in the district include twenty (20) clinics, ten (10) health posts and one first level general hospital. In Zimbabwe, Victoria Falls is a malaria prone area and committed effort should be taken to ensure that people visiting the area have taken adequate preventive measures. Victoria Falls is serviced by one hospital. The hospital has adequate capacity to treat and stock preventive medicines for the prevailing malaria. However, most health facilities do not have enough medicines including several clinics both public and private. There is also EMRAS (Emergency

Medical Rescue Ambulance Service) which provides Primary Response, Inter Hospital Transfers, Diagnostic Transfers, Long Range Road ambulance transfers, evacuation by air, if necessary and medical insurance covers, to the nearest and best medical facility (Reference).

Education Facilities

Education facilities in Livingstone include eighty-three (83) early childhood, ninety (90) primary schools of which fifty-three (53) are private and fourteen (14) are community, nineteen (19) secondary schools of which two (2) are private and seven (7) tertiary institutions. In Zimbabwe, available information indicates that the number of schools both public and private schools is as follows: 6 Secondary Schools, 9 Primary Schools and 1 Vocational College. Due to the tremendous population growth, there is a need for more schools to reduce overcrowding on the existing ones and their infrastructure. There is also a need to establish a training centre that focuses on tourism and wildlife management so that local communities benefit in employment opportunities from the hotels, lodges and parks management.

Aviation

Livingstone has an International Airport called Harry Mwaanga Nkumbula International Airport. International Civil Aviation Organization (ICAO) airport code FLHN and International Air Transport Association (IATA) airport code LVI.

Radio and Television

The district has 3 Private Radio stations-, Mosi-Oa-Tunya Radio, Falls FM and Zambezi FM. The district is also serviced by a national broadcaster ZNBC Radio 1 and 2. In terms of television, the district is serviced by the national broadcaster ZNBC TV, Muvi TV, Top Star TV stations, GOTV and Multichoice.

Electricity Supply

Electricity supply in the district is provided by ZESCO, a state-owned company. The company supplies hydro- electric power. All the urban areas in the district are connected to the national electricity grid. Petroleum products are supplied by private companies through fuel filling stations (Livingstone City Council, 2021). The current installed capacity for Livingstone is 128MVA which gives a surplus of 87 MVA to cater for the next ten (10) years. The current demand for electricity in the district is 41 Mega Volts Amps (MVA) with no deficit. The district has one (01) electricity generating station which has a capacity of 128MW. It also has three (03) main substations which are Linda Substation with a capacity of 63MVA, Lusaka Road Substation with a capacity of 40 MVA and Minor Hotel Substation with a capacity of 20 MVA. Demand is projected to rise to 50 MVA in the next five (5) years due to the anticipated increase in population (Livingstone City Council, 2021).

Alternative Sources of Energy

The other source of energy for the district is petroleum. There are a total of eight (08) fuel filling stations in the district and one (01) bulk storage depot. These facilities are meeting the demand of the district. The estimated consumption rate of petroleum products in Livingstone District is: 19,151.45 litres of diesel; 29,137.58 of unleaded petrol; 363.85 of kerosene and 1,341.38 litres of jet A-1 fuel. Livingstone District further depends on a number of energy sources that include charcoal, wood, gas, paraffin, cow dung, coal, solar and bio fuel used to support economic and social activities of the district (Livingstone City Council, 2021).

Household Energy Use

Household energy usage in the Site includes energy for cooking and lighting purposes. Of the total number of 31,152 households in the district (Table 6.10), 50% of households depend on electricity for cooking, 41% charcoal and 9% use wood (CSO, 2010). The high dependence on charcoal has contributed to the movement of men and women to and from the rural parts of the district to source wood, which is the main source of charcoal (Table 7). This has led to increased pressure around the Victoria Falls Site and the district at large with regards to the already stressed natural vegetation, as the larger populations turn to use of charcoal and other unsustainable sources like wood (Livingstone City Council, 2021).

Table 6.10: Household energy consumption, Livingstone, Zambia (CSO, 2010)

	No. of HH	Wood (%)	Electricity (%)	Charcoal (%)	Gas (%)
Rural	1, 230	76	16	8	0
Urban	29, 922	0	51	42	7
Total HH	31,152				

Of the total number of 31,152 households in the district, 1,230 households are in the rural part of the district (CSO, 2010). Of this number of households, 639 households (52%) depend on candles for lighting, 261 households (21%) depend on electricity for lighting, 20% depend on paraffin and the rest depend on other sources (Figure 6.23).

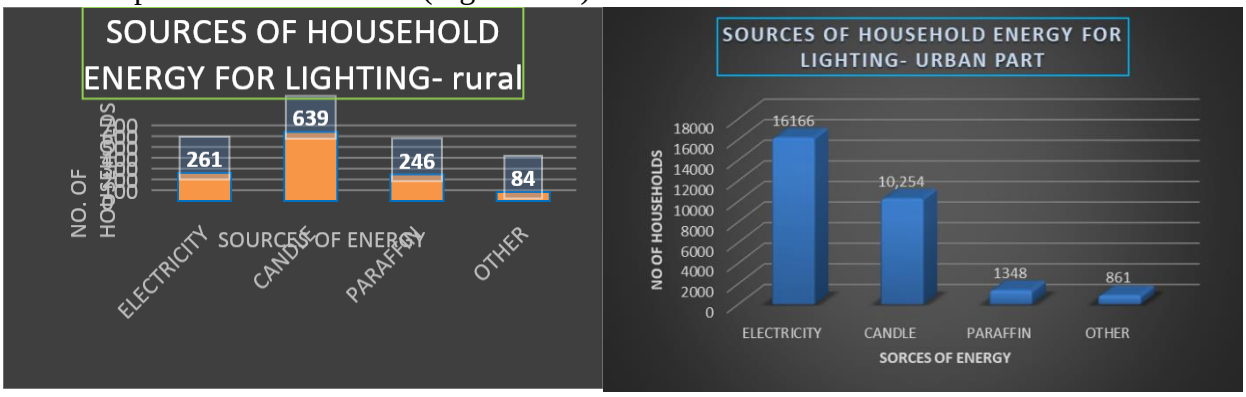


Figure 6.23: Household energy comparisons Rural and Urban Livingstone, Zambia (CSO, 2010)

As illustrated in Figure 4 above, the urban population on the other hand depends more on electricity with 16,166 households (57%) out of a total of 28,629 households, 10,254 households (36%) depend on candle for lighting while 5% of the households depend on paraffin. The rest of the households depend on other sources for lighting (CSO, 2010). However, a large Hydroelectric Power (HEP) project (Batoka Hydro Power Project) is planned with a generation capacity of 2,400MW to be shared between Zambia and Zimbabwe downstream of the Victoria Falls on the Zambezi River. This mega project is likely to put more pressure on the regulation of water falling down on the Victoria Falls. Therefore, the National Heritage and Conservation Commission (NHCC) should make sure that water abstraction for the generation of electricity does not disturb the natural existence of the Victoria Falls World Heritage Site (VFWHS) (Livingstone City Council, 2021).

6.8.8 Institutions and Administration

The following institutions play keys roles in the planning of development and management of natural resources within the Victoria Falls area:

Livingstone City Council

Livingstone gained the status of a City Council in 1996 to join Lusaka, Kitwe, Ndola and later Chipata as the five (5) cities in the country among one hundred and sixteen (116) districts. Before then, Livingstone was the first district in the country to become a municipality in 1928 (Livingstone City Council, 2010). The local authority is governed under the Local Government Act No. of 2019 and Urban and Regional Act of No. 2 of 2010 to draw up development plans for the city. The functions of the council include: making policies and decisions on local government and development, passing by-laws for good governance, promoting infrastructure and economic development through the formulation and approval and execution of a district development plan. It is responsible for issues of planning consents for all developments within its area. The Council is headed by one (1) elected Mayor and twenty (20) Councillors with the day-to-day management carried out by the Town Clerk. The department of city planning is in charge of formulating socio economic and spatial development plans for economic development and land alienation (Livingstone City Council, 2021).

Reserves and Trust Lands

These are governed by the traditional leadership of three (3) Chiefs in the area namely: Mukuni, Sekute and Musokotwane under their Indunas and Village headmen. This authority is governed under the state Lands, Reserve and Trust Acts of 1924. The state land can be convened into leasehold tenure of 99 years (Livingstone City Council, 2021).

National Parks and Wildlife Services

The department is responsible for the management of the Mosi-Oa-Tunya National Park.

National Heritage Conservation Commission (NHCC)

NHCC is the agency mandated to protect and manage the national monuments including natural, archaeological and historical heritage resources. Its headquarters are in Lusaka and it is responsible

for the management and protection of the MoT/VFWHP. Its departments contain expertise on ecology, history, geology, sociology, archaeology and cultural resources. The commission has undertaken a number of Heritage and Environmental Impact Assessments in different parts of the country (Livingstone City Council, 2021).

Forestry Department

The department controls and manages the two (2) local forests: Dambwa and Simonga Forest reserves in the area. Forest regulations provide for the conditions for issuing of licenses for felling trees, removal of forest produce and the utilization and protection of trees (Livingstone City Council, 2021).

Ministry of Tourism and Arts

The ministry is the mother body of all tourism agencies and guides policy direction for tourism agencies operating in the area. Tourism agencies include; Zambia Tourism Agency with the aim of promoting local and international tourism, Livingstone Tourism Agency, which is a private sector body with the aim of coordinating and representing the interests of hotels and tour operators in the area (Livingstone City Council, 2021).

6.8.9 Cross Cutting Issues

Crosscutting issues includes HIV/AIDS prevalence rates, Epidemics, Malaria incidence in Livingstone area

HIV / AIDS Prevalence Rate

The HIV/AIDS prevalence in the district is at 25.3% against the provincial rate at 12.8% and the national rate of 13.3%. In terms of positivity rate, the district is at 6% as of 2018 (Livingstone City Council, 2021). With the current scenario, there is a need by the District Aids Coordinating and Advisory Team to escalate condoms distribution, testing and treatment techniques aimed at reducing the high prevalence rates in HIV / AIDS in the district.

Epidemics

The district is free from epidemic outbreaks of yellow fever, Ebola and Cholera making it a viable tourism destination. Livingstone District as of the first quarter of 2020, had recorded no coronavirus infections, however, it is now affected. The district is now prepared for a possible pandemic and has opened up a quarantine centre for suspected cases of the Coronavirus as well as an isolation centre at the Livingstone General Hospital (Livingstone City Council, 2021).

In the fourth quarter of 2020, the number of COVID 19 cases in the district had surged and control protocols to contain its spread were updated. Strict screening at points of entry (the airport and the border points) were enhanced and strengthened, ensuring all travellers were tested. Additionally, contact tracing of possible exposed individuals in the communities has been prioritized with continuous follow ups being conducted. Strict self-isolation guidelines are also enforced in the communities for individuals who test positive for the virus, with health staff constantly on call to make follow ups (Livingstone City Council, 2021).

Strict operational measures have also been enforced in public and private organizations and institutions such as; masking up, social distancing and hand sanitizing facilities made available and administering corona vaccines especially for front line health workers (Livingstone City Council, 2021).

Malaria Incidence

The Livingstone District Medical Office points out that by the end of 2018, the district had a malaria incidence rate of 3.1 persons per 1000. This is a great improvement from the statistics of the 2017 where the rate was 5.4 persons per 1000. This can be attributed to the improved use of malaria prevention interventions such as Indoor Residue Spraying (IRS), the use of mosquito treated nets, early diagnosis and treatment of malaria (Livingstone City Council, 2021). Livingstone District has zero clinical malaria (malaria which is treated without lab confirmation), meaning all the malaria cases are confirmed at the lab. Further interventions involve larvaciding, which is the killing of the mosquito larva in breeding grounds. The main breeding ground for mosquitoes in the district is the sewer ponds located in Dambwa Site and Service and Mwandi areas (Livingstone City Council, 2021).

6.8.10 Social Economic Strategic Recommendations

Arising from the social analysis of the Site, the following are the strategic interventions recommendations:

1. Ministry of Tourism and Arts working in conjunction with NHCC should ensure that local communities are given priority in relation to employment and provided with training (skills) for future labour in the tourism sector and that the number of local residents employed in any new tourism development be documented;
2. Ministry of Tourism, and Destination Livingstone (a local body) working in conjunction with Livingstone Lodges and Guest Houses Association (LILOGHA) should come up with a human resource management plan / redundancies plans and packages to avoid labour strife;
3. The Department of Forestry, NHCC and the Local Authority should work with other stakeholders to enhance protection of Dambwa and Simonga Local forests to preserve the natural environment using sustainable ways of harvesting wood for curios, firewood, charcoal and promote afforestation and reforestation;
4. The Energy Regulation Board (ERB), should work with other stakeholders to sensitize the community on renewable energy sources and their use, promote renewable as energy source;
5. Ministry of Tourism and Arts working in conjunction with Livingstone Tourism Agency, Zambia Tourism Agency and other stakeholders should advocate for policies and legislation that address challenges for business growth in the tourism sector to absorb the large youth population; and

6. Ministry of Tourism and Arts, Zambia Tourism Agency, Livingstone Tourism Agency, ZACCI in conjunction with other stakeholders should prepare proposals on stimulation of local investments in tourism for employment creation.

7. In Zimbabwe, the public consultation-social impact assessment (SIA) is governed by the Environmental Management Act (CAP 20:27), section 4 (2c) which says that the participation of all interested and affected parties in environmental governance must be promoted and all people must be given an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation. This section makes the stakeholder consultation an integral part of the environment management process. Environmental Management Act (CAP: 20:21), Section 4 (1) empowers the local community to participate in the implementation and promulgation of legislation and policies that secure sustainable management of natural resources while promoting justifiable economic and social development. This consultation process is a valuable source of information on key impacts, potential mitigation measures and the identification and selection of alternatives.

6.9 Land Use Zambia – Zimbabwe

The study area has a land mass of 1917.03km^2 comprising 695km2 in Livingstone District and 1222.03km^2 part of Kazungula. There is a duo land tenure system in the area namely customary and state land. Customary area is "the area described in the Schedules to the Zambia (State Lands and Reserves) Orders; 1928 to 1964 and the Zambia (Trust Land) Orders, 1947 to 1964" (Lands Act No. 29 of 1995, Cap. 184). This land is an area of land administered by the Chief in the area. While State Land means "land which is not situated in a customary area." (Ministry of Lands, 1995). This land is administered by the President of the Republic of Zambia for the people of Zambia. Land uses (Figure 6.24) in the area include agricultural, forest reserves, residential, commercial, industrial, institutional, recreational, hospitality, national park and other land uses.

They are characterized as follows:

(i) Agricultural land use which is the largest land use in the Area;

(ii) Two (2) local forests reserves, namely Dambwa Forest Reserve number 22 and Simonga Local Forest number 67 in the area;

(iii) Mosi-Oa-Tunya National Park; much of this land is protected and is used for hospitality and tourism related land uses; and

(iv) Urban land uses including residential, commercial, industrial, institutional, recreational and mixed land uses.

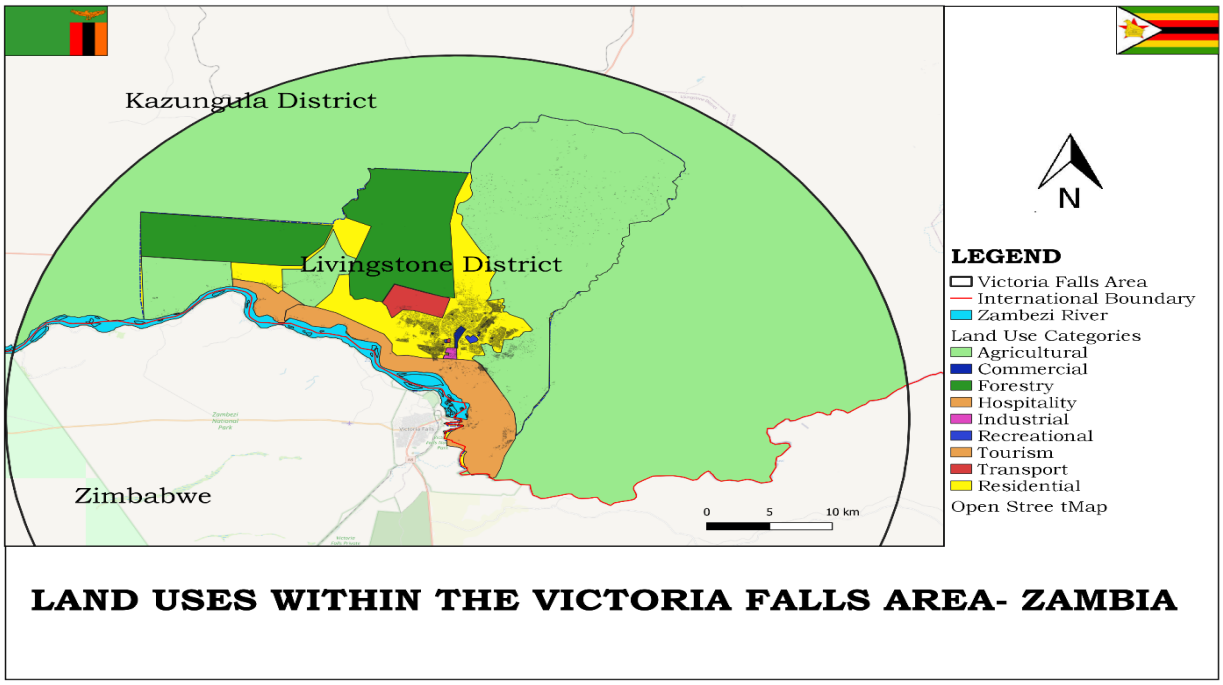


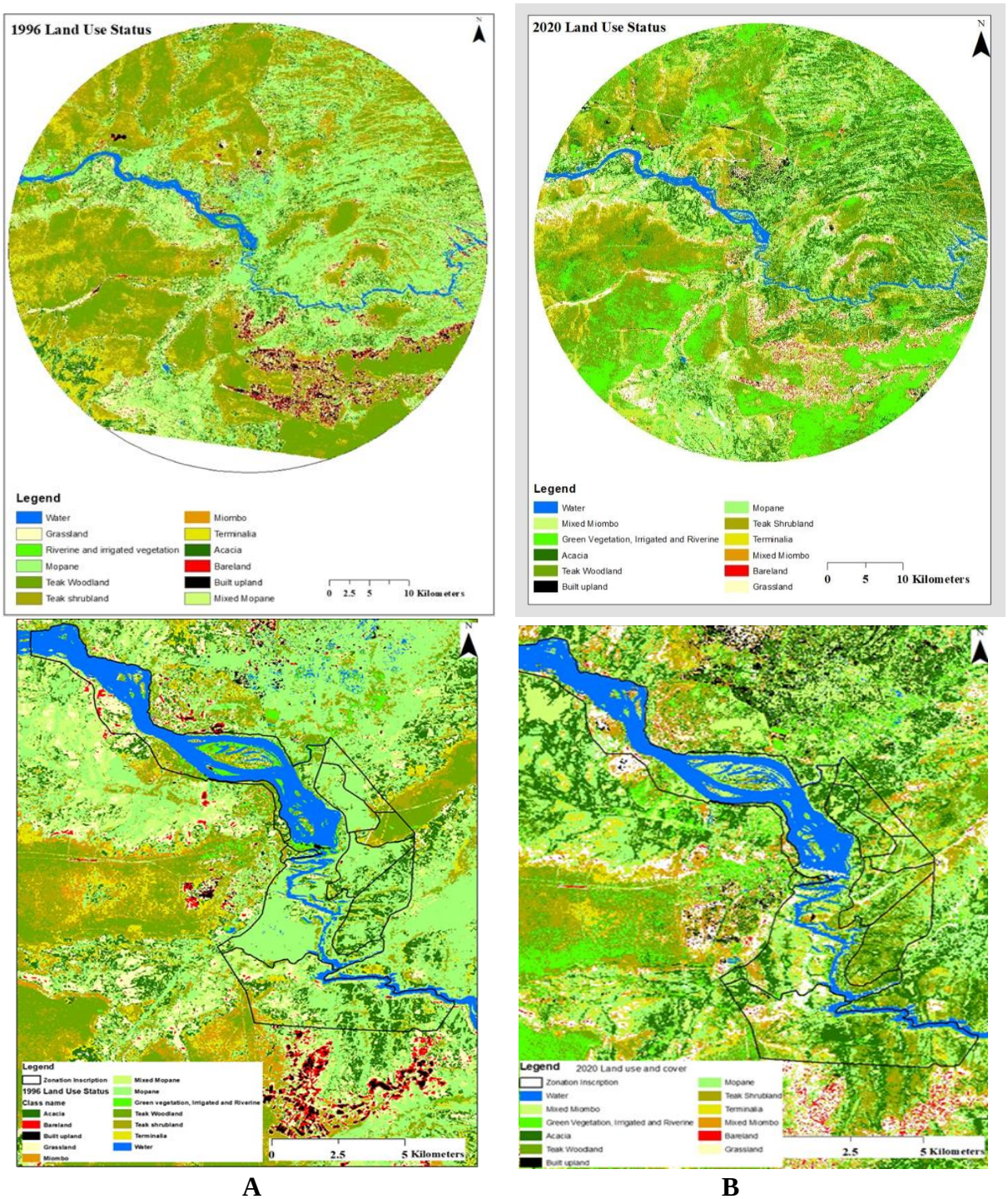
Figure 6.24: Land uses within the Victoria Falls area, Zambia

6.9.1 Changes to Land Use Patterns in the Past 26 Years

As of 1995, Livingstone Town had not reached its development limits. In 2021, the district is closely approaching its development limits as planned by the Livingstone Local Authority. The areas that were left for development, Kasiya, Lusaka Road, Dambwa North and Mwandi have all been allocated for development. The only land in the district for expansion is in Dr Mubitana, Kasiya, Simonga and Shungu wards (Livingstone City Council, 2021). Changes that have occurred in the land uses identified above since 1995 are discussed as follows:

(i) Victoria Falls is experiencing an extreme land use cover change over the past decades due to new residential and commercial developments (UNESCO, 2017). Thus, the need for land change models to help guide the land systems to positive societal and environmental outcomes at a time when attention to changes across land systems is increasing; and

(ii) Land Use and Land Cover of the World Heritage Property and its 30km radius can now easily be captured by remote sensing to show changes that have taken place within the World Heritage Property with special emphasis on 30km radius only (Figure 6.25).



A **B**

Figure 6.25: Comparison of land cover – land use change between 1996 and 2020 in the Victoria Falls area, Zambia – Zimbabwe

6.9.2 Agricultural Land Use

Agricultural land use still remains as the largest land use in the area. Table 6.11 shows the classification of farmers in the area. Agricultural production is widespread in Kasiya, Songwe, Simonga, Sekute, Kamatanda Village, Mukuni and Senkobo areas, which are in the peripheral

areas of Livingstone City. The area produces various crops including maize, fruits, vegetables, wheat and soya beans as well as livestock such as cattle, goats, chickens and aquaculture. The agricultural produce is supplied to the local communities as well as the hospitality and tourism industries.

Table 6.11: Farmer Structure and Distribution in Livingstone District (Ministry of Agriculture, 2021)

Number of Farmers	Unclassified Subsistence (<1ha)	Small Scale (1-5ha)	Emergent (5-10ha)	Medium Scale (10-20ha)	Large Scale (>20ha)	Total
Female	279	717	3	0	0	999
Male	243	967	8	0	5	1,223
Total	522	1,684	11	0	5	2,222

6.9.3 Forest Reserves

There are two local forest reserves in the area, namely Dambwa Local Forest Reserve number 22 accounting for 13,736 Ha and Simonga Local Forest number 67 accounting for 6,400 Ha. These local forests offer tourism related activities such as bird watching and trail walks as well as contributing towards household energy in the form of fuel wood, forestry products such as timber, fruits and nuts and sand mining activities (Figure 6.26) (Ministry of Tourism, Environment and Natural Resources, Forestry Department, 2014).

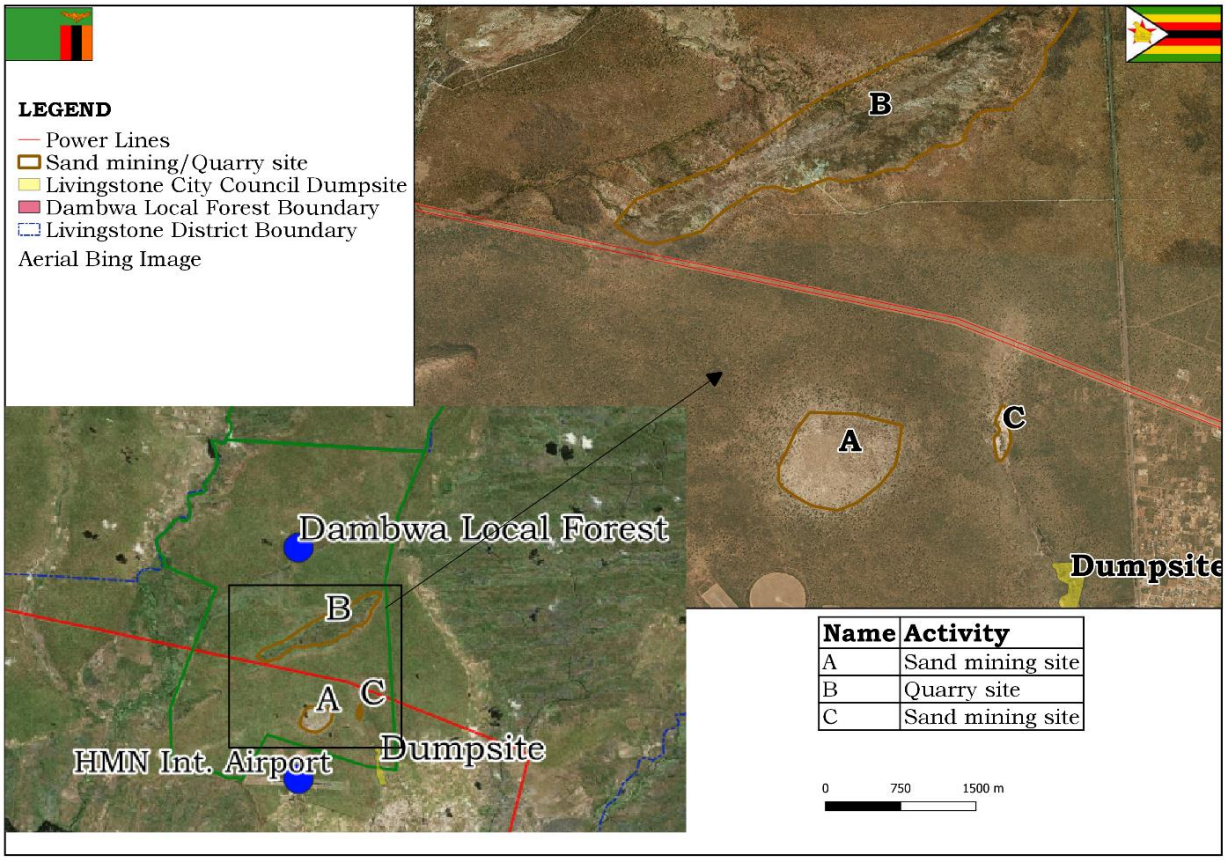


Figure 6.26: Quarry and Sand Mining Activities in Dambwa Local Forest, Zambia. HMN Int. = Harry Mwaanga Nkumbula International

The two local forests have experienced rampant deforestation and encroachment in the past 26 years, affecting their aesthetics, reducing biodiversity and affecting the quality of the environment (Ministry of Tourism, Environment and Natural Resources, Forestry Department, 2014). In 2017, Dambwa Local Forest was de-gazetted, reducing the forest area by 1200 Ha leading to the current coverage of 13,736 Ha. This degazetting of the forest was in order to provide urban land for development for Livingstone District. Another significant development in Dambwa Local Forest is the Livingstone City Council dumpsite, part of which falls within the forest. The dumpsite was established in 2003 on the periphery of the urban area, however, over the years the dumpsite has been increasing in size resulting in part of it encroaching into the forest reserve, and yet to be decommissioned by 2030. Protected land such as the local forests have been encroached upon by settlers. Mosi-Oa-Tunya National Park is zoned for hospitality and tourism land uses according to the Livingstone City Council, National Heritage Conservation Commission and Department of National Parks. The Park measures approximately 6,600 Hectares (66 km²), is 20 km in maximum length and 5km in maximum width. The park's size and shape has been changed minimally since the 1995 SEA report. These changes have led to the realignment of Mosi-Oa-Tunya National Park boundary to cater for communities living in and near the boundary. Most notably was the relocation of Imusho Village from the western side to the north-western side of the park which led to land

bargaining (Zambia Wildlife Authority, 2006). Some land has been forfeited to the local community while other land has been gained for the national park.

There has also been encroachment of the local community on park land who have established settlements within the park boundary. Settlements that border Mosi-Oa-Tunya National Park are expanding towards the park boundary; these include Songwe, Sakubita, Nakatindi, Kashitu and Dambwa Site and Service Extension (Figure 6.27).

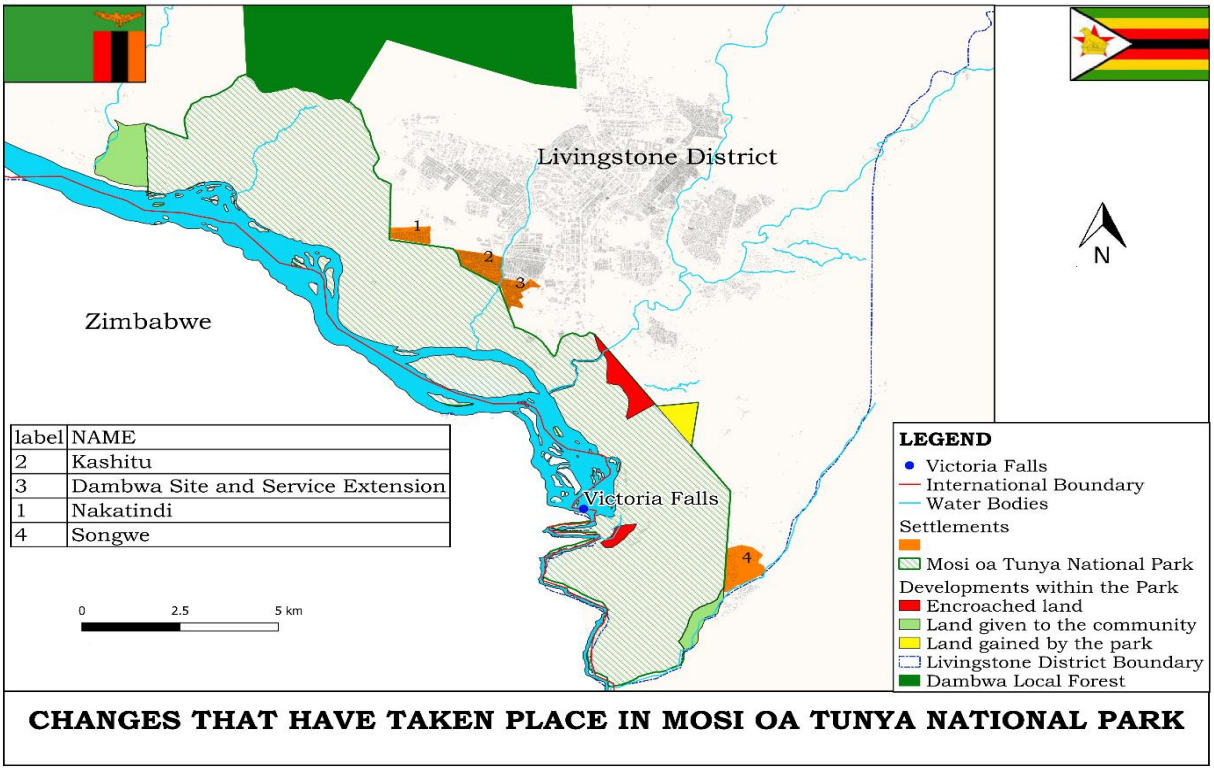


Figure 6.27: Changes that have taken place in Mosi-Oa-Tunya National Park, Zambia

6.9.4 Mosi-Oa-Tunya National Park Development Zones

The Department of National Parks and Wildlife has established four management zones within Mosi-Oa-Tunya National Park, according to Mosi-Oa-Tunya National Park General Management Plan (Zambia Wildlife Authority, 2006). The general management plan identifies these zones as: Semi-Wilderness Zone, Wilderness Zone, Intensive Use Zone and Restrictive Use Zone (Figure 6.28).

Zone I– Semi-Wilderness Zone: The purpose of this zone (Figure 6.28) is to establish a balance between development and conservation of natural resources in the park, so as to sustain the viability of the natural resources. Developments such as lodges, camps, campsites, and picnic sites of permanent and temporal nature will be allowed in this zone. Supporting Park infrastructure such as roads are allowed, however no tarred roads or constructions above tree canopy level are allowed.

Zone II-Wilderness Zone: The purpose of this zone (Figure 6.28) is to "provide for wildlife conservation management and ecotourism" (Zambia Wildlife Authority, 2006). Developments of semi-permanent structures are allowed as well as renovations of all existing development in this zone. The general management plan does not allow for any more developments in the zone.

Zone III – Intensive Use Zone: The purpose of this zone (Figure 6.28) is to "protect the habitat for biodiversity conservation and intensive tourism use" (Zambia Wildlife Authority, 2006). Permissible developments include developments of a permanent nature including lodges, hotels and of a non-permanent nature such as helium highflyer bush camps and roads. Developments are not allowed along the elephant migration corridor. The general management plan does not allow for any fencing of developments or any future developments within this zone or, with an exception of the proposed hotel.

Zone IV – Restricted Use Zone: The purpose of this zone (Figure 6.28) is to provide an area where strict mitigation measures are in place to minimize impacts associated with proposed developments and activities on the unique environment of this zone. Only existing developments will be allowed in this zone, however, extensions of sites in this zone are not permissible. There is a 50m buffer from the highest flood line imposed on all developments. There will be no future developments in this zone.

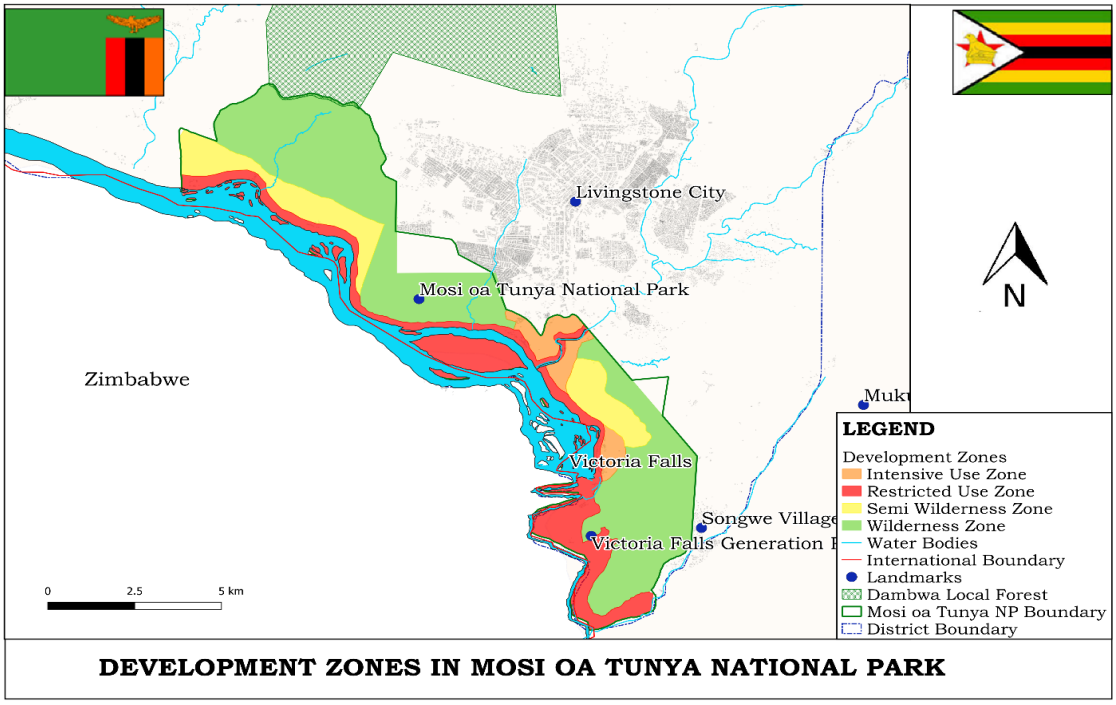


Figure 6.28: Development zones in Mosi-Oa-Tunya National Park, Zambia

Other than the protected zones as prescribed for the WHP and Mosi-Oa-Tunya National Park, the Victoria Falls Property has other features of ecological sensitivity such as the local forests

(Figure 6.29) and water bodies which require protection.

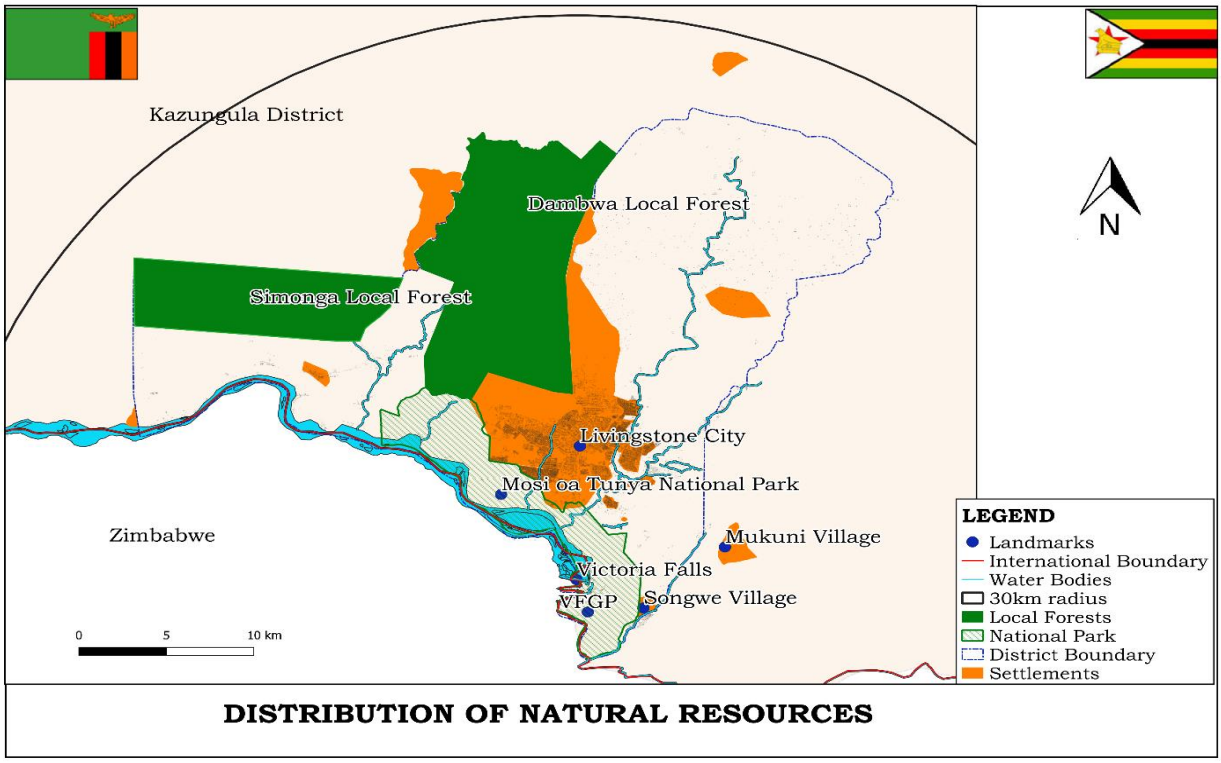


Figure 6.29: Distribution of local forests and water bodies within the area, Zambia. VFGP= Victoria Falls Power Generation Plant

On the Zimbabwean side, Land Use and Land Cover on forests are given in Figure 6.30 which shows the graphical representation of the changes that have taken place between 1996 and 2020 whereas Table 6.12 gives the interpretation of the observed impacts. Figure 6.30 further highlights that, the most significant changes have occurred in Teak Woodland, Teak Shrubland, and Riverine and irrigated land as explained in Table 6.12. Table 6.12 further shows that the area under built up and agriculture are on increase as reinforced by Figure 6.30. This is due to population growth, urbanization, and more land demands within the same particular area. In terms of irrigation more people have resorted to urban farming for livelihoods and survival.

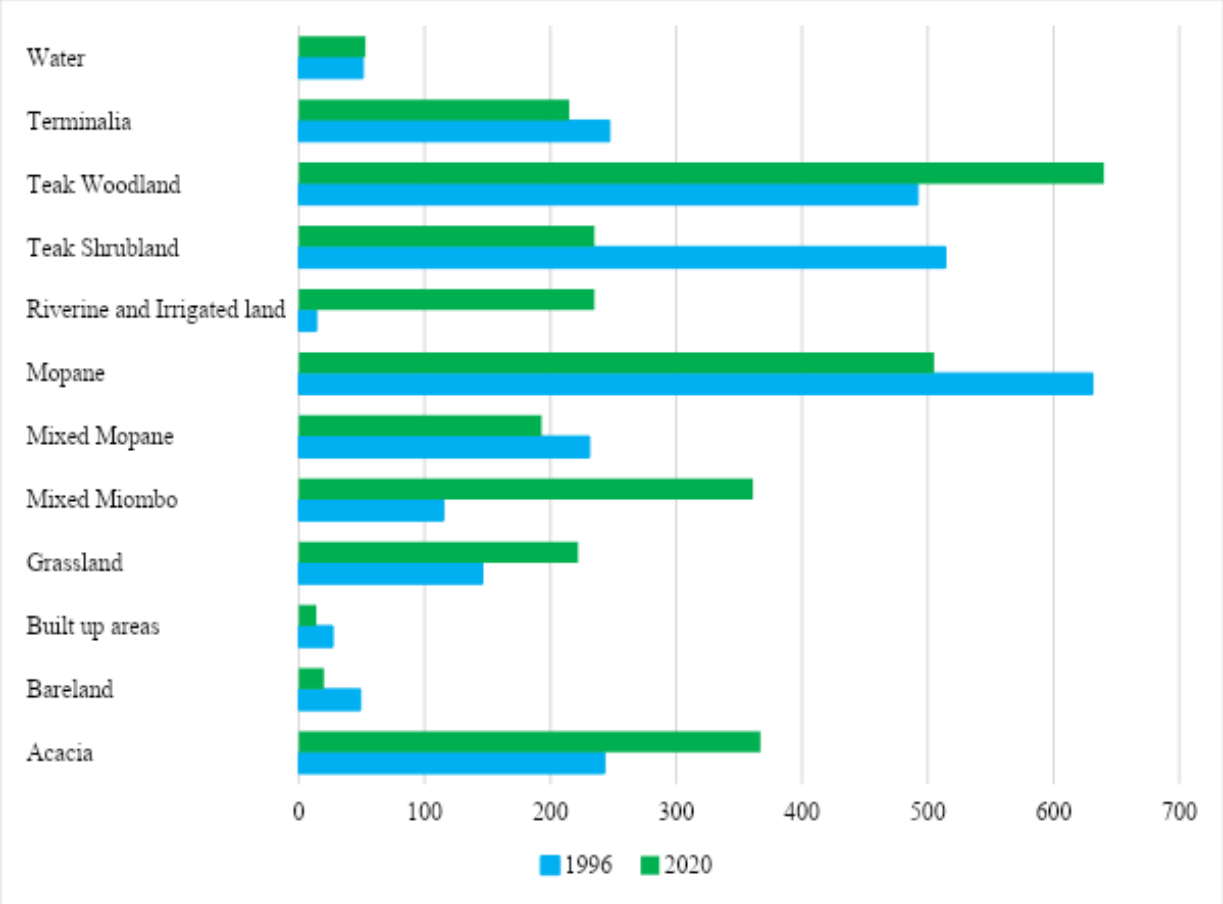


Figure 6.30: Land Use Land Cover Changes within the World Heritage Property and its 30 km radius

Table 6.12: Land Use and Land Cover Changes per Class in the World Heritage Property and its 30km radius

Type	1996	2020	Notes
Acacia	243	367	Increase in acacia, land cover. Bush encroachment has significantly increased over the years & possible causes, protected (elephant damage and loss of top soil) and communal (overgrazing)
Bare land	49	20	2020 had good rains grass cover was good. This is evidence enough that vegetation growth and regeneration has triggered the reduction in land from bare.
Built up areas	27	14	Vegetation land cover was high detection was low for built up areas
Grassland	146	222	Increased due to good rains
Mixed Miombo	115	361	Increase high rate of coppicing
Mixed Mopane	231	193	Decreased (elephant damage). Elephant damage high in V/F National Park around Wild Horizon due to confinement of tourism elephants,

			increased infrastructure development and use of firewood in the urban area as an alternative energy source.
Mopane	631	505	On the decrease
Agriculture land	158	235	Increase in irrigated land Zambia and communal land in Zimbabwe
Teak Shrubland	514	235	On the decrease possible opening of fields.
Teak Woodland	492	640	Increase. Bush encroachments. Not heavily utilized by elephants.
Terminalia	247	215	Slight decrease
Water	51	53	Slight increase surface area. Good rains 2020.

6.9.5 Urban Land Uses

Urban land uses include residential, commercial, industrial, institutional, recreational and mixed land uses. There has been an expansion of the urban land over the past 26 years. Population growth in the area has necessitated an increase in residential land for development and other land uses to support socio-economic development in the area. The expansion of urban land, has mostly been north of area towards T1 Highway Livingstone- Lusaka Road (Livingstone City Council, 2021).

6.9.6 Settlements in the Area

Settlements in the area include all settlements in Livingstone District and four settlements in Kazungula District namely Mukuni, Senkobo, Siandunda/Komanyala and Kamatanda Village. The number of settlements in the area have increased from 16 as documented in 1996 to 35 (31 in Livingstone and 4 in Kazungula) in 2021. Expansion of settlements in the area is limited due to prominent features such as Mosi-Oa-Tunya National Park, local forests and river systems. Expansion of the urban area in the south is limited due to the Mosi-Oa-Tunya National Park, the Victoria Falls and the international border with Zimbabwe. To the west of the area, expansion of settlements is hindered by protected areas such as local forest reserves and the Mosi-Oa-Tunya National Park. Expansion of settlements in the east is limited by the existence of agricultural land. Therefore, settlements have expanded towards the north of the area along T1- Lusaka Road as Livingstone City Council has allocated land for development along the Lusaka Road.

6.9.7 Rural Settlements

There are ten (10) rural settlements within the Site namely Simonga, Sinde, Manjeleti, Mulala, Sakubita, Siandunda/Komanyala villages, Senkobo, Kamatanda, Songwe and Mukuni Village (Figure 7). Thirteen (13) informal settlements exist in the area namely: Namatama, Burton, Zecco, Ngwenya, Malota, Libuyu, Zambezi Sawmills, Dambwa Site and Service, Dambwa Site and Service Extension, Dambwa Site View, Mwandi, Nakatindi and Kashitu. These settlements exist at the fringes of the urban area of Livingstone City (Figure 6.31).

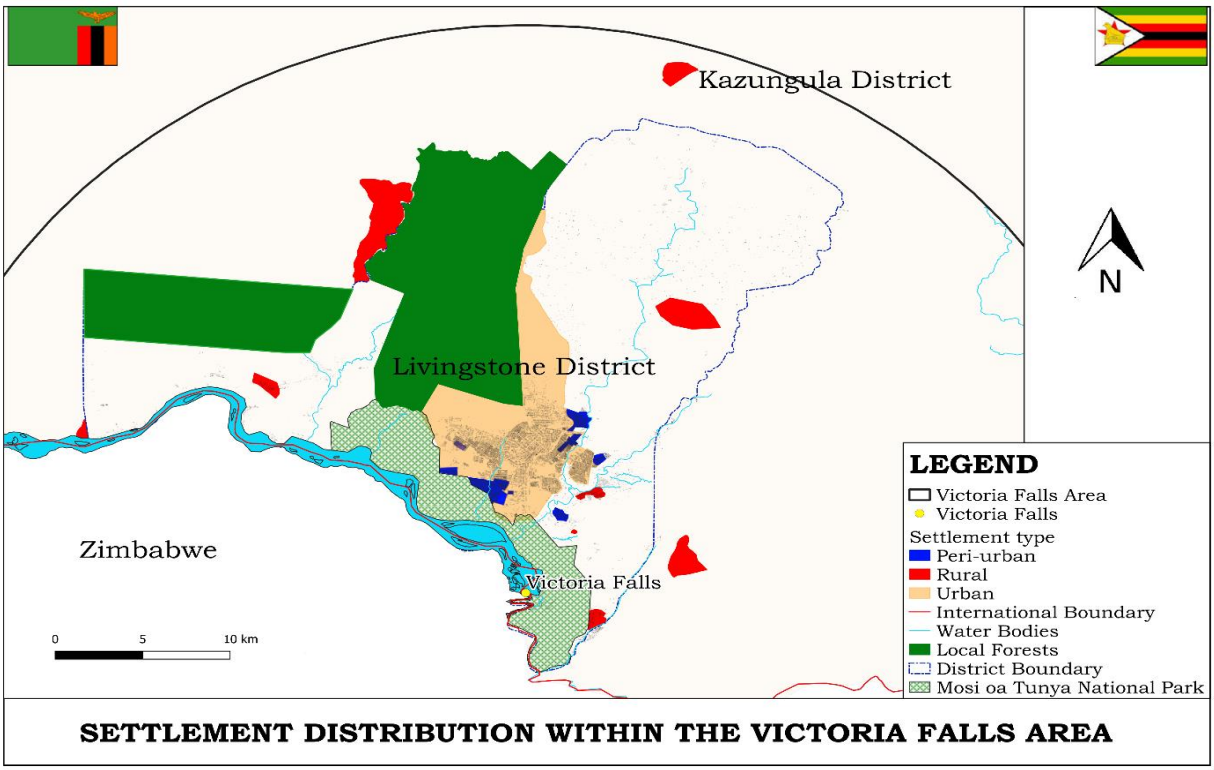


Figure 6.31: Settlement distribution within the Victoria Falls Area, Zambia

Urban planning in the area is the mandate of Livingstone City Council and Kazungula Town Council. The two Local Authorities have over the review period prepared various developmental plans, including strategic plans. Most recently, the districts embarked on the preparation of Integrated Development Plans (IDPs) as required by the Urban and Regional Planning Act No. 3 of 2015, which requires that all Local Authorities in Zambia prepare an IDP for their district (Ministry of Local Government, 2015). An IDP is defined as "the principal strategic planning instrument which gives an overall framework for development within the IDP area and will guide and inform planning, budgeting, management and decision-making in the IDP area by all levels of government and by all actors." The IDPs are expected to run for a ten (10) year period, 2020 to 2030 and both Local Authorities are in the final stages of approval (Ministry of Local Government, 2015). The plan takes into consideration the spatial and participatory aspects of development planning so as to develop a comprehensive development plan. Spatially, the plan takes into consideration where developments are, and proposed to be. Preparation of the plan was based on a participatory approach, drawing from various stakeholders available in the district including the community, as specified in the IDP Guidelines (Volume 1- 4) (Ministry of Local Government, 2019).

On the Zimbabwean side, Victoria Falls Urban Development Trends indicate that from the last recorded population of 25000 people in 1996 the Town has grown to a Municipality in the process and finally a City in the year 2020. This has resulted in different changes within the concept of growth and development. Current population estimates are 40000 people inclusive of the transit

population (ZimStats, 2019). Table 6.13 below shows the gradual growth from 1996 up to date and illuminates the need for physical expansion of urban settlements as an outcome of economic, institutional and social forces. Victoria Falls WHS is experiencing various conservation challenges related to urban development, tourism pressure; invasive species; poaching; water pollution and abstraction; and, institutional challenges (IUCN and UNESCO, 2020).

Table 6.13: Victoria Falls population growth statistics from 1996 to 2019 (ZimStats, 2019)

YEARS	1996	2002	2012	2019
POPULATION	25000	31519	33748	40000

As urban areas harbour enticing services, they have in the years acted as magnets for labour. This development has translated into the physical development of Victoria Falls. Mostly, the city's urban growth has been attributed to rural-urban migration and the search for better opportunities in the tourism and hospitality industry by different people from all the corners of the country (ZimStats, 2019).

Urban Growth

In Zimbabwe, urban areas are growing rapidly and they face a range of opportunities and challenges in that process. Urban planning is important to ensure that the opportunities are maximised and the challenges are minimised. Victoria Falls as a small growing economic zone has a population of 40000 as contrast to 1996 at 25000 (ZimStats. 2019) It is therefore facing the challenges and opportunities to manage the Victoria Falls Site. From the trends the changes have been extreme and thus need to protect and conserve the natural state of the City and the Site (The Victorian, 2018).

Expansion and pressure on urban facilities

According to UNESCO and IUCN (2014) Victoria Falls City**,** Zimbabwe was established within National parks, protected areas making the City's growth limited. The City exists because of its unique environmental assets - the waterfalls, the Zambezi River and wildlife and thus its expansion should take this uniqueness into account. As a tourist resort Victoria City, it is strategically located hence attracting in migration and a significant number of transit population. This has led to an increased investment in hotel accommodation and other tourist facilities which doesn't match with housing and infrastructure. Tourism-related development pressures, combined with an influx of persons seeking economic opportunities, are placing significant stress on the very environmental assets that support Victoria Falls. The City is growing rapidly, wildlife habitat and movement corridors are impacted, and trees are cut for building material, fuel and souvenir carving (UNESCO, 2018).

Residential

According to the IUCN, (1996) Victoria Falls in 1996 was still a Town and had an estimated number of about 300 stands including the low and high density. This has changed over the past 2

and half decades Victoria Falls is now a city and the current statistics of residential stands now at 9000plus including another density which was not there 25 years ago (Nalumino & Meynell, 1996).

Commercial, industrial and institutional stands

Victoria Falls commercial and industrial areas have largely been dominated by the tourist service provision companies for the past decades. However, an introduction of steel and wood work has been adopted within the industrial area (UNESCO, 2017).

Development Control and management of Victoria Falls and Surrounding areas

The Victoria Falls is the flagship of the growing Zimbabwe Tourism Industry and this status should be appropriately guarded, preserved and promoted in a sustainable manner through clear policy guidelines. The activities surrounding the site have a direct bearing on the World Heritage Site (UNESCO, 2014). Although the Master Plan project has not been completed, the Plan Area is still being managed using the various management and control tools, these include documents, policies, regulations and other relevant legislation (Chronicles, 2021). The emphasis is to ensure that land use development balances are promoted in a sustainable manner that does not threaten to damage 'the property'. The property is generally intact and the outstanding universal values have been preserved to date (Mzembi, 2016). The surrounding areas are also being developed with strict development conditions and standards being enforced to a greater extent. However, it should be noted that the need to develop further even in the most sensitive parts of the 30km radius is overwhelming and thus a threat to its natural state (UNESCO, 2017).

Victoria Falls City is still using the 1975 Outline Scheme as the major guiding legislation and also using Section 49 of the Regional Town & Country Planning Act, Chapter 29; 12 of 1996 for change of reservation applications. It has also adopted the building bylaws to curb unsustainable development for example maintaining tree height as the maximum building heights (VFM, 2017).

Housing situation

As people have tended to move from rural to urban areas, and the boundaries of those urban areas have been constrained by policies, Victoria Falls, with an estimated population of 40 000 is facing challenges in housing with a current backlog of 15 000 (ZimStats, 2020). The development of industry, in Victoria Falls case, the tourism industry has resulted in the urgent need for housing from stakeholder players and employees. As a result, the city faces a huge demand from people who need shelter, but due to geographical location the city has exhausted spatial land for housing, (VFM, 2017) with the option for vertical expansion that does not exceed 11m i.e. the tree canopy. (Muchadenyika, 2015). In the bid to address the above the local authority has made a plea to the government to assist with a potential land bank for the city (Chronicles, 2020). It has further adopted the urban regeneration programme, which is going to increase sustainability of the city as a prime destination in the region and continent at large. The task is to do away with dilapidated infrastructure and sprucing up the image of the town, its residential and commercial properties

thereby creating a quality standard of infrastructure and harnessing the concepts of urban densification (The Victorian,2017).

Water supply

The City gets its water from the Zambezi River therefore it does not have the problem of water shortage. However, the challenge was the pumping and carrying capacity, due to the gradual population growth (The Victorian, 2017). For the past decades the central Government has been the one in control of the abstraction point at the Zambezi River. The Zimbabwe National Water Authority (Zinwa) finally handed over raw water management rights to Victoria Falls City Council marking the beginning of devolution of water supply to the city (Chronicles, 2021).

Solid waste management

As part of priority projects earmarked for development, work on the dumpsite began in 2020 with the solid waste disposal site improvements, construction of one cell, a leachate collection pond and access road. Victoria Falls has committed the first chunk of funds received from devolution disbursements from Central government to the construction of an Engineering landfill at the dumpsite. The City Council has in time purchased three vehicles for collecting solid waste from the city and hotels on a daily basis. The residential areas are serviced almost once per location every week. The city has managed to tackle the adverse impacts of late collection of waste though the population of baboons has competed rigorously with the efforts (The Victorian, 2020).

6.9.8 Impacts as a Result of the Changes that Took Place from 1996 to 2020

The expansion of urban land in the past 26 years, has led to both positive and negative impacts in the Site. These are:

Positive Impacts:

1. The planned expansion by the City Council has led to coordinated development of Livingstone District. The city has designated land areas for different land uses such as commercial, institutional, recreational and residential. This has provided the growing population with land for residential and commercial activities which will ensure that developments are conducted in the designated land use; and
2. The planned expansion of the urban land has also aided in absorbing the growing population by providing urban land where development can occur and prevent unplanned growth of settlements.

Negative Impacts:

1. The increased population growth has led to the development of unplanned settlements. Currently, the area has thirteen (13) unplanned settlements. These unplanned settlements exist on the periphery of Livingstone City and border protected zones such as Mosi-Oa-Tunya National Park and the forest reserves. Unplanned settlements such as Dambwa Site and Service Extension, Nakatindi and

Kashitu as well as other settlements such as Sinde, Songwe, Simonga and Mukuni Village, border the national park. The close proximity of settlements to this protected area has led to human-wildlife conflict. These settlements continue to be in conflict with wildlife, as baboons, monkeys, warthogs and elephants continuously enter the settlements in search of food. Other animals that come into conflict with humans in the area include hippos, buffaloes and crocodiles. Without mitigation measures, settlements such as Songwe Village that exists on the southern edge of Mosi-Oa-Tunya National Park, is expected to expand into the national park. An expansion into the park will reduce the wildlife habitat and propagate human-wildlife conflict and deforestation in the park. To avoid or mitigate human-wildlife conflict in the Property, a 500m buffer between the national park and settlements was established. However, this buffer zone has been encroached upon by settlements such as Songwe and Dambwa Site and Service extension. The encroachment into this buffer allows animals to freely roam into these residential areas. To further prevent this conflict the Mosi-Oa-Tunya National Park has been fenced to prevent the movement of animals into the settlements and humans into the park. However, sections of this fencing have been vandalised by the community as reported by the Department of National Parks and Wildlife;

2. The close proximity of residential, industrial, agricultural, hospitality and tourism land use to the national park, local forests and WHP has led to negative impacts in the area such as pollution in the form of litter, noise, water and air pollution. Settlements in the area have continued to indiscriminately dispose of their solid waste affecting the quality of the environment in the area. Livingstone City Council has the mandate to collect and dispose of solid waste and it endeavours to do this with the aid of other stakeholders, including Community Based Enterprises. The city and its stakeholders however, faces challenges with the collection of solid waste as communities resist disposing their waste in the recommended methods and instead dispose of their waste in undesignated places such as the national park and forest reserves;
3. Poaching of wildlife by communities that live near and around the national park is another negative impact of settlements near Mosi-Oa-Tunya National Park. Residents in settlements adjacent to the national park enter the park to hunt game; and
4. The two (2) local forest reserves in the area are important carbon sinks. The continued deforestation of the forests for wood fuel, expansion of settlements and agricultural practices, affects their ability to absorb carbon dioxide from the atmosphere. An increase in carbon dioxide in the atmosphere leads to an increase in global temperatures thereby, leading to global warming resulting in climate change over time. The effects of climate change have a significant impact on the Outstanding Universal Value (OUV) of the Victoria Falls.

6.10 Ecology/Biological Features

The whole study area lies in agro-ecological regions I in Zambia, IV and V in Zimbabwe, which are characterized by low fertility soils (e.g., Kalahari Sands). Rainfall is between 450-650 mm and with periodic seasonal drought and severe dry spells in the rainy season. Agricultural production is limited to livestock production and drought resistant crops; nevertheless, some maize is produced in the area, despite its unsuitability. This natural region is also suitable for game ranching. The predominant habitat is woodland making about 90% of the area (Table 6.14). On the Zimbabwean side, the protected area network which forms the natural wildlife habitat is made up of the Zambezi National Park (56,010ha); Victoria Falls National Park (Victoria Falls A, 1,904ha and B, 436ha). The forest areas within the 30km radius are managed by the Zimbabwe Forestry Commission. The Forestry Commission manages about 58,900 ha of the Mvutu, Fuller and Panda Masue Forest estates. Communal Land makes the bulk of the area. There is also Private Land around Victoria Falls City and protected areas.

There are two main vegetation zones in the vicinity of the Victoria Falls/Mosi-Oa-Tunya World Heritage Site: the riverine forest close to the river and the semi-deciduous open woodland further away. A closer analysis of these woodlands reveals six main vegetation types based on biological features (Zambia-Zimbabwe JSMC, 2016) namely: (i) Riparian Forest; (ii) Kalahari Woodland; (iii) Mopane; (iv) Mixed Scrub Vegetation; (v) Mukusi Woodland; and (vi) Miombo woodlands.

The riverine vegetation community, and its extension, the rainforest, have a high diversity of plant species considering its size, with more than 800 species having been recorded. The variety of the plant species adds to the great aesthetic value of the site, and the trees along the river are important for river bank stability. An important feature of the vegetation of the rainforest is the large number of herbaceous and climbing plant species. The rainforest also contains some species of restricted distribution or outlying populations although they have not been categorised as 'threatened', but provides an important habitat. Further from the river, vegetation species composition is mostly determined by edaphic factors, with the deep Kalahari Sand vegetation dominated by teak (*Baikiaea plurijuga*), while the shallow basalt soils are predominantly Mopane (*Colophospermum mopane*) woodlands, with the rest of the tree species shown in Appendix 6.1a. Vlei/grassland systems e. g. Chamabonda vlei, associated with soils of low drainage are an important component of the vegetation in the area. Species composition of the vleis varies with the moisture regime. Dominant species include *Digitaria milinjiana, Heteropogon contortus* and thatching grasses. Outside the VFWHS but within the 30 km radius study area, Dambwa Local Forest No. 22 which lies within the Zambezian phytoregion (White, 1983) was also considered as a sample plot for data collection (Appendix 6.1b).

Table 6.14: Vegetation types in the 30 km radius of the Victoria Falls, Zambia-Zimbabwe

Vegetation Type	Geological association	Biome characteristics
Colophospermum mopane woodland	Basalt sodic soil	Zambezian dry
C. mopane-Kirkia acuminata woodland	Basalt soils	Zambezian dry
Mixed *Mopane- Combretum* woodland	Basalt soils	Zambezian dry
Baikiaea plurijuga woodland	Kalahari sand soils	Zambezian dry
Mixed *B. plurijuga* woodland	Kalahari sand soils	Zambezian dry
Mixed Miombo woodland	Kalahari sandy loam	Zambezian dry-wet
Acacia (Vechellia) woodland	Basalt and riparian soils	Zambezian dry
Terminalia mixed woodland	Basalt and Kalahari sand soils	Zambezian dry
Commiphora-Sterculia African woodland	Basalt soils	Zambezian
Mixed riverine	Riparian flood plain	Zambezian wet
Open dry grassland	Basalt and Kalahari soils	Zambezian dry
Open wet grasslands	Basalt soils	Zambezian wet

Forest lands are managed by the respective forest departments in each country. On the Zimbabwean side the main objectives of the establishment of the forest were to (i) produce exploitable timber of the main commercial species on a sustained yield basis; (ii) increase productivity through multiple land use practices including utilization of minor forest products; (iii) increase the soil and water conservation value of the forests; and (iv) develop the amenity value of the forests. Selective and concentrated on three commercial species, *Baikiaea plurijuga* (Zambezi teak), *Pterocarpus angolensis* (blood wood/mukwa/kiaat), and *Guibourtia coleosperma* (mchibi) for railway sleepers, furniture and flooring. Currently there is no timber harvesting for commercial purposes in the forest area within the 30km radius. The management of forest areas has been faced by a number of resource challenges. In both Zambia and Zimbabwe, there is significant illegal cutting for fuel wood, illegal charcoal production and selective poaching of curio wood trees, particularly at the edges of the forest areas, and is a management challenge.

Utilization of trees in the forest is significant, with 74% of all stems with signs of utilization being from five commercially valuable species, and 63.5% from one; *Baikiaea plurijuga*. Exploitation of woodland for fuelwood, charcoal, timber and curio wood has been particularly heavy near forest areas, communal/trust lands and towns. In some areas the canopy cover has been reduced to less than 35%. Mopane Woodland is a good fodder species for browsing animals; its attraction for elephants has meant that in some areas where elephants have concentrated and there are no tourism developments, the Mopane Woodland has been reduced to coppiced bushes, e.g., parts of the Zambezi National Park. The Riparian Forest is found along the Zambezi River and its inland tributary banks and on the islands. It is important for river bank stability, as a habitat for much of the biodiversity in the area and as a landscape feature. A special section of riparian forest is the "rainforest" overlooking the Falls which is maintained by the spray. The rainforest is vulnerable to reduction in the spray particularly in drought years and to invasion by exotic species such as *Lantana camara.*

The WHS is habitat to mammals, fish, amphibians and reptiles. The species diversity is 75% birds, 13% reptiles and 8% mammals. The WHS and surrounding area is home of the White Rhino and rare Taita Falcon. Others include the Elephant, Zebra, Kudu, Hippo, a number of birds, fish, reptile and amphibian species (Zambia-Zimbabwe JSMC, 2007). The WHS was initially a prime wildlife habitat. Large mammals represent the most significant fauna (Appendix 6.2). There are about 30 mammal species, in the Core and Buffer Zones, of which about 28 species are medium to large mammals. Elephants constitute more than 90% of the mammalian biomass. About 30 species of large and medium sized **mammals** are found in the area, especially in the national parks which include among others Elephant, Buffalo, Giraffe, Zebra, Wildebeest, Impala, Kudu, Warthog, Baboon, Velvet Monkey, Hippo, Bushbuck, Waterbuck and White Rhino, which is a specially protected species (Zambia-Zimbabwe JSMC, 2007). The distribution of mammals depends upon a combination of vegetation type and land use. Animal movements, especially elephants, buffalo and hippopotamus occur. These are both seasonal and diurnal movements - towards the end of the dry season herds of elephants move towards the Zambezi River and wherever water is available; during the wet season the animals are more dispersed and occupy upland well drained areas. Daily movements follow a pattern of overnight feeding near or across the river, and moving inland at night. Tourism infrastructure developments are a concern in restricting animal movements in certain areas.

The VFWHS and periphery has 415 **bird** species (Appendix 6.3), of which 36 species are raptors, 13 species breed in the gorges, 16 species are protected and the rest are migratory birds. About 25% of the species are waterfowls. The gorge system below the falls is an important breeding habitat for a wide range of raptors, which led to the Batoka gorges being listed as an 'Important Bird Area'. The islands and riverine are also important habitats, hosting a number of rare and threatened (Zambia-Zimbabwe JSMC, 2007). There are three distinctive habitats for birds - the inland woodland areas, the upstream riverine areas and the down-stream gorges. 15 of the 23 protected species in Zimbabwe are found in the area (Appendix 6.4). In the gorges the birds of prey are the most ornithologically significant, especially the Taita falcon. Other species of conservation interest apart from the raptors include the African Skimmer (*Rynchops flavirostris*) a globally threatened species, the sensitive Pel's Owl (*Scotopelia pel*), Brown Firefinch (*Podica senegalensis*) and Half-collared Kingfisher (*Alcedo semitorquata*). The survival of these species is conservation dependent and their presence is a useful indicator on the state of the environment. The gorges had one of the world's highest densities of Taita Falcon at inscription. The increasing disturbance of the Taita Falcon and Black Eagle breeding sites in the gorges by noise from helicopter flights is of concern (Zambia-Zimbabwe JSMC, 2007).

Creation of the dam at the Batoka Gorge will certainly submerge rocks that the Rock pratincole use for roosting, breeding and nesting for population below the Victoria Falls (Figure 6.32, 6.33).

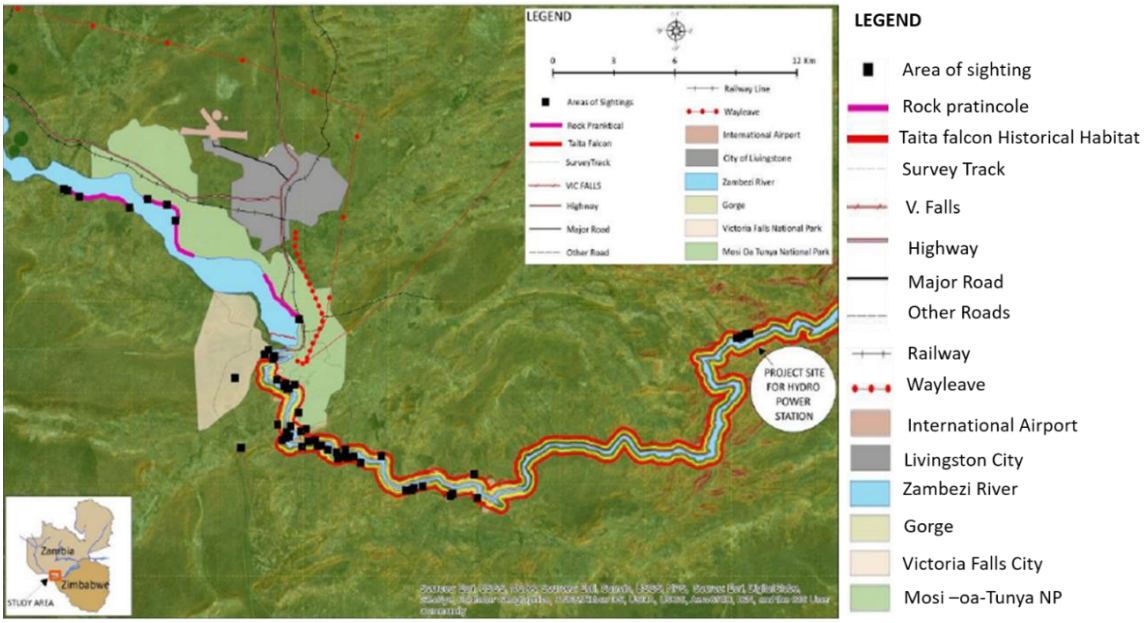


Figure 6.32: Rock pratincole and Raptor sighting points during the Zambia-Zimbabwe 2018 (Taita falcon and Rock pratincole Reconnaissance Survey along and within the WHS and downstream Victoria Falls to the BGHES Dam site) (Department of National Parks and Wildlife Zambia and Zimbabwe Parks and Wildlife Management Authority, 2018)

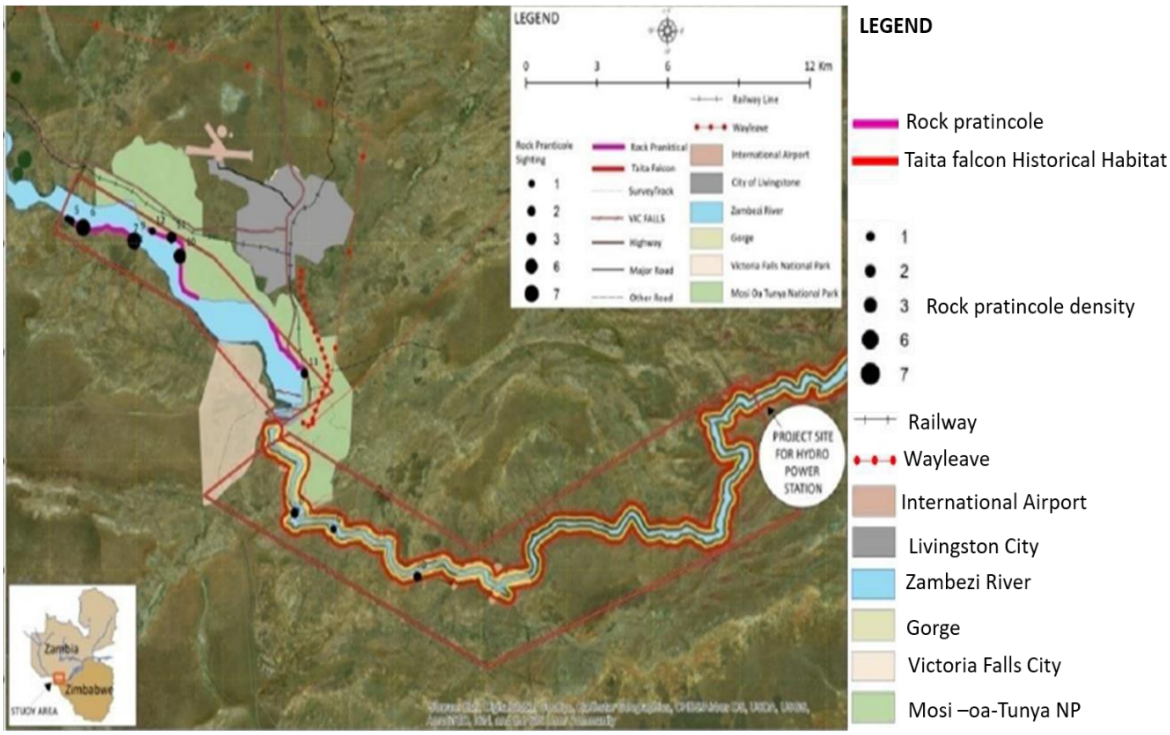


Figure 6.33: The Rock pratincole density map as observed during the Reconnaissance Survey along and within the WHS and downstream Victoria Falls to the BGHES Dam site (Department of National Parks and Wildlife Zambia and Zimbabwe Parks and Wildlife Management Authority, 2018)

The islands in the river are important habitats for a wide range of birds' especially rare species such as African Skimmers and Pel's Fishing owl.

Afro-tropical and Palearctic **migrants** that come to southern Africa to breed, or breed in the northern summer in Europe, Russia and Asia, but spend the northern winter in Africa as non-breeding migrants, respectively. Examples of Afro-tropical migrants of particular interest and concern are the Rock Pratincole (*Glareola nuchalis*), African Skimmer (*Rynchops flavirostris*) and Carmine Bee-eater (*Merops nubicoides*) along the Zambezi (Timberlake, 2000). Birds of economic significance include the ducks, geese, francolins and guineafowl which are utilized as food in some areas. Species of negative importance include the Red-billed Quelea (*Quelea quelea*), which have been devastating small grain crops in some areas. The overall impression based upon bird surveys is that bird numbers are declining due to a number of factors including drought, clearance of vegetation and disturbance. Among the most affected species is the Taita falcon, which has had few confirmed sightings in recent years.

Distinctive **fish** populations live up and down stream of the Falls which act as a major barrier to fish movements. About 84 species occur above the Falls and 64 below, but only 30 species are common to both sections of the river (Zambia-Zimbabwe JSMC, 2007) (Appendix 6.5). Insufficient information is available on fish populations and movements, and on the effects of sport and subsistence fishing.

Knowledge on the biodiversity of **reptiles and amphibians** is relatively good, although there are still large gaps in our knowledge of distributions. The study area comprises the Upper and Middle Zambezi, which have clear differences in species composition due to the changes in habitat.

Invertebrate biodiversity known include dragonflies (*Odonata*), butterflies (*Lepidoptera*), freshwater molluscs, dung beetles and grasshoppers/crickets (*Orthoptera*) which are confined to wetland habitats such as the rainforest play a critical role as indicators of ecological integrity. Insects of socio-economic and epidemiological interest – mosquitoes, tsetse fly, locusts, ticks and agricultural pests have been the focus of detailed research and control programs.

Agriculture in the area consists of predominantly subsistence farmers who produce sorghum, millet, maize, groundnuts and melons (Appendix 6.6). There has been an increase in productivity of livestock in recent years, especially in cattle. On the Zimbabwean side this has been matched by an increase in the number of goats. There is evidence of overgrazing due to localized concentration of livestock around water points and encroachment into nearby state forest areas. The incidences of negative Human Wildlife Interactions (HWI) have been reported in communal and urban areas. In communal areas, crop damage is one of the serious threats to livelihoods. Several non-lethal mitigation measures are used. However, in some cases, lethal methods are used on Problem Animals (PA) when non-lethal means fail to yield results.

6.10.1 State of Ecological Conservation 1996-2020

To date there is no evidence to show that the values associated with criteria (viii) are being compromised. However, the values pertaining to criteria (vii) have inevitably been impacted in varying degrees by tourism infrastructure, facilities and services development. These are also

affecting the relevant conditions of integrity of the property particularly the Wilderness Value. The various factors / issues affecting the property between 1996 and 2020 are hereby given.

6.10.2 World Heritage Property Development Zones

There exist three (3) ecological zones within the World Heritage Property namely high ecologically sensitive, medium ecologically sensitive and low ecologically sensitive zones (Figure 1 above) (Zambia-Zimbabwe Joint Site Management Committee, 2016).

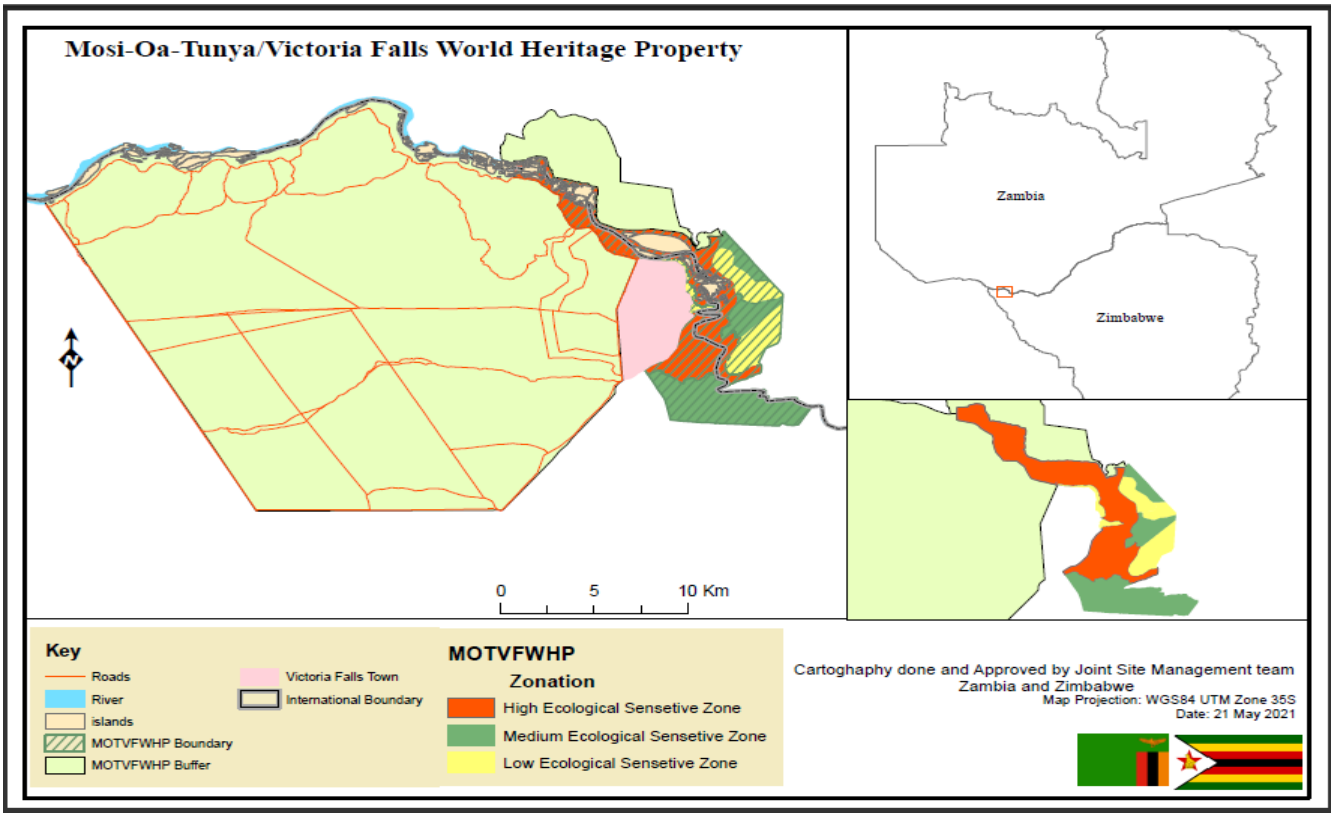
High Ecologically Sensitive Zone: This zone is located at the core of the World Heritage Property and consists of the Zambezi River gorges and the riverine vegetation. Structures of a non-permanent nature are permitted in this zone. Activities that compromise the aesthetic values of the site or developments that fence in animal migration areas or corridors are prohibited in this zone.
Medium Ecologically Sensitive Zone: This zone is meant to provide for natural preservation of resources and reduce utilization pressure on the core of the site. Structures of a semi-permanent nature are permissible in this zone, other activities such as nature walks, campsites and picnic sites are allowed. No further permanent developments are permitted in this zone.

Low Ecologically Sensitive Zone: This zone allows for medium- and large-scale developments that are compatible with conservation principles and objectives of the WHP. Infrastructure of a permanent nature are permissible in this zone including road construction and water reticulation; and activities such as camping, hiking and game viewing are permissible. Activities such as sand mining are mostly illegally done. The ecological zones in the Victoria Falls World Heritage Site listed above, are further discussed in the Joint Integrated Management Plan 2016-2021.

Environmental Sensitive areas: In Zimbabwe**,** environmentally sensitive areas (ESAs) are used. These are landscape elements or places which are vital to the long-term maintenance of biological diversity, soil, water or other natural resources both on the site and in a regional context. They include wildlife habitat areas, steep slopes, wetlands, and prime agricultural lands (Nang'alelwa, 2008). Victoria Falls is one of many communities faced with the pressures of balancing economic development with environmental protection, it has been recognized that uncontrolled development may lead to an irreversible loss of the sensitive environment. Communities, therefore, develop local comprehensive plans that identify the geographical distribution of ESAs, and specify land-use strategies and regulations for protecting them (UNESCO, 2014) as divided in zones.

The zoning plan for the WHP is based on the understanding that certain activities and management practices are more ecologically appropriate within specific areas of the WHP than in others (UNESCO and IUCN, 2014). The zones created provide guidelines for dealing with the management issues where they occur. These guidelines are used in the implementation of the management activities proposed under each management programme. The zones are divided into three as given in Figure 6.34:

1. High ecologically sensitive;
2. Medium ecologically sensitive; and
3. Low ecologically sensitive.



6.10.3 Impacts on Ecological Habitats, Tourism/Visitor/Recreation in the Victoria Falls

Tourism receipts and activities have been increasing around Victoria Falls on both sides. This has seen a rapid increase in the demand for development land as tourism business and investments increase. This has prompted the need to develop tourism accommodation, amenities and service infrastructure such as hotels and lodges within the World Heritage Property (WHP), its buffer area and within the 30km radius. These activities have impacted in the Ecological Habitats as follows:

Housing development

The development of urban residential areas driven by population has been on the increase since 1996. When the SEA was conducted in 1995, observations and sentiments were that the land available for urban developments was almost used up. On the Zimbabwean side the conferment of a city status to the former Victoria Falls town will potentially increase economic and influx of people in the city. There are plans to establish a satellite town within the 30 km radius and another Smart City near the Batoka Gorge Hydro-Electric Scheme (BGHES) project site. These two urban centers may help relieve pressure on Victoria Falls City.

Tree harvest for commercial and subsistence use

The principal drivers of deforestation are agricultural expansion, infrastructure development, wood extraction for fuel or charcoal production and fire, whilst the underlying drivers are high levels of poverty, low employment and employment opportunities, insecure land tenure, weak institutional capacity and lack of synergy in forest management policies (Vinya et al., 2012). Since 2012, load shedding came into effect in Zambia due to an electricity deficit in the country, and charcoal became the principal energy source in Livingstone and the country. The increased demand for charcoal contributed to unsustainable utilization of forest resources causing deforestation and degradation, and loss of forest ecosystem function (Dlamini et al., 2016).

On average 68% of harvested forest products are for household subsistence needs (Figure 6.35), with wood products accounting for 66% of harvested resources. Comparison with data from previous surveys suggests that harvesting of larger trees within the forest has been significant since 2002, resulting in a 50% decline in volume per hectare, a 65% decline in mean diameter at breast height (DBH) and a 15% decline in mean height, of trees of ≥ 7cm DBH. Previous surveys have assessed regeneration of the forest as low (Forestry Department, 2016)



Figure 6.35: An active charcoal kiln in Dambwa Local Forest, Livingstone, Zambia resulting in deforestation

On the contrary, vegetation cover within the fenced area of the Victoria Falls has improved by as much as 60% in the last ten years because of the on-going tree planting programmes that are targeted in the said area over the period. Human impact on vegetation is generally correlated with distance from the World Heritage Site, being highest in the surrounding communal lands where illegal harvest of trees has traditionally targeted commercially viable species like *Baikaea plurijuga, Pterocarpus angolensis* and *Guibortia coleosperma*. Tree species preferred in the curio industry like *Pterocarpus angolensis, Combretum imberbe, Afzellia quanzesis and Kirkii acuminate* may suffer the threat of local extinction (Forestry Department, 2020). A tree nursery of indigenous trees (Figure 6.36) has since been established within the Site. Ecological habitat restoration and rehabilitation by members of staff and volunteers using indigenous plants is still on-going (Figure 6.36) (NHCC SWR, 2017).



Figure 6.36: NHCC members of staff taking part in a tree re-planting exercise and; Right photo: the tree nursery in the Victoria Falls World Heritage Site, Livingstone, Zambia

Tree species in the fenced area of the WHS have been tagged to aid in the monitoring of the diversity status of the resource being managed, especially that the Site values are hinged on the aesthetics which depend on the sustainability of the ecosystem therein (NHCC SWR, 2013).

Elephant pressure on vegetation

A significant amount of pressure on the integrity of the vegetation both in the VFWHS core and 30km radius emanates from elephant pressure. The elephant population has continued to rise and is a major threat to both plant species diversity and the riparian vegetation community as it may lead to loss of canopy cover, resulting in degradation of the landscape (WWF SARPO, 2005). The planted trees actually attract the elephants into the fenced area of the Site, especially in periods of drought when the trees provide a guaranteed source of food for the elephants (NHCC SWR, 2016).

Invasive alien species

Invasive Alien Species (IAS) recorded outside the fenced area of the WHS include L*antana camara*. The extent of its distribution and density may result in the displacement of indigenous plant species, with concomitant loss of habitats for other life forms if concerted efforts to control it are not put in place. A three (3) year UNEP/GEF Project "Removing Barriers to Invasive Plant Management in Africa" was implemented within the World Heritage Site recording major successes in the fenced area of the Site and immediate environs (Figure 6.37).



Figure 6.37: Mechanical clearing and chemical control of lantana camara in the Victoria Falls World Heritage Site, Livingstone, Zambia

Habitat recovery and other parameters are being monitored, with restoration efforts being met with considerable success in the recovery of the habitats within the fenced area of the site where IAS control has been a success.

Effects of water abstraction on the rain forest

In the fenced area of the VFWHS, the "rain forest" could be threatened due to continued water abstraction and frequently recurring droughts due to climate change. Often the spray of the forest is replaced by dry spells. This results in the visual impact of dry falls on the Zambian side and the slowing down of the natural process of the river. However, since the last SEA, the electricity company ZESCO has reviewed its annual power plant maintenance programme extended from two months to four months (September to December). This has ensured shutting down part of the power plant to allow enough water to flow over the Falls during dry periods. Also, the water level monitoring is automatically controlled to ensure the abstraction is maintaining water level to fall above 881.6 meters above sea level. In addition, the injection of 300MW into the power grid from the Maamba Power Coal Plant in mid-2016 has helped to reduce the power shortfall in the southern grid of Zambia thus reducing the water abstraction from the Property (Zambia-Zimbabwe JSMC, 2016).

Loss of wildlife corridors

Wildlife corridors in the Mosi-Oa-Tunya National Park and periphery serve a number of purposes including protecting wildlife and helping animal populations thrive. They function as a means to decrease human-animal conflict by vehicle-animal collisions and help combat the negative effects of habitat fragmentation. However, land clearing for tourism developments have led to loss of habitats and migration routes for wildlife and loss of wilderness value. The formation of the Kavango-Zambezi (KAZA) Transfrontier Conservation Area (TFCA) has helped to enhance protection of the area as it acts as an ecological buffer. KAZA is an initiative among the five partner countries of Angola, Botswana, Namibia, Zambia and Zimbabwe in a collaborative venture among the public, private and NGO (Development Partner) sectors as well as the local or surrounding communities. The VFWHS is within this TFCA initiative and this has provided an additional ecological buffer to ensure maximum, sustainable management and conservation of the property's biodiversity thus enhancing its authenticity and integrity (KAZA-TFCA, 2019). The other important one is the Zambezi – Mosi-Oa-Tunya Wildlife Dispersal Area (WDA) which has the Victoria Falls / Mosi-Oa-Tunya World Heritage Site at its heart (Figure 6.38).

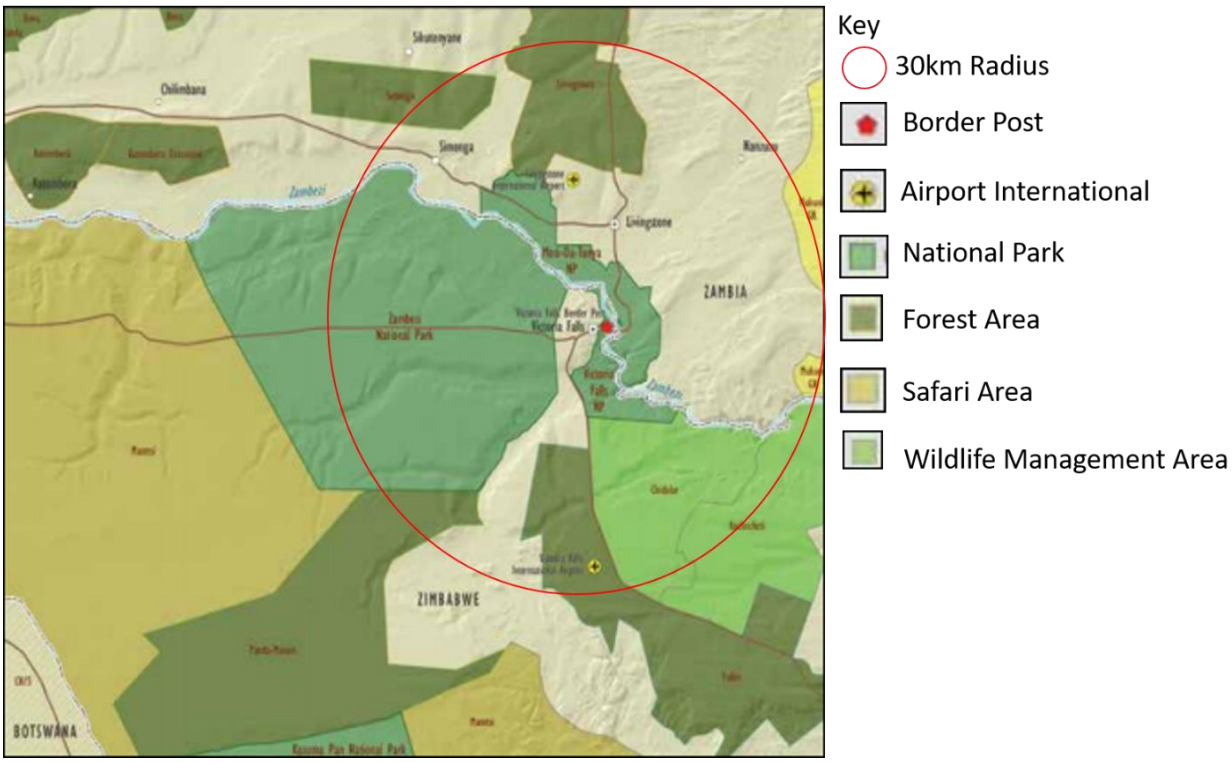


Figure 6.38: Map of Zambezi - Mosi-Oa-Tunya Wildlife Dispersal Area of the KAZA TFCA extracted from the Zambezi Trans-frontier Conservation Area (KAZA TFCA) Integrated Development Master Plan (2015-2020) (Kavango et al., n.d.). The red circle shows the 30 km study area delimitation

Loss of bird life and mitigation

Bird counting in the World Heritage Site has been carried out consistently twice every year for the past 5 years, revealing a total of 374 bird species. Results indicate that there are a number of birds that are threatened by illegal trapping, poisoning by pesticides and destruction of their habitats. The Mosi-Oa-Tunya National Park and the Batoka Gorge house a number of globally threatened species (Table 6.15). The use of vulture parts for purported ritual purposes is one of the main driving forces. Bird kills from development of infrastructure such as power-lines and vehicle collisions have been recorded. Loss of habitat from logging, development and pollution has also been recorded. Energy production schemes such as the BGHES potentially threaten species such as taita falcon, rock pratincoles, black eagles and many other raptors and cliff nesting birds. Invasive alien species cause a range of impacts, from reduced reproductive success (usually through eating eggs and chicks: 66%), direct mortality through predation and disease (60%), to ecosystem degradation (through invasive plants and herbivores modifying habitat structure (45%) (Birdlife International, 2017). Climate change results in extreme weather conditions such as droughts, floods and extreme temperatures that leads to habitat alterations and associated negative impacts on birds. Incidences of wildfires also impact negatively on bird life.

Table 6.15: IUCN status of globally threatened bird species (Livingstone Museum, 2021)

No.	SPECIES	IUCN STATUS	NOTES
1	Slaty Egret	Vulnerable	The Slaty Egret is a rare visitor. The last open record made was in 2017 when it was openly spotted on seasonal marshes during the Livingstone Museum Biannual Waterbird count. The biggest threat of the Slaty Egret is habitat loss.
2	African Skimmer	Near - threatened	The African Skimmer is generally uncommon. It is a partial intra-African migrant, arriving in southern Africa when water levels of rivers start falling at the beginning of the dry season. African Skimmers are usually spotted on the banks of Siloka Island. However, numbers have notably reduced over the years.
3	Taita Falcon	Vulnerable	The Taita Falcon is a cliff-nesting species. It is mainly restricted to high cliffs and gorges. Lack of recent sightings anywhere else suggests it is now rare in Zambia. The general level of disturbance continues to rise. This can be attributed, in part, to the ever-increasing human population, effects of expanding tourism, flooding and more.
4	Pallid Harrier	Near-threatened	The Pallid Harrier is a Palearctic migrant occurring mainly between late October and late February. This species nests on the ground. It breeds on open plains, bogs and heathland. Habitat loss is one of potential factors that threaten this species.
5	Lappet-faced Vulture	Endangered	The Lappet-faced Vulture's world population is known to have decreased profoundly. In Zambia, the population numbers are quite alarming. Declines are almost entirely due to human activities, including disturbances from habitat destruction and cultivation, disturbances at nesting sites, direct persecution and poisoning by poachers who fear the presence of vultures will alert authorities to their illegal activities.
8	White-backed Vulture	Critically Endangered	In 2015, the White-backed Vulture was declared as Critically Endangered by IUCN because of the severe ongoing decline in population size. A major cause of population decrease is habitat loss. Other threats are identical as those outlined for the Lappet-faced Vulture.
9	Great Snipe	Near Threatened	The Great Snipe is a Palearctic migrant occurring mid-November to January, with some remaining until northwards passage in April. This species is experiencing a population decline, owing primarily to habitat loss.
10	Hooded Vulture	Critically Endangered	The Hooded Vulture is classified as Critically Endangered. It faces similar threats as the rest of the vultures

In addition, it is feared that the constant noise from helicopters and big trucks may cause noise pollution which affects their behaviour, fitness, breeding and growth, and often leads to chronic stress. Constant noise may also form an acoustic blanket muffling the audio cues that birds rely on to detect predators, competitors and their species. Noise levels from aircrafts were however monitored at regular intervals to ascertain the extent of noise pollution, using an acoustic calibrator (sound level meter) (NHCC SWR, 2013).

A number of management actions can be taken to mitigate against threats to birdlife including site area protection and management. Promotion of conservation of important bird habitat such as wetlands that increase ecosystem benefits to communities such as provision of water, food (fish), craft raw materials (reeds and edges), pollution control, climate change effects mitigation. There is need to demystify all beliefs and practices that advance the use of bird parts for purported ritual purposes through: (i) encouraging safe agricultural practices in communal, commercial private farms and Victoria Falls city residential areas; (ii) improved organic waste management to reduce incidences of persistent organic pollutants (POP); (iii) conducting education, awareness and raising communication among all societal groups; (iv) supporting and capacitating bird sanctuaries and nurseries in and outside protected areas within the WHS ; (v) increased information gathering for investigation of bird population and distribution status through research, monitoring and use of citizen science data; and (vi) harnessing policy and legislation at national, regional and global level.

Human wildlife conflict / co-existence

Currently, the Zambian side of the VFWHS is experiencing an increase in human-wildlife conflicts (Table 6.16), especially from baboons. The baboons have increased in number and therefore exerting pressure on their already limited food supplies. In their continued search for food, the baboons are becoming a major source of concern with regard to safety of visitors and litter management. Human-elephant conflicts are also a common occurrence with impacts ranging from raiding crops, destroying water supplies, demolishing grain stores and houses to injuring and even killing people. Their livelihood activities limit elephant home range and population density through direct and indirect competition for water, food and space (Shaffer, 2019).

Table 6.16: Records of Human-wildlife conflicts in the past 4 years in Livingstone District and surrounding areas (Department of National Parks and Wildlife, 2020)

Year	Total Species	Total Reports	No. of Areas Affected	No. of Chiefdoms affected	Total No. of Death		Total No. Attended to	No. of animals controlled
					Livestock	**Human**		
2017	10	65	35	3			58	8
2018	8	64	25	3			55	12
2019	8	402	19	4			386	20
2020	17	686	90	13	39	19	557	40

As a **mitigatory measure**, part of the Mosi-Oa-Tunya National Park was fenced to reduce human-wildlife conflicts whilst elephant deterrent lines were also used to keep away elephants from properties in the Site periphery. Baboon proof bins have also been introduced in the property to arrest the problem of littering and human-wildlife conflicts. Human-wildlife coexistence is also being encouraged through sensitization campaigns and awareness creation (Zambia-Zimbabwe JSMC, 2014).

Wildfires

The greatest risk to the long-term sustainability of the natural resources vis-à-vis vegetation in the VFWHS is the risk of unwanted fires. The vegetation is a core element in the food chain, which supports the balance of nature and ecological stability. To counter the negative effects of wildfires, site management developed and implemented comprehensive fire management and suppression measures which, among other things, included the formation and maintenance of fire breaks during the dry season. A total of 20km of firebreaks have been created in and around the Property. The firebreak or control line is a line which has been cleared down to the earth and can be used to break a fire triangle by separating a moving fire from the fuel ahead of it. The incidents of unplanned fires drastically reduced after fire management measures were implemented. The measures also included increased stakeholder participation in fire management like creation of firebreaks. These stakeholders included tour operators, business community, conservation groups, government and the local community (NHCC SWR, 2018). A total of 20km of firebreaks have been created in and around the Property in Zimbabwe". Every year Zimbabwe updates a fire management plan with fire management activities such as fire guard construction and early burning.

Solid waste disposal

Littering in the Site and its periphery is as a result of indiscriminate disposal of solid waste by both humans and baboons. The baboons gain access to the bins or grab food in plastics from unsuspecting visitors, causing littering upon disposal of such. To counter this, the old bins have been replaced with new 'baboon proof' bins (Figure 6.39). This has reduced site littering to a large extent. Clean up operations (Figure 6.39) are also conducted with the support of stakeholders who comprise of volunteers, community members, hoteliers and staff from other government departments. Other initiatives include awareness campaigns and law enforcement operations (NHCC SWR, 2019).



Figure 6.39: Stakeholder participation in site clean-ups and the baboon proof bins installed in the Site, Livingstone, Zambia

Solid waste on the Zimbabwean side comes with increased urbanization and tourism activity. Although the Victoria Falls City Council has been facing some challenges in refuse collection, efforts have been put in place to keep the city clean. The wildlife management agencies on both sides have also put in place innovative measures to reduce solid waste. Over 20 baboon proof bins have been put in place to contain litter before it is carried to the city dump site on the Zimbabwean side. This has greatly reduced human wildlife conflict and littering around the World Heritage Site

Surface water pollution

Sewage from the city, unregulated releases from industrial and agricultural sites, litter and indiscriminate dumping of wastes collectively exacerbate the problem of water and land habitat pollution. Leaking of sewerage is through the pond's basement and embankment points. Sewage from boat traffic on the Zambezi River is another source of water pollution. The NHCC therefore conducts regular Site patrols to some tour operators to monitor compliance to waste disposal guidelines. Mitigation measures have been put in place such as a requirement for all such boats to use chemical toilets in place of flush toilets (Zambia-Zimbabwe JSMC, 2012).

In **Zimbabwe,** surface water pollution has not been recorded as a major concern. However, with urban expansion accidental spills from household effluent may find its way into surface water sources. There is evidence of direct discharge of raw effluent in the rivers such as Masue.

Air pollution

The use of fossil fuels by vehicles and the aviation and hotel industry can ultimately lead to acid rain production, dissolution of the ozone layer, smog, and the general elimination of "clean air" from the WHP. The Victoria Falls Steam locomotive also contributes a fair share of air pollution as it is fuelled by coal. Bush clearing and charcoal burning also contribute to carbon emissions in the air. These emissions can lead to poor health of fauna and flora life and also of the human populace in general. The NHCC collaborates with the Zambia Environmental Management Agency (ZEMA) to monitor and sensitize the people, school groups and institutions involved on the negative impacts of air pollution and the need to keep the air clean (Musonda, 2020).

In **Zimbabwe,** there are no heavy industries in Victoria Falls City and therefore the impact on air pollution is not known. Potential sources of greenhouse pollution include burning of refuse, household fires, hotel industry and tour operator vehicles and other vehicles (Dube & Nhamo, 2021). There is no substantial evidence to indicate the magnitude of impact at present.

Drought / Global climate change

The impact of climate change on biodiversity is difficult to assess because changes occur slowly and its effects interact with other stress factors already imposed on the environment (Kappelle et al, 1999). Ecological communities of plant and animal species, called biomes, are shifting as the planet warms. Loss of species habitat in the Falls area would lead to loss of ecological, aesthetic, social and economic values (Zambia-Zimbabwe JSMC, 2007).

The WHP falls in the arid area receiving on average 650 mm per annum with a trend of annual variations up to 1999 being noted (Dube & Nhamo, 2018). Post 1999, a shift to a three-to-four-year cycle variability due to increased incidence of El Niño and La Niña over the region, compounded by global warming, is leading to climate change. The extreme rain and extreme drought episodes are evidence of this climate variability. The temperature in Victoria Falls City for example, has been increasing over the years with the marked increase being recorded in October and November. Despite this climate variability, the water discharge post 1996 has been reported based on climatic and hydrology measurement data to be over annual average 1171

cumecs in 2001/2 season compared to 1995/6 and 1998/9 season (Moore et al., 2008). The lowest flows are recorded in November (297 m^3 s^{-1}) and October (393 m^3 s^{-1}) due to the delay in the onset of the rainy season (Moore et al., 2008). The lower water flow levels in these two months have in recent years raised public alarm and speculations; however, this is likely to have temporal effects particularly on the aesthetic nature of the falls. Temporal stress may also be experienced on the rainforest vegetation in the drought years.

Invasive / alien terrestrial species

The main invasive plant that threatens the integrity of the natural ecosystem in the WHP is the *Lantana camara*. In Zambia this is particularly found in the area across the knife-edge bridge near the Eastern Cataract. In Zimbabwe this plant is present in the Victoria Falls rainforest. Over the years control of the *Lantana camara* has taken place on both sides. Mechanical and chemical methods are being used to control the alien species with 18 Ha out of 24 Ha cleared by 2020 (Appendix 6.7).

Habitat loss, fragmentation, and degradation

Tourism expansion, deforestation, pollution and invasive species are some of the ways in which ecosystem processes are disrupted. The potential for tourism expansion in the study area is high and likely to bring benefits to the city and the community if well managed and marketed. However, the expansion has to meet some ecological and socio-economic requirements to be viable, acceptable and successful. It is therefore a priority conservation effort to revegetate the Site by way of planting trees (Musonda, 2017).

Effects of damming

The transformation and loss of habitat by construction of the dam wall, associated infrastructure and inundation of the reservoir will be the major effect of the Batoka Gorge Hydro-Electric Scheme (BGHES, 2019). The loss of the Batoka Gorge habitat from inundation of the reservoir and loss of wildlife dispersal area-riverine areas forms important migratory and connectivity corridors. Further, loss of rare indigenous trees, loss of native fish species, and the potential spread and invasion of alien fish species along the river and dam are anticipated as highlighted in different studies (Moore et al 2008; Ronco et al., 2010; Kunz, 2011) particularly if the dam height is over 175m. It should be lower to minimize the extent of inundation. Key management measures required include:

1. Protecting non-impacted parts of the Batoka Gorge (rim, cliffs, scree slopes) reduces the loss of critical habitat;
2. Specialists' studies to thoroughly assess the entire Batoka Gorge to determine the occurrence and status of important bird species of conservation significance;
3. Developing an appropriate Biodiversity Action Plan to address the risks;
4. Considering a 'compensation scheme', through which the project could support an offset programme for the loss of habitat, range and the supporting ecosystem for the Taita falcons; and

5. Funding can be directed towards research, monitoring and habitat rehabilitation as well as management of the species in both countries.

However, the challenge is that avoiding impacts to important habitats is not entirely feasible.

Loss of species diversity

The likelihood of loss of species diversity may be attributed to several factors. Disturbance of spawning habitats for fish by moving boats and their propellers is one of them. Loss of riparian vegetation and wilderness value due to the increasing numbers of jetties along the river bank may be another. Habitat loss and fragmentation due to clearing of land for other uses can also lead to the loss of species diversity (Zambia-Zimbabwe JSMC, 2007).

6.11 History and Development

6.11.1 Archaeology of the Area

The Victoria Falls area and the surrounding environment are underlain by Palaeozoic-Mesozoic sedimentary rocks called the Karoo Super group. The Karoo Super group is a geosyncline deposit consisting of a glacial deposit at the initial stage and basaltic lava at the last stage. The basaltic lava is widely distributed along the middle section of the Zambezi River. The basaltic lava of the Karoo Super group is covered with Tertiary-Pleistocene sedimentary rock called the Kalahari Group which consist of calcretes, silcretes and ferricretes (laterites) which are members of the Duricrust Group (Burret, 2015).

The Karoo Batoka Basalt dates back to about 180 million years ago. The basalt is found on both sides of the Batoka Gorge as well as constituting the dominant land surface of the study area especially in the eastern portion. In this area, the soils are generally shallow and the surface is characterised by either basalt bedrock or basaltic soils. The process of seasonal alternate wetting and drying causes these soils to have a distinctive self-churning character resulting in the upward and downward deflation of artefacts. Within the larger study area, the basalt is mantled by a thin layer of silicified limestone often transformed to chalcedony -a cryptocrystalline form of silica (Burret, 2015).

The western section of the study area is marked by the remains of the Kalahari paleo-dunes. These dunes consist of a thick deposit of wind lain deposited red sand, that have been subject to extensive bioturbation that has destroyed any internal sedimentary structure. The Kalahari Sands Formation is relatively recent in origin and overlies the basalt in many places. In other areas, it is underlain by the Karoo beds including sandstones, chalcedony, gravels and clays (Fanshawe, 2010, Mbewe 2015).

6.11.2 The Stone Age

The Stone Age archaeology in the Victoria Falls area is well represented in the Zambezi Valley especially the Zambian side of the river. This is a result of intensive studies carried out in and around the Victoria Falls area and Livingstone in general. These studies have revealed a rich and long antiquity of human settlement in the Zambezi Valley. The earliest evidence in the area is found in the older gravels in the rocks of the Kalahari sands. The chalcedony, quartzite and

sandstone provided early man in the Victoria Falls area with raw materials for the manufacture of his implements (Burret, 2015).

The broad sequence includes the Late Stone Age, the Middle Stone Age and the Early Stone Age. Each of these phases contains sub-phases or industrial complexes, and within these we can expect regional variation regarding characteristics and time ranges. For Cultural Resources Management (CRM) purposes it is often only possible to identify the presence of the three main phases.

The three main phases can be divided as follows:

1. Late Stone Age (LSA); associated with Khoi and San societies and their immediate predecessors. Recent to 30 thousand years ago;
2. Middle Stone Age (MSA); associated with Homo sapiens and archaic modern humans. 30-300 thousand years ago; and
3. Early Stone Age (ESA); associated with early Homo groups such as Homo habilis and Homo erectus. 400 000-> 2 million years ago (Burret, 2015).

The Early Stone Age

This period lasted from almost 2 million years up to about 50,000 years ago. In Zambia, the Victoria Falls was one of the first places where stone tools were identified during the first half of the twentieth century. The presence of Early Stone Age (ESA) sites suggests that the Victoria Falls and its associated resources have for a long time been attractive to human occupation.

In 1940, Desmond Clark recorded Early Stone Age artefacts at the flat platform above Songwe Gorge at its confluence with the Zambezi and along the Maramba Terraces. The Early Stone Age sites occur here in small thin patches of gravel with Middle Stone Age artefacts on its surface. He interpreted the gravels as marking the former margin of the Zambezi River where gravels were deposited before the formation of the incision of the Batoka Gorge and the cutting of the first of the falls (Clark, 1950).

Clark further identified and recorded a number of ESA sites along the Livingstone-Sesheke Road to the west of the Victoria Falls. He called these sites Anderson's Drift which extended to the Zambezi River. Here, Oldowan and Acheulian stone tools were found on the 'older gravels.' Similarly, redeposited Early Stone Age materials have since been identified within the gravels in a number of other locations (Barham, 2013).

ESA artefacts are characterized by choppers (Figure 6.40) and other heavy-duty tools made from flakes of various stone materials. These simple, facetted cobblestones are found in secondary contexts in the older alluvial gravels of the Zambezi River (Katanekwa, 1981).



Figure 6.40: Typical Early Stone Age (ESA) Choppers from Anderson's Drift Site (Barham, 2017)

The Middle Stone Age

This period lasted from about 45,000 to about 10,000 years ago. This period with its Bembezi or Sangoan Tradition represents a later refinement of stone tools to smaller, pointed hand axes (Figure 6.41) with the adoption of a more skilled flaking technique. These tools and those of the following Middle Stone Age (dating to between 200,000 to 35,000 years BP) are common throughout the region. The younger gravels, which are found on both sides of the Zambezi River, contain numerous Middle Stone Age lithics (Barham, 2017). There are several temporal and regional variations in the Middle Stone Age with the Bambata Tradition the most common in the Victoria Falls area (Barham, 2017). There were more Middle Stone Age sites than any of the other period found during the various surveys carried out. Middle Stone Age and a particular variant called the 'Sangoan' which is characterised by a combination of large hand-held tools (core axes, picks) and smaller tools some of which appear to have been designed to be hafted. The Sangoan is the regional transitional industry that marks the ESA/MSA boundary, and Clark (1950) described the Maramba Sangoan as well preserved (Le Quesne, 2015).



Figure 6.41: A Hand axe common during the Middle Stone Age (MSA) period from Anderson's Drift Site (Barham, 2017).

The younger gravels themselves contain glass-like stone which was sought after by Early and Middle Stone Age groups for tool-making. At some time, after the gravels were deposited, they were covered by sands, probably windblown. Today, only small patches of sand and gravels remain for all sites within the Mosi-Oa-Tunya National Monument (Barham, 2017).

During the current study, twelve clusters of artefacts, identified as Sangoan, were located on the lower surfaces of the scarp within an elevation between 959m-962m above mean sea level were recorded by means of photographs and coordinates.

The Late Stone Age

The Late Stone Age (LSA) lasted from about 6000 B.C. to A.D. 100. This period is characterized by development of important hunting weapons, the bow and arrow and other small lithic artefacts. These micro lithic tools were components in larger tools made from organic material. Blades, small retouched tools and scrapers (Figure 6.42) are diagnostic tool forms, while cores show multiple parallel flaking or are smaller pyramidal forms. The majority of the LSA sites have been recorded on the edges of dambos, valleys, along streams and riverbanks (Phillipson, 1968).

In the Zambezi Valley, LSA assemblages have been lumped into regional variations of the 'Wilton Techno-Industrial complex'. These sites were mostly recorded on the edge of the gorge and around Livingstone, with a high frequency of LSA sites found on the banks of the Zambezi above Victoria Falls (Clark, 1952).



Figure 6.42: Typical Late Stone Age (LSA) Scrapers from Mukuni area (Mbewe, 2015).

6.11.3 Iron Age

This period started about 2,000 years ago. Iron Age cultural material and artefacts found at most Iron Age archaeological sites in the area consist of broken pottery, iron slag, tuyere (Clay pipes) fragments, iron artefacts and beads (Figure 6.43). Several Iron Age settlements are known in the Livingstone area mainly from the research conducted by the Livingstone Museum during the 1950's and 1960's (Vogel, 1971a, 1971b, 1975a, 1975b).

The Early Iron Age in the Victoria Falls area referred to as the Shongwe culture dates back to around AD200. By the twelfth century, Tonga speakers, still dominant across much of south and central Zambia, had settled in the region. In the sixteenth century, the Toka-Leya people, now the dominant community in the region, began to appear in the archaeological record (Le Quesne, 2015). Several Iron Age sites are on record close to the current areas under investigation.



Figure 6.43: Potsherds and Iron slug from Ng'andu Village Iron Age site (Mbewe, 2015)

6.11.4 Archaeological Baseline - Previous Work

The Stone Age and Iron Age of the Victoria Falls area were extensively researched in the early and mid-twentieth century. Most notably by Desmond Clark who published the seminal study on the subject, The Stone Age Cultures of Northern Rhodesia, in 1950. His work focused on evidence for early human settlement preserved in Pleistocene River terraces of the Zambezi. In terms of the current study area, Clark's work provides relatively limited directly relevant information as it concentrates strongly on the valley to the north and south of Victoria Falls. However, the analysis contained in Clark's work on the development of the Zambezi in the Pleistocene and Holocene (i.e. the past 2.5 million years) and the associated evidence for early human settlement provides essential context for understanding the nature and distribution of prehistoric archaeological remains in the vicinity of the Strategic Environmental and Social Assessment (SESA) project area (Le Quesne, 2015).

In terms of the Iron Age of the area the most comprehensive work was conducted by Joseph Vogel out of the Livingstone Museum from the 1960'onwards (Vogel 1971a). Hence, the area has shown evidence of the existence of human inhabitants from all the Stone Age to the recent Iron Age periods.

6.11.5 Survey Characterization: Research Findings

As earlier alluded to, the two major methods applied during the current study were meant to identify and document as much of archaeological resources as could possibly be present in the project area and appraise them according to their significance, and assess possible impacts on them. As a consequence of this research, 37 new sites were identified and documented in the study area. The details of the documented sites are given in (Appendix 6.8a and Appendix 6.8b)

6.11.6 Cumulative Impacts to Archaeology

Potential cumulative impacts include the following:

1. Increased human presence in the area may further expose or damage heritage resources, especially the looting of archaeological sites for artefacts; and
2. Infrastructure developments such as Housing Units, Hotels, Roads and Power Transmission lines for ZESCO will expose further archaeological resources not currently

documented and recorded and therefore should be done under the supervision of the regulatory agency – for example, the National Heritage Conservation Commission.

6.11.7 The History of the People around the Victoria Falls Area

The archaeological evidence shows that the Victoria Falls Area has been occupied by humans for many centuries. The oral traditions support the idea that the Bushmen locally known as Kwengo were the first inhabitants of the area. However, they have since been displaced from the area by the Bantu Speaking people.

The Bantu Speaking People who have since 1800 inhabited the Victoria Falls Area included the Toka-Leya, the Subiya, the Valley Tonga and the Mbukushu (Kafungulwa Mubitana, 1975). Of these groups, the Leya under Chiefs Sekute and Mukuni had settled on both the north and south banks of the Zambezi River by 1850s. According to Mubitana, the two groups of the Leya under the two chiefs are interrelated in language, beliefs, and customs, but only distinguished by political bounds (Mubitana, 1975).

The Leya of Chief Mukuni are believed to have been in the area longer than those of Chief Sekute. Mubitana goes further to argue that the two Leya have different origins. He suggests that the Leya of Chief Mukuni originated from the Leya of Central Province and that they had settled in the Victoria Falls area between 1400 and 1500 (Mubitana, 1975).

On the other hand, the Leya of Chief Sekute are believed to have originated somewhere in the vicinity of Zumbo as part of the area that is the cradle of the Rozwi-Leya-Nyai. It is reported that Dr. David Livingstone who visited Kalai Island in 1855 saw the graves of the ancestors of the Leya who were driven from the island by the Kololo of Sebitwane. This goes to show that the Leya of Chief Sekute were established in the area for a long time before the arrival of David Livingstone.

The Toka under Chief Musokotwane were probably the largest of the societies inhabiting the north bank of the Zambezi in the immediate vicinity of the Victoria Falls. They are culturally and linguistically similar to the Leya, but differ in historical origins of their chiefs. The Toka were originally Tonga from Kalomo and in the Victoria Falls area they settled in the Nwezi, Sinde and Senkobo areas under Chief Musokotwane. Thus, the Leya and the Toka, simply referred to as the Toka-Leya are considered to have been the local people of the area. They called the Victoria Falls 'Shongwe' a term that has since fallen into disuse (Mubitana, 1975)

The Subiya were another group of people who occupied both the north and south banks of the Zambezi River. They were also closely connected with the Leya. Those nearest to the Victoria Falls area settled in Katombora-Mambova area, while others settled in Sesheke district. In the past, the Subiya were brought under the domination of the Lozi and became an integral part of the Lozi.

The Mbukushu originally came from the neighbourhood of Katima Mulilo rapids of the Zambezi River. The Mbukushu were eventually absorbed by the Subiya and later came to be ruled by Subiya Chiefs. Like the Subiya, they too have become an integral part of the Lozi.

The valley Tonga inhabited the area downstream of the Victoria Falls on both banks of the Zambezi River. They are also related to the Toka-Leya in languages, customs and beliefs. Mubitana has observed that there is practically no difference between spoken Toka and Leya, both of which are dialects of Tonga (Mubitana, 1975)

The Kololo Influence in the Victoria Falls Area

The Kololo, an immigrant Sotho-speaking group that fled from the Mfecane disturbances in South Africa arrived in the Victoria Falls area under Sebitwane. The Kololo who called the Victoria Falls 'Mosi-Oa-Tunya' loosely translated as 'smoke that thunders' attacked and invaded the Leya of Chief Sekute around 1836.

It was during the reign of Sebitwane and later his son Sekeletu when Dr. David Livingstone visited the Victoria Falls area from the South. In 1855 while on his transcontinental journey from Angola to the Indian Ocean, Livingstone saw the falls for the first time. On 13th November 1855, Livingstone with his Kololo guides left Sesheke for Kalai Island where they spent a night. The following morning, Livingstone with his Kololo and Toka-Leya guides set out to Kazeruka Island, now called Livingstone Island, renamed after him to view the falls.

On the way to the island, Livingstone was struck by the beauty of the river and its banks, which he described in the following terms:

"*The whole scene was extremely beautiful; the banks and islands dotted over the river are adorned with sylvan vegetation of great variety of colour and form…it had never been seen before European eyes; but scenes so lovely must have been gazed upon by angels in their flight" (D.W. Phillipson, 1975, p.73)*

While on the Livingstone Island where he obtained his first view of the falls, he remarked:

"*No one could perceive where the vast body of water went; it seemed to lose itself in the earth….. the most wonderful sight I had witnessed in Africa." (Phillipson, 1975, P.79)*

Livingstone called the falls 'Victoria Falls' after the British Monarch. To date the Falls still bear the same name. Livingstone's visit to the falls was followed by public lectures and publication of reports and books about his experiences. As a result, he stimulated interest in other Europeans who came to visit the area as Explorers, Hunters, Traders and Missionaries (Phillipson, 1975).

The European Penetration in the Victoria Falls.

During the scramble for Africa by European Powers, Litunga Lewanika whose rule from 1885 to 1916, spanned the period of European penetration in the Victoria Falls area, preferred British

protection, which he obtained through the Lochner Treaty of 1890. As a matter of fact, the Lochner Concession represented the interests of the British South Africa (BSA) Company of John Cecil Rhodes. Earlier in October 1889, the British Government conferred extensive rights upon the Company both north and south of the Zambezi. Following the signing of the Lochner Concession, the first Permanent European Settler; F.J. 'Mopane' Clarke arrived and took up residence at the Victoria Falls. Soon after that, many white settlers, traders and hunters crossed the Zambezi at its narrowest point called Old Drift or Sekute's Drift and made the first European settlers' town at the Old Drift Settlement, while the Administrative Post known as Victoria Falls Station was established five kilometers away. By 1903, the European population at the settlement had grown to sixty-eight, including seventeen women and six children. The settlement came to be called Livingstone. However, the Old Drift Settlement soon proved to be unsuitable and unhealthy due to malaria and black water fever which claimed the lives of early pioneers.

In 1904, the Administration decided to site a new township on the sand belt at Constitution Hill. By 1905, the Administration forced all the settlers to move to the new site while the Old Drift settlement was abandoned. Meanwhile new developments took place at the new town called Livingstone. The Post Office was opened while new buildings were constructed as stores, hotels, banks, churches, houses, Clinics, hospitals and administrative blocks.

In those early days one of the important developments was the construction and extension of the Railway line from Mafeking in the south to the north beyond the Zambezi River. The planned extension of the Railway was in line with Cecil Rhodes' grandiose scheme of the Cape – Cairo Railway. This was realized following the discovery of coal deposits at Wankie in 1903. The Railway reached Wankie in 1903 and the Victoria Falls in 1904.

The construction of the Victoria Falls Rail Bridge, which commenced in 1904, was a significant historical event for the Victoria Falls area. The Bridge was constructed where the Zambezi River makes its exit through a gorge, which at its narrowest is only 60 metres in width. It was constructed within the range of the spray of the falls at a height of over 100 metres above the roaring waters (Phillipson, 1975)

The Bridge, which at the time of construction in 1904 was the highest bridge in the world was planned and built to fulfil John Cecil Rhodes' wish. John Cecil Rhodes' wish was for the spray from the falls to fall upon the trains as they cross the bridge. He further wished the trains to step on the centre of the bridge so that travellers could see and appreciate the grandeur of the falls. (The Bulawayo chronicle 1930) The Bridge is an engineering masterpiece which together with the Victoria Falls has attracted thousands of visitors to the area. In 1907, Livingstone became the new capital of North-Western Rhodesia, after Kalomo town was abandoned. A major event in the early history of Livingstone town was the visit of the Duke and Duchess of Connaught in 1910; during which time Lewanika and other Barotse royalty came to Livingstone for the occasion. Lewanika arranged an exhibition and demonstration of traditional Lozi crafts in the Barotse Centre. Lewanika made an excellent impression on the visitors and the settlers.

In 1911 the amalgamation of two territories of North Western and North Eastern Rhodesia came into effect and Livingstone became the capital of Northern Rhodesia.

By 1911 the population of Livingstone and its immediate environs exceeded two thousand, including more than three hundred Europeans. At that time over one fifth of the Europeans in Northern Rhodesia lived in Livingstone. In 1835, Lusaka which was a much more central place became the new capital of Northern Rhodesia. (Phillipson, 1975)

6.11.8 The Management and Conservation of Historical Buildings and Historical Sites in the Victoria Falls Area

Being a historic town, Livingstone still retains a large number of early buildings that are protected under the NHCC Act. The buildings were initially built to serve different purposes. Some were built as hotels, administrative blocks, houses, stores, post offices, banks, hospitals and churches, while others served as security installations as prisons, police and court structures. A comprehensive list of historical buildings refers to (Appendix 6.9)

The historical sites in the area include the War Memorial Statue within the Victoria Falls, the Old Drift Cemetery, the Victoria Falls Bridge and the Railway Museum Open Air National Monument (Zambezi Saw Mills Locomotive Shed), to mention but a few. For an inventory of historical sites, refer to Appendix 6.10.

6.11.9 Anthropology

Communities living around the 30 Km radius of the Mosi-Oa-Tunya/Victoria Falls uphold belief systems and practices that they have upheld for decades. McGregor (2003), she asserts that the Victoria Falls has a much longer history of being placed in different geography of connections, associated identities and memories other than those of the arrival of the first British pioneers and Southern African cultures. The Leya people of Mukuni perform one ceremony in the Mosi-Oa-Tunya/Victoria Falls. This is known as *Lwiindi lwa basilombelombe*. This takes place at a shrine known as *Chipuzyo.* Other shrines such as the *Katola buseka*, and *Samba dwazi* are no longer in use for their intended rituals. The *Lwiindi lwa basilombelombe* ceremony commences from the *namunkale* royal grave site in Mukuni and proceeds to the Victoria Falls where water is collected to be used for rainmaking rituals. This is mainly conducted in the month of January of every year. During the research the following themes became prominent:

6.11.10 Beliefs in the Management of the Falls

According Edward Shils (in Bell, 1992), a belief and a ritual are intertwined and yet separable, and yet rituals depend on beliefs for them to be performed (Zulu, 2016). Beliefs reside in the intangible elements of culture and they are made manifest through different cultural performances and material culture. These are handed over from one generation to the other through various means and mediums such as folklore, songs, music, taboos and myths. It is these strong beliefs that the Leya people of Mukuni have upheld at the Mosi-Oa-Tunya/Victoria Falls as a sacred place, a place

of worship where rituals are performed at different times of the year to enact the symbolic values of their belief system. It has been through taboos and myths that generations have upheld the falls as a sacred site and this has triggered the protection of the site because of its sacredness.
The people of Mukuni strongly believe that the waters of the falls have power to cure various ailments; the water collected at a sacred site has the powers to be used as a sacrament to pray for abundant rainfall, a good harvest.

6.11.11 Rituals

All the rituals performed by the Leya people of Mukuni have a direct link to the Victoria Falls and the Zambezi River. Bell (1992) notes that "a ritual is typically viewed as an expression of a belief and holds social power and has the ability to generate change in one's status" (Bell, 1992). Zulu (2008) affirms that rituals such as *Lwiindi lwa basilombelombe* is a typical example of the way that the symbolic enactment of conceptual orientations changes social statuses of young men who have become of age. The *Lwiindi lwa basilombelombe* takes place from the month of January, however preparations start in December. The main material object of this ritual is water collected at a sacred site located at the Victoria Falls. The water is used for performing rituals to plead with the ancestors to bring rains and good harvest. The same water is used at the *Kaanda Kaleza* (Rain Temple), at *Chizabingo*, at *Namilangu* and graveside libation rites (Mukuni, 2013).

Lwiindi lwa basilombelombe is a four (4) days ceremony where traditional rituals are performed at different sacred sites by different traditional actors to mainly petition for rains from their God and ancestors. It is undeniable that certain structural elements of conducting rituals have been changing while others have been abandoned due to various factors such as the dynamism of cultural, socio-economic factors and the booming tourism industry in the falls area including the prevalence of Christianity (Mwendabeli, 2021 interview). The most noticeable change includes the Tunemanema Rite. Tunemanema are young virgin women who met the young men before proceeding to the Namunakela sacred site. The young women carried clay pots filled with water on their heads to wash Basilombelombe, an act believed to bring them out of a state of performing sacred tasks of their human world (Bedyango, 2021 interview). It is believed that in this process the young men undergo an act of consecrating and dedicating themselves to ancestral spirits and duties of manhood in the community (Mwendabeli, 2021 interview). The act of Tunemanema washing the basilombelombe also entailed marriage. This rite is no longer practiced because most of the people in Mukuni Village have converted to Christianity and practicing traditional rituals such as this is considered as ungodly and primitive. The Mwendabeli informed me that there is a lack of interest in traditional practices by the younger generation, which has barred the transference of traditional values from the older people. The Mwendabeli also informed me that World trends learnt through the educational system and language factor has affected the performance of rituals (Mwendabeli, 2021 interview).

6.11.12 Sacred site(s)

The Mosi-Oa-Tunya/Victoria Falls site had three main shrines where the Leya of Mukuni performed different rituals at different times of the year. These included *Katola buseka* shrine,

Achipozyo shrine (rainmaking shrine) and *Nsamba dwazi* shrine. These sites are located in different location around the Victoria Falls. Some of the sacred sites have been abandoned due to cultural factors:

1. *Katola buseka* shrine: The shrine is located where the current position of the Victoria Falls bridge was constructed. The shrine was used mainly to appease ancestral spirits of the departure by pouring locally brewed beer on the site (Mwendabeli, 2021 interview). With time the ritual was discontinued due to cultural reasons I was not informed of;
2. *Acipuzyo* shrine: This shrine is located somewhere around the falls area at the *Chisamu Cilikumbete* (hugging tree) and this is the place where the Sichichele and basilombelombe draw water to be used in the rain making rituals. The shrine is still active and is sacred for the Leya people of Mukuni; and
3. *Nsamba dwazi* shrine: This shrine is located somewhere down the boiling pot. It was at this shrine that the Bedyango played a key role in cleansing community members of various diseases, infertility and misfortunes. This ritual site is no longer active.

Lwiindi lwa basilombelombe ritual ceremony - The Leya of Mukuni

Lwiindi lwa basilombelombe is the most significant and well celebrated ritual for the Leya people of Mukuni as it encompasses a number of significances. *Basilombelombe* is a Leya name meaning 'warriors' who have become men through the rite of passage. The warriors are expected to take up new roles as defenders of the Royal throne and their families. The rituals performed during this ceremony are pivotal for Leya people of Mukuni for making intercession and plea for rains, good harvest and abundant hay for livestock. Basilombelombe Ceremony is also ideologically important in terms of legitimizing Mukuni's kingship, as is the case in all kingships where the King is a symbol of divinity and provides the earthly link between the living and the long line of spiritual ancestors living in the world hereafter (Mukuni, 2013). Different material cultures are used in this ritual among which include calabashes, spears, limestone, *Kaanda ka leza* (small house of GOD) and tree leaves.

On first day, the Munokalya Mukuni, Be-Dyango and Mutoozi we Namunaki visit the Royal graves and perform rituals to appease the ancestral spirits of the pervious chiefs through traditional songs of praise *by Chiyemas* and *bana ba Kwenlele* (grandchildren of the Royal family). It is at this point that the chief assigns Basilombelombe (worriers) to fetch water from the Victoria Falls. Basilombelombe are led by Sichichele. The Sichichele is a Royal family member charged with the responsibility of leading the Basilombelombe ritual. He is the main custodian of the ritual including all its material objects. It is the Sichichele who prepares the young men to race to the Mosi-Oa-Tunya/Victoria Falls World Heritage site to collect water from the *Acipuzya Shrine* located at the *Chisamu Cilikumbete* (hugging tree) at the falls. Along the way there are different rituals performed at the Chizabingo Shrine where rituals are conducted to pray for rains (Mwendabeli and Bedyango, 2021 interview). Details of these rituals were not given because of their sacredness. It is after the prayers at the Chizabingo Shrine that the Basilombelombe smear their bodies with white lime (*mpembe*) a symbol of becoming pure and attaining a new life of being an adult. They also dress in tree leaves a symbol of being one with nature and race back to the grave sacred site to hand the collected water to the Chief for other rituals performed at the *Kaanda*

ka Leza, *Namunaki* and Namilangu royal ritual huts. Other material objects used in this ritual is a calabash used to collect water and spears,

On the second day, The Munokalya Mukuni and the Be-Dyango sleep at the Kumekwendu, a Shrine. Drumming and different songs are sung throughout the night. I was not told the symbolic meanings of why the two slept at this shrine. The third day is a day of visiting the graves of all the chiefs and their children. Tuntunmana Ritual is conducted on the fourth day. This is a ritual where 10 elderly women are selected by the Be-Dyango to chastise the Chief on his governance system. This ritual takes place at the Namilangu Grave site. During this ritual, the selected women are at liberty to insult the Chief on bad decisions he made and he is not allowed to answer back. This ritual is highly centered on the role of women in the society of the Mukuni people. Women are highly regarded for the motherly role they play in humanity (Be-Dyango, 2021 interview). Appendix 6.11 gives a summary of rituals and sacred shrines for the ethnic groups living around the Victoria Falls Area.

Royal ceremonies of the Sekute people

The people of Chief Sekute have for centuries been practicing rain making rituals during the Lwiindi Ceremony. The Lwiindi Ceremony for the Sekute people is also a time to remember to pray for abundant rainfall, good harvest and protection from pandemics and natural calamities and pay homage to their ancestors by presenting three main offerings; water, milk and traditional brewed beer. The ceremony has been taking place in the months of November. The preparation of traditional beer is specifically done by the Royal family member known as *Ina Sinandu*. The collection of water and milk is done by the *Sekutenyana.* The rain making rituals are conducted at royal graves of selected previous chiefs.

On the first day of the ceremony, the *Ina Sinandu* and *Sekute nyana* select a black bull for slaughter. Different rituals are performed on the slaughtered bull, however not much detail was given as it was considered sacred information (Senior Headman, 2021, Interview). The meat is boiled and eaten without salt by all the Royal family and villagers. To attain the peak of the ceremony, ancestral graves are visited where water, milk and traditional brewed beer are offered to the ancestors. The first grave to be visited is that of *Chipuluputa.* Songs of praise and those seeking forgiveness for any shortcomings are sung to the deceased Chief. Other songs sung petition their ancestors for abundant rainfall. While performing this ritual, it is believed that thick dark clouds must start gathering and it must rain heavily (Senior Headman, 2021, Interview). The second stop is the grave of *Luwizi* where similar ritual is performed. The third stop is the grave of *Siasingu* who was the mother of Chief *Chipuluputa*. Drumming, singing and dancing continue all night as people celebrate the commencement of the rainy season. On the second day, The Chief and the *Ina Sinandu* visit the graves of *Talima, Kalonga* before heading back to the village for other rituals. Similar to the people of Mukuni, the people of Sekute have *kaanda ka leza*, a temporal shelter constructed mainly for performing rituals during the Lwiindi Ceremony.

These rituals have continued however, it was noted that most of the elderly with traditional knowledge are very old and have forgotten certain facts with regards meaning and symbolisms of the performed rituals.

Royal ceremonies of the Musokotwane people

The main traditional ceremony of the people of Musokotwane is *Lukuni Luzwa Buuka* whose literal translation means insects coming out of a piece of wood after being disturbed. The piece of wood is viewed as the people of Musokotwane whereas the insects refer to intruders who came to disturb their peace (Mufuzi, 1996). *Lukuni Luzwa Buuka* is a ceremony where the Toka commemorate when they conquered invaders into their area. They give thanks to their God (Leza) for granting them victory over their adversaries (Mufuzi, 1996). With time, the ceremony faded away, however, it was revived in 1993 and it is hosted every year towards the end of the month of August. The ceremony is divided into two phases. Phase one of the ceremony is not open to the public because of its sacredness, however, it mainly involves performing rituals at ancestral grave sites (Mufuzi, 1996). The burial sites are Malunga located near the Harry Mwaanga International Airport, in Livingstone. Two Chiefs were buried at this grave site: Chief Matakala and Chief Lusungo. The second burial site is Mabula where Musokotwane Namahalika Lishimi Mulena I was buried. These burial sites are highly reverenced as sacred and during the last mission of David Livingstone, he observed and recorded how the Toka planted the largest elephant tusk at the head of the grave or entirely closed it with choicest ivory (Livingstone, 1857). The second phase of the ceremony is open to the public and it involves singing traditional songs and dancing and performing poetry in praise of the Chief, the ancestors and the people of Musokotwane. Other activities performed include praying for rains and giving thanks for various concerns such as good harvest, request to avert epidemics, locust plagues and other disasters.

In her ethnography (Colson, 1956) observed how the Tonga of the plateau constructed small huts which they called *kaanda* or spirit hut. They regarded these huts as the domicile or symbol of powerful spirits called *basangu.* The spirits had control over the rains and power over epidemics and any other disasters. The rain making ceremony consisted of killing a black beast, pouring of traditional brewed beer to the earth as a way of pleasing the ancestral spirits.

6.11.13 Study Limitations

It was observed that the subject matter is very sensitive and as a result the people interviewed could not disclose complete information to an ‘outsider’ because of its sacredness. It was also noted people have different names and narrations pertaining to certain sacred sites, practices and their significance including material objects used at various shrines. This also could be alluded to the fact that people are slowly forgetting certain cultural facts. It was also obvious that the younger generation had no interest in the cultural ceremonies but were more focused on sustaining their livelihood through socio-economic activities such as making and trading in crafts.

6.11.14 Impacts of findings on the Outstanding Universal Values

The anthropological values of the Mosi-Oa-Tunya/Victoria Falls are not part of the Outstanding Universals Values as prescribed by UNESCO World Heritage Centre. However, the anthropological values form an integral part of the attributes of the site. It is these attributes that have played a critical role in the management of the values of the site. Over the years, the site has been treated more of a spiritual site than a natural site which it was enlisted for. Different spiritual groups including the Muslims, Buddhists, Hindus, Christians to name a few have been seen visiting the falls to conduct prayers in their own styles according to their respective beliefs because they all believe God dwells in the indescribable beauty and wonder the falls displays. The reverence different tourists bestow on the site has aided the effective management of the site and its values.

6.12 Tourism Features

The Government of the Republic of Zambia has identified tourism as one of the portentous sectors to realize the economic potential of Zambia besides mining and agriculture. The sector has immense potential to create job opportunities, generate revenue for the government in form of taxes and earn foreign currency. Through the developed Zambia Tourism Master Plan (2020), the Government of the Republic of Zambia has realigned the sector's vision and strategies to the national vision and to foster a systematic development of the tourism assets. The Tourism Master Plan (2020) identified strategic interventions and their implementation aimed at attaining long term objectives as outlined in the vision 2030 (Ministry of Tourism and Arts, 2020). Tourism developments in 30 Km radius of the Victoria Falls site, Livingstone side include:

1. New Mosi-Oa-Tunya Resort – Construction in progress will have more than 200 rooms, 600 Conference facility and Jetty for the boat;
2. Victoria Falls Eye Project - Will construct a hotel with 60 rooms;
3. New Harry Mwaanga Nkumbula International Airport, new terminal building would be able to handle about 700,000 passengers annually;
4. There are currently 13 lodges along the Zambezi River down upstream with jetties;
5. The proposed Zambia Institute of Chartered Accountants (ZICA) proposed site for construction of the Conference facility with 3,000 sitting capacity and
6. Construction of Modern Intercity Bus Terminus and a Market.

Besides visiting the Victoria Falls, a variety of tourist activities and packages have been developed in the last twenty years. These activities have prolonged the number of days tourists stay in Livingstone. Among such activities include:

1. Visiting the Livingstone Island;
2. Game viewing;
3. Helicopter and microlight flights;
4. Boat cruises;
5. White water rafting;
6. Canoeing;
7. Bungee jumping;
8. Zip-line sliding;

9. Jet extreme;
10. Rowling, regatta;
11. Horse ride Safari;
12. Elephant back riding;
13. Steam train ride;
14. Quad bike ride;
15. Zambian Tradition dancer performances; and
16. Crafts and Curios.

6.12.1 Tourism Development (1995-2020)

The Zambian economy has undergone significant transformation since the introduction of liberal economic policies in the early 1990s. The policy shift resulted in a greater involvement of the private sector in the economic development of the country. The Zambian economy is characterized by progressive diversification where tourism is contributing significantly both in terms of composition of output and exports. The introduced liberal economic policies had their pros and cons and among the cons was bankruptcy and closure of the textile, timber, radio and television and motor assembly industries in the city of Livingstone. It was these industries, which formed an economic backbone of Livingstone and Southern Province.

In an effort to revive the economy of the Livingstone Town, His Excellency President Michael C. Sata declared Livingstone City as Tourist Capital in 2013. Among other reasons are that the Victoria Falls was recognized as the main tourism brand of the nation. Being the only World Heritage Property in the country and one of the seven natural wonders of the world, the government of the day was determined to invest in branding and marketing the destination to both the local and international markets (Ministry of Tourism and Arts, 2013).

Over the years, infrastructure development such as hotels, lodges and international airports in the City of Livingstone have boosted tourist arrivals. Road infrastructures have also contributed to the positive growth of tourism as tourists can drive into the city from different towns and neighbouring countries. The current statistics of tourists age group to the Victoria falls comprised of 32.2% (25-30 years), while the least was 1.3 % (15-20 years) (Appendix 6.12).

The tourists visit to the Victoria Falls comprised 75% of domestic tourists and 25% international tourists. The majority of the tourists were females 51% and males 49% (Appendix 6.13). The domestic tourists were from different towns of Zambia while international tourists mainly came from America, United Kingdom, China, Italy, Germany, South Africa, Botswana and Namibia. Sixty percent of tourists visiting Victoria Falls come with their families, 29% with friends and 11% alone.

Current situation as compared to the 1995 SEA: Changes in Tourism Development

As observed in the 1995 SEA report, Livingstone lagged behind in terms of tourism infrastructure development compared to Victoria Town, Zimbabwe. In the last two decades, the City of Livingstone has witnessed substantial tourism infrastructure development. The city has 137

accommodation establishments, 12 Restaurants and 44 tour operating companies offering diverse tourism related activities to meet both the local and international demand.

At the time of the last SEA, Livingstone had two hotels, Inter-Continental and Rainbow Hotels. The Government of Zambia through the Ministry of Tourism and Arts implemented policies aimed at promoting sustainable tourism development through the privatization process. The privatization process led to the sale of the Mosi-Oa-Tunya/Intercontinental Hotel and Rainbow lodge to the Sun International Hotel Limited in 1998. The Sun International Hotel Limited later sold significant shares of its portion to Avani/ Minor International; the current proprietors (Industry Update, 2014).

6.12.2 Tourist Trends to the Victoria Falls (2000 -2020)

In the years under review, the City of Livingstone has experienced a considerable raise in tourists' arrivals. The World Heritage Site receives both international and domestic tourists throughout the year (Figure 6.44) (Appendix 6.14). It has been observed that the peak season for the Victoria Falls is during high water levels; March to August. In the period under review, the highest patronage was recorded in 2018 with 199,508 tourists while 2020 recorded the lowest of 85,414 mainly because of restriction of movement because of Covid- 19 pandemic (Figure 6.44).

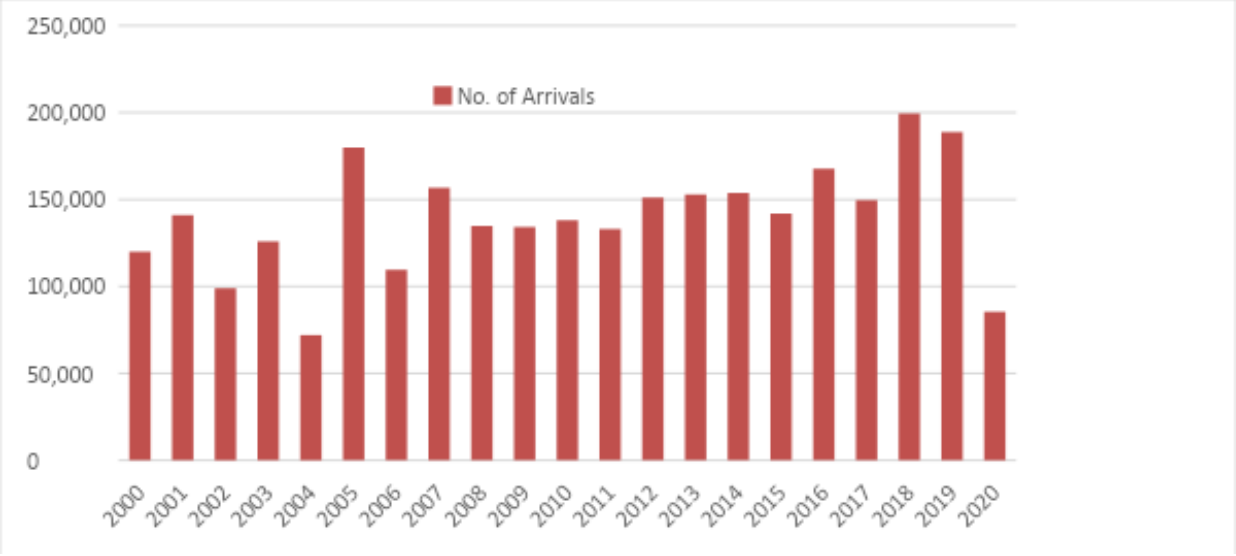


Figure 6.44: Tourist numbers at the Victoria Falls (2000-2020) Livingstone side (NHCC 2020)

This could be alluded to several factors such as effective tourism marketing strategies implemented by the States Party of Zambia through the Ministry of Tourism and Arts and Zambia Tourism Agency. Statistical data was collected from strategic entry points such as International Airport, the Victoria Falls, Museums and the Mosi-Oa-Tunya National Park.

International Tourist Arrivals between 2000-2020

In the past twenty (20) years, international tourist arrivals in Livingstone (Appendix 6.15) have been on the rise and this could be attributed to a number of factors such as good infrastructure development of road network, international airport, various tourism activities, reliable public transport to mention a few. Since the construction of the Harry Mwaanga Nkumbula International

Airport in 2013, the tourist capital has continued recording a steady increase in the tourist arrivals. International scheduled flights such as South African Airways, Kenyan Airways, Conair/British Airways and Air link contributed to the upward tourist trend in the city. Tourists mainly visitors from countries such as United Kingdom, United States of America, China, Germany, South Africa, Botswana, Namibia to name a few. Statistical data of international arrivals were obtained from the Harry Mwaanga Nkumbula International Airport (Zambia National Airport Corporation Limited, 2021), and Victoria Falls border post in Livingstone as illustrated in Figure 6.45.

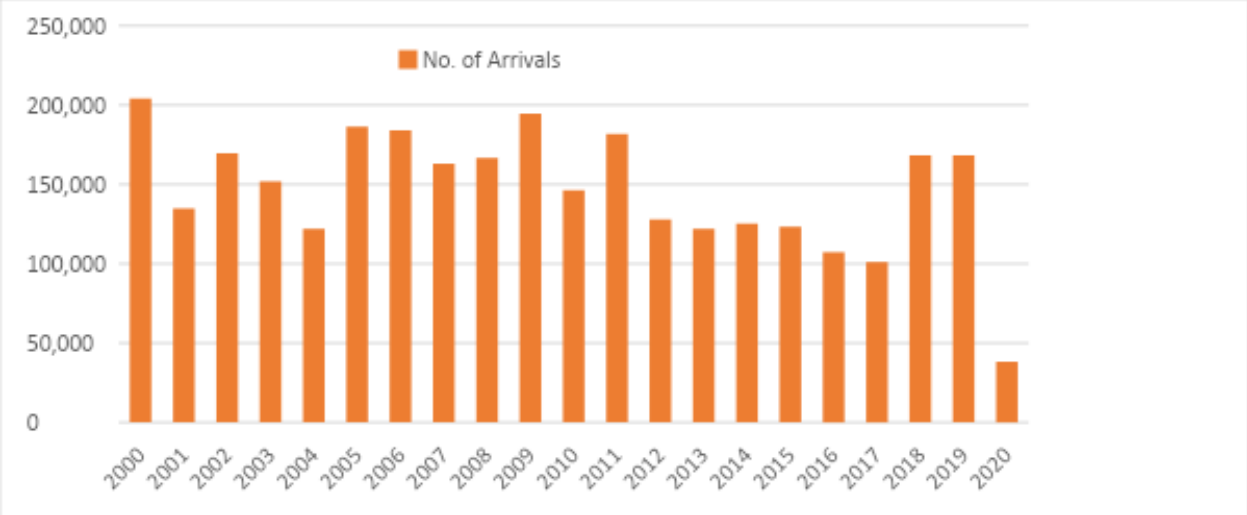


Figure 6.45: International Tourist Arrivals at HNIA and Victoria Falls Border Post

Domestic Tourists Trend at the Victoria Falls

The Victoria Falls recorded a steady growth of domestic tourism as indicated in Figure 4. The year 2007 and 2018, the falls recorded the highest patronage representing 54.1% and 31.6% increase respectively. This is could be alluded to effective tourism marketing strategies employed by the Ministry of Tourism and Arts and the Zambia Tourism Agency and a number of tourism related activities that the City hosted. The Victoria Falls recorded a decrease in the tourists in the period 2019 and 2020 because of the Covid-19 pandemic (Figure 6.46).

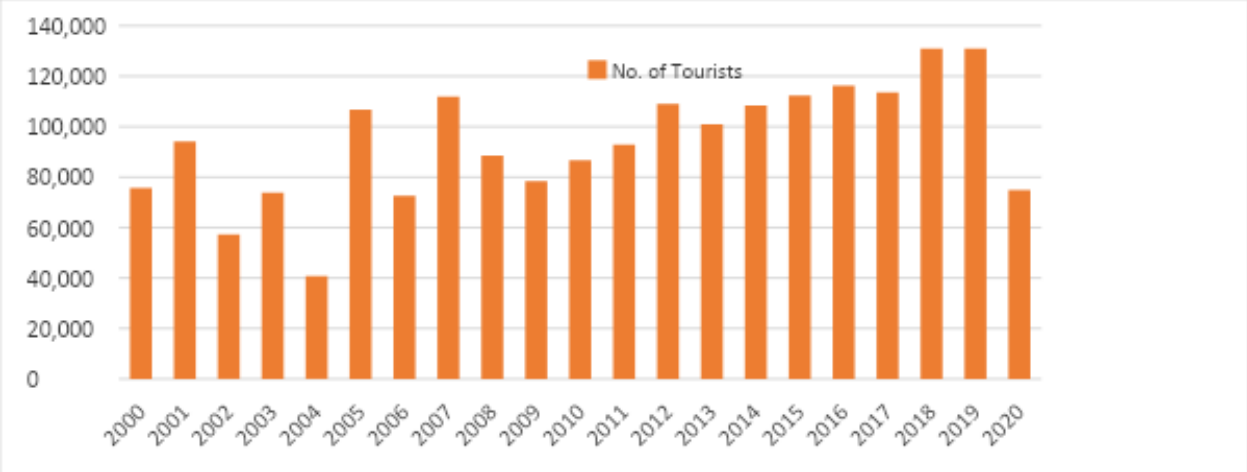


Figure 6.46: Domestic tourist numbers at the Victoria Falls (2000-2020) Livingstone side (NHCC 2020)

6.12.3 Accommodation Establishments in the Study Area

The growth of tourism in the study area necessitated an increase in accommodation facilities. This growth could be ascertained to the high numbers of both local and international tourist arrivals in the Livingstone City. There has also been a high demand for Meeting Incentives Conferences and Exhibitions (MICE) in Livingstone. The study area has a total of 10 hotels, 77 lodges, 32 guesthouses, 9 apartments, 3 backpackers, 4 bed and breakfast and 2 campsites. (Appendix 6.16). The 137 accommodation establishments range from upscale luxurious to budget cost accommodation facilities (Ministry of Tourism and Arts, 2020).

Number of Rooms and Bed Spaces in Livingstone

The study area (Table 6.17) (Zambia Tourism Agency 2021) has a total of 2,482 rooms and 5,243 bed spaces. The lodges have a total of 1,145 rooms and 2,286 bed spaces. The hotels have a total of 856 rooms and 1,847 bed spaces. Guesthouses have a total of 186 rooms and 379 bed spaces. Backpackers have a total of 160 rooms and 320 bed spaces. Apartments, bed and breakfast and campsites have 295 relatively very low number of rooms and 731 bed spaces as compared to other types of accommodation facilities.

Table 6.17: Accommodation Establishments in the Study Area (Ministry of Tourism and Arts, 2020)

City	Type	No. of Est.	No. of Rooms	Bed spaces	Total
Livingstone	Hotel	10	856	1,847	1,559
	Lodge	77	1,145	2,286	1,131
	Guest House	32	186	379	88
	Apartment	9	80	280	54
	Back Packer	3	160	320	75
	Bed & Breakfast	4	29	55	19
	Camp site	2	26	76	34
	Motel	-	-	-	-
	Total	**137**	**2,482**	**5,243**	**2,960**

Average Room Occupancy Rates (2000-2020)

The room occupancy in the past twenty (20) years (Table 6.18) continued to fluctuate due to various reasons. The year 2015 the hospitality industry recorded the highest occupancy rate of 69% while the year 2020 had recorded low occupancy rates of 36.6 percent, due the effects of COVID-19 pandemic. This led to loss of jobs in the hospitality industry.

Table 6.18: Average Room Occupancy Rates (2000-2020) (Ministry of Tourism and Arts, 2020)

Year	Average Room Occupancy Rate	Year	Average Room Occupancy Rate	Year	Average Room Occupancy Rate
2000	46.4	**2008**	48.9	**2016**	42.1
2001	45.5	**2009**	52.3	**2017**	44.6
2002	42.1	**2010**	56.8	**2018**	47.1
2003	40.1	**2011**	51.6	**2019**	50.3
2004	41.4	**2012**	54.9	**2020**	36.6
2005	42.8	**2013**	60.1		
2006	44.1	**2014**	61.9		
2007	58.2	**2015**	69.8		

6.12.4 Employment Statistics in the Hospitality Industry

Since the declaration of Livingstone as a Tourist Capital of Zambia in 2013, the hospitality industry has been pivotal to boosting the socio-economic development of the Area. The industry has been the major employment sector. By December 2019, 2,960 males and females were employed in the industry. Figure 6.47 highlights the statistics of employees in the tourism industry as at 31st December, 2019.

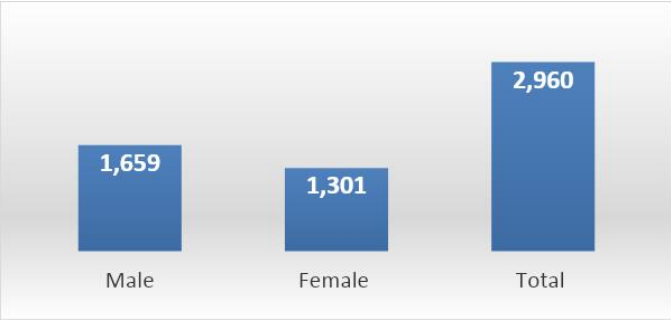


Figure 6.47: Number of employees by gender in Livingstone City, Southern Province, Zambia

6.12.5 Zoning of the World Heritage Site and Tourism Activities

Following recommendations highlighted in the 1996 SEA report and in line with the Joint Integrated Management Plan 2016-2021 (JIMP 2016), the World Heritage Site (WHS) was subdivided into three zones namely (i) High ecologically sensitive zone (ii) Medium ecologically sensitive zone (iii) Low ecologically sensitive zone (JIMP 2016-2021). The JIMP (2016-2021) stipulates permissible, prohibited and permitted tourist facilities/infrastructures in the three zones as highlighted in the Table 6.19.

Table 6.19: Permitted and Prohibited Tourism Activities in the World Heritage Site

S/N	Permitted activities	Prohibited activities	Permitted Facilities / Infrastructure
01	Rafting	Resource extraction except for research purposes	Existing infrastructure
02	Angling	Cable Car	Common Marina
03	Gorge Swing	Boating along river bank and islands	Management facilities e.g. toilets, walking trails
04	Bush meals	Wet bikes; Water skiing	Eco-lifts
05	Photographic tourism	Ballooning	Picnic sites
06	Abseiling	Use of Speedboats above 45hp engine	Hides
07	Boat Cruises	Construction of facilities of height above native tree canopies	
08	Rafting	Fencing of infrastructure and other developments in the zone	
09	Falls Viewing	Ferris wheels	
10	Rap jumping	Erecting new permanent infrastructure	
11	Traditional rites	Herding of domesticated animals	
12	Research and Monitoring	Painting buildings/ facilities in non-earth colours	
13	Canoeing	Funicular	
14	Kayaking	Developments or fencing in animal migration areas/ corridor(s)	
15	Game Viewing and walking safaris	Littering, mining	
16	River boarding	Loud Music	
17	Jetting (30-45hp)		
18	Tour guiding		
19	Boating		
20	Bunge Jumping		
21	Cultural Ceremonies		
22	Moonlight viewing		
23	Picnics		
24	Law enforcement and management operations		

6.12.6 Mosi-Oa-Tunya National Park – Tourist Trends (2000-2020)

The Mosi-Oa-Tunya National Park is part of the World Heritage Site. In the year 2011, the park recorded the highest number of tourists, while in the year 2020 recorded the lowest number of tourists (Figure 6.48) (Appendix 6.17).

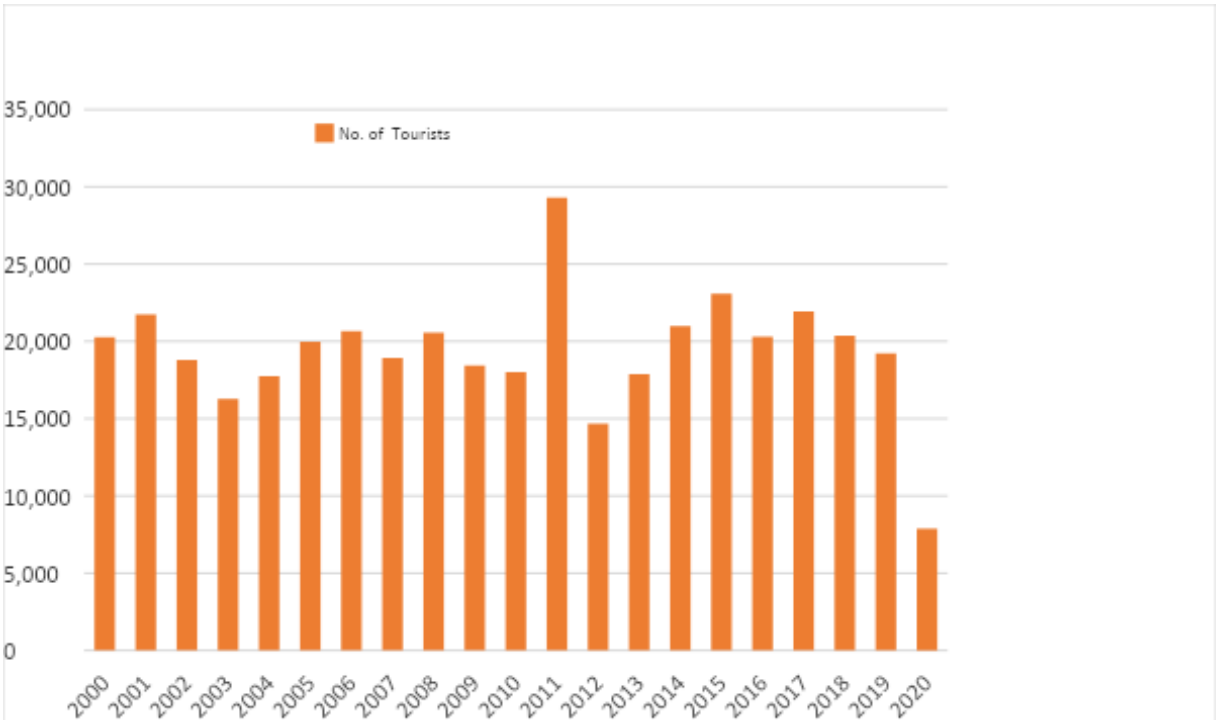


Figure 6.48: Mosi-Oa-Tunya National Park – Tourist Trends (DNPW 2020)

Mosi-Oa-Tunya National Park –International Tourists Trends (2000-2020)

The Mosi-Oa-Tunya National Park recorded 53.6 percent decrease of international tourists visiting the park in 2012 compared to the 18.3 percent recorded in 2008 (Figure 6.49). In 2011, the park recorded an increase of 76.5 percent compared to 0.4 percent recorded in 2009.

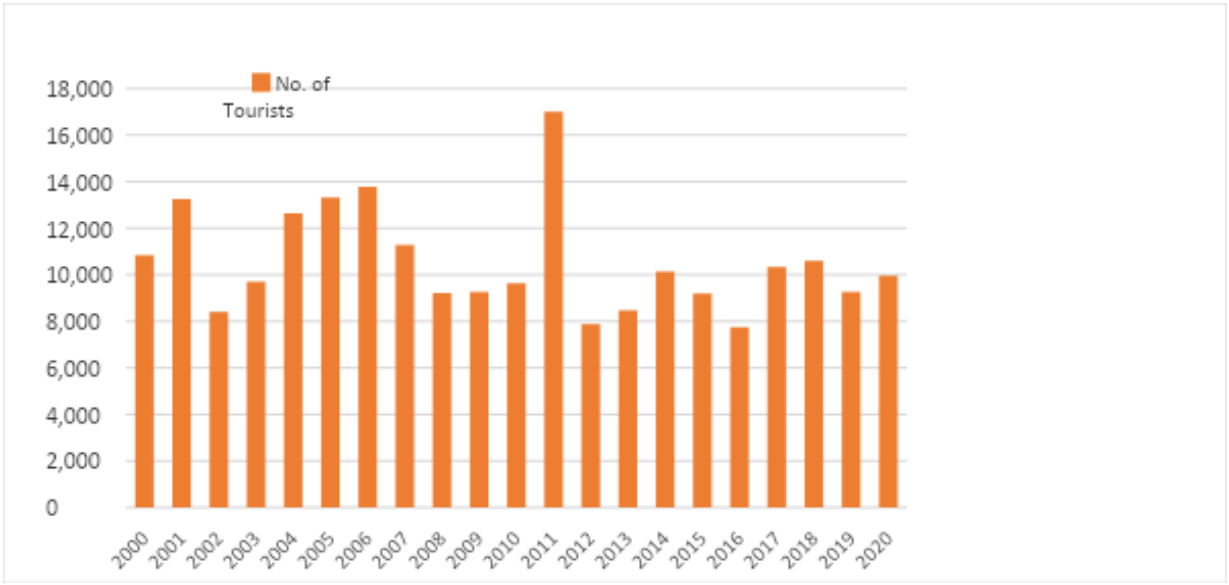


Figure 6.49: Mosi-Oa-Tunya National Park –International Tourists Trends (2000-2020), (DNPW 2020)

Mosi-Oa-Tunya National Park -Domestic Tourists Trends (2000-2020)

The domestic tourists in 2008 recorded the highest percentage increase of 48.9 from the 10.7 percent that was recorded in 2007 (Figure 6.50). However, in the year 2020 the park recorded (37.8) percent decrease in the number of domestic tourists visiting the park, due to the Covid-19 pandemic.



Figure 6.50: Mosi-Oa-Tunya National Park -Domestic Tourists Trends (2000-2020), (DNPW 2020)

6.12.7 Livingstone Museum- Tourist Statistics Trends (2003-2020)

The Livingstone Museum is one of main tourist attractions in the Livingstone City. Since its establishment the museum has been attracting both domestic and international tourists (Figure 6.51) (Appendix 6.18). In the year 2007, the museum recorded the highest number of tourists while the year 2020 had the lowest number of tourists due to the global covid-19 pandemic.

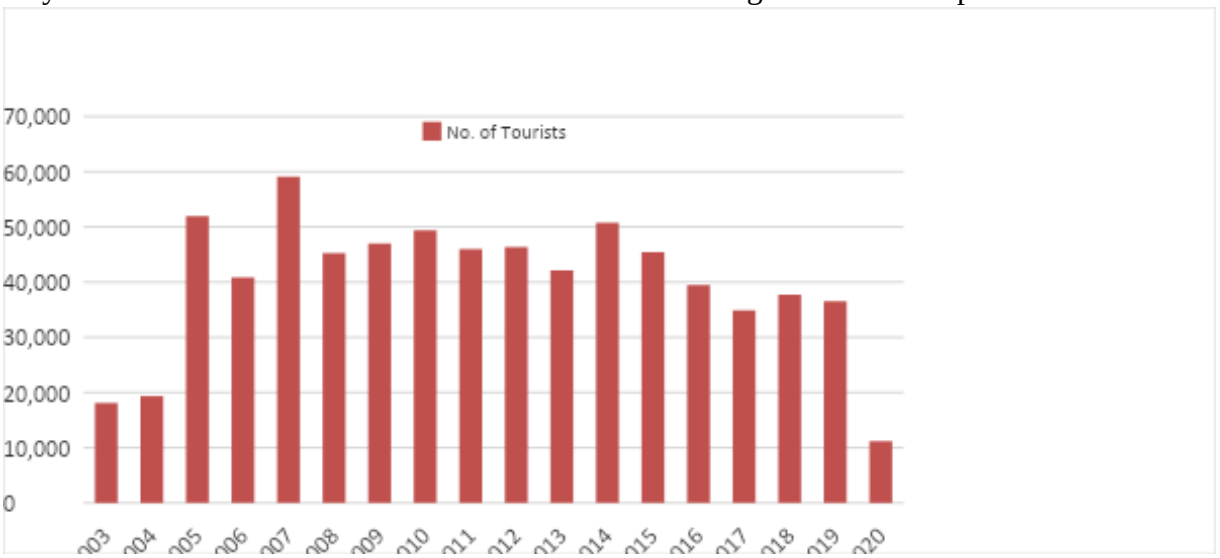


Figure 6.51: Livingstone Museum Tourists Trends (2003-2020) (National Museum Board- Livingstone Museum, 2020)

Livingstone Museum – International Tourists Trends (2003-2020)

Visitation trends of international tourists visiting the Livingstone Museum was fluctuating (Figure 6.52). The museum recorded a highest visitor turn out in 2005, representing a percentage increase of 160.9 percent from the 30.9 percentage increase recorded in 2004. The museum also recorded an increase in visitor turn out in 2014 and 2015 respectively. However, the year 2020 recorded the major decrease in visitor numbers of 86.7 percent due to the Covid-19 pandemic which led to the temporal closure.

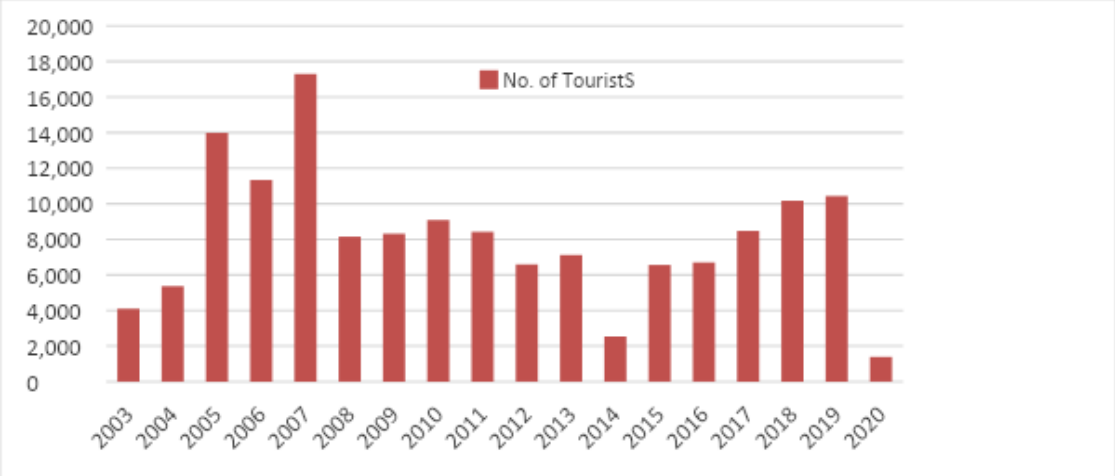


Figure 6.52: International Tourist Trends to Livingstone Museum (National Museum Board, 2020)

Livingstone Museum – Domestic Tourists Trends (2003-2020)

The museum recorded high patronage in the year 2005 and 2007 of 171.1 and 41.4 percent respectively (Figure 6.53). The museum recorded the highest tourist visitation of close of 50,000 in 2014 while the lowest visitor turnout was recorded in 2020 due to the Covid 19 pandemic. Among the products offered by the museum include guided tours, educational tours, researcher facilitation for schools and institutions within Livingstone, Zambia and abroad.



Figure 6.53: Domestic Tourists Trends (2003-2020) to Livingstone Museum (National Museum Board, 2020)

7.0 IMPACTS OF THE SCENARIOS

The area surrounding the Victoria Falls is classified as tropical dry or deciduous forests and woodland of different woodland characteristics (Appendix 7.1). The predominant woodland type is Kalahari Woodland, which grows on the overlying Kalahari Sands. Kalahari Woodland occurs principally on the Kalahari Sands and is characterized by Zambezi Teak (*Baikiaea plurijuga*), False Mopane (*Guibourtia coleosperma*) and False balsa/Mongongo nut tree (*Schinziophyton rautanenii*). The woodland provides species of economic importance, being exploited for fuel wood, timber for making curios and furniture, and medicinal plants. Exploitation is particularly heavy near the towns and in the communal/tribal trust lands. The 494 km^2 (49,400ha) Kalahari Woodland are protected by the Zimbabwe Forestry Commission and the Zambia Forest Department respectively and provide habitat for wildlife and ecosystem services (Mudekwe, 2007). However, the impacts of developments, activities and resource uses, which have significant environmental, social and economic impacts are considered for each scenario. There are four focal areas of life which may be changed as a result of developments around Victoria Falls - wildlife and the general environment, tourism, urban and rural life. The most significant implication of increased visitor numbers is the expansion of hotels and tourist facilities to meet the demand. These result in loss, degradation and fragmentation of habitat. The constriction of wildlife movements leads to changes in animal behaviour and increased negative human and wildlife interactions. These factors combine with the visual impact of development and the aircraft noise to reduce the natural wilderness value of the Victoria Falls area. The visitors are attracted to the spectacle of the Falls in its pristine state. There is a feed-back loop, for if the tourists become disappointed with the spectacle, either because of reduced wilderness value, or because of altered flow regimes over the Falls, the numbers of visitors would not necessarily decrease but their stay may not be prolonged. The demand for curios is slightly different, but selective cutting of trees ultimately leads to loss of biodiversity around the various forests, urban and rural communities. There is linkage between the rural and urban areas; rising urban populations increase the demand for fuelwood and charcoal, for agricultural and livestock produce and for curios. This may be very beneficial provided that the demand can be met sustainably. The danger is in the fact that unsustainable cutting of trees for fuel, curios and agricultural land can lead to rapid deforestation: too many livestock can lead to overgrazing. This will result in loss of land productivity, a loss of income for the rural people who work it, and hence a change in the quality of rural life.

The effects of long-term climate change and the extremes of normal have been highlighted as a factor impacting the property from 2006. This climatic variation needs to be taken into account as it has potential temporal impacts on rainforest vegetation. Changes in rainfall, drought patterns, and temperature and evapo-transpiration rates will all have effects upon the river flows and ultimately the rainforest vegetation. This will be particularly noticeable at the low flow regimes in the dry season. Simple examples are:

i)Walk in the rain forest at the Falls: The rainforest walk is a strong multiplier driver on both sides of the borders being the highest revenue earning activity on the Zimbabwean side. With the increase in cross border packages for tourists from as far as Chobe, Botswana, the rainforest walk continues to attract short and long staying tourists, and will soon have some degradation. The rainforest walkway on the Zimbabwean side is paved with concrete surfaces of varying width (Figure 7.1). The main path from the public entrance point through all viewing points back to the entrance point is 1.03 km in length with the minimum existing width is approximately 0.6m and the maximum <2.5m (on limited sections such as public entrance to Livingstone Statue). There are no concerns of path erosion as faced earlier before the paving of the paths which has helped a lot to maintain the integrity of the area despite large volumes of tourists.



Figure 7.1: No erosion signs are visible along the entire path in the rainforest on the Zimbabwean side

ii) Pressure on forest: The population growth and urban expansion increase the pressure on the woodlands as a result of growing need for fuelwood and charcoal. Cutting, sale of firewood from communal, tribal trust land and charcoal production will be likely to be experienced unless there are changes in energy provision. Studies on forest products have highlighted that on average 37% of people engage in curio (Mudekwe, 2007).

7.1 Impact Assessments on Carrying Capacity and Limits to Growth

In order to attempt to predict and describe the impacts of increased resource use implicit in the different scenarios of tourism growth and reduced water flow down the River Zambezi, impacts of each scenario therefore, those developments, activities and resource use which have significant environmental, social and economic impacts are considered. Each one will first be analyzed in terms of the present effects and impacts observed and issues raised during consultations and from field research work. Whilst some developments may be named to illustrate particular aspects others will be generalized to explain potential impacts. Detailed analysis of specific projects is avoided because the purpose of this study is a general longer-term implication of development trends. The second stage will be an analysis of the future impacts according to the different scenarios. In this case a brief description of each impact is noted on a summary table on which two characteristics - adverse/beneficial and significance - are indicated according to the shading (Table 7.1). The impact rating ranges from ‘No negative impact ‘were there are no perceived negative impacts to ‘Major adverse impact ‘where there are perceived to be catastrophic and from ‘No

positive impact ‘where no benefits are realized to ‘Major beneficial’ which are more beneficial and desirable to ecological systems functioning in the short to long term.

Table 7.1: Summary table indicating impact scale (severity)

Major beneficial impacts	
Significant beneficial impacts	
Minor beneficial impacts	
No impact	
Minor impact	
Significant adverse impact	
Major adverse impact	

This assessment, like many SEA and SESA studies, is essentially a value judgment of the impacts of increasing numbers of visitors under present planning and management conditions, i.e., "business as usual". This judgment is based upon the experience of the core team and the detailed study specialists have undertaken based on the growth of each development in the projection scenarios. It also reflects the concerns of the various people, communities and organizations consulted. Basically, an indication of "no impact" at present means that no effect has yet been generally observed, but that an impact could well occur in the future. "Minor impacts" are those which have been observed, but which are relatively limited either in location, degree or reflect upon the residents or tourists. They need to be watched in case they develop into more serious adverse impacts. "Significant adverse impacts" are those which have been raised as issues by concerned people and which may be having a wider effect i.e., they are not confined to a specific locality or activity. They may not have reached a stage at which anything needs to be done to control or manage them, but they will be beginning to have an effect upon the wider situation. Management plans for controlling “Minor, Significant and Adverse Impacts” should be considered at this stage based on guidelines from existing EIAs and Environmental Management Frameworks (EMF) for specific developments. Significant beneficial impacts might be open to enhancement to become major benefits.

7.2 Changing Quality of Wildlife

The increased tourist visitation has a number of implications on the use of the natural resources and landscape, water as well as air space. One such implication is expansion of tourism infrastructure such as camping areas, lodges, and hotels to meet the number of visiting tourists. This has a number of effects such as loss of habitat through degradation, fragmentation and complete loss as natural land is set aside for infrastructure. One indicator of the effects of loss of habitat is associated with negative human interaction involving species such as elephants, buffalo and baboons. Tourism development also impacts on wildlife migratory routes to habitat resources including in some instances Wildlife Dispersal Areas (WDA) across national boundaries. Photographic activities such as game drives, walks and helicopter flights have implications on animal behaviour through disturbance such as noise. Animal vigilance may be affected with long

term consequences such as breeding and recruitment of different species depending on sensitivity to human disturbance.

7.3 Rainforest Walk to View the Falls - Future Impacts on Walkway, Rainforest, Water and Forests

In the long-term tourist visitation to the Victoria Falls as indicated above will have some future impacts on the walkway in the rainforest. These may be extended to Forests and Water, which are all summarized herein:

7.3.1 Future Impacts on Walk to View the Falls

Future impacts related to the walk in the rain forest are related to increase in tourism numbers, which may motivate diverse tourism activities and service infrastructure. The impacts of noise from traffic will likely remain however at a reduced rate than what is currently obtaining. This is due to the opening of the bridge at Kazungula which is anticipated to take some of the heavy vehicle traffic into Zimbabwe off the Victoria Falls border post. There is a high probability that some trucks will go through Botswana and use other Zimbabwean border post and thus reduce traffic as a result of opening this bridge. The impacts as one walks in the Victoria Falls are summarized in Table 7.2.

Table 7.2: Description of impact assuming different growth scenarios. T - Impacts then (perceived impacts in 1996); N - perceived impact now; F - Future anticipated impact

Ecological Impact	**Growth Scenario**														
	Present			**Low**			**Medium**			**High**			**Super**		
	T	**N**	**F**	T	**N**	**F**	T	**N**	**F**	T	**N**	**F**	T	**N**	**F**
Soil erosion															
Riverbank (cliff) erosion															
Loss of biodiversity due to people picking up plants															
Preservation of rare plant, insects, birds and specialized wildlife															
Fire hazard in the dry season															
Increase in light penetration exposing natural habitat to invasion by alien species such as *Lantana camara*															
Litter issues															

Visual impact due to high volume of tourist visiting the falls															
Loss of wilderness value due to overcrowding															
Opportunity for visitor education and increasing appreciation of the Falls															
Noise pollution from trucks, small vehicles and people passing through the border															
Visual impact and adequacy of parking and entrance on both sides															
Noise from helicopters flying over the Falls															

The paving of the rainforest walkway has helped significantly to reduce soil erosion. However, erosion may be experienced on the cliff edge from reduced infiltration resulting from constant run off created by paving. As given in Table 4 above, white indicates No impact; orange - Minor impact; light green - Minor beneficial impact; green - Significant beneficial impacts, red - Significant adverse impact and deep red - Major adverse impact. As an example, to understand Table 4 above, soil erosion will not pose adverse negative impacts in the present and low growth scenarios because the developments are still within the carrying capacity, however adverse impacts are likely to happen due to developmental pressure as indicated by dark red. Another example is "Opportunity for visitor education and knowledge on Falls' ' which is currently good (minor beneficial impact) as indicated by the light green on the present and low growth scenarios. However green, stands for significant beneficial impacts and is on all the later growth scenarios assuming an increase in marketing through embracing technology (digital marketing) will result in increase on dissemination of relevant information of the world heritage site.

7.3.2 Carrying Capacity and Future Limits of the Rainforest

The carrying capacity of the rain forest is also likely to be exceeded particularly just after the COVID-19 pandemic as increased visitation is anticipated. However, this is likely to be short term. In the long run a gradually increasing tourist numbers will be expected as travel becomes easier due to improved transport networks. The visual impacts from tourism development will be anticipated as space is running out. Tourism developments may take place outside the core are of the WHP but may be close enough to have visual impacts.

7.3.3 Pressure Upon Forested Areas

One of the most pressing problems arising out of population growth and urban expansion is the pressure on the woodlands which surround Victoria Falls city. This comes about from three different factors - the clearance of woodland to make way for agriculture (mainly subsistence), the cutting for fuel wood and charcoal production, and selective cutting for curio curving. The curio business becomes more attractive with increased demand from tourists during peak seasons. A high growth in tourist arrivals will likely increase curio trade and would certainly impact on selected tree species for curving.

7.3.4 Future Impacts, Carrying Capacity and Limits of Use of Forest

Future impacts are related to the loss of woodland from deforestation and land use changes. Another emerging threat is overgrazing from increased livestock. The conversion of land into farming has seen the loss of communal forest. Communal farmers are now encroaching into national protected forest areas in search of grazing land. The limits to use may be experienced as a result of improved rural electrification that may come with the BGHES. Use of renewable solar energy may also reduce threats from deforestation.

Forests: In Zimbabwe the forest resources are found on State Forest, Private, Communal land and Tribal trust Land. The use of forest resources is regulated by national legislation. However, open access use to resources is a main characteristic of communal land. Illegal exploitation of forest resources occurs in state protected forest and private land. Assuming different growth scenarios, forests, communal land and tribal trust lands may be impacted (Table 7.3).

Table 7.3: Ecological impact on forest, communal land and tribal trust lands on the Zimbabwean side. T - Impacts then (perceived impacts in 1996); N - perceived impact now; F - Future anticipated impact

Ecological Impact	**Growth Scenario**														
	Present			**Low**			**Medium**			**High**			**Super**		
	T	**N**	**F**	T	**N**	**F**	T	**N**	**F**	T	**N**	**F**	T	**N**	**F**
Increased threat of deforestation in search for fire wood, charcoal making, timber and wood for curio															
Land degradation from overstocking															
Loss of habitat for wildlife															
Increased human wildlife conflict															

As shown in Table 5 above, white indicates no impact, orange minor impact and red significant adverse impact. As an example, to understand Table 5 above, "increased threat of deforestation in search for firewood, charcoal making, timber and wood for curio on present growth scenario has no significant impacts, however a steady increase is shown on low to medium where minor impacts will be experienced. High and super growth scenarios show significant adverse impacts on the threats of deforestation; this may be accounted for by high growth, which means an increase in population will call for more resources.

7.3.5 Impacts for Water Abstraction

Description of impact assuming different growth scenarios on water abstraction is illustrated in Table 7.4.

Table 7.4: Summary of Impacts on Water Abstraction. T - Impacts then (perceived impacts in 1996); N - perceived impact now; F -Future anticipated impact

Ecological Impact	**Growth Scenario**														
	Present			**Low**			**Medium**			**High**			**Super**		
	T	**N**	**F**	T	**N**	**F**	T	**N**	**F**	T	**N**	**F**	T	**N**	**F**
Low levels of flow impacting on natural value															
Less spray for the falls to keep vegetation vibrant															
Disturbance to aquatic fauna															
Possible loss of biodiversity															
Invasion by alien L. camara															
Disturbance to wildlife															
Possible increase in water pollution															

As given in Table 7.4, white indicates no impact, orange - minor impact and red - significant adverse impact. To understand Table 6 above, water abstraction currently does not have significant impacts on "disturbance to wildlife" especially the aquatic life however the Table shows that on super growth scenario with red - significant adverse impacts on wildlife might occur assuming increased development that will increase water abstraction, which in turn could affect the wildlife ecology.

7.4 Tourism Development Scenarios

Various data sources have been used to generate the tourism growth scenarios. These included:

1. The visitor statistics for tourist arrivals obtained from the Ministry of Tourism and Arts;
2. Areas earmarked for tourism development area, Zambia Tourism Master Plan (2018-2038), Ministry of Tourism and Arts, (2018);
3. Visitor Statistics to the Victoria Falls, from the National Heritage Conservation Commission (NHCC);
4. Visitors to the Livingstone Museum, from National Museum Board;
5. Visitors to the Mosi-Oa-Tunya National Park, from Department of National and Wildlife; and
6. Tourism Investment Guide, Ministry of Tourism and Arts.

In this study, four scenarios of low, medium, high and super growth (Table 7.5) in visitor numbers over the next ten (10) years have been developed from figures obtained from the Ministry of Tourism and Arts and other tourism statutory bodies. In developing these predictions, assumptions were made with regards the status of the Victoria Falls as a tourist destination.

Table 7.5: Scenario for tourism developments in the Victoria Falls area

		PRESENT	LOW	MEDIUM	HIGH	SUPER
Yearly Visitor Staying	Zim	220,000	440,000	660,000	1,100,000	1,100,000
	Zam	52,800	104,720	151,800	282,000	634,000
	Total	**220,000**	**440,000**	**660,000**	**1,100,000**	**1,100,000**
	Zim	603	1,205	1,808	3,014	3,014
	Zam	235	322	723	1,315	2,630
	Total	**838**	**1,527**	**2,531**	**4,329**	**5,644**
Average Day, Day Visitors	Zim	30	60	90	151	151
	Zam	14	26	37	66	166
	Total	**44**	**86**	**127**	**217**	**317**
Total Average Day, Visitors	Zim	633	1,265	1,898	3,165	3,165
	Zam	162	291	404	734	1,858
	Total	**795**	**1,556**	**2,302**	**3,899**	**5,023**
Rooms Required	Zim	1072(+381)	2,135	3,204	5,340	5,340
	Zam	2560(+392)	1,280	1,786	2,756	4,512
Bed Spaces Available	Zim	2144(+762)	4,310	6,406	10,680	10,680
	Zam	5329(+60)	2,236	2,789	3,634	7,268
	Zim	2,144	4,310	6,406	10,680	10,680
Max. Visitors/Day (Capacity Day)	Zam	854	1,316	1,864	3,128	7,782
	Total	**2,998**	**5,626**	**8,270**	**13,808**	**18,462**
Average No. of Campers/day	Zim	150	301	452	753	753
	Zam	56	92	126	234	576
Hotel Area Required (Hectares)	Zim	71(+22)	159	238	397	397

	Zam	59(+5)	53	69.0	120.0	280
Increase in Rooms	Zim	-	+700	+1750	+3887	3,887
	Zam	-	+392	+423	+1,507	4,515
Number of Different sized hotels and Lodges required						
Large Hotels-150-250 Rooms	Zim	1+1	-	+1	+3	+3
	Zam	+1	-	-	+1	+5
Medium Hotels- 75-150 Rooms	Zim	5+1	+2	+5	+10	+10
	Zam	+1	+1	+2	+3	+5
Small Hotels- 25-74 Rooms	Zim	3+2	+4	+8	+10	+10
	Zam	+3	+2	+4	+5	+10
Lodges - < 25 Rooms	Zim	9	+7	+12	+30	+30
	Zam	8+6	+4	+8	+15	+20
Campsites	Zim	2	+1	+2	+3	+4
NB: Figures in brackets with a + sign indicates the number of each item under construction or in the pipeline						

To understand Table 7.5, one has to assume, for example, that:

1. Number of rooms will have an increase 392 rooms, due to the construction of hotels and lodges;
2. Maximum number of Visitor to the Victoria per day is expected to increase to 854 at present to 7,782 on a peak day for a super growth; and
3. One big hotel at present which is under construction will have more than 200 rooms.

7.4.1 Scenarios for Tourism Activities and Facilities in the Victoria Falls Area

The next ten (10) years scenario was developed (Table 7.6) in relation to tourism activities and tourism facilities in the study area. The following factors are required to be considered in order to sustain the tourism industry in the study area.

1. Political stability, that allure tourists and tourism investments;
2. Trends in the World demand for tourism remains uncertainty due to the global COVID-19 Pandemic;
3. The aesthetic beauty of the Victoria Falls is not diminished by increased visitor numbers or by altered river flows; and
4. Infrastructure developments for international travel facilities such as roads and airports can manage with the increased numbers of visitors.

Table 7.6: Scenarios for Tourism Activities and Facilities at the Victoria Falls (Ministry of Tourism and Arts 2020)

		PRESENT	LOW	MEDIUM	HIGH	SUPER
Average Day, Visitors Total		823	1,607	2,373	4,026	5,353
		988	1,928	2,848	4,831	6,424
Capacity Day, Visitors Total		3,135	5,466	8,008	13,592	18,058
		3,762	6,559	9,610	16,310	21,670
Rain Forest Walk	Zim	407	813	1,220	2,034	2,034
Average No/Day	Zam	122	220	306	555	1,405
	Zam	146	264	367	666	1,686
	Total	**529**	**1,033**	**1,526**	**2,589**	**3,439**
Max/Hr. on Average Day	Zim	106	207	305	518	688
Max/Hr. on Capacity Day	Zam	392	683	1,001	1,699	2,257
	Zam	**470**	**820**	**1,201**	**2,039**	**2,708**
Cruise Boats on River	Zim	411(+130)	813	1,220	2,034	2,034
Capacity of cruise boats (Persons)	Zam	240	220	306	554	1,406
	Zam	**288**	**264**	**367**	**665**	**1,687**
Persons carried on an average day	Zim	288	569	854	1,424	1,424
	Zam	86	154	214	388	984
	Zam	103	185	257	466	1,181
Boats on River on Average Day	Zim	13	25	39	65	65
	Zam	3	7	10	18	45
	Zam	5	8	12	14	46
	Total	**21**	**40**	**61**	**97**	**156**
	Zim	8+8	12	20	33	33
Jetties	Zam	2+1	4	5	9	23
	Zam	9 +9	18	21	26	30
Canoe Trips: Trips/Yr.	Zim	1,900	3,813	5,720	9,533	9,533
	Zam	572	1,031	1,430	2,600	6,587
	Zam	601	1,083	1,502	2,730	6,916
	Total	**2,472**	**4,844**	**7,150**	**12,133**	**16,120**
Persons Carried	Zim	22,800	45,760	68,640	114,400	114,400
	Zam	6,864	12,376	17,160	31,200	79,040
	Zam	7,207	12,995	18,018	32,760	82,992
	Total	**29,664**	**58,136**	**85,800**	**145,600**	**193,440**

Av. Trips/Day	**Total %**	**6.8%**	**13.3%**	**19.7%**	**33.0%**	**44.2%**
Rafting: Total Persons/yr.	Zim/Zam	50,000	98,525	144,375	245,000	325,500
	Zim/Zam	51,000	100,496	147,263	249,900	332,010
Average Boats/day	Zim/Zam	20	39	57	96	127
	Zim/Zam	20	40	58	98	130
Max Boats on River/day	Zim/Zam	55	96	141	243	317
	Zim/Zam	56	98	144	248	323
Vehicles in Zambezi NP						
Total Day Visitor/year	Zim	44,000	88,000	132,000	220,000	220,000
Vehicles on Average Day	Zim	30	61	90	150	150
Vehicles on Capacity Day	Zim	107	215	320	534	534
No. of persons carried/year	Zim/Zam	44,372	89,550	133,122	221,870	292,657
Flights/yr.	Zim/Zam	11,662	22,380	33,280	55,500	73,164
Average Flights/day	Zim/Zam	32	61	91	152	200
Flying time per day(hrs.)	Zim/Zam	15.5	30.5	45.5	76	100
Number of aircrafts (fixed wing + helicopters)	Zim	7	10	12	15	18
Increase in ancient noise level	Db(A)		+2.8	+4.5	+6.7	+9
	Zam	2	-	-	+2	+3

NOTE:

1. Highlighted in RED, are figures for Zimbabwe from the 1996 SEA report.
2. Highlighted in GREEN, are figures for Zambia, which I have made predictions based on the tourism developments in the pipeline.
3. Highlighted in YELLOW, did not change anything, I have no data on the aviation industry.
   Refer to the 1996 SEA report.

The scenarios implies that there is need for high potential demand for tourism facilities and activities, and therefore an impact on the demand of tourist facilities and activities in the area is inevitable. The following are the implications from the above figures in Table 5:

1.There is a high likelihood of increased demand to construct more hotels to meet the envisaged accommodation demand for tourists;

2.The City of Livingstone is envisaged to grow in populations as employment opportunities in the tourism industry will increase;

3.Most service providing companies are likely to expand their capital base while meeting the demand in tourism industry;

4.It is envisaged that there will be pressure exerted upon the surrounding forested areas for fuel wood, clearance of agricultural land and raw material for curio making; and

5. There will be a diversification in tourism activities and services offered besides the current one.

7.4.2 Predicted Development Scenarios from 2020 to 2030

As the population continues to grow in the Property, it is expected that there will be a need for the urban land to be extended so as to provide infrastructure and other developmental needs for the population. Although Livingstone City Council has areas zoned for development, the anticipated expansion of urban land will not always conform to the city's plan, therefore it is expected that existing unplanned settlements at the periphery of the urban area will continue to expand outwards. This expansion will be towards the protected areas of the national park, forest reserves and water bodies hence there is a need to plan for protection measures especially adjacent to the WHP.
It has been observed that unplanned settlements are expanding near water bodies in the area such as Dambwa Stream, Sinde, Maramba and Nansanzu rivers. The surrounding community use these water bodies for domestic use and agricultural purposes and it is expected that there will be a continued trend to settle near and around these water bodies as a result of worsening drought conditions that have been experienced in the area in the last 20 years. Water bodies in the area are important tributaries of the Zambezi River and provide additional water sources for wildlife, however, activities conducted along the tributary affects the Zambezi River.

7.5 Zoning for New Tourism Developments

The 1995 SEA indicated that there was not any proper zoning for developments in the area. As of 2021, there exists specified development zones and land uses in both Livingstone and Kazungula districts, defined by the local authorities for tourism and hospitality land uses in the area for tourism development and investment. The National Heritage Conservation Commission and the Department of National Parks and Wildlife have defined zones within Mosi-Oa-Tunya National Park (Figure 7.2). These zones specify the type of and where developments can occur within the park.

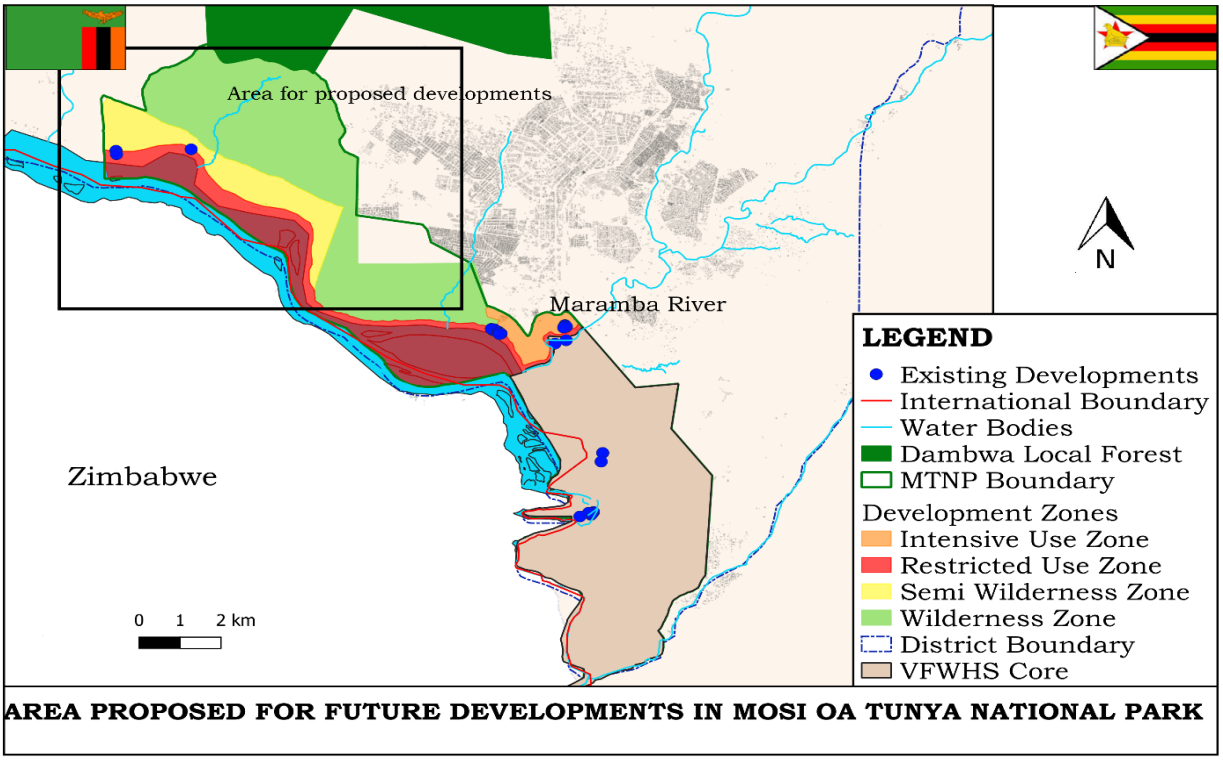


Figure 7.2: Area Proposed for Future Developments in Mosi-Oa-Tunya National Park, Zambia. VFWHS= Victoria Falls World Heritage Site/Property

The area south of the Maramba River is the core of the World Heritage Property, developments in this area are restricted. Therefore, zoning for new tourism developments have been proposed north of the Maramba River taking into consideration of the different development zones as defined by the Department of National Parks and Wildlife. Of the four zones defined in this area, the semi-wilderness zone allows for some types of developments to occur. Therefore, zoning for new proposed tourism developments in this zone (Zambia Wildlife Authority, 2006). On the Zimbabwean side, the new and proposed developments within the 30km radius is evidenced by the generous land allocations leading to new developments. Victoria Falls City has managed to gradually change into a different and unique environment over the past decades (The Victorian, 2017).

Victoria Falls City Status

Victoria Falls was proclaimed a city with the formal colourful ceremony of conferment of the new status being presided over by President Mnangagwa on the 9th of December 2020 (GOZ, 2020). The new status recognises its national and global importance as the capital and hinge of Zimbabwe's tourism industry, as well as putting it on an equal footing with its older twin across the river, Livingstone (The Victorian, 2020).

Tourism infrastructure

Tourism is a fast-growing industry and a valuable sector, contributing significantly to the local economy and society making it an important economic, social and cultural activity in many societies, both in developed and developing countries (Telfer and Sharpley, 2007). Victoria Falls National Park has become a centre for 'extreme sports' with white-water rafting, bungee-jumping, abseiling and a gorge swing which are new sports for the Tourism City all in operation (Rangarirai and Sibanda, 2016). This has further attracted a number of safari camps, hotels, lodges and other tourist facilities within the 30km radius of the World Heritage area. Figure 7.3 shows some of the Tourism infrastructure within Victoria Falls and its 30km radius. According to Rangarirai and Sibanda, (2016) the tourism industry in Zimbabwe is one of the good performing industries; it could be better had it not been for the current macro-economic challenges facing the country. The government has facilitated the development of tourism support facilities and services that include hotel and accommodation, conference facility, sightseeing, Tourism hospital, (Madzara, 2012). Figure 7.4 shows some of the sites that have been proposed in order to improve tourism infrastructure and industry.

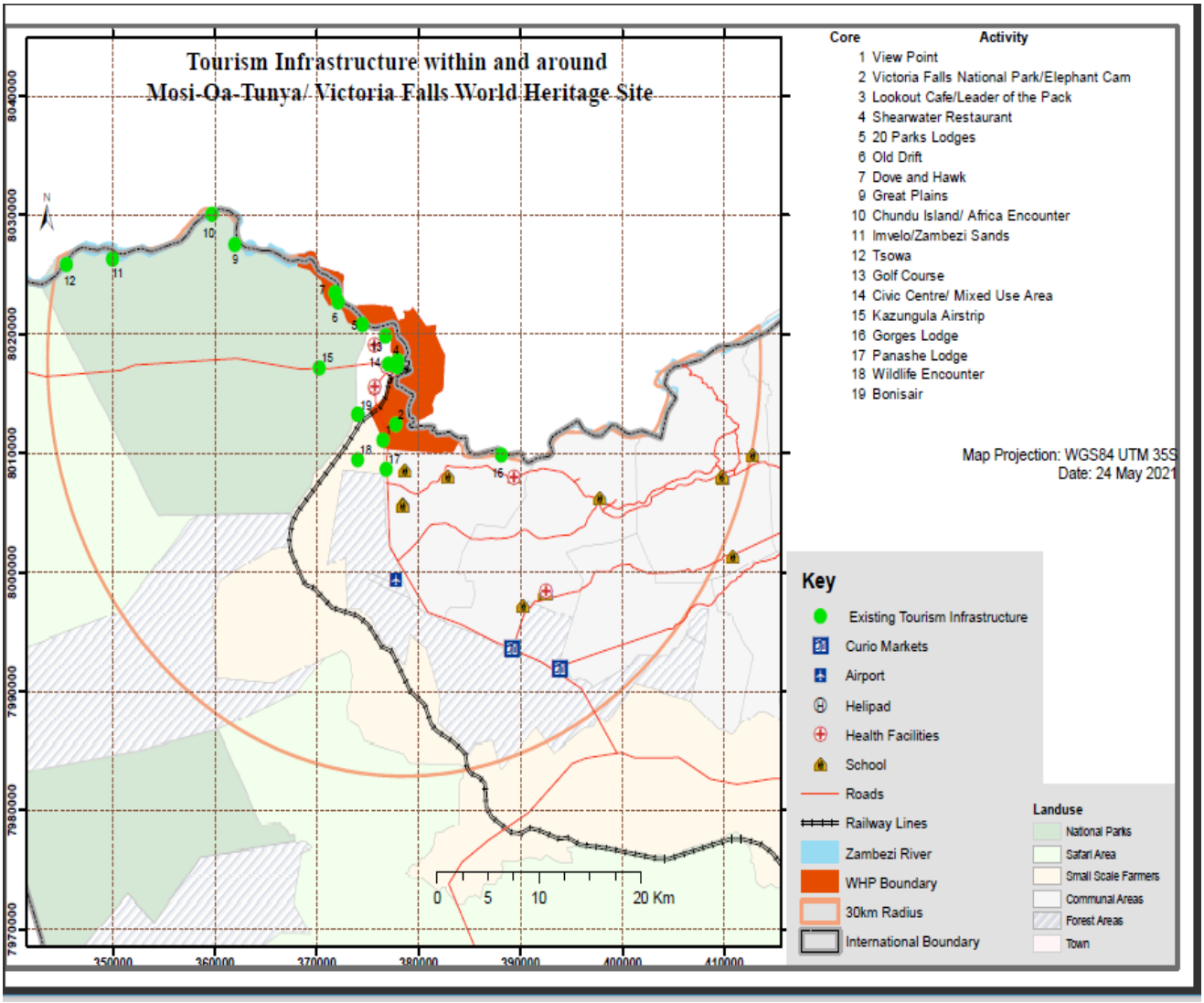


Figure 7.3: Showing Tourism infrastructure within and around the World Heritage Site (Field Mapping, 2021)

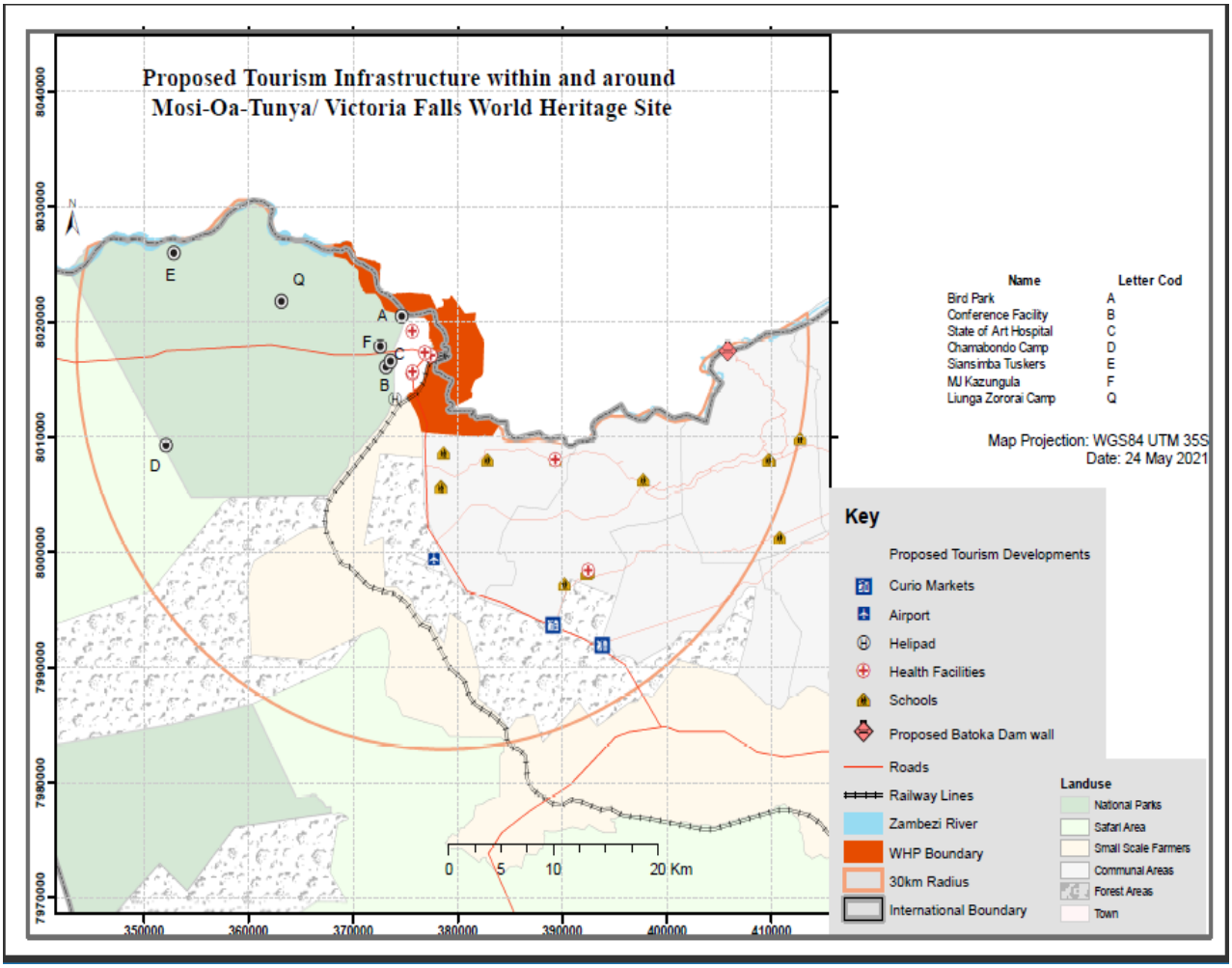


Figure 7.4: Proposed Tourism Infrastructure Development Source: (Field Mapping, 2021)

Masuwe Estate Tourism Integrated Park

Integrated business parks are a modern part of development, as they encompass a one-stop-shop for businesses because they are carefully planned to cater for the necessary needs. It is expected that the integrated business park will include access roads, parking facilities and landscaped gardens (GOZ, 2020).

The Mosi Oa Tunya Development Company will spearhead tourism infrastructure development in Masuwe Estate in Victoria Falls, in partnership with relevant Government ministries and agencies and private sector partnership. Its work will result in the modernisation of Victoria Falls to ensure business and tourism complement each other for the modernisation of the tourism resort. Through this company, investors, especially those in the tourism sector, will be attracted to set base in the greater Victoria Falls area (Herald, 2020). Mosi-Oa-Tunya Development Company is mandated to establish an integrated park in Masuwe Estate, which is set to change the way of doing business in Victoria Falls. The Park will result in the development of infrastructure, including hotels, shopping malls, a medical facility, a convention centre and an upmarket golf course. Casinos, a

theme park, presidential villas, town houses, offices and banking halls will also be part of the business integrated park (GOZ, 2020).

Special Economic Zone

For developing countries, special economic zones (SEZs) traditionally have had both a policy and an infrastructure rationale (Murota, 2017). In terms of policy, the SEZ can be a useful tool as part of an overall economic growth strategy to enhance industry competitiveness and attract foreign direct investment (FDI) (Baissac, 2013). The designation of a swathe of land around Victoria Falls, stretching up to Binga, has been made a special economic zone and is set to provide the impetus for investment and further development of the area. It is expected that the special economic zone will host integrated resorts, research, innovation and educational parks, medical and recreational parks, power generation and aquaculture (Herald, 2021).

Victoria Falls International Airport

The recent expansion of the Victoria Falls International Airport by China Jiangsu International Economic and Technical Cooperation Group Ltd (CJI) has been credited for increased tourist arrivals. The expansion improved the equipment and facilities, as well as the capability of safeguarding civil aviation security, with a number of airlines now flying directly to the resort city. Wide body airplanes such as Boeing 747 and 767 and Airbus 340 and 380 can now take off or land on the newly-built airfield runway (Herald, 2020).

Victoria Falls Stock Exchange

The Victoria Falls Stock Exchange is operated by the Zimbabwe Stock Exchange Limited, and is ready for take-off after the Exchange Control (Special Provisions for Securities Listed on Victoria Falls Stock Exchange) Regulations were published under Statutory Instrument 196 of 2020 recently. What differentiates this stock exchange is that securities listed on it will be traded solely in US dollars or any other convertible currency (GOZ, 2020). The importance of denominating the stock exchange in US dollars is that it allays fears of investments being eroded. This means the Victoria Falls Stock Exchange will be able to attract investors from different parts of the world, who will be able to raise capital from the bourse for investing in other projects (GOZ, 2020). End Zimbabwe

7.6 Mitigation of Cumulative Impacts of the Tourism Growth Scenarios

The cumulative environmental impacts relate to tourism growth can be alleviated through investment in green energy, controls on solid and liquid waste, adoption of recycling systems for solid, organic and liquid waste; increasing maintenance of roads and paths, use of earth colours to prevent visual pollution, energy saving lighting and well-maintained vehicles and equipment to reduce noise and air pollution. Controls can be used to limit the number of people taking up particular activities, e.g., entrance to the rainforest, canoe trips etc. Some adverse impacts, however, entail a real loss of resource - loss of habitat, deforestation, loss of biodiversity and

destruction of archaeological sites are examples of this. The costs of this may be reflected in loss of wilderness value and hence in tourist revenue.

8.0 PLANNING AND MANAGEMENT OF RESOURCES OF VICTORIA FALLS

The management of the Victoria Falls and the rainforest of the World Heritage Site require that:

1. ***As tourist numbers grow, protection will have to be increased by the following measures***:
   1. Manage time spent by visitors in the rain forest by charging additional fees for overstaying so as to reduce the number of people at any given time;
   2. Create common rules for large groups;
   3. Rehabilitate pathways and sides to prevent erosion;
   4. Agree on common safety measures and improve barricades to reduce accidents;
   5. Agree on fire prevention such that there is no smoking in rainforest;
   6. Agree on standards for visitor facilities;
   7. Improve rainforest entrance and car parks;
   8. Improve visitor facilities outside rainforest;
   9. Improve waste management and recycling; and
   10. Improve environmental interpretation for World Heritage Site to create awareness on the need to protect the resource.
2. ***Ecosystem management measures necessary for maintaining the rainforest include***:
   1. Carry a systematic manual and chemical eradication of *Lantana camara*; and
   2. Rehabilitation of rainforest with indigenous species.
3. ***Riverbanks and Riparian Forest measures:***
   1. Consider rolling out of afforestation program of indigenous plants;
   2. Protect plants from elephant damage by adopting environmentally friendly methods;
   3. Enforce EIAs EMF for tourism developments along rivers; and
   4. Manipulation of game water in the interior of the park to relieve pressure on vegetation along the Zambezi River.
5. ***Recommendations for Jetties include***:
   1. Guidelines for jetty construction;
   2. Restrictions on the number of jetties;
   3. Jetty design criteria; and
   4. Study on the riverbank marina on the Zimbabwean side.
5. ***Recommendations for islands on the river include*:**
   1. Consider islands as Specially Protected Areas;
   2. Consider no developments on islands within the World Heritage Site;
   3. Consider temporary campsites to be permitted on islands outside the World Heritage Site;
   4. Permit access of day visitors to most islands;

5. Restrict access to Siloka Island;
6. Consider other islands to be designated "no access" islands;
7. Consider establishing fish breeding reserves;
8. Adopt an “island” scheme for tour operators; and
9. Erosion control measures.

10. National parks and Wildlife areas recommendations include:

1. Limit development in protected areas by scientifically based management plans and park zonation;
2. Maintain a buffer zones around national park;
3. Avoid use of fences to ensure flow of genetic material;
4. Management and monitoring of artificial waterholes;
5. Pursue policies of compatibility of land use upstream of the Victoria Falls.;
6. Measures to reduce poaching pressure;
7. Adopt and try out elephant population control measures to reduce pressure on vegetation;
8. Monitor and prevent vehicle numbers, damage to roads, speed limits in parks;
9. Strengthen the institutions of national parks through training and financial resources; and
10. Involvement and co-operation of tour operators in park and wildlife management.

11. Forest areas and the curio trade

In order to protect the forests on both communal and forest lands from a combination of firewood cutting, poaching and curios, the regulation and enforcement, together with the provision of alternatives for both fuelwood and employment is required. This should include:

1. Tree planting program for fuelwood, timber for commercial use and curio;
2. Promotion of agro-forest in the rural areas;
3. Promotion of fuel-efficient stoves;
4. Increased electricity supply;
5. Commission more studies on curio wood management; and
6. Encourage and fund alternative solar energy projects.

In Zimbabwe, the stakeholders commented on the socio-economic activities as outlined in Table 8.1

Table 8.1: Stakeholders Comments – Socio economic activities in Zimbabwe

STAKEHOLDER	COMMENTS
District Development Coordinator (DDC)- Hwange District	1. The property contributes to the GDP of the District and it must be maintained into the future. 2. The site must be maintained in its natural state and development in the red zone must be discouraged.
Hwange Rural District Council (HRDC).	1. The property must be kept in its pristine state so as to maintain its appeal and appetite to the international community. 2. Stream lining pricing and increase entry fees to reduce visitor ship pressure on the property. 1. Hotels, lodges, activities such as jetting and helicopter rides affecting the property. 2. Solo management from ZIMPARKS

	3. Poor coordination in marketing causing South Africa marketing it as theirs. 4. Collate visitors' data and figures 5. Control development of hotels, lodges and activities 6. Any development in the Park to be seconded by stakeholders
Forestry Commission	1. In Situ conservation of biodiversity in the rainforest. 2. Take all necessary steps in continued conservation and protection of the property 3. High degradation due to wood harvesting for power and charcoal. 4. Intensify reforestation in the park 5. Use alternative energy sources such as solar 6. Conduct awareness campaigns
Department of Land Management	1. Tourism Industry Development, that is, employment creation and revenue collection. 2. Lives lost with people falling into the gorges. 3. Make safety plans to avoid people falling into the gorges. 4. Local cultural activities enrichment to discover the intangible side of the site.

8.1 Management Plans

One of the major concerns in 1995 for the future was the lack of coordination for planning and management within the different agencies in each country and between the two countries (Goriupand Harvey, 1997). There were no formal mechanisms for stakeholder involvement in the planning and management processes. To address this shortfall a number of institutional arrangements were put in place. One of the key developments was the preparation and adoption of a Joint Site Management Plan (JSMP) for the WHP. This has been driven by the Joint Management Committee (JMC) with assistance from a Joint Technical Committee (JTC) with membership from government agencies from both Zambia and Zimbabwe on issues affecting the WHP. This has positively affected the protection and management of the WHP (Mosi-Oa-Tunya/Victoria Falls | Natural World Heritage Sites).

As indicated earlier, the primary and secondary factors affecting positively the WHP include management and institutional factors such as use of management plans and legal framework, which have helped in the conservation of natural heritage. This has been addressed in capacitating the human resources through training and capacity building. Technical and site managerial level has also been going-on. Both state parties through various government agencies have put in considerable financial and material resources towards activities in the management and protection of the WHP. Governance issues have also been addressed to a greater extent through involvement of grass roots citizens, stakeholders, women and the youth in various programmes. Biological resources using modifications in various forms have also ensured the persistence of endangered and vulnerable species of mammals and birds**.** Creation of Vulture Safe Zone (VSZ) for suitable habitat with food sources, in addition to protection from poisoning has been undertaken. Protection of large nesting trees such as African Baobab from elephant damage has also been going on. The Victoria Falls vulture restaurant and Victoria Falls crocodile farm attract hundreds of vultures. Other examples include that Bird watch Zambia has secured 15,000 ha of the Chisamba Important Bird Area (IBA) for the benefit of vultures and natural ecosystems in general. Social cultural use of heritage as a tourism product has also ensured that the traditional practices survive.

In conformity to the dictates of the World Heritage Convention, the state parties of Zambia and Zimbabwe have been reporting on the state of conservation of the property on an annual basis including working on addressing some of the issues raised for example in the 2001 and 2006 UNESCO reaction missions (UNESCO World Heritage Centre - Reactive monitoring Process).

8.2 Recommendations to Avert the Impacts from 2021 to 2030

The following are recommendations:

1. Ministry of Tourism, Environment and Natural Resources through the Livingstone Forestry Department, will work with other stakeholders in developing deliberate policies to protect the local forests in the area and the development of Joint Management Plans for Dambwa and Simonga Local Forests. The policies and plans will reinforce protection, define development and protection zones, identify stakeholders and their roles in management and identify sustainable practices that can be conducted in the forests reserves;
2. There exists specified land uses and development zones within the property defined by plans and policies developed by institutions such as National Heritage Conservation Commission, Department of National Parks and Wildlife and Livingstone City Council; and legislation (such as the Urban and Regional Planning Act, Environmental Management Act, Zambia Wildlife Act, National Heritage Conservation Commission Act, etc.) intended to guide development and protect the environment. It is recommended that the multi-sectoral Joint Site Management Committee is strengthened and continues to enforce these policies and legislation. These should be strengthened as they offer protection to the natural resources surrounding the Victoria Falls Property by defining areas where development and the type of development can occur in the Property;
3. Ministry of Tourism and Arts and National Heritage Conservation Commission will lead a collaborative effort with all relevant stakeholders, to define new development zones in and around the area, especially for tourism and hospitality land uses, to ensure that new developments do not compromise the OUV of the Victoria Falls Property;
4. On the **Zimbabwean side downwards**, consensus on concerted management efforts and those institutions should use stakeholders' management approach instead of solo management by ZIMPARKS, Zimbabwe Tourism Authority and Victoria Falls Council;
5. Consensus that the project has economic benefits as it will generate revenue for the country and Zimbabwe Parks and Wildlife Authority;
6. The pricing to be adjusted upward to reduce overcrowding by tourists;
7. Loss of biodiversity due to population growth and demand for energy;
8. Destruction of animal habitats as a result of the cutting down of trees and removal of some other vegetation such as grass;
9. Pollution of the Zambezi River through waste disposal (liquid and solid). This pollution ranges from groundwater pollution as a result of the sewer system and affluent to the rivers, and pollution of the environment due to littering and poor disposal;

10. Habitat fragmentation is likely to occur due to structures within the wildlife corridors thus leading to human wildlife conflict; and
11. Loss of cultural values on the property, soil erosion and land degradation.

9.0 STRATEGIC ENVIRONMENTAL AND SOCIAL ASSESSMENT RECOMMENDATIONS

In order to meet the high-end scenarios, the Zambia Tourism Agency (ZTA) was established under the Ministry of Tourism and Arts. The Agency is mandated to identify, package and market Zambia's cultural and natural tourism products to both domestic and international markets. In the period under review and going forward, the agency developed and employed various marketing strategies to market the Victoria Falls both at domestic and international platforms. Domestically, the Agency showcased Zambia's tourism potential at the Zambia Trade Fair, Provincial investment expositions, Agriculture and Commercial shows, Livingstone International Cultural and Arts Festival (LICAF). Through the Ministry of Tourism and Arts, the Agency has commemorated the World Tourism Week exhibiting different tourism activities aimed at promoting both domestic and international tourism products. Internationally, the Agency has over the years marketed the destination by attending and expos exhibiting Zambia's diverse rich cultural and natural heritage. Similarly, on the Zimbabwean side positive profiling of the property is on-going through international and local marketing exhibitions. Pursuant, the tourism activities in the Victoria Falls, a section of the business operators in Livingstone, Tour Operators, indicated sustainable tourism practices that should maintain the pristine of the area, calling for a number of practices to be upheld in the area. The 38 percent majority of the tour operators have been implementing the no use of plastics, 23 percent planting trees (this is an ongoing activity), 20 percent solar energy installation and 5 percent environmentally friendly engine boats (Figure 9.1).

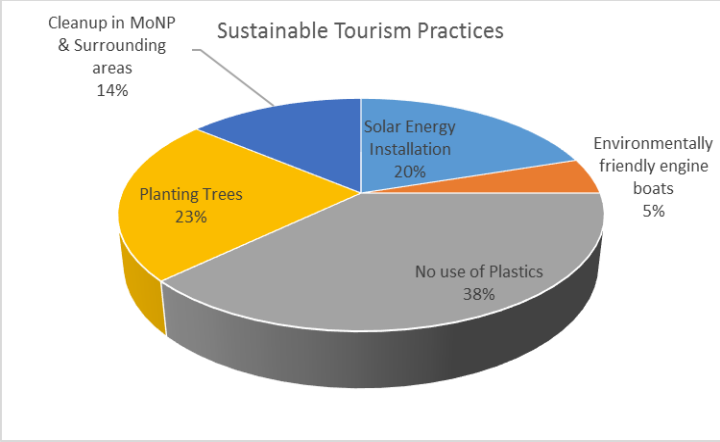


Figure 9.1: Sustainable Tourism Practices in the Victoria Falls area

They felt that the Victoria Falls is the main tourism attraction, forex earner and asset to a wide range of businesses in the City of Livingstone. It is the main propeller that supports the supply chain to various businesses. The property facilitated 80% in terms of accommodation with an average stay period ranging from 1 to 5 days, 14% of tour operation, 6% in restaurant businesses scaling up the much-needed employment and forex in the country. This could only happen if the following observations are upheld:

1. Tourism developments at Victoria Falls and its surrounding areas, should adhere to the UNESCO guidelines and the existing Joint Integrated Management Plan;
2. Sensitize all tourists to adhere to the rules, avoid littering, use designated walking trails in order to preserve the natural flora;
3. The ongoing control and eradication of invasive alien species in the Area should be upheld in order to preserve the natural aesthetics of the Area;
4. Tourism infrastructure development in the high ecological sensitive zone must be discouraged as this would negatively impact the integrity of the Property;
5. The Batoka Hydro Dam construction must adhere to UNESCO guidelines to protect the integrity of the property;
6. Water abstraction for hydroelectric generation by ZESCO should be controlled especially during the low water season to attract tourists on the Zambian side;
7. The Forestry Department should strictly monitor deforestation in the Area; and
8. It is a tourism product and a business asset.

The tourists were excited to visit the Victoria Falls based on the following features: 22% Waterfalls; 19% Aesthetic beauty; 16% Victoria Falls Bridge and Landscape; (10%) Zambezi River and Boiling pot 10% and 7 % Gorges (Appendix 9.1). The tourists were motivated to visit the Victoria Falls through the following: 38% Aesthetic beauty; 33% Friends or family influence; and 29% Adverts on social media.

In order to make Victoria Falls a choice for tourists, those interviewed indicated the following should happen (Appendix 9.2): guidelines on dos and don'ts should be improved 25%; need for Information Centre 21%; construct additional barriers along the walkways 15%; audio guides devices 14%;
limiting visitors access 7%; more marketing 5%; installation of lift to the boiling pot; Internet Connectivity (Wi-Fi); Signage to be improved 3%; and 2% change rooms. For infrastructure development at the Victoria Falls tourists indicated as follows: 11% construct more change rooms; 4% construct a barrier at the boiling pot; while 62 % affirm that there is adequate infrastructure; and 23% propose for more infrastructure.

We thus recommend the following strategic environmental and social assessments directions:

1. Take measures to ensure robust ESIA for all potential projects within and outside the WHS, the World Heritage Impact Assessment principles are given full consideration as per the 2013 World Heritage Site Advise Note on Environmental Impact Assessment;

2.Take steps to limit the visitor accommodation facilities in line with the medium growth scenario as a maximum for the Victoria Falls area;
3.Continue to promote the policies of low volume, high value tourism in both countries with emphasis on the continuing high Wilderness Value in the area;
4.Consider the World Heritage Site as a shared resource to manage under agreed common policies;
5.Harmonization of land use policy and regulations in each country and joint management policy and plan for the property;
6.Advocate for the speed up process on the preparation of a statutory Master Plan for Victoria Falls City and limit major developments within the city until this is complete;
7.Advocate and implement use of green energy in the urban and adjacent rural areas to reduce deforestation;
8.Advocate for afforestation and reforestation targeting indigenous tree species that are used for timber and the curio industry to ensure long term sustainability; and
9.Strengthen research and monitoring activities within and around the property to provide adequate information to guide policy and developments;
10. National Heritage Conservation Commission to implement the maximum visitor access of 250 at once to the Victoria Falls;
11. National Heritage Conservation Commission and the Department of National Parks and Wildlife to implement the Joint Integrated Management Plan (2016-2021) of the Victoria Falls/Mosi-Oa-Tunya on tourism developments at the Victoria Falls;
12. Department of National Parks and Wildlife to re-force maximum boat restriction on the river at any given time, to avoid pollution;
13. The Department of Forestry working with the Zambia Environmental Management Agency to sensitizing the charcoal burners and curio traders on effects of cutting trees on the environment and the Victoria Falls;
14. The Zambia Environmental Management Agency to enforce policy on the prohibition of non-biodegradable plastic use which are not environmentally friendly;
15. The Zambia Revenue Authority (ZRA) to develop a fast truck clearing system at the border post to avoid visual pollution.
16. Regularly monitor the status of biodiversity, control of *lantana camara,* the impacts of anthropogenic activities on the WHS;
17. Conservation planning should be integrated with climate risk assessment;
18. Increase landscape connectivity of protected areas by creating migratory corridors;
19. Conduct economic valuation of ecosystems;
20. Evaluate the effectiveness of different management programmes and interventions;
21. Invest in focused research and develop monitoring systems;
22. Implement the existing monitoring and fire management plans;
23. Extend re-vegetation efforts to the Site periphery;
24. Strengthen enforcement of the EIA policy, World Heritage Convention and other supporting legal frameworks;
25. Carry out hydrological studies related to water abstraction and pollution;

26. Join efforts with ZEMA to monitor compliance of tourism and other activities;
27. Build capacity in ecosystem management;
28. Leverage available financing opportunities;
29. On Zimbabwean side, Natural state of Victoria falls should be maintained and any further development be adopted at a new satellite site;
30. Adherence to the terms of reference of the World Heritage Property operational guidelines;
31. There is need for a land bank for future development of the city;
32. Funding for the Completing the Draft Master plan in Victoria Falls City;
33. Need for the city to develop a GIS database that can be regularly updated and accessible to befitting clients;
34. Need for the city to apply GIS and RS in sitting of land uses or zoning such as the selection of ideal sites for landfills and residential zones;
35. Need for the city to rely on hybrid methods that is combining conventional planning methods and use of GIS and RS to inform land use planning;
36. On the **Zimbabwean** side, afforestation, land rehabilitation, use other sources of energy and replacement of cut trees during establishment;
37. Avoid activities that affect the property with no development in red zone;
38. Must also take all the necessary steps to protect the environment; and
39. Employ local people

10.0 CONCLUSION

The tourism developments in the last two decades within the Victoria Falls Area has some significant threats to the integrity of the Property and the Zambezi River upstream and downstream sections. Since the last SEA of 1995, there have been several changes in the spatial appearance of the Victoria Falls World Heritage Site and its 30km radius with extreme population growth resulting in new infrastructure developments such as tourism sites and housing spaces. This has led to increased land use/ land cover changes and has contributed to diverse impacts such as deforestation, gully erosion, urban sprawl, human and wildlife conflict, which need urgent attention for sustainable development and management of the site.

The rock formations in the Victoria Falls namely basalts and Kalahari Sands have structural weaknesses born out of weakened zones (joints and fault lines) and poor consolidation of the rocks respectively. The weaknesses will negatively affect infrastructural development and are prone to soil erosion. Although fossil remains were not recorded within the 30 km radius of Victoria Falls care should be taken when sandstone layers and alluvial deposits are exposed during infrastructural development as the likelihood of finding the remains are there.

Visitors come to Victoria Falls to see the water falling in particular, and therefore increasing rainfall trends have positive implications on maintaining a healthy hydrological environment in

and around the rainforest of the Falls. The dry season's significant decrease of magnitude < - 0.21 mm/month in rainfall has a negative impact on tourism numbers since tourists come to see the high flows and the magnificent waterfalls. The wet (Nov-March) season rainfall magnitudes of the trends > 0.8 mm/month are large even though the trends are insignificant. Future predicted rainfall trends from 2021 to 2050 shows a significant decrease in rainfall for Livingstone/Victoria Falls and Pandametanga stations. The magnitudes of decreasing rainfall are -0.45 mm/year and -0.1 mm/year respectively for Livingstone/Victoria Falls and Pandametanga. This surely implies the rainforest is at risk of experiencing water stress. The decline in average rainfall results in a decline in groundwater recharge and ultimately increase pressure on the available water resources. The water quality has significantly deteriorated in recent years, with 2021 data showing increased pollution and adverse impacts on the outstanding universal value of the site. With population increase and increase in water demand sites, the water is bound to increase from 1995 to 2050 thus putting pressure on the water resources.
However, in general, the VFWHS is intact and the outstanding universal value (OUV) has been preserved. The Falls area continues to conform to the necessary criteria as a 'superlative natural phenomenon' and the ‘most important and significant natural habitat’ where threatened species of animals and plants of outstanding universal value survive'. There have not been any major developments in the property that compromise the OUV. Infrastructure developments have been centered around administration and management structures. While the management framework adopted for the property is effective, there is a need for it to be strengthened through funding to ensure more regular consultations between the structures. Funding remains the major challenge to effectively conduct major conservation initiatives.

Protected areas, particularly the VFWHS, are some of tourism’s main attractions, and are subject to growing impacts and challenges. Maintaining such areas requires adequate practices to guarantee environmentally sound management of the Site and at the same time to ensure that local communities benefit from the existence of this Site.

There are similarities in the structure of rituals conducted among the three main ethnic groups living around the Mosi-Oa-Tunya/Victoria Falls World Heritage Property. The people of Mukuni and the people of Sekute all call their ceremonies as Lwiindi, they have similar material cultures and objectives such as that of calling upon the ancestors for abundant rainfall and good harvest by visiting ancestral graves sites and performing rituals accompanied by songs of praise and petition to the deceased. The people of Musokotwane focus on thanking their ancestors for the victories granted to them over their enemies. Material cultures such as shrines known as *kaanda ka leza* are constructed by both the people of Mukuni and the people of Sekute.

Rituals performed in the Area play a critical role in holding the values of the people and place together. They form the basis of the spiritual value of the Area even though there were inconsistencies in performing the annual ceremonies because of financial constraints and pandemics such as COVID-19.

By learning to “tread lightly” on the earth, not only are we ensuring the future of World Heritage sites but also the future of tourism. Sustainable development encourages a win-win situation for everyone involved: the Site is better protected and maintained, the tourist experiences a more pleasant visit, and the local economy is boosted as a result. However, overall disaster risk reduction strategies are important tools for World Heritage properties and should be systematically integrated into management systems, as stated also in Action 5.1 of the Strategy for Reducing Disaster Risks at World Heritage properties, adopted by the World Heritage Committee at its 31st session held in 2007 in Christchurch, Canada.

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APPENDICES

Appendix 2.1: Conservation Status of selected species as well as threats to these species. Notes to some important threats: D - Development. P - Poaching, HL - Habitat loss, CC - Climate change, HA - Human Activity and HD - Human Disturbance

Species	Population Status	Conservation status at regional level	CITES and IUCN Red List status	Threats
Elephant	Increasing	Economically important species (Dunham, 2008)	**CITES** Appendix II (https://cites.org/sites/default/files/eng/app/2020/E-Appendices-2020-08-28.pdf), Vulnerable	P, HL, HD, CC, HA
Buffalo	Stable	Economically important species (Dunham, 2008)	CITES Appendix II (https://cites.org/sites/default/files/eng/app/2020/E-Appendices-2020-08-28.pdf), near threatened	P, HL, HD, HA
Zebra	Declining	Not threatened	Lower risk	P, HL, D
Kudu	Stable	Not threatened	Lower risk	P
Sable	Declining	Economically important species (Dunham, 2008)	Lower risk	P, HL, D, HA
Giraffe	Stable		Lower risk	
Hippopotamus	Numerous along the river	Vulnerable in KAZA	CITES Appendix II (https://cites.org/sites/default/files/eng/app/2020/E-Appendices-2020-08-28.pdf)	D, CC, HL, HA

			Vulnerable	
Lion	Stable	Globally Vulnerable (Dunham, 2008)	CITES Appendix II (https://cites.org/sites/default/files/eng/app/2020/E-Appendices-2020-08-28.pdf), Vulnerable	P, HL, D, HA
Leopard	Stable	Vulnerable in KAZA	CITES Appendix II (https://cites.org/sites/default/files/eng/app/2020/E-Appendices-2020-08-28.pdf), Vulnerable	HL, D,
Waterbuck	Stable	Vulnerable in KAZA	Lower risk	D, HL, CC
Impala	Numerous	Not threatened	Lower risk	
Warthogs	Stable			
Baboon	Increasing			

Appendix 5.1: List of institutions and people interviewed in the Hwange District within 30 km radius on the Zimbabwean side

Name of Stakeholder/Organization	Person Interviewed	Title
EMA	N. Ndlovu	Environmental officer
Forestry Commission	B. Ndlelambi	District Conservator
Hwange Rural District council	N. Ncube	Environ-Natural Resources Officer
Ministry of Lands and Agriculture	M.Masunda	Lands officer
Victoria Falls City Municipality	N. Ncube	Town planner
Parks and Wildlife Management Authority	M.Mbikiyana	Senior Area Manager
Ministry of local government and public works	T. Jemera	District economist

Appendix 5.2: List of interviewed persons in Livingstone area

Name of Person Interviewed	Establishment Name	Position	Place	Date
Mr. Douglas Evans	Chundukwa River Lodge	Operations Manager	Livingstone	14th May 2021
Ms. Joyce Sikabbubba	Avani Hotel	Former Public Relations Manager	Livingstone	17th May 2021
Mrs. Jocelyn N. Mutinta	Zambia Tourism Agency	Tourism Promotions and Marketing Manager	Livingstone	19th May 2021

Appendix 6.1a: Tree species found in the MoT/VFWHS (NHCC, 2015)

SN	Latin (Scientific name)	English name
1	Acacia ataxacantha	Flame thorn
2	Acacia Nigrescens	Knob thorn
3	Acacia polyacantha	White thorn
4	Acacia Sieberiana	Paperbark thorn
5	Acacia tortilis	Umbrella thorn
6	Adansonia digitata	Baobab
7	Afzelia quanzensis	Pod mahogany
8	Albizia harveyi	Common false thorn
9	Azanza garckeana	Snot apple
10	Bauhimia petersiana	Coffee neat's foot
11	Berchemia discolor	Brown ivory
12	Bolusanthus Speciousus	Bee wisteria
13	Cassia abbreviate	Sjambok pod
14	Colophospermum Mopane	
15	Combretum apiculatum	Red bush willow
16	Combretum hereroense	Russet bushwillow
17	Combretum mossambicense	Knobbly creeper
18	Combretum imberbe	Lead wood
19	Commiphora Africana	Hairy corkwood
20	Cordial pilosissima	Woolly saucer berry
21	Cyperus papyrus	Sedge
22	Dalbergia melanoxylon	Zebra wood
23	Dichrostachys cinerea	Sickle bush
24	Diospyros mespiliformis	Jackal berry
25	Diospyros quiloensis	Crocodile bark jackal berry
26	Diplorhyncus condylocarpon	Thorn – pod tree
27	Erythorina livingstoniana	Aloe coral tree
28	Erythroxylum zambesiacum	Zambezi coca tree
29	Faidherbia albida	Ana tree
30	Feretia aeruginescenens	Red – leaved medlar
31	Ficus capensis	
32	Ficus ingens	Red – leaved fig
33	Ficus sycamores	Common cluster
34	Flacourtia Indica	Governor's plum

35	Friesodielsia obovata	Savoria dwabe-berry
36	Garcinia livingstonei	African mangosteen
37	Gardenia resinifolia	Resin Gardenia
38	Greovia flavescens	Sandpaper raisin
39	Guibourtia coleosperma	
40	Hyphaene petersiana	Real fan palm
41	Tamarindus Indica	Tamarind
42	Kigelia Africana	Sausage tree
43	Kirkii acuminate	White Senga
44	Lonchocarpus capassa	Apple – leaf
45	Lobelia kirkii	
46	Mimusops zeyheri	Transvaal red milkwood
47	Manilkara mochisia	Lowveld milkberry
48	Mundulea sericea	Cork bush
49	Peltophorum africanum	Weeping wattle
50	Phoenix reclinata	Wild date palm
51	Phragmites mauritianus	Grass
52	Piliostigma thonningii	Camel's foot
53	Pterocarpus angolensis	Wild teak
54	Pterocarpus antunensi	
55	Sansevieria desertii	
56	Schinziophyton rautanenii (Ricinodendron)	Markettti tree
57	Sclerocarya caffralbirrea	Marula
58	Sterculia Africana	African sat – chestnut
59	Sterculia quinqueloba	Large – leaved star – chestnut
60	Strychnos madagascariensis	Black monkey orange
61	Strychnos potatorum	Black bitter berry
62	Strychnos pungens	Spine – leaved monkey orange
63	Strychnos spinosa	Green monkey orange
64	Syzygium cordotum	Water berry
65	Terminalia prunioides	Lowveld cluster leaf
66	Terminalia sericea	Silver cluster leaf
67	Tricilia emetica	Natal mahogany
68	Vaugueria infausta	Wild medlar
69	Zanha Africana	Velvet – fruited zanha
70	Ziziphus abyssinica	Jujube
71	Ziziphus mucronata	Buffalo – thorn

Appendix 6.1b: Tree species found in Dambwa Local Forest No 22, Livingstone, Zambia

SN	Species name
1.	Diplorhyncus condylocarpon
2.	Baikiaea plurijuga
3.	Grewia monticola
4.	Combretum zeyheri
5.	Commiphora mollis
6.	Colophospermum mopane
7.	Bauhinia petersiana
8.	Pterocarpus angolensis
9.	Dichrostachys cinerea
10.	Lannea discolor
11.	Friesodielsia obovata
12.	Burkea africana

13.	Schinziophyton rautanenii
14.	Terminalia sericea
15.	Brachystegia bohemia
16.	Swartzia madagascariensis
17.	Erythrophleum africanum
18.	Ochna pulchra
19.	Brachystegia spiciformis
20.	Guibourtia coleosperma
21.	Combretum collinum
22.	Strychnos cocculoides
23.	Combretum molle
24.	Xylopia odoratissima
25.	Combretum apiculatum
26.	Combretum mossambienses
27.	Combretum imberbe
28.	Strychnos pungens
29.	Albizia harveyi
30.	Pseudolachnostylis maprounefolia
31.	Albizia antunesiana
32.	Zanha africana
33.	Erythroxylum zambesiacum
34.	Amblygonocarpus andongensis
35.	Brachystegia longifolia
36.	Diospyros batocana
37.	Strychnos spinosa
1.	Vangueria infausta
2.	Piliostigma thonningii
3.	Afzelia quanzensis
4.	Ziziphus abyssinica
5.	Feretia aeruginesciens
6.	Vangueria cyanescens
7.	Grewia flavescens
8.	Acacia schweinfurthii
9.	Euclea divinorum
10.	Ximenia caffra
11.	Securidaca longipedunculata
12.	Ximenia americana
13.	Cassia abbreviata
14.	Dalbergia melanoxylon
15.	Diospyros mespiliformis
16.	Hymenocardia acida
17.	Pericopsis angolensis
18.	Philenoptera violacea
19.	Vangueriopsis lanciflora
20.	Commiphora mossambicensis
21.	Peltophorum africanum
22.	Sclerocarya birrea
23.	Strychnos potatorum
24.	Acacia nigrescens
25.	Acacia nilotica

26.	Albizia tanganyicensis
27.	Flueggea virosa
28.	Commiphora angolensis
29.	Pavetta schumanniana
30.	Pterocarpus rotundifolius
31.	Ziziphus mucronata
32.	Acacia adianthifolia
33.	Acacia polyacantha
34.	Acacia sieberiana
35.	Berchemia discolor
36.	Tamarindus indica
37.	Terminalia mollis
38.	Terminalia stuhlmannii

Appendix 6.2: Large mammals in Victoria Falls Area

SN	Animal Species
1	Elephant
2	Baboon
3	Buffalo
4	Bush buck
5	Common duiker
6	Giraffe
7	Impala
8	Mongoose
9	Puku
10	White Rhino
11	Squirrel
12	Velvet monkey
13	Warthog
14	Water buck
15	Burchell's Zebra
16	Hartebeest
17	Sable
18	Hippo
19	Monitor lizard

20	Crocodile
21	Wildebeest

Appendix 6.3: Bird species checklist for Mosi-Oa-Tunya National Park, Livingstone, Zambia (Livingstone Museum, 2021)

1. Little grebe
2. Great White Pelican
3. Pink-backed Pelican
4. White-breasted Cormorant
5. Reed Cormorant
6. African Darter
7. Grey heron
8. Black-headed Heron
9. Goliath Heron
10. Purple Heron
11. Great Egret
12. Black Heron
13. Slaty Egret
14. Yellow-billed Egret
15. Little Egret
16. Cattle Egret
17. Squacco Heron
18. Rufous-bellied Heron
19. Striated Heron
20. Black-crowned Night-heron
21. White-backed Night-heron
22. Little Bittern
23. Dwarf Bittern
24. Yellow-billed Stork
25. African Openbill
26. Black Stork
27. Woolly-necked Stork
28. White-stork
29. Saddle-billed Stork
30. Marabou Stork
31. Abdim's Stork
32. Hamerkop
33. African Sacred Ibis
34. Hadeda Ibis
35. Glossy Ibis
36. African Spoonbill
37. Fulvous Duck
38. White-faced Duck
39. Spur-winged Goose
40. Comb Duck
41. African Black Duck
42. Egyptian Goose
43. African Pygmy Goose
44. Cape Teal
45. Red-billed Teal
46. Hottentot Teal
47. Southern Pochard
48. Red-knobbed Coot
49. Osprey
50. African Fish-Eagle
51. African Marsh Harrier
52. European Marsh Harrier
53. Pel's Fishing Owl
54. African Crake
55. Black Crake
56. Corn Crake
57. Baillon's Crake
58. Spotted Crake
59. Striped Crake
60. African Rail
61. Common Moorhen
62. Common Buttonquail
63. Black-rumped Buttonquail
64. Lesser Moorhen
65. Allen's Gallinule
66. African Purple Swamphen
67. Red-knobbed Coot
68. African Finfoot
69. Lesser Jacana
70. African Jacana
71. Greater Painted Snipe
72. Black-winged Stilt
73. Water Thick-knee (Dikkop)
74. Collared Pratincole
75. Rock Pratincole
76. Long-toed Lapwing
77. Blacksmith Lapwing
78. White-crowned Lapwing
79. African Wattled Lapwing
80. Kittlitz's Plover
81. Three-banded Plover
82. Marsh Sandpiper
83. Common Greenshank
84. Lesser Yellowlegs

85. Wood Sandpiper
86. Common Sandpiper
87. Little Stint
88. Curlew Sandpiper
89. Ruff
90. Grey-headed gull
91. Whiskered Tern
92. White-winged Tern
93. African Skimmer
94. Giant Kingfisher
95. Pied Kingfisher
96. Malachite Kingfisher
97. Half-collared Kingfisher
98. African Black Swift
99. African Emerald Cuckoo
100. African Goshawk
101. African Cuckoo-Hawk
102. African Hawk Eagle
103. African Grey Hornbill
104. African Palm-Swift
105. African Pied Wagtail
106. African Pygmy Kingfisher
107. Amethyst Sunbird
108. Amur Falcon
109. Ashy Flycatcher
110. Augur Buzzard
111. African Harrier-Hawk
112. African Marsh Harrier
113. Ayre's Hawk Eagle
114. Bearded Scrub-Robin
115. Burchell's Coucal
116. Bearded Woodpecker
117. Black-backed Puffback
118. Black-collared Barbet
119. Black-crowned Tchagra
120. Black-headed Oriole
121. Blue Waxbill
122. Bat Hawk
123. Barn Owl
124. Black Coucal
125. Black Goshawk
126. Black-chested Snake Eagle
127. Bateleur
128. Booted Eagle
129. Black-winged Kite
130. Bronze Mannikin
131. Brown Firefinch
132. Brown Snake Eagle
133. Black Eagle
134. Brown-capped Tchagra
135. Brown-hooded Kingfisher
136. Blue-cheeked Bee-eater
137. Black-bellied Bustard
138. Ring-necked Dove
139. Chinspot Batis
140. Coppery-tailed Coucal
141. Collared Sunbird
142. Crowned Hornbill
143. Common Buzzard
144. Crowned Eagle
145. Coqui Francolin
146. Crested Francolin
147. Dark-capped Bulbul
148. Diederik Cuckoo
149. Dark Chanting goshawk
150. Dickinson's Kestrel
151. Emerald-spotted Wood-Dove
152. Eurasian Hobby
153. Fork-tailed Drongo
154. Honey Buzzard
155. Hooded Vulture
156. Harlequin Quail
157. Helmeted Guineafowl
158. Golden Weaver
159. Golden-tailed Woodpecker
160. Green-winged Pytilia
161. Grey-backed Camaroptera
162. Grey-headed Bush-Shrike
163. Gabar Goshawk
164. Jameson's Firefinch
165. Lappet-faced Vulture
166. Lesser Striped Swallow
167. Levaillant's Cuckoo
168. Little Banded Goshawk
169. Little Sparrowhawk
170. Lizard Buzzard
171. Lesser Spotted Eagle
172. Long-billed Crombec
173. Lesser Kestrel
174. Lanner Falcon
175. Little Swift
176. Little Bee-eater
177. Mountain Wagtail
178. Martial Eagle
179. Natal Spurfow
180. Orange-breasted Bush-Shrike
181. Orange-winged Pytilia
182. Ovambo Sparrowhawk
183. African Paradise Flycatcher
184. Pied Crow
185. Pallid Harrier
186. Peregrine Falcon
187. Red-billed Firefinch
188. Red-billed Helmet Shrike

189. Red-billed Hornbill
190. Red-billed Quelea
191. Red-chested Cuckoo
192. Red-eyed Dove
193. Red-faced Cisticola
194. Red-faced Mousebird
195. Red-throated Twinspot
196. Red-winged Starling
197. Rock Martin
198. Red-footed Falcon
199. Red-necked Falcon
200. Scarlet-chested Sunbird
201. Schalow's Turaco
202. Senegal Coucal
203. Shikra
204. Striped Kingfisher
205. Senegal Coucal
206. Spectacled Weaver
207. Spotted Flycatcher
208. Steppe Eagle
209. Spotted Eagle Owl
210. Shelly's Francolin
211. Swainson's Francolin
212. Southern Carmine Bee-eater
213. Swallow-tailed Bee-eater
214. Southern Black Flycatcher
215. Spotted flycatcher
216. Tawny-flanked Prinia
217. Tawny Eagle
218. Taita Falcon
219. Terrestrial Brownbul
220. Tropical Boubou
221. Trumpeter Hornbill
222. Village Indigobird
223. Village Weaver
224. White-backed Vulture
225. White-headed Vulture
226. Western Banded Snake Eagle
227. White-bellied Sunbird
228. White-browed Robin-Chat
229. White-fronted Bee-eater
230. Willow Warbler
231. White-faced Owl
232. Wire-tailed Swallow
233. White-rumped Swift
234. Woodland Kingfisher
235. Wahlberg's Eagle
236. Yellow-bellied Greenbul
237. Yellow-billed Kite
238. Yellow-breasted Apalis
239. Yellow-fronted Canary
240. Giant Eagle Owl
241. Barred Owlet
242. Wood Owl
243. Marsh Owl
244. Freckled Nightjar
245. Alpine Swift
246. Mottled Swift
247. Horus Swift
248. European Bee-eater
249. Lilac-breasted Bee-eater
250. European Roller
251. Racket-tailed Roller
252. Purple Roller
253. Broad-billed Roller
254. Painted Snipe
255. Spotted Thick-knee
256. Three-banded Couser
257. Bronze-winged Couser
258. Black-winged Pratincole
259. Common Ringed Plover
260. Crowned Lapwing
261. Common Greenshank
262. Bar-tailed Godwit
263. Terek Sandpiper
264. Turnstone
265. Sanderling
266. Laughing dove
267. Namaqua dove
268. Green Pigeon
269. Meyer's Parrot
270. Grey Go-away-bird
271. Jacobin Cuckoo
272. Black Cuckoo
273. Striped Crested Cuckoo
274. Red-chested Cuckoo
275. Emerald Cuckoo
276. European Cuckoo
277. Klaa's Cuckoo
278. Red-eyed Bulbul
279. Miombo Rock Martin
280. Kurrichane Thrush
281. Thrush Nightingale
282. Collared Palm Thrush
283. Familiar Chat
284. Arnot's Chat
285. Mocking Chat
286. Little Rush Warbler
287. River Warbler
288. Sedge Warbler
289. Reed Warbler
290. Marsh Warbler
291. Great Reed Warbler
292. Lesser Swamp Warbler

293. Lecterine Warbler
294. Green-capped Eremomela
295. Yellow-bellied Eremomela
296. Burnt-necked Eremomela
297. Willow Warbler
298. Garden Warbler
299. Common White-throat
300. Fan-tailed Cisticola
301. Rattling Cisticola
302. Neddicky
303. Greater Black-backed Cisticola
304. Bleating Bush Warbler
305. Pallid Flycatcher
306. African Hoopoe
307. Green Wood hoopoe
308. Southern Red-billed Hornbill
309. African Grey Hornbill
310. Scimitarbill
311. Yellow-fronted Tinkerbird
312. Crested Barbet
313. Greater honeyguide
314. Lesser Honeryguide
315. Bennet's Woodpecker
316. Golden-tailed Woodpecker
317. Cardinal Woodpecker
318. Bearded Woodpecker
319. Olive Woodpecker
320. Monotonous Lark
321. Dusky Lark
322. Chested-backed Sparrow-lark
323. Grey-backed Sparrow-lark
324. European Sand Martin
325. African Sand Martin
326. Banded Martin
327. Grey-rumped Swallow
328. Red-breasted Swallow
329. Lesser Striped Swallow
330. Greater Striped Swallow
331. Pear-breasted Swallow
332. Yellow Wagtail
333. Striped Pipit
334. Black Cuckoo-Shrike
335. Arrow-marked Barler
336. Southern Black Tit
337. Grey Penduline Tit
338. Scarlet-chested Sunbird
339. White-bellied Sunbird
340. Purple-banded Sunbird
341. African Yellow White-eye
342. African Golden Oriole
343. Red-backed Shrike
344. Lesser Grey Shrike
345. Brubru
346. White Helmetshrike
347. Retz's Helmetshrike
348. Miombo Blue-eared Starling
349. Violet backed Starling
350. Red-billed Oxpecker
351. Yellow-billed Oxpercker
352. House Martin
353. Northern Grey-headed Sparrow
354. Red-billed Bufalo weaver
355. White-browed Sparrow Weaver
356. Lesser Masked Weaver
357. African Masked Weaver
358. White-winged Whydah
359. Thick-billed weaver
360. Melba Finch
361. Common Waxbill
362. Yellow-crowned Bishop
363. Yellow Bishop
364. Yellow-mantled whydah
365. Southern Red Bishop
366. Yellow-throated Petronia
367. Cut-throat Finch
368. Pin-tailed Whydah
369. Broad-tailed Paradise Whydah
370. Long-tailed Paradise Whydah
371. Black-throated Canary
372. Yellow-fronted Canary
373. Cinnamon-breasted rock Bunting
374. Golden-breasted Bunting

Appendix 6.4: Bird check list - List of Avian Species in Zambezi National Park, Zimbabwe

1. African Darter	2. African Fish Eagle
3. African Grey Hornbill	4. African Harrier-hawk
5. African Jacana	6. African Mourning Dove
7. African Openbill	8. African Pied Wagtail
9. African Wattled Lapwing	10. African yellow-white eye
11. Arrow-marked babbler	12. Ashy Flycatcher
13. Bearded Vulture	14. Bearded Woodpecker
15. Black-collared Barbet	16. Black-eyed bulbul
17. Blue waxbill	18. Brown-crowned Tchagra
19. Brown-hooded Kingfisher	20. Cape Bunting
21. Cape turtle Dove	22. Cattle Egret
23. Chestnut Helmeted shrike	24. Collared palm thrush
25. Common Scimitarbill hoopoe	26. Coppery Tailed Coucal
27. Crested Francolin	28. Dark Chanting Goshawk
29. Dark-capped bulbul	30. Dark-capped Bulbul
31. Dickinson`s Kestrel	32. Egyptian Goose
33. Emerald-spotted Wood Dove	34. Fork-tailed Drongo
35. Giant Kingfisher	36. Golden Oriole
37. Great egret	38. Green Wood-Hoopoe
39. Green-backed heron	40. Grey Go-Away bird
41. Grey Lourie	42. Hadeda Ibis
43. Hamerkop	44. Helmeted Guinea Fowl
45. Hooded vulture	46. Indigobird
47. Jameson`s Firefinch	48. Laughing Dove
49. Little Bee-eater	50. Little Egret
51. Lizard Buzzard	52. Magpie shrike
53. Malachite Kingfisher	54. Marabou Stork
55. Meves's Starling	56. Meyer's Parrot
57. Namaqua Dove	58. Pied crow
59. Pied Kingfisher	60. Pied Kingfisher
61. Purple roller	62. Red-billed Buffalo Weaver
63. Red-billed Helmeted shrike	64. Red-billed Hornbill
65. Red-billed Hornbill (Southern)	66. Red-billed Ox-pecker
67. Red-billed Quelea	68. Red-Eyed Dove
69. Red-face Mouse bird	70. Red-headed Quelea
71. Reed cormorant	72. Sacred Ibis
73. Scarlet chested Sunbird	74. Scarlet chested sunbird
75. Spotted Thick-Knee African Darter	76. Spurred-winged Fowl
77. Squacco Heron	78. Swainson`s Spur fowl
79. Tawny-flanked Prinia	80. Tropical Boubou
81. Trumpeter Hornbill	82. White-backed vulture
83. White-browed Robin Chat	84. White-Browed Sparrow Weaver
85. White-crested helmet shrike	86. White-crowned Lapwing
87. White-fronted Bee-eater	88. White-headed vulture

89. White-Rumped sandpiper	90. Wire-tailed Swallow
91. Yellow-bellied Greenbul	92. Yellow-billed Oxpecker
93. Yellow-fronted Canary	

Appendix 6.5: Fish species common to the Zambia-Zimbabwe sections of the Zambezi River

1. Fish Species found in the Upper Zambezi River

Common Name	**Scientific Name**
African Pike	*Hepsetus Odea*
Banded Jewelfish	*Hemichromis Elongatus*
Black – Spot – Climbing Perch	*Ctenopoma Intermedium*
Blackback Barb	*Barbus Barnardi*
Blotched Catfish	*C. Stapperssii*
Broadhead Catfish	*Clariallabes Playtprosopos*
Brownspot Large Mouth	*S. Thumbergi*
Chobe Sand Catlet	*L. CF. Dorae*
Copper-stripe Barb	*Barbus Multilineatus*
Dwarf Citharine	*Hemigrammocharax Machadoi*
Dwarf Stonebasher	*Pollimyrus Casterlnaui*
Gorgeous Barb	*Barbus Bellcrossi*
Greenwoods Happy	*S. Greenwoodi*
Hamiltons Barb	*Barbus Afrohamiltoni*
Jubbs Topminnow	*Hypsopachax Jubbi*
Largespot Sqeaker	*Synodontis Macrostinational park*
Leopard Speaker	*Synodontis Leopardinus*
Longfin Large Mouth	*S. Lonnational parknus*
Manyspined Climbing Perch	*Ctenopoma Multispinis*
Meshscale Topminnow	*Aplocheilichthys Hutereaui*
Common Name	**Scientific Name**
Multibar Citharine	*H. Multifasciatus*
Northern Kneria	*K. Polli*
Ocellated Spiny Eel	*A. Vanderwaali*
Okavango Catfish	*C. Dumerilii*
Okavango Tilapia	*T. Ruweti*
Orange Band BWSLlfish	*Northbranchius Taeniopygus*
Red Spot Barb	*Barbus Tangandesis*
River Sardine	*Mesobobolo Brevanalis*
Roadbar Citharine	*Nannochararax Macropterus*
Shorttail Spiny Eel	*Afromastacemelius Frenatus*
Slender Stonebasher	*Hippopotamyrus Ansorgii*
Slide – Spot	*Barbus Neefi*
Spottail Barb	*Barbus Afrovernayi*
Spotted Squeaker	*Synodontis Nigromaculatus*
Thamalakane Barb	*Barbus Thamalakanesis*

Upjaw Barb	*Coptostomobarbus Wittei*
Upper Zambezi Squeaker	*Synodontis Woosnami*
Upper Zambezi yellowfish	*Barbus Cordringtoni*
Upper Zammbazi Labeo	*L. Lunatus*
Western Bottlenose	*Mormyrus Lacerda*
Ynagambi Castfish	*S. Yanganbianus*
Zambezi Grunter	*Auchenoglanis Ngamensis*

2. Fish Species found in both Upper and Lower Zambezi River

Common Name	**Scientific Name**
African Mottled Eel	*Anguilla Bengalensis Labiata*
Banded Tilapia	*T. Sparmanii*
Barotse Barb	*B. Barotseensis*
Beira Barb	*B. Radiatus*
Bluntooth Catfish	*C. Ngamensis*
Broadstriped Barb	*B. Anectens*
Bulldog	*Marcusenius Macrolepidotus*
Churchill	*Petrocephalus Catostoma*
Dash-tail Barb	*B. Poechii*
Dwarf Barb	*B. Puellus*
Green Happy	*S. Codringtonii*
Greenhead Tilapia	*O. Macrochir*
Hyphen Barb	*B. Bifrenatus*
Johnstons Topminnow	*A. Johnstoni*
Line-spotted Barb	*B. Lineomaculatus*
Nembwe	*S. Robustus Jallae*
Neumanns Rock Catlet	*C. Neumanni*
Orange – fin Barb	*B. Eutaenia*
Pink Happy	*S. Giardi*
Purple Labeo	*L. Congoro*
Purpleface Large Mouth	*S. Macrecephalus*
Rainbow Happy	*Serranchromis Carlottae*
Common Name	**Scientific Name**
Red Barb	*B. Fasciolatus*
Red Breast Tilapia	*T. Rendalli*
Redeye Labeo	*L. Cylindricus*
Shartooth Catfish	*Calrias Gariepinus*
Sickle – fin Barb	*B. Haasianus*
Silver or Butter Catfish	*Schilbe Mystus*
Silver Robber	*Micralestes Acutidens*
Slender Robber	*Rhabdelestes Maunesnsis*
Snake Catfish	*C. Theodorae*
Southern Kneria	*Kneria Auriculata*
Southern Mouth Brooder	*Pseudocrenilabrus Philander*
Spotted Sand Catlet	*Leptoglanis Rotundiceps*
Stargazer Mountain Catfish	*Amphilius Uranoscopus*
Straight-fin Barb	*B. Paludinosus*

Stripped Robber	*Brycinus Lateralis*
Stripped Topminnow	*A. Katangae*
Thinface Large Mouth	*S. Angusticeps*
Threespot Tilapia	*Orechromis Andersonii*
Tigerfish	*Hydrocynus Forskahlii*
Zambezi Happy	*Pharyngochromis Darlingi*
Zambezi Parrotfish	*Hippopotamyrus Discorhynchus*

(iii) Fish Species found in the Lower Zambezi River

Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
Brown Squeaker	*S. Zambezensis*	Leaden Labeo	*L. Molybdinus*
Chessa	*Distichodus Scheng*	Manyame Labeo	*Labeo Altivelis*
Clouded Squeaker	*S. Nebulosus*	Nkupe	*Distichodus Mossambicus*
Cornish Jack	*Mormyrops Deliciosus*	Paper-mouth	*B. Mattozi*
Eastern Bottlenose	*M. Longirostris*	Pongola Rock Catlet	*Chiloglanis Emarginatus*
Electric Catfish	*Malapterurus Electricus*	Purple Labeo	*L. Congoro*
Imberi	*B. Imberi*	Shortsnout Chiselmouth	*Varicorthinus*
Kariba Tilapia	*O. Mortimeri*	Three-spot Bark	*B. Trimaculatus*
Lake Tanganyika Sardine	*Limonothrissa Miodon*	Vundu	*Heterobranchus Longifilis*
Large-scale Yellowfish	*B. Marequensis*		

Appendix 6.6: Farming Activity: small grains, maize and water melons are largely grown in the communal area of Chief Shana and Chief Mvutu in Hwange Communal land adjacent Victoria Falls City and World Heritage Property

Maize Field 	Harvested maize 
Millet 	Water melons 

Appendix 6.7: Invasive species control - Removal of *L. camara* in the Rainforest, Zimbabwe



Appendix 6.8a: Archaeological sites identified and documented

Sites identified during the 1996 Strategic Environmental Assessment Study (Muringaniza, 1996)

Site Name	Map No	Location	Site Type
Masue River	1725DD	LL 77 13	Stone Age
Victoria Falls NP	1725DD	LL 77 14	
Victoria Falls NP	1725DD	LL 77 16	
Victoria Falls NP	1725DD	LL 77 15	
Victoria Falls	1725DD	LL 77 18	
Masue River	1725DD	LL 78 13	
Masue River	1725DD	LL 78 13	
Masue River	1725DD	LL 78 16	
Masue River	1725DD	LL 78 16	
Victoria Falls NP	1725DD	LL 75 14	
Victoria Falls NP	1725DD	LL 76 14	
Masue Confluence	1725DD	LL 79 13	
Vic Falls area	1725DD	LL 79 16	
Victoria Falls	1725DD	LL 78 19	
Cummings Farm	1725DD	LL 739 104	
Victoria falls N. P	1725DD	LL 83 10	
Masue River	1725DD	LL 78 13	Early Iron Age
Victoria Falls	1725DD	LL 80 20	Late Iron Age
Victoria Falls N. P	1725DD	LL 77 15	Early Iron Age
Big Tree	1725DD	LL 774 194	Middle Iron Age
Big Tree	1725DD	LL 774194	Early Iron Age
Victoria Falls	1725DD	LL 770 186	Late Iron Age

Victoria Falls	1725DD	LL 78 15	Late Iron Age
Cummings Farm	1725DD	LL 739 104	Early Iron Age
Monde	1725DD	LL 78 09	Late Iron Age
Monde	1725DD	LL 78 07	Late Iron Age
Chidobe	1725DD	LL 83 10	Stone Age
Chisuma	1725DD	LL 90 11	Traditional Site
Chisuma	1725DD	LL 89 09	Late Iron Age
Chisuma	1725DD	LL 89 08	Stone Age
Chisuma	1725DD	LL 89 07	Late Stone Age
Kachecheti	1725DD	LL 87 04	Late Stone Age
Kachecheti	1725DD	LL 88 03	Late Iron Age
Kachecheti	1725DD	LL 90 02	Late Iron Age
Masuku	1826AA	01 99	Late Iron Age
Masuku	1826AA	03 26	Late Iron Age
Kasikili	1726CC	03 11	Traditonal Site
Kasikili	1726CC	09 09	Late Iron Age
Kasikili	1726CC	10 08	Late Iron Age
Kasikili	1726CC	11 09	Late Iron Age
Kasikili	1726CC	12 09	Late Iron Age
Kasikili	1726CC	09 08	Traditional Site
Zambezi River	1726CC	08 19	Traditional Site
Victoria Falls	1825BB	LL 70 08	Early Stone Age
Shara	1825BB	LL 82 09	Iron Age Furnace

Appendix 6.8b: List of new archaeological sites in the Victoria Falls Area

(A) New Stone Age Sites in the Mosi-Oa-Tunya National Park. GPS = Global Positioning System.

S/N	SITE TYPE	LONGITUDE	LATITUDE	ELEVATION	GPS ACCURACY	SITE SIGNIFICANCE
1.	Stone Age Site	Stone Age Site	E25º47'50.3"	960m	4Metters	Low
2.	Stone Age Site	S17º49'16.1"	E25º47'50.5	961 m	4Metters	Low
3.	Stone Age Site	S17º49'16.1"	E25º47'50.5"	962m	4Metters	Low
4.	Stone Age Site	S17º49'22.0"	E25º47'54.1"	961m	4Metters	Low
5.	Stone Age Site	S17º49'21.8"	E25º47'54.0"	961m	4Metters	Low
6.	Stone Age Site	S17º49'22.2"	E25º47'54.5"	961m	4Metters	Low
7.	Stone Age Site	S17º49'18.11"	E25º47'51.2"	963m	4Metters	Low
8.	Stone Age Site	S17º49'17.9"	E25º17'50.7"	960m	4Metters	Low
9.	Stone Age Site	S17º49'17.7"	E25º47'50.6"	954m	4Metters	Low
10	Stone Age Site	S17º49'17.7"	E25º47'50.6"	950m	4Metters	Low
11	Stone Age Site	S17º49'15.6",	E25º47'46.9"	965m	4Metters	Low
12	Stone Age Site	S17º49'16.5"	E25º47'45.9"	962m	4Metters	Low10

(B) New Stone Age and Iron Age Sites in Mukuni Area. GPS = Global Positioning System.

S/N	TYPE SITE	LONGITUDE	LATITUDE	ELEVATION	GPS ACCURACY	SITE SIGNIFICANCE
1.	Stone Age Site	26° 02' 56.5043" E	17° 54' 39.5495" S	920.765564	4 Meters	Low
2.	Stone Age Site	26° 02' 32.7875" E	17° 54' 26.4599" S	935.920715	4 Meters	No
3.	Stone Age Site	26° 02' 15.7559" E	17° 54' 04.8671" S	941.675537	4 Meters	Low to medium
4.	Stone Age Site	26° 03' 13.0933" E	17° 54' 48.1716" S	936.143555	4 Meters	Low to medium
5.	Stone Age Site	26° 03' 20.2824" E	17° 54' 41.2631" S	927.70813	4 Meters	Low
6.	Stone Age Site	26° 03' 24.6312" E	17° 54' 20.8260" S	939.399231	4 Meters	Low
7.	Iron Age Site	26° 03' 48.0925" E	17° 54' 47.7181" S	932.01825	4 Meters	Low
8.	Iron Age Site	26° 03' 39.1067" E	17° 55' 01.3475" S	923.824524	4 Meters	Medium
9.	Stone Age Site	26° 03' 41.4431" E	17° 55' 10.3188" S	919.777039	4 Meters	Low
10.	Iron Age Site	26° 00' 02.8619" E	17° 55' 19.4159" S	997.239502	4 Meters	Medium
11.	Iron Age Site	26° 00' 02.8297" E	17° 55' 23.3437" S	1006.080566	4 Meters	Medium
12.	Iron Age Site	26° 00' 03.1607" E	17° 55' 27.3359" S	1010.349731	4 Meters	Medium
13.	Iron Age Site	26° 00' 12.0097" E	17° 55' 29.1901" S	1009.20105	4 Meters	Medium
14.	Iron Age Site	26° 00' 17.3305" E	17° 55' 29.9460" S	1009.144409	4 Meters	Medium
15.	Iron Age Site	26° 00' 34.4161" E	17° 55' 31.6560" S	1008.565613	4 Meters	Medium
16.	Iron Age Site	26° 00' 17.4961" E	17° 55' 26.4973" S	1008.803345	4 Meters	Medium
17.	Iron Age Site	26° 00' 15.7753" E	17° 55' 24.9276" S	1008.44458	4 Meters	Medium
18.	Iron Age Site	25° 59' 41.5681" E	17° 55' 24.3733" S	1016.381287	4 Meters	Medium
19.	Iron Age Site	25° 59' 33.9107" E	17° 55' 20.3269" S	1013.3349	4 Meters	Medium
20.	Stone Age Site	25° 57' 57.0853" E	17° 54' 51.0624" S	977.796265	4 Meters	Medium
21.	Stone Age Site	25° 58' 15.9205" E	17° 54' 50.8967" S	983.596924	4 Meters	Medium
22.	Intangible Heritage Site	25° 57' 12.8905" E	17° 54' 38.3404" S	N. A	N. A	High
23.	Intangible Heritage Site	25° 58' 04.7020" E	17° 54' 39.6657" S	N. A	N. A	High

Appendix 6.9: List of historical buildings and structures in Victoria Falls Area

S/N	Heritage Name	Heritage Type
01	Capital Theatre	Theatre Hall
02	Chief Justices Res GRZ No. 41/23S	House
03	Civil Commissioner's	Office
04	Coillard Memorial Hall	Church
05	Constabulary 90	Police Office
06	Council GRZ No. 84/85	Clinic
07	Finance Bank Building	Bank
08	First Civic Centre	Offices
09	First Livingstone Hospital	Hospital
10	Goods Shed R NO. 1093/1174	Shed
11	GRZ NO. /96 Town Area	House
12	Government House NO. 6510	House
13	GRZ NO. 95/209, Town Area	House
14	GRZ NO. 21/67S Town Area	House
15	GRZ NO. 42/658 Town Area	House
16	GRZ NO. 44/660 Town Area	House

17	GRZ NO. 45/27S Town Area	House
18	GRZ NO.49/84/85 Town Area	House
19	GRZ NO. 57/528 Town Area	House
20	GRZ NO. 59/533 Town Area	House
21	GRZ NO. 68/46S Town Area	House
22	GRZ NO. 68/47S Town Area	House
23	GRZ NO. 71/47S Town Area	House
24	GRZ NO. 87/55S Town Area	House
25	GRZ NO. 88/54S Town Area	House
26	GRZ NO. 90/52S Town Area	House
27	GRZ NO. 91/57S Town Area	House
28	GRZ NO. 39/19S Town Area	House
29	GRZ NO. 77/118S Town Area	House
30	GRZ NO. 80/130/131/13 Town Area	House
31	GRZ NO. /144 Town Area	Shop
32	GRZ NO. /282/283 Town Area	ZAF Transit hostel
33	GRZ NO. /144 Town Area	ZAF Transit hostel
34	GRZ NO. /146 Town Area	ZAF Transit hostel
35	GRZ NO. /148 Town Area	Shop
36	GRZ NO. /149 Town Area	Shop
37	GRZ NO. /172 Town Area	Shop
38	GRZ NO. /233 Town Area	House
39	GRZ NO. /925 Town Area	Shop
40	GRZ NO. /233 Town Area	House
41	GRZ NO. /233 Town Area	House
42	GRZ NO. /336 Town Area	House
43	GRZ NO. /240 Town Area	House
44	GRZ NO. /132 Town Area	House
45	GRZ NO. /120 Town Area	Shop
46	GRZ NO. /124 Town Area	Shop
47	GRZ NO. /125 Town Area	Shop
48	GRZ NO. /126 Town Area	Shop
49	GRZ NO. /112 Town Area	Shop
50	GRZ NO. /113 Town Area	Shop
51	GRZ NO. /116 Town Area	Shop
52	GRZ NO. /128/129/130/131	House
53	GRZ NO. /107 Town Area	House
54	GRZ NO. /112 Town Area	Shop
55	GRZ NO. /113 Town Area	Shop
56	GRZ NO. /116 Town Area	Shop
57	GRZ NO. /117 Town Area	Shop

58	GRZ NO. /95 Town Area	House
59	GRZ NO. /465 Town Area	House
60	GRZ NO. 16/31S Town Area	House
61	GRZ NO. 18/33S Town Area	House
62	GRZ NO. 19/34S Town Area	House
63	GRZ NO. 22/278S Town Area	House
64	GRZ NO. 27/291S Town Area	House
65	GRZ NO. 30/182S Town Area	House
66	GRZ NO. 31/17S Town Area	House
67	GRZ NO. 33/16S & 15S Town Area	House
68	GRZ NO. 34/14S Town Area	House
69	GRZ NO. 35/13S Town Area	House
70	GRZ NO. 37/11S Town Area	House
71	GRZ NO. 75/493 Town Area	House
72	GRZ NO. 3/2S Town Area	House
73	GRZ NO. 4/3S Town Area	House
74	GRZ NO. 5/4S Town Area	House
75	GRZ NO. /73 Town Area	Church
76	GRZ NO. /385 Town Area	House
77	GRZ NO. /39/38 Town Area	House
78	GRZ NO. /64 Town Area	House
79	GRZ NO. /67 Town Area	House
80	GRZ NO. /375 Town Area	House
81	GRZ NO. /195 Town Area	House
82	GRZ NO. /55 Town Area	House
83	GRZ NO. /232 Town Area	House
84	GRZ NO./206 Customs	Immigration Offices
85	GRZ NO. /2845 Town Area	House
86	GRZ NO. /2785 Town Area	House
87	GRZ NO. /1128/33 Town Area	Church (kitchen)
88	GRZ NO. /74 Town Area	Clergy House
89	GRZ NO. /304 Town Area	House
90	GRZ NO. /305 Town Area	House
91	GRZ NO. /306 Town Area	House
92	GRZ NO. /528 Town Area	House
93	GRZ NO. /529 Town Area	House
94	GRZ NO. /530 Town Area	House
95	GRZ NO. /533 Town Area	House
96	GRZ NO. /534 Town Area	House
97	GRZ NO. /535 Town Area	House
98	GRZ NO. /536 Town Area	House

99	GRZ NO. /537 Town Area	House
100	GRZ NO. /658 Town Area	House
101	GRZ NO. /660 Town Area	House
102	GRZ NO. /188 Town Area	House
103	GRZ NO. 81/2 Town Area	House
104	High Court GRZ No. 85S/57	Court/Offices
105	Jewish Synagogue Town Area	Church/School
106	Lady Mores Town Area	House
107	L. F. Moore GRZ NO./106 Town Area	Chemist
108	Livingstone Central Hospital	Hospital
109	L/stone Post Office GRZ No 745/7/19	Office
110	Maramba Beer Hall, Maramba	Beer Hall
111	Mukuni Park Town Area	Park/Garden
112	Nanoos Shop Town Area	Shop Complex
113	NO. 38S House, Town Area	House
114	NO. 6319 A House, Town Area	House
115	NO. 754/7/148 House, Town Area	House
116	Northwestern Cold Storage/188	Factory
117	Northwestern Hotel/157 Town Area	Hotel
118	Old Boma GRZ NO. 38/18S Town Area	Offices
119	Old government house Town Area	Administrative Post
120	Old Post Office Town Area	Office
121	Old Trades School Town Area	School
122	Pest Control Town Area	Office
123	Provincial Medical Office's GRZ No14/10	Office
124	R NO. 1137/11 Loco Shed, 217 Area	Shed
125	R NO. 1102, Town Area	House
126	Social Welfare Offices GRZ No. 82/280S	Office
127	St. Andrews Anglican Church	Church
128	SWR Heritage Centre, 217 Area	Office
129	Zambezi Boat Club	Club/Monument
130	Zambezi Sawmills Loco Sheds	Sheds/Museum

Appendix 6.10: Inventory of historical sites in the Victoria Falls Area

SN	HERITAGE NAME	HERITAGE TYPE
01	Zambezi Boat Club Monument	Building
02	Victoria Falls Bridge	Rail Bridge
03	Old Drift Cemetery	Cemetery-Graves of Early European settlers
04	Old Drift Settlement	The initial settlement for pioneer settlers
05	Zambezi Saw Mills Locomotive Shed (The Railway Museum National Monument)	Initially used as the locomotive shed for Zambezi Saw Mills Company
06	Barotse Park (Mukuni Park)	A historical site where King Lewanika met with the Duke of Connaught in 1910
07	Old Drift Monument/Old Drift Crossing Point	A crossing point used by Early Settlers on the Zambezi
08	World War I Memorial	Cenotaph- A memorial site for the British fallen soldiers

Appendix 6.11: List of sacred sites in the World Heritage Property and the 30 km radius, Livingstone, Zambia

NAME OF SHRINE	Location	Type	Frequency of use	Purpose	Associated Impacts
Chizabingo	Vicinity of the Victoria Falls	Temporal constructed structure	Once a year	Used for invoking Leza (God) for rains.	Cultural dynamism
Gombwe Royal	Mukuni Village		Once a year	A site for reaffirmation of co-rulership between Mukuni and Be-Dyango	Cultural dynamism
Simukale	Mukuni Village		Once a year	Resting shrines	Cultural dynamism
Kaanda Kaleza	Mukuni Village	Small temple of God.	Once a year	Used for intercession for rains and good harvest.	Cultural dynamism
Acipuzya	Victoria Falls World Heritage Site	Sacred Site	Once a year	Point where water is drawn for rain rituals	Cultural dynamism
Katola Buseka	Victoria Falls World Heritage Site	Sacred Shrine	Once a year	A site where rituals were offered to appease the deceased	Abandoned ritual
Nsamba dwazi	Victoria Falls World Heritage Site	Sacred Shrine	Once a year	Cleansing of pandemics	Abandoned ritual
Namakabwa Island Heritage Site	The Livingstone Island	Burial shrine	Abandoned	Burial site of previous Mukuni Chiefs	Loss of cultural value
Namunakela	Lumpasa (Chief Mukuni's palace).	Royal Burial Grove	Once a year	A sacred shrine where state functions of tribal coronation, and royal ceremonies take place.	Abandonment of cultural practice
Namunaki	Lumpasa (Chief Mukuni's palace).	Royal Burial Grove	Once a year	A sacred tomb (Ntantala) of the	Abandonment of cultural practice

				founder of the Mukuni Royal Dynasty	
Ntantala	It is raised above the floor at the centre of Namunaki.	Sacred site	-	This is the seat of power, being the tomb of the founder Mukuni.	Abandonment of cultural values
Chitungu	A hut at Mukuni 's palace	A hut	-	A hut where the Mukamudyanka, (3) Royal drums are stored.	Abandonment of cultural values
Magamba	The Royal burial site	Royal grave	-	Burial site of the successive departed monarchs	
Malunga	Near the Harry Mwaanga International Airport	Royal grave	Once a year	Burial site for two Chiefs of Musokotwane	Abandonment of cultural values
Mabula	Musokotwane Village	Royal burial site	Once a year	Burial site for two Chief	Abandonment of cultural values
Mungangla	Sekute Village	Royal grave	Once a year	Royal burial site	Cultural dynamism
Chipuluputa	Sekute Village	Royal grave	Once a year	Royal burial site	Cultural dynamism
Talima	Sekute Village	Royal grave	Once a year	Royal burial site	Cultural dynamism
Kalonga	Sekute Village	Royal grave	Once a year	Royal burial site	Royal burial Site
Luwizi	Sekute Village	Royal grave	Once a year	Royal burial site	Royal burial site
Siansingo	Sekute Village	Royal grave	Once a year	Royal burial site	Royal burial Site
Kaanda ka leza	Sekute Village	Shrine	Once a year	Used in rain making rituals	Cultural dynamism

Appendix 6.12: Statistics for tourist age groups visiting the Victoria Falls

		15-20 Years	**20-25 Years**	**25-30 Years**	**30-35 Years**	**35-40 Years**	**40-45 Years**	**45-50 Years**	**50+ Years**	
Gender	Male	0	2	17	9	29	7	9	1	74
	Female	2	4	26	7	19	2	14	2	76
Total		2	6	43	16	48	9	23	3	150
Percentage		1.3	4.0	28.7	10.7	32.0	6.0	15.3	2.0	

Appendix 6.13: Type of tourists to the Victoria Falls

	Type of Tourists				Total
	Local-Livingstone		Local-Outside Livingstone	International	
Gender	Male	15	37	22	74
	Female	20	40	16	76
Total	35		77	38	150

Appendix 6.14: Number of tourists to the Victoria Falls (2000-2020)

Year	*2000	*2001	*2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Domestic	75,707	94,147	57,267	73,759	40,775	106,742	72,632	111,896	88,467	78,312	86,737	92,847	108,915	100,983	108,487	112,354	116,260	113,866	149,830	130,986	74,782
Int'l	44,296	46,909	41,882	52,136	31,227	73,044	36,792	44,716	46,437	55,882	51,411	40,206	42,090	51,965	45,303	29,575	51,450	35,964	68,522	57,763	10,632
Total	120,003	141,056	98,949	125,895	72,002	179,786	109,424	156,612	134,904	134,194	138,148	133,053	151,005	152,948	153,790	141,929	167,710	149,830	218,352	188,749	85,414

Appendix 6.15: International tourist arrival trends in Livingstone (2000-2020)

Ports of Entry	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
HMNIA	2,678	2,373	2,526	2,312	2,638	58,876	65,049	73,588	66,124	55,794	73,047	88,011	54,342	58,063	55,084	56,013	49,446	45,678
VF	201,556	132,417	166,987	149,417	119,363	127,567	118,987	89,491	100,543	138,830	73,299	93,905	73,488	63,786	70,156	67,321	57,816	55,383
Total	**204,234**	**134,790**	**169,513**	**151,729**	**122,001**	**186,443**	**184,036**	**163,079**	**166,667**	**194,624**	**146,346**	**181,916**	**127,830**	**121,849**	**125,240**	**123,334**	**107,262**	**101,061**

Appendix 6.16: List of accommodation establishments in the Livingstone area

No.	Name of Establishment	Type of Establishment	Town	No. Rooms	Bedspaces	Physical Location	Male	Female	Total
1	Mose Apartment	Apartment	Livingstone	7	30	Plot 54 Mose Street	5	5	10
2	Eliba Apartment	Apartment	Livingstone	12	28	Plot 1166 Kalambo Crescent	2	4	6
3	Asante Apartment	Apartment	Livingstone	9	46	Highlands	5	5	10
4	Sumbulwa Apartment	Apartment	Livingstone	5	20	Plot 1067B/39B-Highlands	2	0	2
5	Falls View Apartments	Apartment	Livingstone	4	24	Off Airport Road	2	3	5
6	Hive Apartments	Apartment	Livingstone	8	24	Airport Road, Near Airport	2	4	6
7	Sweet Home Apartments	Apartment	Livingstone	8	20	Off Airport Road	1	3	4

8	Fawlty Towers Backpackers	Apartment	Livingstone	31	62	Plot 216 Mosi O Tunya Road	12	10	22
9	Prime Apartment	Apartment	Livingstone	16	32	Mainasoko Road	2	3	5
1	Jolly boys Backpackers	Backpacker	Livingstone	75	150	34 Kanyanta Road	11	12	23
2	Livingstone /Victoria Falls Back packers	Backpacker	Livingstone	54	108	559 Mokambo Road	14	16	30
1	Gloria Bed& Break Fast	Bed and Break Fast	Livingstone	8	13	Ghandi Street	2	2	4
2	North Stay Inn Bed & Break Fast	Bed and Break Fast	Livingstone	6	12	Plot 2613, off Botswana Rd,3494 Dambwa North	2	2	4
1	African Bush Camp/Thorn Tree	Camp site	Livingstone	12	48	Along Kazungula Road	14	12	26
2	Camp Nkwazi	Camp site	Livingstone	10	20	Along Kazungula Road	12	3	15
1	Guest Mate	Guest House	Livingstone	9	18	Plot 387 Obote Avenue	2	4	6
2	Likute Guest House	Guest House	Livingstone	13	30	Plot 43/44 Likute Way	2	2	4
3	Gemistar Guest House	Guest House	Livingstone	3	8	Plot 27 Mambo way	1	2	3
4	Servunik Guest House	Guest House	Livingstone	9	20	Plot 24 Mambo Way	1	3	4
5	Nalundu Guest House	Guest House	Livingstone	5	10	Plot 278 Mambo Way	1	1	2
6	La Patino Guest House	Guest House	Livingstone	8	18	Plot 4634 Nehru Way (off, Mutelo St.)	3	4	7
7	Jasy Guest House	Guest House	Livingstone			Mambo Way			0
8	Zambia Youth Guest House	Guest House	Livingstone	10	20	Kalambo Crescent	3	1	4
9	Eland Guest House	Guest House	Livingstone	10	20	Highlands	2	2	4
10	Nokenu Guest House	Guest House	Livingstone	10	20	Plot 1575 Kanina Crescent, off Lusaka Rd	1	1	2
11	Thompson Guest House	Guest House	Livingstone	5	10	Ellen Brittel, off Lusaka Rd	2	2	4
12	Wane Guest House	Guest House	Livingstone	6	12	Ellen Brittel, off Lusaka Rd	1	3	4

13	Kana Guest House	Guest House	Livingstone	5	10	Plot 2644/40 Ellen Brittel, off Lusaka Rd.	1	2	3
14	Royal Kwandu Guest House	Guest House	Livingstone	9	18	Plot 2644/49 Ellen Brittel, off Lusaka Rd.	2	2	4
15	Hilcrest Guest House	Guest House	Livingstone	6	12	Hilcrest Sec School	1	2	3
16	Kays Guest House	Guest House	Livingstone	11	22	Plot 2613/13 Off Airport Road	1	3	4
17	B & J Guest House	Guest House	Livingstone	4	8	Plot 2613/03104 Off Airport Road	2	1	3
18	Canan Guest House	Guest House	Livingstone	6	12	Along Kombe Drive	1	1	2
19	Decha Guest House	Guest House	Livingstone	11	22	Along Kombe Drive	3	3	6
20	Stone Guest House	Guest House	Livingstone	11	24	Along Kombe Drive	3	3	6
21	Mambo way Guest House	Guest House	Livingstone	6	12	Mambo way	2	2	4
22	Konje Guest House	Guest House	Livingstone	7	14	Plot 169 Off Mosi-Oa- Tunya Road	1	1	2
23	Magdon Guest House	Guest House	Livingstone	9	18	Plot 117 Mosi-Oa- Tunya Road	2	2	4
24	Sicha Guest House	Guest House	Livingstone	5	10	Plot Kombe Drive	2	0	2
25	Thorn Tree Safari Guest House	Guest House	Livingstone	12	24	Off Mosi-Oa-Tunya Road	4	3	7
26	Big Tree Guest House	Guest House	Livingstone	8	16	Behind Bus Station	2	3	5
27	Redoch Guest House	Guest House	Livingstone	12	24	Behind Bus Station	2	2	4
28	Mbizi Guest House	Guest House	Livingstone	7	14	Ellen Brittel	3	4	7
29	La Residence Guest House	Guest House	Livingstone	7	11	Plot 3065 John Hunt Way	1	2	3
30	Mamtcho Lodge	Guest House	Livingstone	8	16	Along Airport Road	1	2	3
31	Starcha	Guest House	Livingstone	16	32	Plot 2072 C/D Off Libuyu Road- Maramba	3	2	5

1	New Fairmount Hotel	Hotel	Livingstone	97	155	Along Lusaka Road, Town	47	46	93
2	Golden Chop Stick Hotel	Hotel	Livingstone	40	80	Plot 660 John Hunt Way	8	12	20
3	Protea Hotel	Hotel	Livingstone	80	280	Plot 2110 Mosi-Oa-Tunya Road	35	27	62
4	Warm Harbour Hotel	Hotel	Livingstone	25	114	Plot 475 Mosi-Oa-Tunya Road	8	12	20
5	Oriental Swan Hotel	Hotel	Livingstone	41	82	Plot 92 Mosi-Oa-Tunya Road	8	17	25
6	Avani Hotel	Hotel	Livingstone	212	424	Off Mosi-Oa-Tunya Road	312	274	586
7	Royal Livingstone Hotel	Hotel	Livingstone	173	346	Off Mosi-Oa-Tunya Road	289	226	515
8	Court Yard Hotel	Hotel	Livingstone	52	72	Plot 2869 Mosi-Oa-Tunya Road	30	23	53
9	Chrismar Hotel	Hotel	Livingstone	59	150	Sichango Street - Road National Park	60	19	79
10	David Livingstone Safari& Spa	Hotel	Livingstone	77	144	Plot 111 Riverside Drive	60	46	106
1	Pumulani Lodge	Lodge	Livingstone	8	16	Plot 281, off Mosi- Oa-Tunya Road	2	2	4
2	Rite Inn Lodge	Lodge	Livingstone	10	15	Plot 301, Mose Street	5	4	9
3	Zambezi Ultima Lodge	Lodge	Livingstone	16	32	Plot 36 Likute Way	3	7	10
4	Victoria Falls Waterfront Lodge	Lodge	Livingstone	49	90	Plot U1909 Sichango Street	42	12	54
5	Munga Eco Lodge	Lodge	Livingstone	5	10	Plot # 8005/M, Off Mosi-Oa-Tunya Road	2	2	4
6	Taita Falcon Lodge	Lodge	Livingstone	7	14	Songwe Gorge	16	1	17
7	Stanley Safari Lodge	Lodge	Livingstone	20	40	Off Mukuni Road	4	6	10
8	Chanters Lodge	Lodge	Livingstone	11	22	2 Obote Avenue - Nottie Broad	1	3	4
9	Lilamwuno Lodge	Lodge	Livingstone	16	21	Plot 2765 Likute Way	2	6	8
10	Chapa Classic Lodge	Lodge	Livingstone	27	46	66 Nehru Way	5	7	12

11	Golden Days Exec. Lodge	Lodge	Livingstone	16	32	Plot 35 Chisamba Way	4	6	10
12	Mamtcho Guest House	Lodge	Livingstone	8	16	Plot 3069 John Hunt Way	2	2	4
13	Sikalongo Lodge (1)	Lodge	Livingstone	5	10	Plot 2109 John Hunt Way	1	4	5
14	Sikalongo Lodge (2)	Lodge	Livingstone	19	38	Off Lusaka Road- Highlands	3	6	9
15	Queens Hills Lodge	Lodge	Livingstone	60	120	Mushili Way Road	6	6	12
16	Tamala Mapeso Lodge	Lodge	Livingstone	11	22	Plot 372/1373 Kalambo Crescent	2	2	4
17	Richlands Lodges (1)	Lodge	Livingstone	11	22	Plot 2671 Mutelo Street	13	11	24
18	Richlands Lodges (2)	Lodge	Livingstone	31	62	Nyasa Road	5	4	9
19	Henry Dunavant (Red Cross) Lodge	Lodge	Livingstone	25	50	Plot 455 Mokambo Road	4	3	7
20	Thatos Lodge	Lodge	Livingstone	11	22	Plot 109 Senanga Road	2	4	6
21	Olga's Italian Lodge	Lodge	Livingstone	8	16	Plot 29 Mokambo Road	9	13	22
22	Nshima Tower Boutique Lodge	Lodge	Livingstone	10	20	Off Lusaka Road- Highlands	1	4	5
23	Trench Town Lodge	Lodge	Livingstone	16	32	Highlands	1	3	4
24	Asenga Lodge	Lodge	Livingstone	10	20	Plot2898/127-High Lands	10	6	16
25	KM Executive Lodge	Lodge	Livingstone	16	32	Plot 2898/53 Highlands	2	5	7
26	Falls Gardens Lodge	Lodge	Livingstone	12	24	Plot 4424/248-Highlands	2	5	7
27	Tasha Lodge	Lodge	Livingstone	12	24	Plot 4424/200 Highlands	6	6	12
28	Limbo Lodge	Lodge	Livingstone	14	28	Highlands	5	2	7
29	Tukale Lodge	Lodge	Livingstone	12	22	Highlands	3	3	6
30	Cypress Lodge	Lodge	Livingstone	10	22	Highlands	2	2	4
31	Royal Olympia Lodge	Lodge	Livingstone	9	18	Highlands	2	1	3
32	White Rose Lodge	Lodge	Livingstone	11	24	Plot 44241/17 Highlands	2	2	4
33	Kwesu Lodge	Lodge	Livingstone	8	16	Highlands	1	1	2

34	Mosi-Oa-Tunya Exe Lodge	Lodge	Livingstone	10	20	Plot 4424/37-Highlands	2	6	8
35	Pumuna/Standard way Lodge	Lodge	Livingstone	8	16	Plot 2898/213-Highlands	1	2	3
36	Sunbird Lodge	Lodge	Livingstone	8	16	Highlands	2	2	4
37	Pakali Lodge	Lodge	Livingstone	10	20	Plot 2644 Ellen Brittel, off Lusaka Rd.	3	3	6
38	Cross Road Lodge	Lodge	Livingstone	27	58	Plot 2644/66Ellen Brittel, off Lusaka Rd.	13	11	24
39	Wasawange Lodge	Lodge	Livingstone	35	64	Off Airport Road	26	13	39
40	Wilu Lodge	Lodge	Livingstone	18	31	Plot 2644 Ellen Brittel	2	6	8
41	Golden Strides Lodge	Lodge	Livingstone	13	26	Plot 734 Ellen Brittel	2	1	3
42	Junior Pleasure Resort	Lodge	Livingstone	18	32	Off Airport Road/Ellen Brittel -Plot 2644/95-Nahumba Road	6	4	10
43	Sunset Lodge	Lodge	Livingstone	22	44	Off Airport Road	4	8	12
44	Naluzip Lodge	Lodge	Livingstone	6	12	Off Airport Road	1	1	2
45	Panama Lodge	Lodge	Livingstone	20	40	Kuta Way	2	3	5
46	Divine Lodge	Lodge	Livingstone	7	10	Plot 712/43 Chimwemwe Road	2	3	5
47	Ngolide Lodge	Lodge	Livingstone	16	32	Off Mosi-Oa-Tunya Road	8	3	11
48	Zig Zag Lodge	Lodge	Livingstone	12	24	Plot 693 Linda Road	3	6	9
49	Road Lodge	Lodge	Livingstone	17	34	Plot 20100 Mosi-Oa-Tunya Road	10	12	22
50	Okavango Lodge	Lodge	Livingstone	16	32	Plot 518 Limulunga Road	2	4	6
51	Ngoma Zanga Lodge	Lodge	Livingstone	6	12	Plot 963 Kariba Crescent	1	2	3
52	Green Tree Lodge	Lodge	Livingstone	6	16	Plot 2015 Kombe Drive	4	4	8
53	Pamyesu Lodge	Lodge	Livingstone	11	22	Plot Chilanga Lane	3	3	6

54	RSK Lodge	Lodge	Livingstone	14	28	Plot 386/1570 Chilanga Lane	3	3	6
55	House of Africa/Zambezi Cafe	Lodge	Livingstone	15	30	Plot 214 Mosi-Oa-Tunya Road	2	6	8
56	Desert Flower Lodge	Lodge	Livingstone	2	4	Sichango Road - Opposite Maramba cult. Village	1	1	2
57	Royal Sichango Lodge	Lodge	Livingstone	14	28	Off Sichango Road	3	4	7
58	Maramba River	Lodge	Livingstone	30	80	Plot 554/M Mosi-Oa-Tunya Road	4	8	12
59	Livingstone Hostels	Lodge	Livingstone	11	22	Plot 01 Kaunda Road	6	8	14
60	Woodlands Lodge	Lodge	Livingstone	26	37	Plot 4400 Gweembe Street	3	9	12
61	Tabonina Lodge	Lodge	Livingstone	11	22	Plot 1057 Maina soko Street	3	4	7
62	Kaazmain Lodge	Lodge	Livingstone	30	60	Plot Number 2764, Mainasoko Road	11	13	24
63	Kuta way Lodge	Lodge	Livingstone	17	34	Kuta Way	3	4	7
64	Panama Lodge	Lodge	Livingstone	20	40	Kuta Way	4	8	12
65	Southern Queen	Lodge	Livingstone	17	34	Behind Bus Station	1	4	5
66	Redoch			10	20	Behind Bus Station	0	2	
67	Libala Inn	Lodge	Livingstone	19	38	Off Francistown Road, Elaine Brittel	6	8	14
68	Roysam Lodge	Lodge	Livingstone	12	24	Plot 161, along airport road	2	2	4
69	Golden Strides	Lodge	Livingstone	13	26	Ellen Brittel	2	1	3
70	Toka Leya Lodge	Lodge	Livingstone	12	30	Off Kazungula, Mosi-Oa-Tunya National Park	34	12	46
71	Chuma & Susi Lodge	Lodge	Livingstone	16	32	Along Kazungula Road	52	22	74
72	Tongabezi Lodge	Lodge	Livingstone	16	26	Along Kazungula Road	92	33	125

73	The River Club Lodge	Lodge	Livingstone	11	22	Farm 1519A - Along Kazungula Road	39	10	49
74	Chundukwa Lodge	Lodge	Livingstone	12	24	Along Kazungula Road	4	3	7
75	Islands of Siankaba Lodge	Lodge	Livingstone	7	14	Along Kazungula Road	4	8	12
76	Waterberry Lodge	Lodge	Livingstone	8	28	Along Kazungula Road	47	14	61
77	Royal Chundu Lodge	Lodge	Livingstone	14	28	Plot 9003, Nakatindi Road, Katombora	55	33	88
78	Aunty Josephine	Lodge	Livingstone	25	50	Off Libuyu Road- Maramba Market	2	5	7
79	Kamunjila	Guest House	Livingstone	9	18				
	Total			**2,560**	**5,329**		**1,651**	**1,324**	**2,973**

Appendix 6.17: Number of tourists to the Mosi-Oa-Tunya National Park (2000-2020)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Domestic	9,439	8,491	10,387	6,594	5,127	6,661	6,888	7,628	11,355	9,186	8,387	12,297	6,777	9,403	10,854	13,890	12,550	11,615	9,791	9,961	6,199
Int'l	10,828	13,250	8,405	9,689	12,635	13,311	13,784	11,284	9,218	9,254	9,632	17,000	7,882	8,480	10,131	9,193	7,753	10,330	10,587	9,261	9,961
Total	**20,267**	**21,741**	**18,792**	**16,283**	**17,762**	**19,972**	**20,672**	**18,912**	**20,573**	**18,440**	**18,019**	**29,297**	**14,659**	**17,883**	**20,985**	**23,083**	**20,303**	**21,945**	**20,378**	**19,222**	**16,160**

Appendix 6.18: Number of tourists to the Livingstone Museum (2003-2020)

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Domestic	14,006	13,984	37,915	29,552	41,776	37,122	38,681	40,340	37,602	39,748	35,008	48,187	38,839	32,769	26,461	27,584	26,094	9,797
Int'l	4,100	5,367	14,000	11,330	17,312	8,149	8,319	9,080	8,419	6,590	7,121	2,536	6,560	6,701	8,466	10,159	10,429	1,391
Total	18,106	19,351	51,915	40,882	59,088	45,271	47,000	49,420	46,021	46,338	42,129	50,723	45,399	39,470	34,927	37,743	36,523	11,188

Appendix 7.1: Woody Vegetation check list -Zambezi National Park, Zimbabwe

1. *Terminalia stulhmannii*	2. *Dichrostachys cinerea*
3. *Acacia tortilis*	4. *Combretum imberbe*
5. *Terminalia stulhmannii*	6. *Bauhinia petersiana*
7. *Baphia massaiensis*	8. *Combretum collinum*
9. *Baikiaea plurijuga*	10. *Ochna pulchra*
11. *Grewia bicolor*	12. *Terminalia serecea*
13. *Diplorhynchuscondylocarpon*	14. *Baikiaea plurijuga*
15. *Croton gratismus*	16. *Baphia massaiensis*
17. *Colophospermum mopane*	18. *Terminalia stulhmannii*
19. *Acacia nigrescens*	20. *Combretum imberbe*
21. *Gymnosporia senegalensis*	22. *Combretum hereroense*
23. *Terminalia stuhlmannii*	24. *Combretum imberbe*

25. *Sclerocarya birrea*	26. *Terminalia randii*
27. *Colophospermum mopane*	28. *Euclea divinorum*
29. *Erythroxylum zambesiacum*	30. *Colophospermum mopane*
31. *Gymnosporia senegalensis*	32. *Gymnosporia buxifolia*
33. *Dalbergia melanoxylon*	34. *Acacia nigrescens*
35. *Combretum hereroense*	36. *Croton gratismus*
37. *Diospyros mespiliformis*	38. *Combretum hereroense*
39. *Gymnosporia buxifolia*	40. *Combretum imberbe*
41. *Erythroxylum zambesiacum*	42. *Euclea divinorum*
43. *Terminalia stuhlmannii*	44. *Acacia nigrescens*
45. *Colophospermum mopane*	46. *Diospyros mespiliformis*
47. *Peltoforum africanum*	48. *Gymnosporia senegalensis*
49. *Acacia tortilis*	50. *Terminalia randii*
51. *Cassia abbreviate*	52. *Baphia massaiensis*
53. *Bauhinia petersiana*	54. *Friesodielsia obovata*
55. *Baikiaea plurijuga*	56. *Combretum apiculatum*
57. *Baikiaea plurijuga*	58. *Baphia massaiensis*
59. *Baikiaea plurijuga*	60. *Bauhinia petersiana*
61. *Croton gratismus*	62. *Combretum apiculatum*
63. *Brachystegia spiciformis*	64. *Burkea Africana*
65. *Baikiaea plurijuga*	

Appendix 9.1: What excited you most about the Victoria Falls?

Landscape		Waterfalls	Zambezi River	Gorges	Victoria falls Bridge	Boiling Pot
21		31	9	7	20	12
54		71	34	23	52	32
28		36	18	13	30	19
103		**138**	**61**	**43**	**102**	**63**

Appendix 9.2: Your views on how best the Victoria falls can be improved

		Security	Audio guides device	More Marketing	Barriers along the walk ways	Guidelines on Do's and Don't	Signage to be improved
Type of Tourists	Local-Livingstone	0	3	2	6	10	0
	Local-Outside Livingstone	2	8	5	11	20	2
	International	1	11	1	6	7	2
Total		3	22	8	23	37	4

		Internet (Wifi Connectivity)	Change Rooms	Installation of lift to boiling pot	Limiting visitors access	Need for Information Centre	
Type of Tourists	Local-Livingstone	1	1	1	4	7	35
	Local-Outside Livingstone	4	2	2	4	17	77
	International	0	0	1	2	7	38
Total		5	3	4	10	31	150