APPLICATION OF REGENERATIVE ARCHITECTURAL PRINCIPLES IN DESIGN OF RESORT HOTEL; GURARA FALLS

BY

YAHAYA ABUBAKAR SARATU
DEPARTMENT OF ARCHITECTURE
AHMADU BELLO UNIVERSITY, ZARIA
NIGERIA

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BY

YAHAYA ABUBAKAR SARATU B.sc (A.B.U 2008)
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May, 2012

DECLARATION

I wish to declare that this work titled "The application of the principles of regenerative architecture in design of resort hotels" has been researched by me in the department of Architecture under the supervision of Arc. Dr. S. N. Oluigbo. The information derived from literature has been duly acknowledged in the text and a list of references provided. No part of thesis was previously presented for another degree or diploma at any university.

Yahaya Abubakar Saratu

_____	_____	_____
Name of Student	Signature	Date

CERTIFICATION

This thesis entitled "The application of the principles of regenerative architecture in design of resort hotels" meets the regulations governing the award of the degree of Master of Science, MSc, Degree of Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

_____	_____
Dr S. N. Oluigbo	Date
Chairman, Supervisory Commitee	
_____	_____
Dr M. Sagada	Date
Member, Supervisory Commitee	
_____	_____
Dr M. Abdulkareem	Date
Head of Department	
_____	_____
Prof. A. A. Joshua	Date
Dean, Postgraduate school	

DEDICATION

This thesis is dedicated to my family as a whole both the living and the dead, may their souls rest in peace, Amen. For the untiring love, blessings, inspiration and moral support they showed towards my success. Words cannot express my gratitude, may Allah (SWT) grant you all Aljanah Firdausi Amen.

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I am grateful to the Almighty Allah who gave me the wisdom, knowledge, guidance, understanding, patience and strength for the successful completion of my course of study. "Say nothing could befall us except that which Allah had decided for us"!

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May Allah bless and reward you all, Amen.

ABSTRACT

The building and construction industry is the highest active contributor to environmental degradation the world faces today. According to literature sources, the construction industry has been under immense pressure to review its practices for quite some time now. Regenerative architecture is an approach developed to improve on products and services delivered by the industry. Regenerative design is an approach that recognizes the damage that is occurring at an environmental level and replenishing the damage by treating the natural and built environment as equal partners, as this mutual beneficial relationship between these two will improve the natural environment. Tourism and its related activities such as hotels and recreational facilities can have an adverse impact on the environment, but when properly developed and managed, these tourism products can serve as mechanisms for protecting the natural environment. This aim can be achieved when planners and designers implement regenerative design innovations and technologies in developing such facilities. This purpose of this study is to illustrate the application of certain regenerative principles in the development of resort hotels with particularly in Nigeria which is the location of study. These principles were employed to foster the harmonization of nature with the built environment and to perform certain functions within the building which include; passive cooling, sustainable site design, construction material management, energy conservation and management, water management and environmentally sensitive indoor environment quality. In application, the features of these principles include; use of roof gardens, treatment of natural systems and built forms as equal partners, use of renewable and recyclable building materials, use of environmentally sensitive materials in the interiors and use of natural materials on building facades and landscape. The research findings validated the arguments presented in the literature review that regenerative design approach to planning and design will reduce most of the environmental problems in an aim to actively healing the environment/ecosystem. Studies revealed that regenerative principles were mostly applied in the foreign case studies while they were minimally utilized in the local case studies. The study further seeks to ascertain the appropriateness of these regenerative architectural design features to resort hotels designs.

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ABBREVIATIONS, DEFINITIONS, GLOSSARIES AND TERMS

Resort: is a full-service lodging facility that provides access to or offers a range of amenities and recreation facilities to emphasize a leisure experience. Resort serve as the primary provider of guests' experience, it also provides areas suitable for vacations. (Eric 2009).

Tourism: This can be described as practicing touring for the pleasure or an industry of attracting tourist and catering for them (Wikipedia, 2008).

Tourist Resort: Is a place created for the purpose of frequent visit for tourist pleasure or during holidays (Wikipedia, 2008).

Spas: spring or resort with thermal or mineral water used for drinking and bathing. The name was taken from a town near Liège, Belg., to which persons traveled for the reputed curative properties of its mineral springs.

Recreation can be defined as the process or means of refreshment or entertaining oneself. It could also be defined as a leisure time activity, engaged for the sake of refreshment.

Recreational Resorts often comprise of facilities such as botanical gardens, water accessories, aquatic zoos, zoos, bars, grandiose gardens, etc (Shantimani, 2010).

Regenerative architecture: is the practice of engaging the natural world as the medium for, and generator of the architecture. It responds to and utilizes the living and natural systems that exist on a site that become the "building blocks" of the architecture (Littman, 2009).

Renewable Energy: The energy that comes from natural resources such as sunlight, wind, water, rain, tides, and geothermal heat, which are renewable and can be replenished naturally (Energybuildings.org).

CHAPTER ONE

INTRODUCTION

This chapter introduces the research area, topic and what the researcher aims to achieve at the end of the research. The objectives to achieving the aim are identified and listed. It further depicts the limitations to be faced in the course of carrying out the research. A breakdown of the overall content of the following chapters is briefly discussed.

1.1 BACKGROUND OF STUDY

The impelling need for sustainable design in the tourism industry is motivated by the increasing building activities by tourist organizations; these include hotels, parks, airports, and other resort facilities. These building activities, if not carefully considered, ruin the beauty and integrity of their surroundings (IHRA, 2005). Resorts hotels are an example of such tourism buildings. However, sustainability in architecture as understood by modern society today, is an inadequate measure for current and future architectural design, for it aims no higher than trying to make buildings “less bad” (Littman, 2009). The intention of sustainable design is to "eliminate negative environmental impact completely through skilful, sensitive design. It is the philosophy of designing physical objects, the built environment, and services to comply with the principles of economic, social, and ecological sustainability (McLennan, 2004).The current standard of building requires very little in regard to the environment and the standard that is set for what is considered a “sustainable” building is extremely low.

The dynamic in architecture as it pertains to the environment, expects little in order to be deemed a success. When a structure is built, it is celebrated if it employs any level of environmental acknowledgement. Many critics are beginning to look towards a theory of development that moves beyond sustainability predicated on efficiency, towards sustainability

based on active and positive contribution. One such exploration is termed "*Regenerative Design"*. Regenerative architecture is the practice of engaging the natural world as the medium for, and generator of the architecture. It responds to and utilizes the living and natural systems that exist on a site that become the "building blocks" of the architecture (Littman, 2009). Reed, (2007) a very prominent and important figure in Regenerative Design as well as in the larger context of architecture, the environment and society, offers a brief definition of Regenerative Architecture. "*...a conservation, or high performance, approach focused on reducing our impact AND a living system understanding focused on learning how to engage nature as a co-equal partner"*

Regenerative architecture as a model has many similarities to sustainability. However the largest difference is that a regenerative model aims to leave a positive environmental impact on a site, instead of creating a project that has as little impact as possible, as sustainability does. (Pyke, 2011) suggests that regenerative architecture recognises the damage that is occurring at an environmental level and humanity needs to stop treating the natural and built environments as separate entities and instead create a mutually beneficial relationship between the two where the built environment acts to improve the natural environment. According to Littman, (2009) regenerative architecture has two focuses; firstly, it is an architecture that focuses on conservation and performance through a focused reduction on the environmental impacts of a building, which is embodied in the material selection, reduced energy consumption, and intelligent design. The second, more profound piece of regenerative architecture is the treatment of the environment as an equal shareholder in the architecture. It is a practice that employs a full and comprehensive understanding of natural and living systems in the design of a structure (Reed, 2007). It is an architecture that embraces the environment and uses the millions of years of engineering and evolution as the foundation for

a regenerative structure. Regenerative design is based on the premise that everything we build has the potential for the integration of the natural world as an "equal partner" in the architecture.

The impelling need for sustainable design in the tourism industry is motivated by the increasing building activities by tourist organizations; these include hotels, parks, airports, and other resort facilities. These building activities, if not carefully considered, ruin the beauty and integrity of their surroundings (IHRA, 2005). Resorts hotels are an example of such tourism buildings. Tourism is one of the world's largest and fastest growing industries, coastal tourism and recreation are important parts of the largest and the most rapidly growing activity in the world. It is now possible to travel great distances within a much shorter time without difficulties. Some developed countries have boosted their economy by exploiting the revenue earning potential of the industry and have developed their tourist destinations. Due to the current fast growing high demand for new tourists' destinations to satisfy the rapid growing population of individuals in pursuit of leisure and recreation has resulted to the development of resorts and other recreational facilities. Resorts are places where people go for vacation and whose main business is to provide visitors with recreation, relaxation and most uniquely accommodations and entertainments (Britannica, 2010).

1.2 PROBLEM STATEMENT

A lot of tourist's destinations in Nigeria do not attempt to harness the maximum use of natural potentials of the site, that is; most resorts do not imbibe the application of regenerative architecture principles and this causes damages which are very vital to tourism and resorts and increase the rate of environmental destruction. A personal identification with the architecture around us might bring about a clearer understanding of the relationships that exist between all

things, and begin to reinforce the realization of our own relationship to the larger natural world.

This thesis will address the absence of clear criteria and guidelines showing the authentic values and importance of regenerative architecture and the possible ways in which its principles can be applied for planners and architects while developing the schemes of resorts and most of all accommodate towards a more sustainable resort design.

1.3 AIM AND OBJECTIVES

1.3.1 AIM

The aim of this thesis is to:

a. The research seeks to design a resort hotel that promotes harmony between human habitation and the natural world and to inquire into the viability of regenerative architecture as a contemporary means of achieving a sustainable resort design.

1.3.2 OBJECTIVES

Objectives are set to help achieve this aim, which are:

a. To understand and provide a historical review of literature on regenerative architecture approaches covering it's concepts, principles, implementation strategies and subsequent adoption to the architectural industry.
b. To identify elements of regenerative architecture principles which are applicable to resort hotel designs.
c. To study ways in which these principles have been applied in resort and hotel design
d. Propose a resort hotel for Gurara falls while applying the findings of the principles of regenerative architectural design

1.4 SCOPE

This research is principally focused studying resort hotels and regenerative design. The studies will be reviewed in an attempt to check for the application of regenerative architecture principles in these resort designs and to discover existing planning problems of resorts and how they can be solved by applicable principles of regenerative architecture. The research mostly hinges on that aspect of regenerative architecture that makes it a viable tool for sustainability, regeneration, expression – the creation of a symbol, and an icon. Beyond this, issues of respect for site and use of building materials and technology shall also be studied.

1.5 JUSTIFICATION

Since Architecture goes hand in hand with its environment, it is only sufficient to explore the relationship between the natural land form and architectural design form, its psychological effect on the human mind and how architecture is used to achieve a well balanced harmonious and aesthetic environment and most especially to create an architectural landmark for the central northern axis of Nigeria.

Viewing the present scenario of the world, the issue of regeneration and sustainable architecture must be raised by the architects. As architects design to alter the landscape and built forms. The need to understand and be responsible for its far-reaching consequences is inherent to the future of the ecosystem.

There is a vast possibility inherent from learning from nature. The future of architecture shall greatly benefit from the emerging regenerative architecture that complements Mother Nature and draws its inspiration from it. We are all apart of nature so why not design buildings that are based on the beauty that we enjoy in nature. Nature is the starting place for understanding what is beautiful to the human being. As the saying goes “health is wealth”.

1.6 ARCHITECTURAL SIGNIFICANCE

To provide the public with a functional and sustainable resort hotel design that aims to replenish the level degradation/destruction on the ecosystem by using the principle as stated above to depict the natural terrain of the site and ensuring the natural land forms on the site are un-tampered with.

CHAPTER TWO

LITERATURE REVIEW

This chapter intends to present a contextual background of the research topic by introducing the concept, principles and ideas behind Regenerative Architecture. Thus, briefly discussing the related trends which it is built upon, and addressing some of the problems associated with current way of practice all aimed at improving some of the issues being faced today. The chapter will give a further insight into previous works by reviewing relevant theories, concepts, current issues and debates by other researchers in a bid to find solutions that will address the prevailing issues threatening the environment by providing more sustainable architectural solutions.

2.1 CONCEPT OF REGENERATIVE DESIGN

The term sustainable is defined by *Oxford English Dictionary* (2010) as being "able to be maintained at a certain rate or level" and "conserving an ecological balance by avoiding depletion of natural resources". According to literature, regenerative design theories spring from earlier concepts of sustainable development. In 1987, the World Commission on Environment and Development in its published report (WCED) defined it as "meeting the needs of the present generation without compromising the needs of the future generation". Furthermore, (Paul, 2008) suggests that it is the most commonly accepted definition. The concept of sustainable development is intended to embrace the idea of ensuring that the future generations inherit the Earth which supports their livelihood in such a way that they are no worse off than generations today (Pearce, Atkinson 1998). The idea of environmental sustainability is to leave the Earth in as good or better shape for future generations than we found it for ourselves. By a definition, human activity is only environmentally sustainable

when it can be performed or maintained indefinitely without depleting natural resources or degrading the natural environment (World Commission on Environment and Development, *1987)*). In developing a sustainable system, the WCED recognises three major pillars that must be integrated to form the framework for a successful sustainable development. These pillars include environmental responsibility, social equity, and economic viability as shown in figure 2.1 (Adams, 2006).

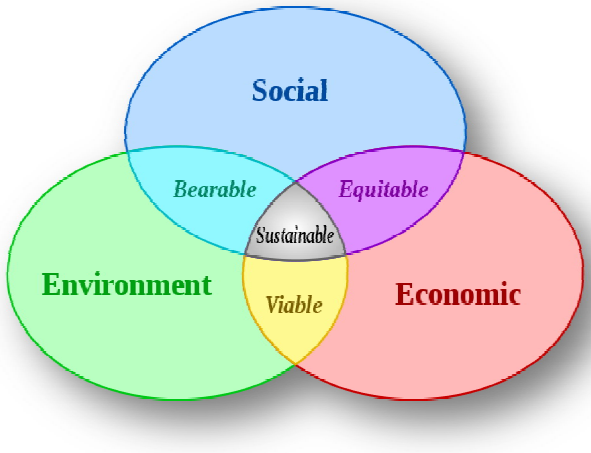


Figure 2.1: An illustration of three intersecting circles connecting the three pillars of sustainability (Source: Adams, 2006).

Although literature has proven that sustainability has been successfully achieved by various architects (McLennan, 2004; Hodges, 2009; Littman, 2009). However, for the past few years has been undergoing criticism in regards to its performance (0wen, 2009; Alier et al., 2010). According to Cole, (2012), regenerative design challenges the orthodoxy of current green building practice and the design tools that support it. Hodges, (2009) supports the argument by suggesting that while attempting to be ecological, most sustainable design projects proved to be simply examples of conservation design. Thus, suggesting that most sustainable design efforts tended to remain energy and resource consumptive i.e. remaining linear and

degenerative rather than regenerative. This critical criticism of sustainability required a new approach to design and construction resulting in emergence of regenerative design as a potential solution. Howard et al., (2008) suggests that regenerative design diverges from the perception of sustainability in three key ways. Firstly, it shifts the frame of reference from minimal to positive impact. Secondly, it questions human/environment relations based on the Cartesian separation of subject and object. Thirdly it attempts to reconnect environmentalism with a socio-political dimension, which has been lacking in much sustainability discourse. According to Lyle, (1996) the primary difference between regenerative model and the sustainability model lies in their end goals. He goes on further to suggest that in the current sustainability drive, efficiency has very much been the main focus of efforts as it has been for human consumption and production. In contrast, regenerative systems have a very different focus as regenerative design thinking seeks to overturn this concept of efficiency. Rather than asking the question of "Is it efficient", the primary question that regenerative systems ask is this "is it EFFECTIVE?" Figure 2.2 shows a positive upward movement from conventional design through green design to a fully restorative and regenerative design. In order to actively achieve sustainable development; the supply system for energy and materials must be continually self-renewing or regenerative in their operation. Hence, sustainability requires ongoing regeneration (Lyle, 1996; McDonough and Michael, 2001).

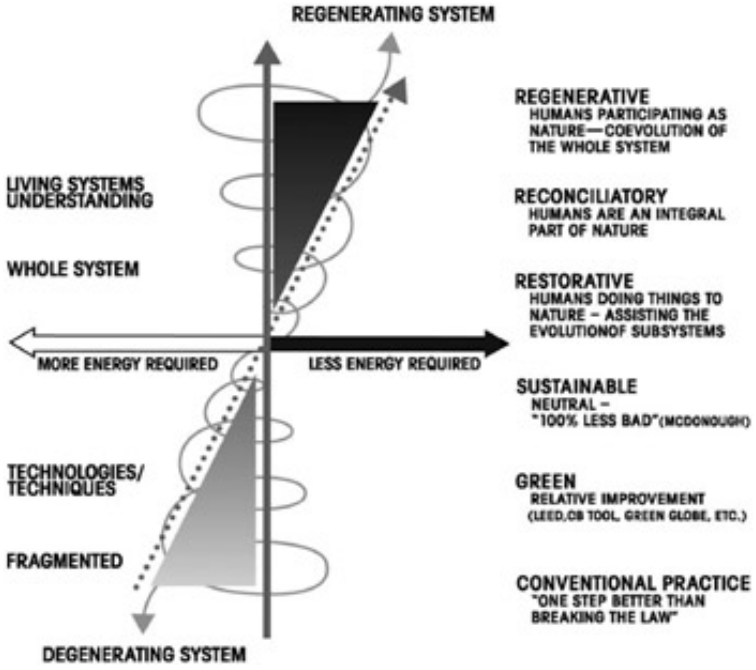


Figure: 2.2 Trajectory of environmentally responsible design
(Adopted from Reed, 2006)

2.1.1 REGENERATIVE ARCHITECTURE

Architecture is defined as "the art or practice of designing and constructing buildings." This is a common definition of architecture, though it is incomplete; the breadth of possibilities for regeneration and integration are nonexistent as the definition limits us to architecture being solely a building. However, Zari et al., (2009) argues that it is important to recognise that the built environment does not solely comprise buildings infrastructure and public spaces; it also includes human community and cultural experiences. Buildings exist as a part of a place/site, which our definition of architecture does not account for. The question is why do we remove the building from the site in our definition of architecture? The building requires the site for its existence, but we view them as separate elements. Perhaps we can expand the definition of architecture to "the art or practice of designing and constructing place, through the integration of site and building." This definition is more complete and comprehensive as including the site

in architecture is the only way for a building to be "beyond sustainable" or regenerative (Ryn, 2005).

Architecture is regenerative when the term architecture incorporates more than just the building. The definition of a truly sustainable built environment is changing rapidly (Zari et al, 2009). The architecture is the place, the site, the systems, the energy, the building, the fauna and flora, etc. According to (Zari and Jenkin 2009), the relationship between these components influences how the built environment develops over time and contributes to creating a 'sense of place'. The 'sense of place' is the character or essence of a location, comprising all features whether they are natural or constructed. Over the past years, however, regeneration has been garnering increasing interest as a means of reframing green building practices and, carrying with it, qualitatively different and broader connotations than that used previously (Cole, 2012). A regenerative design is an architecture that is purely embedded into the site. It exists as one piece, one system that co-evolves as one complete entity. Once this understanding of architecture is adopted, the opportunities for regenerative architecture become almost limitless.

The health of the ecosystem is improved and the architecture is now producing more than it consumes, having a positive existence; this is called regeneration. The expansion of our built world paradigm allows for humans and the environment to exist in integration. It allows humans to return to a place of equilibrium and regeneration in our life places. The upward spiral of environmental health can begin, which ultimately increases the health of the human species as well as the environment, needless to say it is in our best interest to adopt a process of regeneration and integration. According to Mang, (2001) regenerative design is the proposed design approach that best reflects the thinking that will shape the next phase of development within the field of sustainable design. We can have regenerative architecture

when our production output from the system is greater than the net input of resources into the system. The architecture, in its new definition, is producing a surplus of food, more clean water than it consumes, more energy than it consumes, provides richer diversity than was before the structure became part of the system (Littman, 2009). Regenerative design offers a positive vision of reversing the environmental degradation and community fragmentation that have become all too common in the built world. It provides a model for harnessing the forces of development to renew and revitalize the environment and restore ecological integrity (ASLA, 2008). Fundamental to that effort is the attention to particular aspects of the site which are both cultural and natural that often must be transformed or renewed in order to restore integrity of place.

The goal of a truly sustainable built environment is restoration or regeneration, where success is measured by improvements in health and wellbeing for humans, other living beings, and ecosystems as a whole (Kellert, 2004; McDonough & Braungart, 2002; Reed, 2007b). A regenerative built environment becomes a conduit for producing resources and energy; remediating past pollution; and transforming and filtering waste into health giving resources. This requires a living or whole-systems approach to development that takes into account both the human and non-human ecology of the built environment (Zari et al, 2009). Regenerative design is also about relationships between humans and the natural environment, between buildings and their occupants, and between natural and constructed environments. Regeneration therefore is a process of engagement rather than a set of outcomes. This process of engagement has significant environmental, economic, social and cultural benefits related to community building and participation.

2.1.1.1 GUIDING PRINCIPLES FOR REGENERATION

Murphy and Marvick (1998) went on further to present us with a model for developing a successful and comprehensive regenerative architecture. William McDonough, a very prominent architect who employs many of these principles in his work has developed set principles called The Hannover Principles. They are a set of design guidelines that were created for the World Exposition in Hannover, Germany in 2000. They prescribe a method for designing that is based on the elements Earth, Air, Fire, Water and Spirit and that humans must coexist with nature. The Hannover Principles describe the innate interdependence that humans have with the natural world including the effects of our designs on the viability of ecosystems. They consider "all aspects of human settlement", and the interactions of people with their built environment and nature.

The Hannover Principles

- Insist on rights of humanity and nature to co-exist
- Recognize interdependence.
- Respect relationships between spirit and matter.
- Accept responsibility for the consequences of design
- Create safe objects of long-term value.
- Eliminate the concept of waste.
- Rely on natural energy flows.
- Understand the limitations of design.

However, Van Der Ryn and Cowan (2005), argued that there are other factors to consider. They went on further to develop sets of design guidelines that are crucial and extremely influential for regenerative architecture. The first is entitled "***The Five Principles of***

Ecological Design." They highlight the importance of knowledge of place and the importance of designing structures that compliment the natural world. The guidelines emphasize the importance of integrating the natural systems and processes in the most fluid manner possible by suggesting "the more seam-less these factors are integrated into the design, the less human activities will detract from the health of nature.

- Solutions Grow From Place.
- Ecological Accounting Informs Design.
- Design with nature.
- Everyone is a Designer.
- Make Nature Visible.

The second set of guidelines is called The ***Todd's principles of Ecological Design***, John and Nancy Jack Todd. The intention was to create a set of guidelines that would clearly and definitively place nature "at the center of the design process." These principles focus on nature being the teacher and generator of design. It incorporates architecture, food production and waste management into the principles so as to acknowledge, suggesting that these features are the three most important criteria to address regenerative and ecological design.

The Todds' Principles of Ecological Design

- The living world is the matrix for all design.
- Design should follow, not oppose, the laws of life.
- Biological equity must determine design.
- Design must reflect bio-regionalism.
- Projects should be based on renewable energy sources.
- Design should be sustainable through the integration of living systems.

- Design should be co-evolutionary with the natural world.
- Building design should help heal the planet.
- Design should follow a sacred ecology.

According to (Littman, 2009; Hodges, 2006) all three of these design models exhibit many similarities in their prescription. They are all based on the same basic premise, though each has their own fundamental focus, whether it is architecture or design in general. The basic theme that is concurrent throughout all three is the premise that design needs to be in response to the local biosphere and the specific place that the architecture is generated for.

2.1.2 THE PRINCIPLES OF REGENERATIVE ARCHITECTURE

John Tillman Lyle in his book "Regenerative Design for Sustainable Development" identified six (6) principles of regeneration which are explained below Lyle (1994). They include: To design with effectiveness as end goal; Close loop system; Integrate human processes with natural processes; Symbiosis between different elements; Multiple pathways to the same goal; Within renewal capacity.

To produce a design that is effective to both human and natural environment

This is mainly concerned with making good decisions. 'Good' is not defined as for the sole benefit of the human species, but "good" in terms of all species. We are not detached from the ecosystem and we need to start to recognize what is good for us may not be good at all for the ecosystem.

Design of closed looped system

We need to design and remake our production processes to form closed loops where material flows are cycled and remove the concept of waste. This field of study is termed industrial ecology. An industrial ecosystem is a system in which the consumption of energy and

materials is optimized, waste generation is minimized and the effluents of one process serve as the raw material for another process.

Integrate human processes with natural processes

We are very much part of nature, as much as we don't realize it. However, plants covert carbon dioxide to the oxygen which we breathe. The hydrological cycle constantly replenishes the freshwater supply. It is necessary to redesign human processes to be aligned with natural processes, to protect, reinforce and strengthen them where possible. For example, rather than building seawalls to protect against erosion and flooding, it's far more effective to use natural vegetation to do the same work.

Symbiosis between Different Elements

We need to start designing our systems to take advantage of share linkages that would provide mutual benefit. This is similar to processes in nature where bees and flowers for example share are mutually dependent.

Multiple pathways

Like ecosystems, there is need to design systems to have multiple means to the same goal. Going by the efficiency theory, only one method should be the best, but viewing from the lenses of effectiveness, it creates a dynamic web of flexible, mutually supporting relationships. Although flowers depend on bees to pollinate, alternative pathways exist like the hummingbird, which also fulfil the same function.

A design within renewal capacity

Any system, when overloaded, will degrade over time. Hence, regenerative systems must work within the carrying capacity. Thus, the role of the designer is to decide what appropriate development is and how much is optimal development.

However, Littman, (2009) argues that the above principles identified by Lyle, (1994) as explained above are rigid and not specifically made for regenerative architectural design. He went on further to breakdown these six principles into nine which offer a design process and criteria mainly for regenerative architecture. These principles include: which are further explained below in the following section.

i. Whole systems design integration
ii. Integration into the landscape
iii. Principle of Intelligent limits
iv. Principle of Concentration
v. Principle of intelligent construction
vi. Principle of bold ecology
vii. Principle of "community."
viii. Experience of place
ix. Principle of culture

For the purpose of this thesis report, the design principles identified by Littman, (2009) will be adopted as it best suits the research topic. The table 2.1 below explains the principles which are further sub categorized according to their features.

Table 2.1: The Nine Principles of Regenerative Architectural Design

Regenerative design Principles	**Features**
Whole Systems Design Integration	A. All systems and entities are accounted for and incorporated into the system design B. All systems are involved in communities of mutually supportive relationships C. Principle of multiplicity D. Principle of redundancy
Integration	A. Analysis of the landscape and its natural elements is the foundation and origin of/for design

Into Landscape	B. Dwelling and landscape integration creates a new unit/whole entity C. The construction of the dwelling unit is naturally artificial or artificially natural.
Intelligent Limits	A. Every given program has a minimum required limit, but potentially infinite maxima. B. The design reflects natural equilibrium of program C. Each material and space is potentially maximized and integrated to its fullest potential positive net input into the whole system
Concentration	A. Less is more B. Each space is accounted for and is necessary. C. Flexible spaces/programmatic duality
Intelligent Construction	A. The system is constructed using natural and artificial processes B. The construction is designed to maximize material efficiency C. Each material is implemented to its maximum potential D. The architectural image is embodied in construction and materiality
Bold Ecology	A. Ecological systems are regenerative B. Ecological production provides positive net output C. Ecology embodies all natural elements and harnesses the artificial D. Energy is transcendent E. Ecology is image
Community	A. Scale is irrelevant to the importance of an entity/ group B. Support for the exchange of experience and social practice is embodied C. All members of the community are participants in and influencers of the design
Experience of Place	A. The image of the place formulates positive experience B. The experience is driven by clear systemic form C. The place is experience able by the individual and by the communities alike. D. The experience of the place is positive E. The place describes story
Culture	A. The social history of the place is present in the design B. The geological history is complimented and preserved C. All present cultures are constituents of the place D. Cultural permanence is accommodated E. The quality of life for all cultures is enhanced by the design and intervention

2.1.2.1 Whole Systems Design Integration

This principle embodies and describes what is inarguably the most crucial of guidelines among all. The first states, "**All systems and entities are accounted for and incorporated into the overall system design."** What this means is that in the design process the site should be viewed as a whole system and within that system we cannot begin to pick and choose which elements are important to our needs and us. Human needs are not the only needs that must be accounted for within the system and approaching the design process with the intention of operating within the whole system without segregating, alienating or overlooking any of the members of the whole system community of the given site.

The second guideline states that, **"all systems are involved in communities of mutually supportive relationships."** This is a guideline that, when followed, reinforces the first guideline by requiring each system element be comprehensively treated within the design, allowing for each relationship to strengthen the whole system. The whole system is constructed with a conglomeration of mutually supportive relationships within the system. A system cannot exist without the mutual support of system elements. An example of this can be seen in a well implemented living roof system. The roof of the structure is planted using local sedum, grasses and vegetation and provides a habitat for these species to thrive. The plantings, in turn, provide the structures with a great deal of thermal insulation, storm water capture and purification and eliminates the heat island effect of a traditional roof, just to list a few.

The third guideline is called the **"principle of multiplicity"**. This states that each entity within the system should perform more than one function or satisfy more than one need within the system. This is a principle that is at the core of perm culture design and is traditionally describing one of the methods for designing poly cultures within edible forest gardens and

perm culture gardens; the theory behind it is universal, though, and can be applied readily to regenerative architecture.

The fourth guideline is the **"Principle of Redundancy".** It states that each need within the system is met with more than one solution. This is also a principle that is at the core of perm culture design. This Principle is based on the recognition that within a natural system there is no one solution for the healthy operation of the system. An implementable and realizable example of this within regenerative architecture is the acquisition of usable energy such as solar, wind and biomass. In a regenerative design it is necessary to consider the implementation of at least two of these options for meeting demand for energy, thus solving the problem of energy with more than one solution, strengthening the energy system, solidifying our energy input, making it more reliable, efficient and beneficial.

2.1.2.2 Integration Into The Landscape

This principle carries with it three main focus points.

The site analysis of the landscape, its natural elements and systems are the foundation for and generator of the design: It is describing the process as a generative one, transforming data, knowledge, and insight collected from the site into architectural and landscape form. In applying this method, offers the opportunity to create a design that is purely of and for the site.

The dwelling and landscape integration create a new whole entity: What this means is that by designing through "whole systems design" and "integration into the landscape" there is no longer a bifurcation between the dwelling and the landscape. Hence, creating a new entity which integrates both the site and architecture as it is now embodying both elements.

The construction of the dwelling is naturally artificial or artificially natural: This means to understand that architecture is an artificial entity, as it is something that is imposed upon a landscape. In regenerative architecture, it is important to bridge the gap between the artificial and the natural, thus synthesizing the relationship between the two.

2.1.2.3 Principle of Intelligent limits

This principle states that every program has a minimum required limit, but has a potentially infinite maximum, the design reflects the equilibrium of the program, and each material and space is potentially maximized and integrated into its fullest potential positive net input into the whole system. Intelligent limits is crucial to the design process because it ensures that an equilibrium can be met within the system, though an equilibrium can occur in many different conditions and can evolve in many different ways based on what is imposed upon the site. In the design, intelligent limits is applied in order to achieve an equilibrium that is regenerative and without limiting the potential for regeneration within the system.

2.1.2.4 Concentration

This principle is primarily concerned with space. Each system element has a relative location or locations within the site and it is often overlooked that the special relationships between system elements can have enormous impacts on the operation of the system. Design each element relative location with the intention of maximizing the capability of that system and what it can provide to its counterpart systems. The principle of concentration is largely concerned with maximizing the usable spaces. In analyzing site and systems one can understand what the potential is for a given space. Also, on the other hand, care not to over program a space, as well as omitting spaces from “design,” as our intervention is not always

the best solution for a given site, system or space. It is important to remember that less can be more.

2.1.2.5 Principle of Intelligent Construction

It refers to the construction of the architecture, as well as to the construction of systems, and the site. Intelligent construction regards efficiency of materials, by adopting the use durable materials, diverting 75% of construction waste from landfills, maximize use of regional materials, maximize the use of Materials with recycled Content, use materials that reduce harm to people and the environment as the core of the principle. One other crucial piece is the embodiment of the "image" of the design in the materials. What this means is, the expression of the design can be made through material selection. Materials tell a story about the place, the design, the systems and the users.

2.1.2.6 Principle of Bold Ecology

Bold ecology is a term that insinuates the implementation and proliferation of ecological systems that perform multiple functions, are regenerative and provide a positive net output. The bold ecological system transcends our current perceptions of ecology, as it embraces and embodies everything that ecological systems have to offer us as well as to the whole system. We engage with the ecology, it provides us with our shelter, sustenance and place. It becomes more than simply ecology, as our lives are embedded within it.

2.1.2.7 Principle of Community

Communities can be composed of homogenous elements as well as collections of diverse entities. They can occur and exist at extreme minima and maxima, and are always defined by their connectedness to all other communities, and without the existence of all other

communities the distinction of one singular community would not be possible. Communities evolve on every level of scale, and through the self-organizing nature of communities, systems are born. All communities in a system are composed of a sub-set of communities that exist on a smaller scale and coalesce to form the system. Each system and community can be subsequently disassembled to reveal the components that constitute their existence.

2.1.2.8 Sense of Place

The experience of the place principle embodies a set of qualities and phenomenological characteristics that are identifiable in and specific to any place. The experience is one that should be positive and driven by clear systemic form. The place should be experienced by communities and individuals, and should tell a story about the place. The experience of place reflects the intentions of the design and describes the regenerative nature of the system. Understanding place helps determine design practices such as solar orientation of a building on the site, preservation of the natural environment. Van der Ryn (2006), in his book "*ecological design"* suggests that "Solutions Grow from Place," it states that solutions grow from the unique cultural and physical characteristics of place, which are so often ignored by standardized designs.

2.1.2.9 Principle of Culture

Culture is an absolutely essential principle, which manifests itself on all layers of scale and is present in every species, poly culture, structure and system. Each cultural entity is a constituent of the place and should be harnessed and celebrated through the design process. Each place tells a story and has a history embedded within it and it is through cultural expression that these stories are told. The cultural expression is identified through pattern recognition during the place analysis process.

2.1.3 STRATEGIES FOR REGENERATIVE DESIGN

John Tillman Lyle proposed the following twelve strategies for regenerative design in his book "Regenerative Design for Sustainable Development". These design strategies encompasses the key principles discussed above, (Lyle, 1994).

Letting Nature Do the Work

Many of the mechanism and processes of regenerative design are inherently performed by nature. Under conventional design these process are replaced by engineered systems which are costly in terms of energy requirements and environmental disturbance. Nature provides these services and with a little augmentation we can tap into these processes and utilize them for our benefit and reconnect to the environment.

Considering Nature As Both Model and Context

When developing a landscape, re-establishing the connectivity and continuity in nature is crucial (Lyle, 1994.) Utilizing nature as a model for design allows insight into underlying connectivity and material flow through the ecosystem.

Aggregating Not Isolating

Dismantling complex problems can reveal the characteristics of its individual parts, enabling design to recreate through understanding the processes involved. Aggregation leads to rich links, minimizing the energetic needs of production. Regenerative design has to be concerned with the interactions among the parts, the connections, as with the parts themselves to develop successfully (Lyle, 1994).

Seeking Optimum Levels for Multiple Functions

Regenerative systems will always have multiple goals. These goals can be in conflict, therefore manage the system to maximize the system, not an individual element (Lyle, 1994). Managing the connectivity of the system to create the optimal outcome is equivalent to maximizing the system.

Matching Technology to Need

This strategy is about applying appropriate technologies for the proper use. For example instead of using a conventional air conditioning system, we can use natural ventilation and other cooling techniques such as cooling tubes and sunshades (Lyle, 1994).

Using Information to Replace Power

Maintaining open lines of communication and a feedback monitoring systems allow for greater information sharing and result in community based decision-making and management (Lyle, 1994).

Providing multiple pathways

Multiple pathways allow for a flexible response to changing market conditions, supply and demand alterations, and system malfunction (Lyle, 1994).

Seeking common solutions to dissipate problems

Instead of separating and compartmentalizing life-support systems, recognize and utilize the interconnectivity to create common solutions. Specifically recognize system interactions and solutions provided within the same system (Lyle, 1994). An example is our water management system; conventionally water is managed in terms of supply, storm water and sewer

management. This system has the potential to be interconnected and effectively managed more efficiently, and resulting in reduced water use and sewer demand.

Managing storage as a key to sustainability

Maintaining adequate storage and balancing the rate of replenishment with the rate of use are important keys to successful sustainable community. Nature has available storage devises in groundwater basins and the atmosphere for oxygen and other gases (Lyle, 1994). Regenerative design incorporates natural storage mechanisms and develops its own.

Shaping form to guide flow

Energy and material flow through system within the physical medium of the environment and determine the rate of flow. By shaping the environment, we can guide flow. “Flow follows form follows flow” (Lyle, 1994).

Shaping form to manifest process

In regenerative design technologies are more difficult to hide (Lyle, 1994). Instead of cloaking the technologies in a façade we utilize them as a means for design, for many are integrated to their context and can be utilized for education secondarily. “Cultural habits and preconceptions change slowly, but if we can manifest the inherent elegance of ecological processes in visible forms, those forms will become symbols of the time” (Lyle, 1994).

Prioritizing for sustainability

There has been a slow increase in regenerative and sustainable design in the past decade, yet we are in a long period of transition in which our priorities must change (Lyle, 1994). To

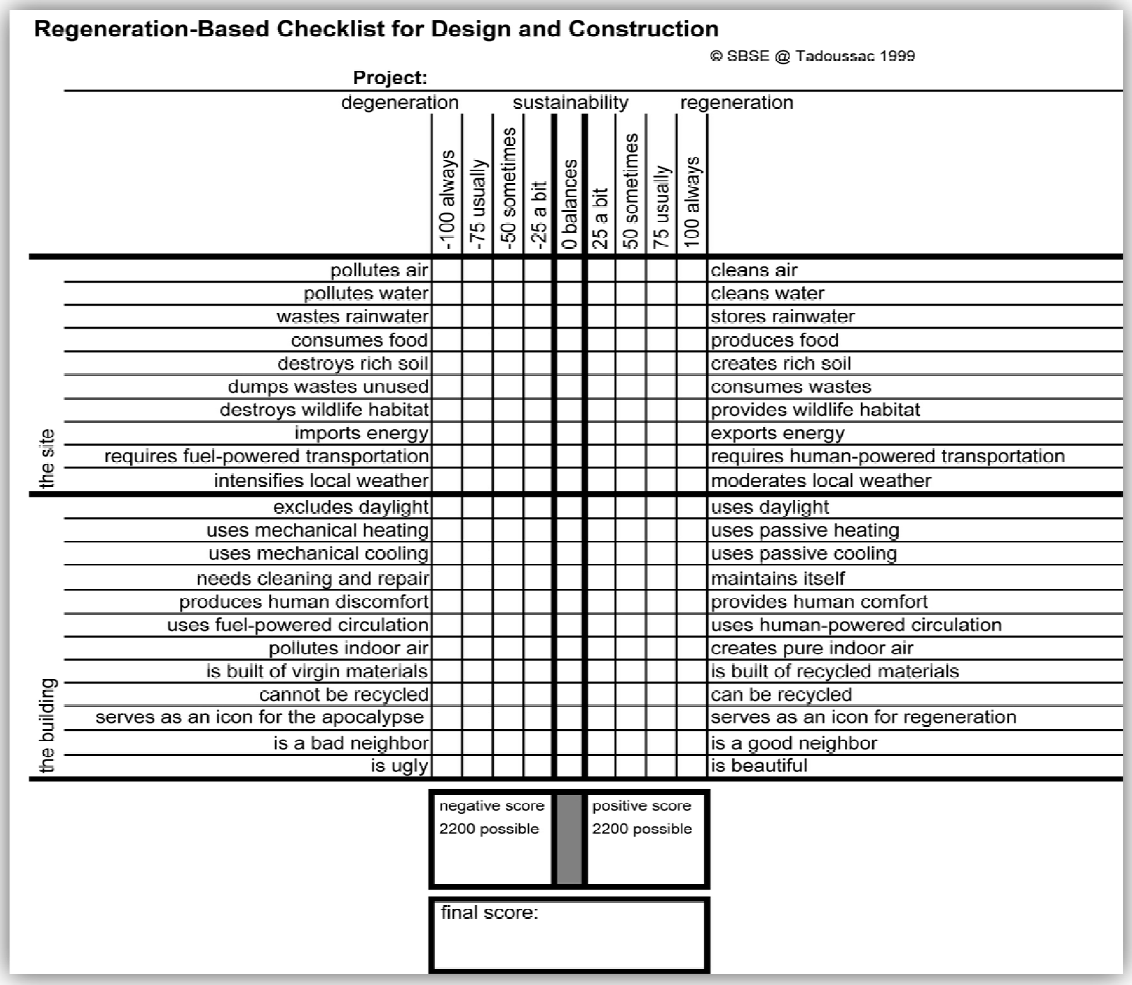
succeed in sustainable design sustainability and regenerative design must take a high priority through all sectors of society, the environment, and government.

2.1.4 EFFECTS OF REGENERATIVE DESIGN ON THE BUILT ENVIRONMENT

Regenerative architecture has the potential to influence and dramatically change the way we build. It is a paradigm that prescribes a deep understanding of the natural world and the systems that exist within it (Littman, 2009). We can build using the environment as our model and guide for the architecture that is generated. It is a process that requires the inclusion of all of the natural processes of the natural world. The essence of regenerative architecture is based on the conception that there is no disconnect between human and nature. It suggests that humans and nature are one; we are not above nature but an integral part of nature. It is based on *whole systems thinking*, which means that everything is connected as one system and that each piece of the system is equally important to the health of the system as a whole. The mental model of whole systems thinking in architecture generates an architecture that is wholly comprehensive and inclusive in nature. It incorporates all parts of the ecosystem and biosphere as equally integral participants in the generation of the architecture (Reed, 2006).

Malcolm Wells in 1969 proposed a Wilderness-*Based Checklist for Design and Construction, which set* the wilderness as the benchmark model for design. His ratings show a wilderness to score a perfect 1500 while a suburban research lab would attain a negative score (Wells, 1969). However, during the summer of 1999 the Society of Building Science Educators (SBSE) studied Wells checklist and revised it to reflect the changes in thinking that have affected sustainable design in the past years. The most notable changes were to organize the checklist into site and building issues and to acknowledge John Tillman Lyle's idea that sustainable design is merely breaking even, while regenerative design renews earth resources (SBSE, 1999). He went on further to suggest that each of the following issues should be

regarded as a continuum from the worst negative impact (on the left) to the best positive impact (on the right) as shown below in figure 2.3. The following section will discuss the site and building issues simultaneously for better understanding.



Regeneration-Based Checklist for Design and Construction

© SBSE @ Tadoussac 1999

Project:

	degeneration		sustainability			regeneration				
	-100 always	-75 usually	-50 sometimes	-25 a bit	0 balances	25 a bit	50 sometimes	75 usually	100 always	
the site	pollutes air									cleans air
	pollutes water									cleans water
	wastes rainwater									stores rainwater
	consumes food									produces food
	destroys rich soil									creates rich soil
	dumps wastes unused									consumes wastes
	destroys wildlife habitat									provides wildlife habitat
	imports energy									exports energy
	requires fuel-powered transportation									requires human-powered transportation
	intensifies local weather									moderates local weather
the building	excludes daylight									uses daylight
	uses mechanical heating									uses passive heating
	uses mechanical cooling									uses passive cooling
	needs cleaning and repair									maintains itself
	produces human discomfort									provides human comfort
	uses fuel-powered circulation									uses human-powered circulation
	pollutes indoor air									creates pure indoor air
	is built of virgin materials									is built of recycled materials
	cannot be recycled									can be recycled
	serves as an icon for the apocalypse									serves as an icon for regeneration
	is a bad neighbor									is a good neighbor
	is ugly									is beautiful

negative score	positive score
2200 possible	2200 possible

final score:

Figure 2.3: Based Checklist for Design and Construction.
Source; (Reed 2007)

2.1.4.1 The Site

Pollutes Air - Cleans Air: Consider exterior air pollution via combustion (furnace, automobile, and lawn mower), ventilation, and off-gassing. Consider air cleaning by native vegetation to create oxygen, absorb CO2, and remove pollutants. Exotic plants which require constant watering and fertilizing are wasteful, expensive, and inappropriate.

Pollutes Water - Cleans Water: Consider water pollution by on-site toxic wastes, pesticides, insecticides, fertilizers, and petroleum products. Consider cleaning of water that falls on or flows through the site by retention and percolation to the water table. Avoid impervious surfaces such as roofs and pavement. Green roofs, earth sheltering, and porous pavement are alternatives. Use retention ponds and percolation basins to control and purify runoff. Also, consider treatment of gray and black water created in the building.

Wastes Rainwater - Stores Rainwater: Consider rainwater harvesting, water recycling, and water conservation. The best place to store rainwater is in the earth, in the water table. It can also be stored in cisterns for domestic use. Gray and black water treated on-site can be reused. Conserving water used for irrigation and domestic use reduces the amount removed from ground water reserves.

Consumes Food - Produces Food: Consider food produced for humans and other species. You may not be able to feed a whole family with the food grown on a small site, but the home grown food cannot be beat. A peach plucked from a fourth-level orchard is bound to better than one that was trucked a thousand miles.

Destroys Rich Soil - Creates Rich Soil: Consider soil destruction through hard landscape creation (the roof and pavement) and pollution. Topsoil is alive; which should not be destroyed. Pesticides and herbicides are death to soil. Erosion strips it away. Soil-building ground covers, earthworms, composted organic wastes, and mulch will restore ailing land to healthful life.

Dumps Wastes Unused - Consumes Wastes: Consider the fate of all wastes created on-site (waste water, trash, pollutants) while the building was being constructed and during its lifetime. Organic wastes can be composted; waste water can be a nutrient for other life forms;

construction wastes, consumer goods, and packaging can be recycled. In nature all things die and return their wastes as nutrients in compost. Our shame is ocean dumping, sanitary landfills, and sewage. Recycling, reuse, grey water systems, and constructed wetlands allow us to avoid these embarrassments.

Destroys Wildlife Habitat - Provides Wildlife Habitat: Consider the impact of the building, its site development, and its occupants on wildlife habitat. Let old families move back into the neighbourhood. Whole communities of wildlife will return and set up housekeeping at our doorsteps once we get the asphalt and manicured lawns out of our blood. Wild creatures don't have to be invited twice. Provide the right habitat and they will appear.

Imports Energy - Exports Energy: Consider the energy required to heat and cool the building, to maintain the site, and to provide electricity for lights and equipment. Solar energy can be used to heat, cool, and daylight buildings. On-site wind, hydro, and photovoltaic generation of electricity is possible. Using solar energy avoids burning fossil fuels which causes air pollution, generates greenhouse gasses, and adds to the city effect. It also replaces large-scale hydroelectric power which disrupts ecosystems. Large manicured lawns usually require fuel-powered equipment for maintenance.

Requires Fuel- Powered Transportation: Requires Human - Powered Transportation. Consider the buildings accessibility by automobile, transit, bicycle, and foot. Pedestrians and bicycle riders burn no fuels and cause no pollution. Mass transit reduces the per capita reliance on fuel consumption.

Intensifies Local Weather - Moderates Local Weather: Consider the microclimatic effects caused by the building and site development. Pavement, masonry walls, and waste heat intensify the city effect while green space and water retention moderate the effects.

2.1.4.2 The Building

Excludes Natural Light - Uses Natural Light: Consider the use of daylight for ambient and task lighting in the building. Electrical lighting systems can be designed to augment day lighting on an as-needed basis.

Uses Mechanical Heating - Uses Passive Heating: Consider the systems used to provide heat to the building. Conservation through intelligent building envelope design can greatly reduce or eliminate the need for mechanical heating systems. Active solar heating systems greatly reduce the use for mechanical components when compared to mechanical systems. Passive heating techniques avoid all mechanical systems, but may require mechanical back-ups.

Uses Mechanical Cooling - Uses Passive Cooling: Consider the systems used to provide shade, ventilation, humidity control, and cooling for the building. Shading can occur through site elements, exterior shading devices, and interior shades. Cooling can be provided by stack and cross ventilation schemes as well as fuel-powered fans. Evaporative cooling systems can be either passive or mechanical. Desiccants as well as air-conditioners can control humidity.

Needs Cleaning and Repair - Maintains Itself: Consider durability of the materials and systems used in the building. Sunlight, water, ice, and pollution-laden air are rough on building materials. Protect exposed surfaces in every way possible. Building with dead materials as we do, we.re forced to compromise, so compromise well. Underground buildings are ideal in this regard, hiding their skins from damaging elements. The more mechanical systems that are installed in a building, the greater is the chance for failure and the requirement for maintenance. Passive systems avoid a plethora of mechanical devices.

Produces Human Discomfort - Provides Human Comfort: Consider thermal, luminous, and psychological comfort, Thermal comfort is enhanced by diverse and appropriate

conditions throughout the year. Constant temperature and humidity is boring. Glare and high contrast cause luminous discomfort. Contact with outdoors conditions can provide psychological comfort.

Uses Fuel Powered Circulation - Uses Human Powered Circulation: Consider both horizontal and vertical circulation schemes. Even when elevators are present, human-powered circulation can be encouraged by visually accessible, prominent, and engaging stairways.

Pollutes Indoor Air - Creates Pure Indoor Air: Consider the building materials, furnishings, and maintenance requirements as sources of indoor air pollution. Materials and furnishings can off-gas volatile organic compounds (VOCs). Cleaning agents may include toxins such as chlorine. Paints, varnishes, stains, and adhesives may off-gas pollutants. Equipment and occupants can create carbon dioxide and monoxide. Choose non-VOC materials, finishes, and furnishings. Use indoor plantings to absorb CO2 and create oxygen.

Cannot Be Recycled - Can Be Recycled: Consider the materials used and the construction techniques employed as well as the suitability of the structure for new uses in the future. Some building materials are easily recycled (metals) and some have enduring value (large wood members). Some construction systems allow for easy disassembly and feature standardized components that can be reused. Some buildings are flexible in accommodating future uses, e.g. a warehouse can easily be converted into loft housing or office space.

Serves as an Icon for the Apocalypse - Serves as an Icon for Regeneration: Consider the symbolic nature of the building. A building that blatantly ignores the ecology, environment, and constraints of the earth's resources spells doom to the planet. A building with high visibility and appropriate responses to ecological issues can serve as a role model and inspire regenerative design.

Is a Bad Neighbour - Is a Good Neighbour: Consider the building and site's relation to its neighbours. A bad neighbour hogs the sun in winter, sends run-off off site, and intensifies neighbouring climate, causes glare, air pollution, and noise pollution.

Building Form is Ugly - is Beautiful: Make an aesthetic judgement. When architecture draws its lessons from the wild, beauty will no longer have to be applied. Organic rightness-appropriateness will repair the broken connection between architecture and its roots.

2.2 RESORT DESIGN

Traditionally, resorts have been places to make social contacts, attend social occasions, to improve health and fitness. Huffadine, (2000) argues that although the social pursuits continue, many other interests have been added which includes golf, ski, beach and theme parks complimented with urban amenities with golf and theme parks gaining enormous popularity. Resorts have been defined in different ways by various researchers. According to Hassan, et al. (2010), resorts refers to a building or a group of buildings designed in a particular setting to cater for both relaxation and recreational activities. (www.wikipedia.org) defined resorts as places, towns or sometimes commercial establishment operated by a single company. Such a self-contained resort attempts to provide for most of a vacationer's wants while remaining on the premises, such as food, drink, lodging, sports, entertainment, and shopping. For the purpose of this research the definition by (Brey, 2009) was adopted. He defined a resort as a full-service lodging facility that provides access to or offers a range of amenities and recreation facilities to emphasize a leisure experience. Resorts serve as the primary provider of the guests' experience, often provides services for business and meetings and are characteristically located in vacation-oriented settings. Plates 2.1 and 2.2 describe the

concept behind resort design, showing off grand sceneries for relaxation and other leisure activities.



Plate 2.1: Disney's Animal Kingdom Lodge – Lake Buena Vista FL
(Source: www.wellerpools.com)



Plate 2.2: Orange Lake Resort – Kissimmee
(Source: www.wellerpools.com)

The modern tourist associates the resort experience with relaxation, luxury, service and care and expects to be pampered. These pleasures are enhanced by the opportunity to participate in a wide variety of sports, recreation and entertainment and also escape from day to day stresses. Hence, this resort sites may front beaches, lagoons, hill slopes or lakes or provide elevated

views with convenient access to the waterfront activities. Resorts have a rich history in the world- homesteaders initially offered accommodation to hunters and fishermen and then grand resorts were built, capitalizing on the steamships' ability to bring visitors into remote locations to promote socialization, relaxation and other recreational activities. The traditional social orientation of resorts has expanded to include the exploitation of other cultures, with guests joining educational lectures and tours (Huffadine, 2000).

The differences between a resort and a conventional hotel can be described in terms of the guest purpose in staying at the facility. The guest at resort does visits for relaxation or recreation in contrast to the guest who stay at the conventional hotel (Hassan et al., 2010). Resorts range over many types, usually categorized according to locations, services rendered and size. Which includes; Island resorts, Hotel resorts, Health resorts, Golf resorts, Luxury resorts, Ecotourism resorts, Mega resorts, Beach resorts, Spa resorts, Ski resorts, Diving resorts, Historical resorts, Lake resorts, and Mountain resorts. According to (BHA, 2006) each resort type has specific features that are tailored to its customers' particular needs and desires. Some features might overlap and some resorts might offer a variety of activities. But generally speaking, each type of resort has its own unique opportunities and challenges. Thus, for the purpose of this thesis, the following section will discuss principally the resort hotel, its definition, classifications and trends in design and planning in a broader context.

2.2.1 RESORT HOTELS

The resort hotel is the most common form of resort development. (HVS, 2011) defined resort hotel as a hotel located in a resort destination which typically offers some recreational amenities which are sometimes seen more as a necessary complement to the basic lodging product rather than exploited as a significant revenue generator and separate business unit. These properties are often sub-categorised depending on their location such as:

I. Beach Resort Hotel

II. Mountain Resort Hotel

III. Urban Resort Hotel

Resort hotels differ from other commercial hotels in various ways. They are located in areas that take advantage of attractive natural features, and they offer more amenities, either on-site or with easy access to off-site facilities. Most resort hotels are situated in areas that provide a beautiful natural setting such as lakes, beaches, mountainous areas, ski slopes etc. This is necessary because most people camp in such hotels to get away from the hustle and bustle of work or spend a vacation in peace and quiet. Others are tourists who travels from faraway places, coming most specially to see the exclusive natural features that may be present on or around the grounds the resort hotel. Recreational and athletic activities are usually of higher priority than other brands of hotels. Most resort hotels provide extensive food and beverages, valet and room service, sightseeing to vacationers. Shantimani, (2010) suggests that a standard resort hotel should provide special activities, indoor and outdoor games for guests such as health clubs, sauna baths, natural body treatments and spa etc. a more leisurely, relaxed atmosphere distinguishes most resort hotels from other types of hotels.



Plate 2.3 Limak Atlantis Resort Hotel, Antalya



plate 2.4 Belconti Resort Hotel, Antalya
(Source: antalyaresorts.com)

2.2.2 CLASSIFICATION OF RESORT HOTELS

In 2006, the East African Community (EAC) approved the criteria for the classification of resort hotels based on the star system of grading hotels. The classification begins from one star and ends at five. Each category will be discussed with reference to critical areas that affect their design and smooth operation.

One Star Resort Hotels

One star resort hotel should have a location that is suitable for a vacation hotel. Its entrance could be suitable and be in harmony with the natural and built environment and in conformity with the building and development regulations applicable to the locality. There should be separate and independent access for the hotel guests and for deliveries. Architectural character and design should be modest in style and beauty and structurally safe. It should have at least ten (10) lettable accommodation units. Furniture and Decor of lobby/ lounge and other public areas should be simple, be of good quality, functional and /ell maintained. At least one (1) multi-purpose room, (1) restaurant and a bar all with good furniture should be provided. Minimum sizes of guest bedrooms should be 12 sqm. Balconies and Suites are not essential.



Plate 2.5: Al Mashrabya Resort Hotel, Hurghada.
(Source: travelrepublic.co.uk)

Two Star Resort Hotels

Two star resort hotels should also have a location that is suitable for a vacation hotel. Its entrance should be suitable and be in harmony with the natural and built environment and in conformity with the building and development regulations applicable to the locality just like the one star resort hotel. There should be separate and independent access for the hotel guests and for deliveries. Architectural character and design should be modest in style and beauty and structurally safe. It should have at least ten (10) let-able accommodation units. Furniture and Decor of lobby/ lounge and other public areas should be simple, be of good quality, functional and well maintained. However, it should be of a better range and quality. At least one (1) multi-purpose room, (1) restaurant and a bar all with good furniture should be provided. Minimum sizes of guest bedrooms should be 12 sqm. Balconies and Suites are not essential.



Plate 2.6: Goa resort hotel, India.
Source (tvtrip.com)

Three Star Resort Hotels

For three star resort hotels, there location should be in close proximity to the main attraction to the area and offer easier accessibility, safety, comfort and tranquillity. Its entrance should be suitable and be in harmony with the natural and built environment and in conformity with the building and development regulations applicable to the locality just like the one star resort hotel. There should be separate and independent access for the hotel guests and for deliveries. Architectural character and design should be more attractive and the building structurally safe. It should have at least ten (10) let-able accommodation units. Furniture and Decor of lobby/ lounge and other public areas should be simple, be functional, well maintained and in addition be of a wide range, high quality and in excellent condition. At least one large room of not less than 75 sqm, well lit, comfortably furnished and well maintained, should be provided to serve for various functions. Minimum sizes of guest bedrooms should be 15 sqm. 50% of the rooms should have balconies. Where Suites are provided, they should be 24 Sqm minimum.



Plate 2.7: Bella Napa bay hotel, Famagusta.
(Source: hotels-world.com)

Four Star Resort Hotels

The location and entrance of a four star resort hotel should be determined and designed just the same requirements as that of a three star resort hotel. All rooms should be approached through a corridor except for cottages. Architectural character and design should more attractive and the building structurally safe. However, the architectural features, instruction and finish off the building in relation to the environment should be of greater money and appeal. It should have at least ten (10) let-able accommodation units. Furniture d Decor of lobby/ lounge and other public areas should have the same features as those of are star but in addition should be of very high quality and be in excellent condition. At least one large room of not less than 75 sqm, comfortably furnished, sound proofed and well maintained, should be provided along with two smaller rooms both carpeted and well lit. The bar should be spacious with a better ambience and facilities to prepare non-stocked refreshments and should not be less than two. Minimum sizes of guest bedrooms should be 20sqm. 75% of rooms should have balconies or terraces. Suites take the minimum size equivalent to a three star.



Plate 2.8: Pestana Viking Beach and Spa resort hotel.
Source: golfholidays.com

Five Star Resort Hotels

A five Star resort hotel is the highest class of a resort hotel. The location and entrance of a five star resort hotel should be determined and designed just with the same requirements as of a four star resort hotel but the locality and the environment including the outlook Id be suitable for a hotel of high internationally recognizable standards. The whole building should be completely detached to give the hotel a distinct autonomy and identity. Architectural character and design should follow that for a four star but should have unique, tent and distinctive features in complete harmony with the environment. It should have at least (10) let-able accommodation units. Furniture and Decor of lobby/ lounge and other ice areas should be have the features of those of a four star but such spaces should be robustly furnished with attention to detail, comfort and elegance. At least one large room which should not be less than 75 sqm, comfortably furnished, sound proofed and well maintained, should provided along with two smaller rooms both carpeted and well lit. Audio visual gadgets internet facilities should also be provided in these rooms. The bar should be spacious a better ambience and facilities to prepare non-stocked refreshments and should not be than two. Such bars should have a high degree of ambience, comfort and creativity. Where the bar is for residents only, a separate public bar should be provided. Minimum sizes of guest bedrooms should be 25 sqm and all rooms should have balconies. Suites are same as three Star, but with more spacious rooms of palatial proportions with all prerequisite internationally recognizable standards.



Plate 2.9: Aegean Dream Resort Hotel, Turgutreis.
(source: travelrepublic.co.uk)

2.2.3 TRENDS IN RESORT HOTEL DESIGN

According to leading industry architects, interior designers, and sustainable tourism consultants, the growing trend in modern day hotel and resort design has begun to take on a new holistic approach thus forming “a new paradigm in international tourism" (Clarke, 2005). This trend promotes a holistic development system integrating body, mind and spirit to create balanced, self-renewing and trainable tourism developments. This development owes strongly to the ecological crises that have become much evident in the world today. In the past, sustainable tourism practice has been less prevalent, resulting in overdevelopment. The environment has been destroyed through the degradation of landscapes, the destruction of local flora and fauna, and damage to marine life through increased sewage outfall. Traditional design of resorts usually looked other way when issues of sustainability were involved such as adopting building methods and materials that were not sympathetic to the environment. Clarke, (2005) highlights some key design principles necessary to attain such a

holistic approach of designing resort hotels towards achieving a design that is more sustainable and sympathetic to the site while still providing the tourist with a sense of place, relaxation and entertainment. These principles are discussed below;

2.2.3.1 Overall Sustainability

To be achieved by ensuring the strategic long-term thinking and planning of tourism projects is done properly, so that they protect the environment as well as local cultures and communities. Benefits of this process includes saving cost through reduced energy consumption, higher property values, greater worker productivity, and easier access to permits and funds from government organizations.

2.2.3.2 Regenerative Design System

This is a design system that allows tourism projects to become part of their natural and cultural environments, by using locally made resources and creating systems that continue to evolve and self-replicate. The relationship between man, building and the environment, combined with cycles of the area, is important combined with the historic and cultural preservation of the site. However, water is recognized as the most precious resource, and ways are developed to ensure its purity and integrity over the long-term is attained. Recently, the International Tourism Partnership launched new guidelines for Design and Construction which hopes to facilitate the future development of more sustainable and environmentally sensitive hotels.

2.2.3.3 Service Philosophy

Service delivery in the hotel industry can often be the key driver towards achieving a successful hotel, which is usually underpinned by contented and hardworking staff. A holistic philosophy respects the individual customs and traditions of its staff, and incorporates their

needs within the hotel's overall management ethos. In addition it seeks to incorporate locals in the management structure to teach the community how to create its own projects, and run them in the future.

2.2.3.4 Sanctuary Spas

This involves the creation of magnificent spa sanctuaries, located in peaceful and restorative environments. Based on the principle of sacred healing of mind, body and spirit, the spa services often incorporate massage, yoga, and meditation, as well as a wide range of detoxifying facial treatments, nutritious vegetable masks, thalassic therapy, reflexology and Reiki. As a fundamental principle, the sourcing of indigenous foods, as well as organic vegetables and free-range game and fish is necessary to provide healthy, holistic and delicious local fare. Ideally, herbs and vegetables will be grown within the hotel's own organic vegetable gardens to be tended by locals.

2.2.3.5 Sensitive Interior Design

Interior designs reflect the natural beauty of the surroundings using exquisite materials such as raw silks, natural linens and wool, and through color, texture and sensitive lighting. Holistic designers creatively blend color, harmony, balance, proportion and style, resulting in a unique environment with a great sense of 'place'. The use of passive lighting approaches to reduce energy consumption, hence, maximizing natural light.

2.2.3.6 Native Landscaping

Particular care to be taken to ensure that native landscaping is preserved, and that planting is harmonious and regenerative, respecting the natural principles of perm culture. Natural ventilation to be adopted where possible, along with water-efficient appliances, and recycling

of inorganic materials, as well as composting of organic materials, is an integral part of the regeneration process.

2.3 APPRAISAL OF REGENERATIVE DESIGN PRINCIPLES IN RESORT HOTEL DESIGN

Literature highlighted on the effects of adopting regenerative design on the built environment. The benefits to its application is wide and numerous in both the designing and planning stages of the site and building form (Malcolm 1987). However, from the critical analysis and discussion of the Wells checklist, it was deduced that not all the principles mentioned above are suitable and applicable to the design of resort hotel. Thus, five out of the nine principles identified by Littman, (2009) were chosen and explained in a broader context in relation to the research facility in the following chapters of this thesis report. These principles are:

i. Integration to Landscape
ii. Bold Ecology
iii. Intelligent Limits
iv. Intelligent Construction
v. Sense of Place

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter identifies the strategy taken on the research area. It consists of Methodology rationale; Data Collection Procedure, Data Collection Tools, Framework, pilot testing as well as chosen approach to analysis are all discussed in this section. According to Perez (2008), research methodology defines the activity of research, how to proceed, how to measure progress, and what constitutes success. It allows the researcher to develop a critical and scientific attitude towards thinking and observing objectively.

3.1 RESEARCH STRATEGY

Research strategy can be defined as the means by which research objectives can be questioned Naoum (2006:37). In another definition, research strategy may be defined as the means by which a researcher intends to implement a research study (Biggam, 2008).There are different strategies to research ranging from case studies, experiments, surveys, histories, and economic and epidemiologic research to mention a few; with each having its advantages and disadvantages (Yin, 2009).

The choice of a research strategy is governed by different factors which dictate the suitability of a particular strategy, as to the approach which is most appropriate to the research questions. Multiple research strategies are commonly used mostly referred to as mixed methods. Both surveys and case studies are suitable for research strategies as surveys usually relate to the present state of affairs and involve an attempt to provide a snapshot of how things are at the specific time at which the data are collected (Denscombe, 2003). While case studies provide up-to-date information (Gray, 2004), allows for an in-depth examination of events (Flyvbierg, 2006) which can be used to contribute to knowledge (Yin, 2009).

In making a choice of a suitable research strategy, Yin, (2009) outlined three guiding conditions which each strategy must satisfy to validate the choice of an appropriate strategy. The three conditions are:

- The type of research question posed
- The extent of control an investigator has over actual behavioural events
- The degree of focus on contemporary as opposed to historical events

Considering the context of this research, the methodology to be adopted is the case study research strategy. Case study as a research strategy is suitable for research undertaken within the context of reality of events (Robson, 2002) providing up-to-date information (Gray, 2004) which can be used to contribute to knowledge (Yin, 2009). Case study serves as an intensive study of a single unit or small number of units which provide reliable information in generalizing response of a large number of units to the study in question (Gerring, 2007). Nonetheless, case study may be adopted for research where research findings are not aimed at providing a representative of a larger population or bases for generalising a phenomenon (Naoum, 2006). The choice of case study as a research strategy is underpinned by the real life investigative nature of the research in obtaining reliable data in the context of how the regenerative design principles can be employed to resort hotel design and thus improving the ecosystem.

3.2 RESEARCH TECHNIQUES

3.2.1 Data Collection Tools

There are four data collection techniques available for conducting research, which are questionnaires, interviews, observations and documents (Gray, 2004; Denscombe, 2003).

In conducting research, a combination of one or more of these techniques might be necessary to better inform a research strategy adopted (Robson, 2002) as the weakness of one method can be compensated by the strength of another. Thus, observation, interviews and documents shall be adopted as research techniques. The adoption of these research techniques for the proposed research was underpinned by the circumstances within which the research was conducted in seeking and capturing the ideas behind the implementation strategies of regenerative design principles by exploring the relationship between site (nature) and buildings. According to Denscombe (2003), the use of mixed methods allows the researcher to adopt triangulation and viewing the research topic from a variety of perspectives. This approach should be adopted for either of these two reasons; towards a more accurate measurement or towards a more complete picture (Descombe, 2003). For the purpose of this research the latter approach was adopted. Triangulation allows the researcher to better investigate, understand the topic and enhance confidence in the validity of the findings. It is used to complement information from other sources. Furthermore, interviews and observations provide valuable information about unit of research (Yin, 2009).

a) Observations

Observation offers the social researcher a distinct way of collecting data. It draws on the direct evidence allowing the researcher record information and events first hand (Descombe, 2003). Observation as a tool does not rely on what people *say* they do, or what they *say* they think. It is based on the premise that, for certain purposes, it is best to observe what actually happens.

b) Interviews

Interview is a powerful means of communication, allowing people articulate their tacit perceptions, feelings and understandings on a particular study or subject. Interviews can be categorized into three types (Arksey and Kinght 1999). Open interview: this involves

engaging in an informal conversation with the interviewee who is able to add his/her views and comments. Pre-Coded interview: this is strictly a formal conversation with questions read from a script. And lastly, the Semi-Structured interview which is a combination of both techniques.

c) Documentation

According to Descombe (2003), documentations can be treated as sources of data in their own right – in effect an alternative to questionnaires, interviews or observation. These documents are mostly of written sources. These include data collected from government publications and official statistics, newspapers and magazines, website pages and the Internet, articles, journals and books.

However, there are limitations to the adoption of these data collection techniques (Yin, 2009) this may hinder the success of study research. The identification of these limitations and strategies in addressing the limitations posed by the adoption of each technique minimizes the effect each technique will have on the conduct of the research topic. In this regard, potential limitations to the adoption of interview and documentation as research techniques for the proposed topic are highlighted below:

i. Availability of professionals to interview and administer questionnaires.

ii. Availability of sufficient time to conduct the interviews.

iii. Workload or schedule of employees involved in the case study

iv. Availability of sufficient time to conduct the interviews.

In addressing these limitations, letters of introduction and request will be sent to the chosen study areas informing them of the research topic and what the researcher aims to achieve after

the study. This approach allowed for planning and adjustment of employee schedule to accommodate the interview sessions to be conducted as well as, facilitating the rate of response by the interviewee as it provides the interview with a feel of the scope of the interview questions. In addition to this, the provision of potential questions to be asked prior to the interview simplified the use of semi-structured interview questions for the research. As it provided an opportunity for the researcher to allow for the interview sessions to flow and incorporate additional issues raised during the interview sessions. Furthermore, the interview sessions were recorded using a tape recorder in addition to the interview transcripts so as to avoid loss of valuable information due to poor memory recall (Biggam, 2008) and also to ease the analysis of captured data. The purpose of this interview is to survey the current situation of the Gurara falls to ascertain and understand the need for change.

3.2.2 Instruments for Data Collection

Case studies in Architecture begin with documentation of the physical characteristics of the case (Oluigbo, 2010). For the purpose of this study, the instruments used for the collection and documentation of this data ware Photographs, sketches, and notes.

Photographs were taken of relevant physical elements of the case studies to ascertain the extent or level of application of principles of regenerative architecture applied in the design, planning, and construction. Sketches were used of some relevant part of the case study where necessary to further describe some features of spatial organization, or to enhance the quality of some details that are not too clear from the pictures taken during the field visit. As an instrument, notes were also taken on the field work to outline the account and extent of the independent variables on the case studies as they relate to the considerations and application of principles of regenerative design.

3.2.3 Data Collection Procedure

According to Oluigbo, (2010) case studies are selected to serve a purpose. Thus, for the cases to be identified, they have to possess some intrinsic virtues which are in relation with the phenomenon under consideration.

The case studies selected for this thesis were sampled purposely for these reasons:

- As resorts or existing resorts hotels with features denoting them as places for lodging and recreation.
- As buildings depicting the regenerative architectural design principles.

In selecting a sample size for this research, factors such as accessibility, research cost, convenience and availability of time for preparing the dissertation work were considered. Due to time and budget constraints four international case studies where done which were complemented with two national case studies equally distributed between the research topics. The researcher believes that it should be sufficient enough to generalize on the results.

A visual survey involves visit of the building and careful observation of its features, guided tour around the building and its facilities which was done by looking and identifying what has been achieved by the already existing resort hotels with reference to enhancement of recreation, this was done by the use of photographs. Information will be gathered to assess the outlined variables shown in table 3.1 for comparative study. The semi-structured interview consisted of 9 staffs of the visited resort hotels allowing the researcher get detailed and precise information on the functionality of the building, its history, construction, administration, events hosted, other relevant information and issues affecting the functionality of the edifice. The local authorities that are well versed in the knowledge of tourism and resort development

with specific interest on the selected site, Gurara falls; Niger state were also interviewed in the order to obtain the necessary information.

The interview sessions were conducted in a face to face pattern as required by the interview participants and held for about 20minutes. Interview was the most helpful technique used during the research. A great deal of enthusiasm and interest was perceived in each interview session which allowed the collection of more information. Additionally, a critical review of existing literature: government policy documents, regenerative design publications, Architectural magazines, architectural reviews (on regenerative design projects and prominent resort hotels) architectural data books (useful for obtaining design guides, functional flows, space requirements), journal articles and unpublished thesis projects in the research area shall be done with all data having sources stated and appropriately referenced.

3.3 APPROACHES TO ANALYSIS

Many literature sources and authors have stated that there are two principal approaches to analysis of research data, which are qualitative and quantitative methods. Qualitative approach to data analysis uses words as principal data of analysis while quantitative approach adopts numbers as principal unit of analysis (Denscombe, 2003). Both qualitative and quantitative approach to data analysis may be necessary. Qualitative approach is most suitable as the research intents to study the extent to which regenerative design principles can be applied in resort hotel design. However, quantitative data will be presented where necessary. According to Corbetta, (2003) qualitative data approach is soft, rich, gives an in-depth analysis of data and is interactive.

In this research, the nature of data needed is rich and deep to be able to accommodate the researcher's aim. This richness of information is necessary to identify understand the concepts

of these principles in order to ascertain their relevance towards improving the environment and achieving a more sustainable ecosystem. Data will be analyzed by both the descriptive statistical method as it gives the general idea. To be presented by using charts, figures, photographs, tables and diagrams.

3.3.1 CASE STUDIES ASSESSMENT CRITERIA

Case study research in Architecture goes beyond the documentation and description of the physical characteristics of the built environment (Oluigbo, 2010). Hence, the findings and results gotten have to be assessed based on specific approaches addressing the research question. This can be in the form of variables that seek to point out certain features of research facility in relation to regenerative design approaches. The basic criteria for assessment are:

i. Site planning and landscaping
ii. Spatial organization and design
iii. Energy sources and resources
iv. Building materials and technology

On the level of reflection of Regenerative Design Principles, a checklist was employed to assess the magnitude of reflection for each principle. The table below shows a sample of check list method applied for the analysis of each case study. It shows the result of observations made on each element as against its reflection on each outlined principle.

Table 3.1: Sample of Variable Used For Case Study Assessment Criteria. Source: (Researcher, 2011)

Principle 1: Integration into the landscape					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Spread of building on site	Vertical development	-			-
	Roof gardens used extensively over the roofs	-			-
	Use of on-site storm water treatment and ground water recharge	-			-
Working with Site Topography and native landscape elements	Integration of the Native Landscape with Development Letting nature inspire the design	-			-
	Preservation of site characteristics: preservation of trees and other natural features on site.	-			-
	The use of building elements that reflect local context	-			-
	-Treatment of Landscapes as Interdependent and Interconnected -Use of Forms Inspired by Nature				

Principle 2: Principle of Bold Ecology					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Minimal energy use reduction	Use of Day lighting Use of Natural ventilation Passive design elements				
Source of water	On-site sources			--	-
	Harvesting, processing and recycling rainwater				
water conservation method	On-site treatment				
Renewable sources of energy	Level of overdependence on mechanical systems to alter the climate.				
	Use of solar panels, wind turbines and bio-gas				
Energy management methods	Natural conditioning techniques such as planting, green roofs,				

Principle 3: Principle of Intelligent Construction					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Building materials	Use of building materials, sealants or adhesives that do not emit or harbor toxic contaminants or do harm to human health and environment			-	-
	Use of bio-degradable materials in building interiors				
Type of Building Material	Use of local building materials like bamboo in claddings				

	Use of durable materials				
	Adequate utilization of natural materials like the rocks and water bodies				
Re-usability of building material	Use of recyclable building materials				
Principle 4: Principle of Intelligent limits					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Reduced impact of building footprints	Minimal cover of site with impervious ground cover like asphalt and concrete paving to allow for ground water recharge				
	-limited employment and overdependence of mechanical systems.				
Principle 5: Experience of place					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Building materials	-use of complimentary local landscape elements				
	-use of resident building materials -				
Mode of construction	-design with respect to solar and wind orientation				
	-selection of pleasant zones for development within site -aesthetics and expression -interaction of community to the design				

3.4 ETHICAL CONSIDERATIONS

Considering the nature of data to be collected from the conduct of this research, ethical considerations as to the confidentiality of all information received and gathered during the course of conducting the research will be taken into account. Thus, interviews done with the consent of participants and data collected stored in a secured password protected laptop. Additionally, data to be collected from books, journals and web pages shall have sources stated and appropriately referenced. Furthermore the ethical guidelines as suggested by (Denscombe, 2003) will be taken into consideration, a researcher should:

- Respect the rights and dignity of those who are participating in the research project;
- Avoid any harm to the participants arising from their involvement in the research;
- Operate with honesty and integrity.

CHAPTER FOUR

PRESENTATION OF DATA

This chapter presents the data obtained from documents, observations and interviews as described in the previous chapter. Data collected from all cases were evaluated based on the outlined criteria of analysis. The foreign case studies however, were obtained from the internet and assessed using the same criteria as used for the local case studies.

4.1 CASE STUDY ONE: OREGON HEALTH & SCIENCE UNIVERSITY CENTER FOR HEALTH AND HEALING (OHSU)



Plate 4.0: View of the Oregon Center for Health & Healing.
Source: (Greenroofs.com)

4.1.1 Background

The Oregon Health & Science University (OHSU) Center for Health & Healing, located in the 38-acre South Waterfront Central District, is one of the largest LEED Platinum projects in the nation and the first medical facility in the world to be built to this standard and in their new

River Campus. It was completed in the Fall of 2006. The Center for Health & Healing is the most resource efficient large scale building in the region, and one of the greenest in the U.S. In 2007 it received Platinum LEED certification, making it the first medical and research facility in the world to have achieved this distinction. The integrated design features this building boasts is amazing and as a result is 61% more energy efficient than required by Oregon code.

4.1.2 Site Planning and Landscaping

The engineers' approach to the design was to harvest nature's "free" resources such as air, water and light, rather than sealing nature out and relying heavily on mechanical systems, as occurs in conventional building. The result is a multiple-use center engineered on a conventional budget that provides for the health, comfort and productivity of occupants as well as respect for the environment. The design boosts dynamic garden design for roof gardens, eco-roofs and courtyards over structures, and their work covers a broad range of sizes and purposes and includes places meant for people to gather and grow gardens as well as sites designed strictly for storm-water management. The green roofs are reducing the peak run-off volumes to the storm sewer, designed to store a minimal amount of water to keep the soil saturated, since the region's climatic pattern (extremely wet winter and extremely dry summer) generate the volume of stored water that cannot equal the demand and supplemental irrigation that is needed. The CHH project team was able to create a building with "expensive" systems such as green roofs, photovoltaic, and onsite sewage treatment without adding capital cost, while also decreasing operating costs and increasing building value.



Plate 4.1: View of the green area and landscaping.
Source: Greenroofs.com

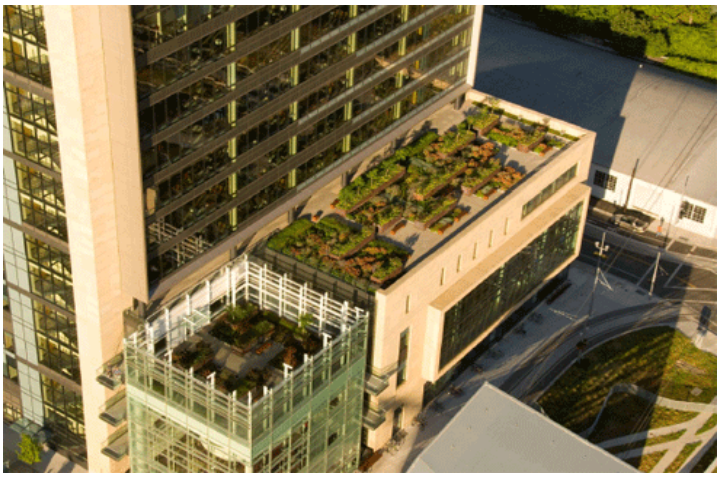


Plate 4.2: View of the non-accessible eco-roof,
Source: (Greenroofs.com)

4.1.3 Energy Sources and Resources

The storm water network connects all rooftop gardens and the fertilizers used contain no phosphorous. The OHSU building incorporates both rainwater and groundwater collection systems on the roof and underground (see plate 4.3 below), which get mixed with the building's own gray water and sent to the basement treatment system. Reclaimed water is stored in cisterns before being pumped upstairs or sent outside to irrigate the building's grounds and rooftop gardens. Excess reclaimed water is piped into the nearby Willamette River. OHSU had to obtain a number of special permits to install its state-of-the-art water

system, which includes a membrane bioreactor in the basement that basically is a small scale sewage plant. The result is that the building uses 60% less water than most buildings its size, and its outflow to the city sewage pipes is virtually nonexistent. Through the installation of a bioreactor on site, the building cleans 15,000 gallons of wastewater a day. The CHH generates 2.1 million gallons annually in potable water savings. A Central Utility Plant (CUP) provides electricity and thermal energy for several of the planned buildings in this area; it is powered by energy-efficient micro turbines. Building integrated solar electric panels on the building's south-facing sunshades, with a total of 60 kW of photovoltaic modules. The sunshades on the south facade keep the sun off the windows in the summer and lower the HVAC system requirements for cooling, while creating a free surface for solar electricity generating panels. The solar electricity generation panels on the 15th and 16th floors create a giant solar air heater, 190 feet long by 32 feet high, to preheat water for the building (see plate 4.4 below).



Plate 4.3: View showing the extensive use of roof gardens and eco roofs.
Source: (Greenroofs.com)



Plate 4.4: View of the solar electricity generation panels on the roof.
Source: (Greenroofs.com)

4.1.4 Spatial Organization and Design

A mixed-use facility of 16-story, 412,000-square-foot building has eight levels devoted to physician practices, medical research, clinics, surgery and imaging, and three floors that house a health and wellness center. The wellness center features a gymnasium, four-lane lap pool, therapy pool, weight training and a day spa. Four levels are dedicated to education and research activities, including space for a biomedical engineering program. The ground floor houses retail spaces; which include a pharmacy, optical shop, a café and classrooms. The centre provides OHSU with laboratories, educational spaces, medical offices, and surgery suites. The building's public uses also include fitness and wellness centre, pharmacy, café, retail space, and a public atrium. Building occupants and visitors can access the building via a streetcar from downtown, via an aerial tram from the main OHSU campus, or by car/ carpool, taking advantage of the building's three-story underground parking garage. OHSU CHH has both extensive green roofs (and eco-roofs) and intensive green roofs (roof gardens), with a mixture of public and private accessibility as shown below in (plate 4.6). Non-accessible eco-

roofs include those found on the 17th floor, and staff-only extensive gardens and office accessible balconies located off the 15th and 16th floors, above.



Plate 4.5: View of the lobby and reception area.
Source: (Greenroofs.com)



Plate 4.6: Accessible intensive green roofs.
Source: (Greenroofs.com)



Plate 4.7: View of the lobby in Oregon Center for Health & Healing
Source: (Greenroofs.com)

The accessible areas include the day patient area on the 4th floor (above) which opens out onto the restorative garden and the 5th floor (below) which opens out onto the courtyard, a common area and intensive green roof. Both programmed for passive recreation, these rooftop gardens allow patients, visitors, staff and faculty to enjoy scenic views of the region, informal social interactions as well as organized gatherings and events. The roof gardens incorporate paths through lush plantings and benches for seating, offering fresh air and a green oasis as a seasonal topic for the soul amidst the stressful world. Natural ventilation in stairwells, displacement ventilation systems in exam rooms to increase patient comfort, MERV-13 filters throughout the building and the use of low VOC finishes throughout the building.

4.1.5 Dominant Building Materials

The dominant building materials found were reinforced concrete, steel, wood and glass. The properties of the glass help accentuate a greenhouse effect inside the space, which raises the air temperature by a few degrees and is enough to heat water at a rate of 530,000 BTUs per hour. Double insulation keeps the office space on the floors from heating up as a result. All the materials in the project are carefully chosen for their green qualities, which were recyclable, locally produced, and are low in toxins and energy use. Low-VOC carpeting and paints, high-efficiency windows and light fixtures, recycled drywall, whiteboard cabinets, and bulletin boards made from strawboard all appear on the building. Half of the wood, such as on the floor of the basketball court, is certified by the US Forest Stewardship Council. According to McGraw Hill Constructions, steel and concrete are inherently LEED-compliant.

Table 4.1 Assessment of the Application of Regenerative Design Principles

Principle 1: Integration into the landscape					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Spread of building on site	Vertical development	•			-
	Roof gardens used extensively over the roofs	-			•
	Use of on-site storm water treatment and ground water recharge	-			•
Working with Site Topography and native landscape elements	Integration of the Native Landscape with Development Letting nature inspire the design	-		•	•
	Preservation of site characteristics: preservation of trees and other natural features on site.	-		•	-
	The use of building elements that reflect local context	•			-
	Treatment of Landscapes as Interdependent and Interconnected Use of Forms Inspired by Nature			•	•

Principle 2: Principle of Bold Ecology					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Minimal energy use reduction	Use of Day lighting Use of Natural ventilation Passive design elements			•	• •
Source of water	On-site sources		•	--	-
	Harvesting, processing and recycling rainwater				•
water conservation method	On-site treatment				•
Renewable sources of energy	Level of overdependence on mechanical systems to alter the climate.		•		
	Use of solar panels, wind turbines or bio- gas				•
Energy management methods	Natural conditioning techniques such as planting, green roofs,				•
Principle 3: Principle of Intelligent Construction					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Building materials	Use of building materials, sealants or adhesives that do not emit or harbor toxic contaminants or do harm to human health and environment			•	-
	Use of bio-degradable materials in building interiors	•			
Type of Building Material	Use of local building materials	•			
	Use of durable materials				•

	Adequate utilization of natural materials like the rocks and water bodies				•
Re-usability of building material	Use of recyclable building materials				•
Principle 4: Principle of Intelligent limits					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Reduced impact of building footprints	Minimal cover of site with impervious ground cover like asphalt and concrete paving to allow for ground water recharge				•
	-limited employment and overdependence of mechanical systems.			•	
Principle 5: Experience of place					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Building materials	-use of complimentary local landscape elements	•			
	-use of resident building materials -				•
Mode of construction	-design with respect to solar and wind orientation				•
	-selection of pleasant zones for development within site -aesthetics and expression -interaction of community to the design				•

4.2 CASE STUDY TWO: STEINHUDE SEA RECREATION FACILITY, GERMANY

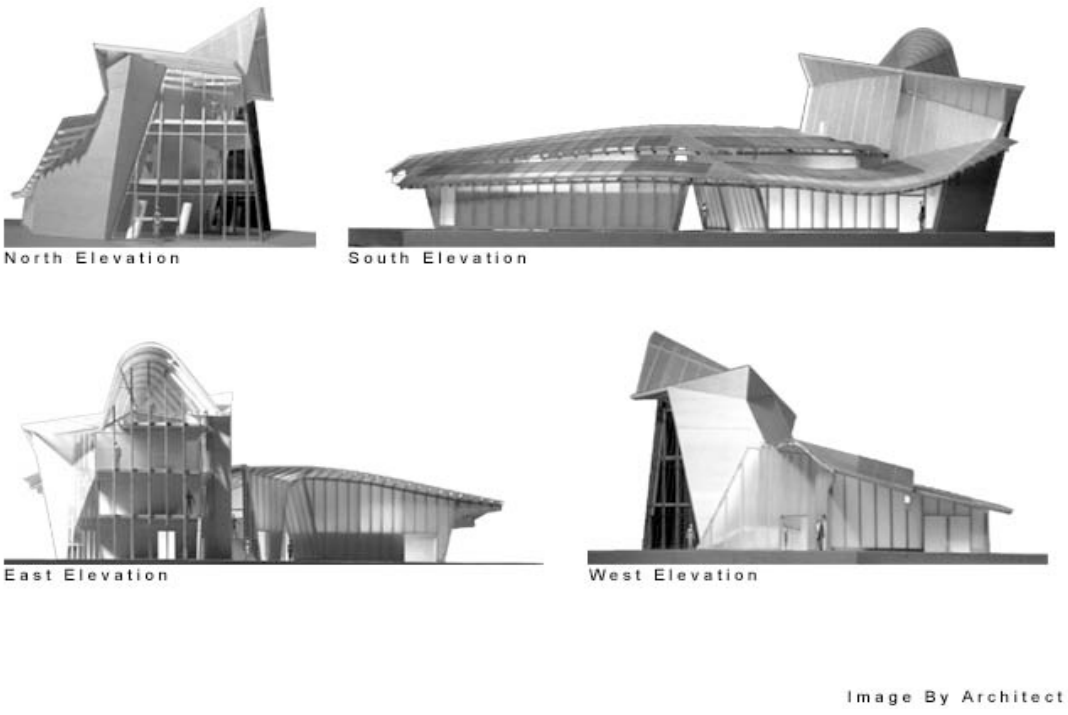


Plate 4.8: Elevations for the Steinhude Sea Recreation Facility in Germany
Source: http://www.solaripedia.com

4.2.1 Background

This is a small recreation facility building within a rural setting completed in June 2000 and located on an island at the south shore of the Steinhude Sea. The 46,000 square meters island (11.4 acres), attached by bridge to the mainland, and is adjacent to sea banks lined with marina piers and residential structures. The four current use zones of the island are the beachfront, a sports plaza, a green area for sunbathing and music performances, and a nature walk with children's playgrounds. The island ecosystem consists of green fields, and a bird sanctuary. The facility accommodates, with minimal ecological impact, a cafe, lifeguard facilities, a boathouse, storage space, public toilets and showers, and an exhibition area and observation deck. The project aesthetically synthesizes the island's recreation and vacation culture. The

facility was a Top Ten Green Building selected by the American Institute of Architects COTE to celebrate Earth Day 2003.

4.2.2 Site Planning and Landscaping

The landscaping emphasizes the rugged natural character of existing vegetation. The southern edge of the building roofline is held unusually low so that it appears to emerge from the landscape see plates 4.9 and 4.10 below. The roof form is curved toward the earth berms to create harmonious lines between built and natural forms. The project aesthetic acknowledges the recreation/vacation culture of the island. The roof form of the main building stretches out as an abstract reclined figure, facing south, to bask in the sun.



Plate 4.9: Aerial view of the Steinhude Sea Recreation Facility
Source: http://www.solaripedia.com



Plate 4.10: The Steinhude Sea Recreation Facility is located on the south shore of Steinhude Sea in north central Germany. Source: http://www.solaripedia.com

4.2.3 Energy Sources and Resources

Energy self sufficiency is a major goal of the project. Photovoltaic panels (153 square meters in surface area) provide power for electric boats and the building lighting on a seasonal basis, see plate 4.11. Energy self-sufficiency includes day lighting, natural ventilation, passive solar design, building automation, and high-performance materials. A natural gas turbine generator provides additional power for peak loads associated with the cafe. The project is connected to the city power grid for distribution of electrical surplus. High standards of energy conservation including natural ventilation and building automation which reduces power consumption. Other sustainability practices incorporated into the design include gray water and harvested water systems, green materials, and waste reduction. The gray water system also supplies the public and staff toilet facilities.



Plate 4.11: The photovoltaic panels serve as roof, daylight provider, and electricity generator in one application. Source: http://www.solaripedia.com

4.2.4 Spatial Organization and Design

Element locations and spaces are determined by their function. The cafe and lifeguard areas are positioned for beach and marina views. The observation deck, 9 meters in height, allows unobstructed views with panoramic graphics panels which identify shoreline landmarks and the historic Wilhelmstein Island. Dramatic night lighting effects are created by ambient spill light from the building, emphasizing the building form as shown below in plate 4.12. The facility houses a gymnasium, health club, bowling alley, ice rink, field house, and indoor racquet sports.



Plate 4.12: The southern edge of the roofline of the Facility is held unusually low so that it appears to emerge from the landscape. Source: http://www.solaripedia.com

4.2.5 Dominant Building Materials

The major construction materials used include wood, translucent wall panels, windows, metal stairs, high-performance materials and green materials see plates 4.13 and 4.14 respectively. The rustic materials such as stained marine plywood further links the form to its natural setting and the translucent polycarbonate walls, reminiscent of the green house, reinforce a strong connection between the indoors and outdoors.



Plate 4.13: Glasses used to ensure maximum day lighting in the Steinhude Sea Recreation facility Source: http://www.solaripedia.com



Plate 4.14: Wood used in the Steinhude Sea Recreation facility include wood studs, plywood, glue-laminated beams, and timber framing. Source: http://www.solaripedia.com

Table 4.2 Assessment of the Application of Regenerative Design Principles

Principle 1: Integration into the landscape					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Spread of building on site	Vertical development	-	•		-
	Roof gardens used extensively over the roofs	•			-
	Use of on-site storm water treatment and ground water recharge	-		•	-
Working with Site Topography and native landscape elements	Integration of the Native Landscape with Development Letting nature inspire the design	-			• •
	Preservation of site characteristics: preservation of trees and other natural features on site.	-			•
	The use of building elements that reflect local context	-	•		-
	-Treatment of Landscapes as Interdependent and Interconnected -Use of Forms Inspired by Nature			• •	•

Principle 2: Principle of Bold Ecology					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Minimal energy use reduction	Use of Day lighting Use of Natural ventilation Passive design elements				•
Source of water	On-site sources			--	-
	Harvesting, processing and recycling rainwater	•			
water conservation method	On-site treatment			•	
Renewable sources of energy	Level of overdependence on mechanical systems to alter the climate.			•	
	Use of solar panels , wind turbines or bio- gas				•
Energy management methods	Natural conditioning techniques such as planting, green roofs.				•
Principle 3: Principle of Intelligent Construction					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Building materials	Use of building materials, sealants or adhesives that do not emit or harbor toxic contaminants or do harm to			•	-

	human health and environment				
	Use of bio-degradable materials in building interiors				•
Type of Building Material	Use of local building materials	•			
	Use of durable materials				•
	Adequate utilization of natural materials like the rocks and water bodies				•
Re-usability of building material	Use of recyclable building materials				
Principle 4: Principle of Intelligent limits					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Reduced impact of building footprints	Minimal cover of site with impervious ground cover like asphalt and concrete paving to allow for ground water recharge				•
	-limited employment and overdependence of mechanical systems.			•	

Principle 5: Experience of place					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Building materials	-use of complimentary local landscape elements		•		
	-use of resident building materials -				
Mode of construction	-design with respect to solar and wind orientation				•
	-selection of pleasant zones for development within site -aesthetics and expression -interaction of community to the design				•

4.3 CASE STUDY THREE: ENVIRONMENT PARK – TURIN, ITALY



Plate 4.15 A view of the complex surrounded by green area.
Source: (http://delicious.com/pepesec/casestudy147)

4.3.1 Background

Environment Park was built in 1996 on the initiative of Regione Piemonte, Provincia of Turin, of the Municipality of Turin and European Union and represents an original experience in the panorama of Technologic and Scientific Parks in Europe, for the connection of technological innovation and eco-efficiency. Environment Park building complex has 30.000 square meters with laboratories, offices, service centres in a building contest characterized from low environmental impact solutions as shown above in plate 4.15.

4.3.2 Site Planning and Landscaping

The complex of Environment Park is composed by two compact groups of buildings, built on three levels; particularly the level 1 is structured as a big platform, which covers the car parks, upon which several buildings rest. Most of buildings were built as a compact whole covered by extensive lawns, which are usable as public park, and separated by the wide split of the green valley.

The architectonic project of Environment Park pursues a strong, technical and symbolic, relation among the greenness and the new architectures. The rivers of the Dora were integrated into the design and it became a qualifying part of the park and of the landscape of Environment Park. However, a band of respect of 70 meters signs the limit of suitability for building: hence, the front built follows exactly the bend of the river. The entire complex, all covered by the greenness, seems to the citizenship as a real public park, completely exploitable by the people who live in the neighborhood and by who visit the Environment Park. The whole complex has the largest green roof in Italy, see plate 4.16.



Plate 4.16: Largest green roof in Italy with 24.000 sqm.
Source: http://delicious.com/pepesec/casestudy147)

4.3.3 Energy Sources and Resources

Environment Park is the first former industrial district in Europe that is completely carbon-free. The green roof covering reduced the cost of realization of buildings and that of the complex – because during the good winter and summer isolation – the overall total consumption of energy is minimized. Sustainable design was achieved by the improvement of microclimate, the filtration of polluting dusts of the air and of the rain waters, the reduction of urban acoustic pollution, the use of sustainable resources, the adoption of natural techniques of administration of the buildings, the choose of no polluting or recyclable materials are some principles of green architecture pursuing with coherence by the project.



Plate 4.17: Depicting the use of photovoltaic cells on the building.
Source: http://delicious.com/pepesec/casestudy147)



Plate 4.18: Depicting the use of photovoltaic cells on the building.
Source: http://delicious.com/pepesec/casestudy147)

The wide use of technological and plant engineering innovations such as photo voltaic panels, supported by the constructive production and verified by applied research, conduce the building system towards regeneration see plates 4.17 and 4.18 above. The interactive front uses the glasses which are completely transparent which allows maximum natural day lighting into the rooms. When it is necessary screen the direct solar rays, a tend follows down automatically in the cavity between the two windows. The empty space is constantly aired by

the air extracted from the rooms which absorbs the solar heat accumulated by the fins of the tend. This mechanism improves acoustic isolation from the outside, energy saving both for the air- conditioning and for the artificial illumination, a better internal comfort as the glass and the walls remain near to the room temperature.

4.3.4 Spatial Organization and Design

The idea of the design comes from the construction of a united landscape which is able to link river, garden and Technological Park in a system of land architecture with a vocation deeply ecological and environmental. It is the sign of the river which build the form of the town. The distributions of the volumes pursue this logic of redistribution of density of the buildings. This allows the proper integration of the buildings built with nature and the landscape, particularly: the buildings for office are low, leveled out in the greenness of the park. The complex houses spaces which includes as ICT services, cleaning and surveillance, maintenance, restaurant – cafeteria, meeting and conference rooms.

4.3.5 Dominant Building Materials

The building materials used had no or low polluting qualities, they are recyclable and reusable. These materials include, glass, concrete, steel and wood see plate 4.19 below. About the 85% of the heating power of the Environment Park is produced by wood chips boiler (wastes product of the pruning the tree-lined roads), energetic sustainable resource for excellence and moreover widely available in Turin. The adoption of an absorbing machine allows the use of the energy of the wood chip boiler to refresh the Environment Park consuming almost only the vegetal waste of the gardens and of the tree-lined roads in Turin. The saving is evident: both economic (for the cost of the fuel) and ecological (for the consistent reduction of the waste mass that have to be disposed in the tips.



Plate 4.19: showing the use of steel, wood and glass on the building
Source: http://delicious.com/pepesec/casestudy147)

Table 4.3 Assessment of the Application of Regenerative Design Principles

Principle 1: Integration into the landscape					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Spread of building on site	Vertical development	-		•	-
	Roof gardens used extensively over the roofs	-			•
	Use of on-site storm water treatment and ground water recharge	-			•
Working with Site Topography and native landscape elements	Integration of the Native Landscape with Development Letting nature inspire the design	-			•
	Preservation of site characteristics: preservation of trees and other natural features on site.	-		•	-

	The use of building elements that reflect local context	-	•		-
	-Treatment of Landscapes as Interdependent and Interconnected -Use of Forms Inspired by Nature			•	

Principle 2: Principle of Bold Ecology

Variables	Features	Remarks			
		Ab	Low	Med	Hi
Minimal energy use reduction	Use of Day lighting Use of Natural ventilation Passive design elements			•	
Source of water	On-site sources	•		--	-
	Harvesting, processing and recycling rainwater				•
water conservation method	On-site treatment				•
Renewable sources of energy	Level of overdependence on mechanical systems to alter the climate.			•	
	Use of solar panels, wind turbines or bio- gas				•
Energy management methods	Natural conditioning techniques such as planting, green roofs.				•

Principle 3: Principle of Intelligent Construction

Variables	Features	Remarks			
		Ab	Low	Med	Hi
Building materials	Use of building materials, sealants or adhesives that do not emit or harbor toxic contaminants or do harm to human health and environment			•	-

	Use of bio-degradable materials in building interiors			•	
Type of Building Material	-Use of local building materials	•			
	-Use of durable materials				•
	-Adequate utilization of natural materials like the rocks and water bodies	•			
Re-usability of building material	-Use of recyclable building materials				•
Principle 4: Principle of Intelligent limits					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Reduced impact of building footprints	-Minimal cover of site with impervious ground cover like asphalt and concrete paving to allow for ground water recharge				•
	-limited employment and overdependence of mechanical systems.			•	
Principle 5: Experience of place					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Building materials	-use of complimentary local landscape elements	•			
	-use of resident building materials				•
Mode of construction	-design with respect to solar and wind orientation				•
	-selection of pleasant zones for development within site -aesthetics and expression -interaction of community to the design				•

4.4 CASE STUDY FOUR: SONGJIANG SCI-FI HOTEL SONGJIANG DISTRICT, CHINA



Plate 4.20: Stunning design concept inspired by the natural water and landscape features of the quarry
Source: http://www.inhabitat.com

4.4.1 Background

The Songjiang Hotel is a five-star resort hotel set within a beautiful water-filled quarry close to Shanghai in China, and was completed in May, 2009. The award winning design by the firm Atkins Architects has its stunning designs concept inspired by the natural water and landscape features of the quarry. The hotel is an integral part of the design of a new city on the outskirts of Shanghai for 500,000 people called Songjiang Garden City. This involved the development of a conceptual master plan using garden city philosophy and sustainable design principles. The site was an abandoned quarry until the proposal by Atkins Architects made proper reuse proposal for it.

4.4.2 Site Planning and Landscaping

The building was designed to reflect the natural landscape of the quarry. The architects drew their inspiration from the quarry setting itself, adopting the image of a green hill cascading down the natural rock face as a series of terraced landscaped hanging gardens. The surrounding water plays an important part in the design, featured in many areas around the hotel. Waterfalls, underwater aquariums, and green areas were integrated into the design to match the existing facing of the quarry as depicted below in plates 4.21 and 4.22 respectively.



Plate 4.21: Aerial view of the hotel,,
Source: http://www.inhabitat.com



Plate 4.22: Aerial view of the quarry in March 2007, before development commenced.
Source: http://www.inhabitat.com

4.4.3 Energy Sources and Resources

The entire hotel is covered with a green roof, while the building uses geothermal energy for its electrical supply and heating. The quarry also provides a good source of heat control and shelter from the environment. Sustainability is integral to the design ranging from using green roofing for the structures above the ground level to geothermal energy extraction see plate 4.23 below. The green roof would also keep the hotel cool in the summer and warm in the winter.



Plate 4.23: Aerial view of the proposed hotel, showing off the green roof,
Source: http://www.arnewde.com

4.4.4 Spatial Organization and Design

The innovative design of the 400-bed resort hotel stands two levels higher than the rock face of the 100 metre deep quarry and includes underwater public areas and guestrooms. It incorporates conference facilities for up to 1,000 people, a banqueting centre, restaurants, cafés and water sports facilities. An aquatic theme runs through the design both visually and functionally. Curved wings of the main body of the guestrooms enclose a naturally lit internal atrium (see plate 4.24), which uses the existing rock face with its waterfalls and green

vegetation. The lowest level of the hotel contains a leisure complex with a swimming pool and water-based sports. An extreme sports centre for activities such as rock climbing and bungee jumping was cantilevered over the quarry and accessed by special lifts from the water level of the hotel.



Plate 4.24: An exterior view of the sonjiang hotel (from inside the quarry),
Source: http://www.arnewde.com

4.4.5 Dominant Building Materials

The dominant building materials found were reinforced concrete, steel, wood and glass. All the materials in the project are carefully chosen for their green qualities, which were recyclable, locally produced, and are low in toxins and energy use.

Table 4.4 Assessment of the Application of Regenerative Design Principles

Principle 1: Integration into the landscape					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Spread of building on site	Vertical development	-			•
	Roof gardens used extensively over the roofs	-			•
	Use of on-site storm water treatment and ground water recharge	-	•		-
Working with Site Topography and native landscape elements	Integration of the Native Landscape with Development Letting nature inspire the design	-			• •
	Preservation of site characteristics: preservation of trees and other natural features on site.	-		•	-
	The use of building elements that reflect local context	-		•	-
	-Treatment of Landscapes as Interdependent and Interconnected -Use of Forms Inspired by Nature				•

Principle 2: Principle of Bold Ecology					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Minimal energy use reduction	Use of Day lighting Use of Natural ventilation Passive design elements				•
Source of water	On-site sources			--	•
	Harvesting, processing and recycling rainwater				•
water conservation method	On-site treatment	•			
Renewable sources of energy	Level of overdependence on mechanical systems to alter the climate.		•		
	Use of solar panels, wind turbines or bio- gas	•			
Energy management methods	Natural conditioning techniques such as planting, green roofs.				•
Principle 3: Principle of Intelligent Construction					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Building materials	Use of building materials, sealants or adhesives that do not emit or harbor toxic contaminants or do harm to human health and environment			•	-
	Use of bio-degradable materials in building interiors				•
Type of Building Material	Use of local building materials		•		
	Use of durable materials				•
	Adequate utilization of natural				•

	materials like the rocks and water bodies				
Re-usability of building material	Use of recyclable building materials				•
Principle 4: Principle of Intelligent limits					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Reduced impact of building footprints	Minimal cover of site with impervious ground cover like asphalt and concrete paving to allow for ground water recharge				•
	-limited employment and overdependence of mechanical systems.				•
Principle 5: Experience of place					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Building materials	-use of complimentary local landscape elements			•	
	-use of resident building materials -				•
Mode of construction	-design with respect to solar and wind orientation				•
	-selection of pleasant zones for development within site -aesthetics and expression -interaction of community to the design				•

4.5 CASE STUDY FIVE: THE MAUNA LANI HOTEL AND GOLF RESORT, HAWAII



Plate 4.25: view of the MAUNA LANI resort hotel.
Source: (www.greatgolfand spa.com)

4.5.1 Background

Traditionally known as Kalahuipua'a, this ancestral home of Hawaiian royalty is now called Mauna Lani Resort, (mountain reaching heaven). Mauna Lani Bay Hotel is a beach front resort (see plate 4.25 above). There are historic fishponds, prehistoric petro glyphs, and the beach front resort itself. Located 20 minutes north of the Kona International Airport, this Kohala Coast beach resort has green sea turtles, tropical fish, ancient fishponds and almost three miles of shoreline to explore. Luxury hotel and tropical resort amenities include five dining venues, Mauna Lani Spa, a Sports & Fitness Club, Tennis Club, two championship Hawaii golf courses, water sports, and year round children's camp. Mauna Lani Resort, with its luxury hotel and beach front is rated one of the most beautiful spots in Hawaii.

4.5.2 Site Planning and Landscaping

The design of the resort follows its natural topography, by integrating the hotel to the natural landscape as shown in plate 4.26 below. Mauna Lani Bay Hotel is a beach front resort and

luxury hotel with award winning Hawaii golf course (see plate 4.27) and award winning resort spa. This tranquil oasis is the only place where one can view the five surrounding Hawaii peaks; the Kohala Mountains, Mauna Kea, Mauna Loa, Hualalai and Haleakala. The hotel/resort also features an outdoor swimming pool (see plate 4.28) surrounded by trees which provide shade to the relaxation.



Plate 4.26: Aerial view of the Mauna lani resort hotel, Hawaii,
Source: (www.greatgolfand spa.com)

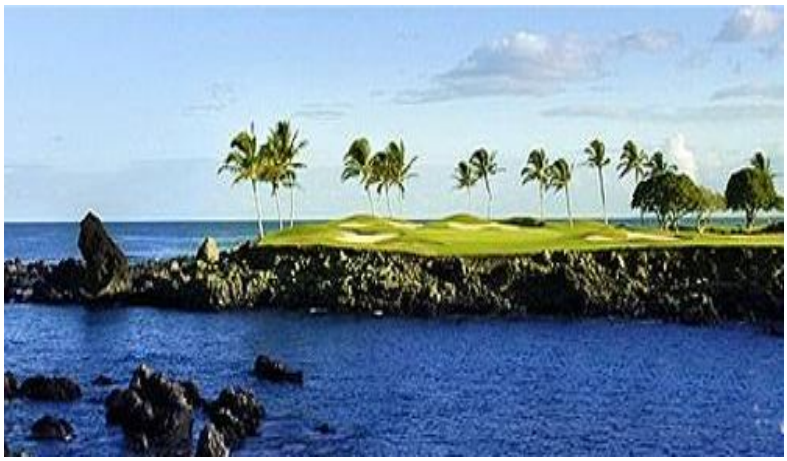


Plate 4.27: View of the golf course at the mauna lani resort hotel.
Source: (www.greatgolfand spa.com)



Plate 4.28: Aerial view of the swimming pool at Mauna Lani resort.
Source: (www.greatgolfand spa.com)

4.5.3 Energy Sources and Resources

The Mauna Lani resort hotel is an example of a building with building integrated photovoltaic (BIPV) at its finest. The BIPV application is strikingly beautiful. This sprawling hotel had acres of roof space, making it the perfect host for a photovoltaic system. In one intelligent stroke, the hotel's owners are displaying their environmental stripes and saving a substantial sum of money in the bargain. Working with Power Light Corporation, they installed a Power-Guard® system of insulating PV roofing tiles that covers 10,000 square feet and generates 250 kilowatts of electricity. The hotel will be spared hundreds of thousands of dollars in utility bills— while the atmosphere is spared tons of greenhouse gases (see plate 4.29).The 250 kW Power Light system at the Mauna Lani Resort (their fourth large PV system) will provide power for irrigation of the resort's two golf courses. Also, 122 of the Mauna Lani's golf cars are Sun Caddies: they have PV panels on top, to help charge the batteries for extended playtime.



Plate 4.29: View showing the use of solar panels on roof
Source: http:// www.thesolarplan.com/articles/upvg-dedi-t.jpg.jpg

4.5.4 Spatial Organization and Design

Mauna Lani Resort sits oceanfront on a stretch of shoreline on the sunny Kohala Coast of the Big Island of Hawaii. Located 23 miles north of the Kona International Airport, this 3,200-acre resort features 29 oceanfront acres and three miles of secluded shoreline. Mauna Lani Resort hotel features a large atrium-style lobby with fish, singing birds, and a waterfall (see plate 4.30 and 4.31 below), five restaurants (see plate 4.32) and three fish ponds. Next to the lush fish ponds is the Bay Terrace. The 343 guest rooms and suites have a tropical ambiance and all rooms have private lanais (balconies). Guestroom features include a desk & chairs, coffee table, couch, two telephones, Wi-Fi and high speed internet access, 27 inch colour TV, personal bar, his and hers marble basins, electronic safe; double and king size beds, refrigerator, clock radio, make-up mirror (see plate 4.33). All rooms have double sinks with the exception of handicap accessible rooms. Rooms are a minimum of 550 square feet with contemporary styling using teak, cane and natural fiber furnishings (see plate 4.33). Rooms

have two double beds or one king. Non-smoking rooms are available. Also available are secluded bungalows located within a minute's walk of the hotel (see plate 4.34) respectively.



Plate 4.30: A view of the Mauna lani bay hotel atrium,
Source: (www.greatgolfand spa.com)



Plate 4.31: A view of the Mauna lani bay hotel lobby showing artificial waterfalls,
Source: (www.greatgolfand spa.com)



Plate 4.32: a view of the Mauna lani bay hotel canoe house restaurant,
Source: (www.greatgolfand spa.com)



Plate 4.33: interior of ocean front bungalow,
Source: (www.greatgolfand spa.com)



Plate 4.34: secluded bungalows at the Mauna lani resort,
Source: (www.greatgolfand spa.com)

4.5.5 Dominant Building Materials

The most prominent building materials employed are wood, timber, concrete and glass. The use of local building materials like bamboo in claddings was adopted as well as the use of biodegradable materials such as wood for building interiors. The interiors adopted the use of contemporary styling using teak, cane and natural fiber furnishing.

Table 4.5 Assessment of the Application of Regenerative Design Principles

Principle 1: Integration into the landscape					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Spread of building on site	Vertical development	-		•	-
	Roof gardens used extensively over the roofs	•			-
	Use of on-site storm water treatment and ground water recharge	•			-
Working with Site Topography and native landscape elements	Integration of the Native Landscape with Development Letting nature inspire the design	-			• •
	Preservation of site characteristics: preservation of trees and other natural features on site.	-		•	-
	The use of building elements that reflect local context	-		•	-
	-Treatment of Landscapes as Interdependent and Interconnected -Use of Forms Inspired by Nature				•

Principle 2: Principle of Bold Ecology					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Minimal energy use reduction	Use of Day lighting Use of Natural ventilation Passive design elements			•	
Source of water	On-site sources			--	•
	Harvesting, processing and recycling rainwater	•			
water conservation method	On-site treatment	•			
Renewable sources of energy	Level of overdependence on mechanical systems to alter the climate.			•	
	Use of solar panels, wind turbines or bio- gas				•
Energy management methods	Natural conditioning techniques such as planting, green roofs.			•	
Principle 3: Principle of Intelligent Construction					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Building materials	Use of building materials, sealants or adhesives that do not emit or harbor toxic contaminants or do harm to human health and environment			-	•
	Use of bio-degradable materials in building interiors			•	
Type of Building Material	Use of local building materials		•		
	Use of durable materials				•
					•

	Adequate utilization of natural materials like the rocks and water bodies				
Re-usability of building material	Use of recyclable building materials				•
Principle 4: Principle of Intelligent limits					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Reduced impact of building footprints	Minimal cover of site with impervious ground cover like asphalt and concrete paving to allow for ground water recharge				•
	-limited employment and overdependence of mechanical systems.			•	
Principle 5: Experience of place					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Building materials	-use of complimentary local landscape elements			•	
	-use of resident building materials -			•	
Mode of construction	-design with respect to solar and wind orientation				•
	-selection of pleasant zones for development within site -aesthetics and expression -interaction of community to the design				•

4.6 CASE STUDY SIX: LE MERIDIEN IBOM HOTEL AND GOLF RESORT, AKWA IBOM STATE – NIGERIA



Plate 4.35: Approach View of the Le Meridien Ibom Hotels and Golf Resort
(Source: http://Le meridien hotels.com/photo_gallery.htm)

4.6.1 Background

Opened in December, 2007 Le Meridian Ibom Hotel and Golf Resort (a four star hotel), is located along Nwaniba road, uruan Akwa Ibom state – Nigeria. It is nestled in a palm- tree forest, with efforts made at incorporating it into the rain forest landscape in an ecologically friendly manner. It's a one storey resort hotel with 163 Rooms and 26 suites. The resort is 90 km from the Calabar Airport and 160 km from the Port Harcourt Airport, It is owned by the Akwa Ibom state government and managed by the Le Meridian Group, now called Starwood Inc. (Plate 4.35) above shows the approach view of the resort hotel.

4.6.2 Site Planning and Landscaping

The Le Meridian Ibom Hotel and Golf Resort, is nestled in a palm- tree forest, the room and suites all with private terraces offer a beautiful view of the palm tree forest, 18 holes golf course and Club house. The Le Meridian has 100 hectares of tropical garden, a fitness and health club, outdoor children's and adult pools, two Jacuzzis, 4 standard tennis courts and

squash facilities. The inner garden adds to the relaxing atmosphere of the complex with a Gazebo overlooking the virgin palm tree forest. It has an 18 hole-golf course with practice pitch integrated into the tropical environment (see plate 4.36a and 4.36b) featuring a golf club house with the panoramic terrace Restaurant and 3 Bars and a Pro Shop. The golf course has a 6.361km walking distance from hole one to eighteen. It has a guest parking lot that can hold up to 100 cars. The hotel also features a landscaped court with walkways between the administrative building and accommodation wing.

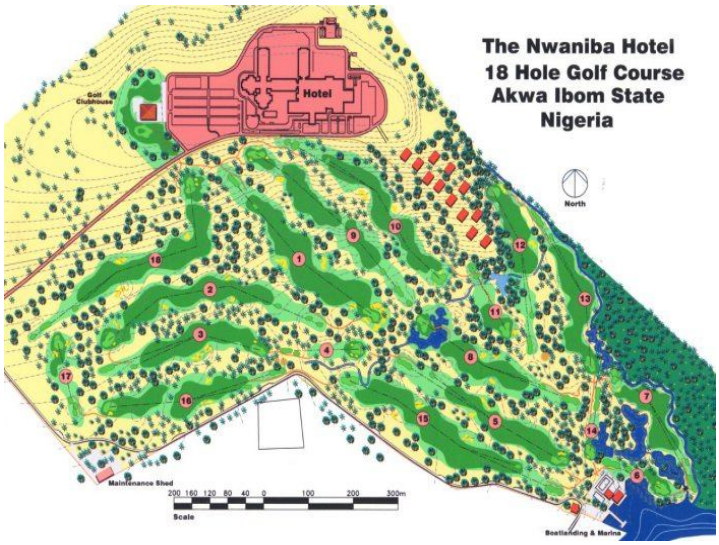


Plate 4.36a: Site plan of Le Meridien Ibom Hotels and Golf Resort.
(Source: http://Le meridien hotels.com/photo_gallery.htm)



Plate 4.36b: The golf course at le meridian Ibom hotel and Golf resort,
Source: field survey (2011).

4.6.3 Energy Sources and Resources

The resort hotel has an on-site water treatment plant which treats the water collected and reused for flushing and watering of the greenery. It features a storm water and rain water collection scheme, while the rain forest surrounding the resort hotel, cools the building naturally, thus, minimizing the rate of energy consumed.



Plate 4.37: Balconies of room and suites facing the landscaped courtyard,
Source: field survey (2011).



Plate 4.38: On-site water treatment plant at le meridian Ibom hotel,
Source: field survey (2011).

4.6.4 Spatial Organization and Design

The Le Meridien Ibom Hotels and Golf Resort four star resort hotel features an outdoor pool (see plate 4.39), a spacious entrance porch and lobby (see plate 4.40) and has all its 163 Rooms and 26 suites with private terraces offering a view of the palm tree forest on one side and the landscaped courtyard on the opposite side. Other facilities at the le meridian hotel

include; a block of chalets (see plate 4.41), 1 Chinese restaurant and 2 bars (see plate 4.42), a Business centre, beauty salon, 3 shops Outdoor swimming pool and Jacuzzi 18- holes golf course with club house, Fitness centre, Sauna, 2 tennis courts, 2 squash courts, a Heliport, 11 meeting rooms, a herbarium.



Plate 4.39: View of the Pool Le Meridien Ibom Hotels and Golf Resort with palm trees which are used around the pool for landscaping and privacy.
(Source: http://Le meridien hotels.com/photo_gallery.htm).

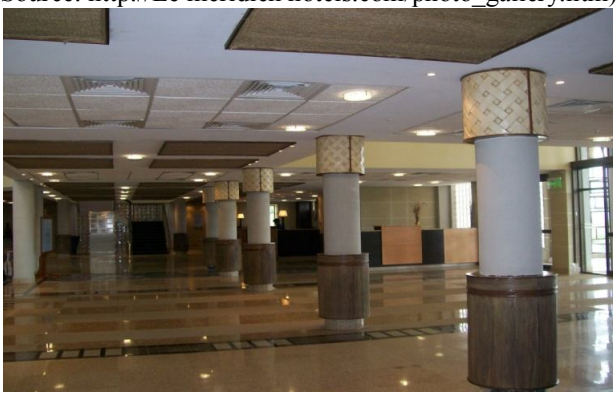


Plate 4.40: Entrance lobby of the le meridian Ibom hotel,
Source: field survey (2011)



Plate 4.41: Block of chalets at the le meridian resort hotel,
Source: field survey (2011).



Plate 4.42: The in-door bar at le meridian resort hotel,
Source: field survey (2011).

4.6.5 Dominant Building Materials

The building materials featured in this building include; concrete, steel, membranes and glass.

Table 4.6 Assessment of the Application of Regenerative Design Principles

Principle 1: Integration into the landscape					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Spread of building on site	Vertical development	-	•		-
	Roof gardens used extensively over the roofs	•			-
	Use of on-site storm water treatment and ground water recharge	-		•	-
Working with Site Topography and native landscape elements	Integration of the Native Landscape with Development Letting nature inspire the design	-			•

	Preservation of site characteristics: preservation of trees and other natural features on site.	-		•	-
	The use of building elements that reflect local context	-		•	-
	-Treatment of Landscapes as Interdependent and Interconnected -Use of Forms Inspired by Nature			•	

Principle 2: Principle of Bold Ecology

Variables	Features	Remarks			
		Ab	Low	Med	Hi
Minimal energy use reduction	Use of Day lighting Use of Natural ventilation Passive design elements			•	
Source of water	On-site sources		•	--	-
	Harvesting, processing and recycling rainwater	•			
water conservation method	On-site treatment			•	
Renewable sources of energy	Level of overdependence on mechanical systems to alter the climate.		•		
	Use of solar panels, wind turbines or bio- gas	•			
Energy management methods	Natural conditioning techniques such as planting, green roofs.			•	

Principle 3: Principle of Intelligent Construction

Variables	Features	Remarks			
		Ab	Low	Med	Hi

Building materials	Use of building materials, sealants or adhesives that do not emit or harbor toxic contaminants or do harm to human health and environment		•	-	-
	Use of bio-degradable materials in building interiors			•	
Type of Building Material	Use of local building materials			•	
	Use of durable materials			•	
	Adequate utilization of natural materials like the rocks and water bodies	•			
Re-usability of building material	Use of recyclable building materials		•		
Principle 4: Principle of Intelligent limits					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Reduced impact of building footprints	Minimal cover of site with impervious ground cover like asphalt and concrete paving to allow for ground water recharge			•	
	-limited employment and overdependence of mechanical systems.		•		
Preservation of site characteristics			•		
Principle 5: Experience of place					
Variables	**Features**	**Remarks**			
		Ab	**Low**	**Med**	**Hi**
Building materials	-use of complimentary local landscape elements			•	

	-use of resident building materials -				
Mode of construction	-design with respect to solar and wind orientation				•
	-selection of pleasant zones for development within site -aesthetics and expression -interaction of community to the design			•	

4.7 SUMMARY AND CONCLUSIONS ON REFLECTION OF REGENERATIVE PRINCIPLES ON THE CASE STUDIES

Analysis carried out on the case studies based on the application of the set principles of sustainable design has revealed that there is a certain degree of distinction on level of application between all case studies. Ratings = Excellent; Very good; Good; Fair; and Poor

Table 4.7: Summary of Case Study Assessment Sheet

PRINCIPLES AND VARIABLES	**CASE STUDY ONE:** Oregon Health & Science University Center For Health And Healing (OHSU)	**CASE STUDY TWO:** Steinhude Sea Recreation Facility, Germany	**CASE STUDY THREE:** Environment Park – Turin, Italy	**CASE STUDY FOUR:** Songjiang Sci-Fi Hotel Songjiang District, China	**CASE STUDY FIVE:** The Mauna Lani Hotel And Golf Resort, Hawaii	**CASE STUDY SIX:** Le Meridien Ibom Hotel And Golf Resort, Akwa Ibom State Nigeria
Principle 1: Integration into the landscape	excellent	Excellent	Very good	excellent	Very good	Very good
Spread of building on site	excellent	Excellent	excellent	excellent	excellent	fair
Working with Site Topography and native landscape elements	Very good	Excellent	good	excellent	good	fair

Principle 2: Principle of Bold Ecology						
Minimal energy use reduction	excellent	Very good	Very good	excellent	Very good	good
Source of water	excellent	Excellent	excellent	excellent	excellent	Very good
water conservation methods	excellent	Excellent	excellent	Very good	fair	fair
Sources of energy	excellent	Excellent	excellent	excellent	excellent	poor
Energy management methods	excellent	Excellent	Very good	excellent	good	poor
Principle 3: Intelligent Construction						
Environmentally conscious Building materials	excellent	Excellent	Very good	excellent	Very good	poor
Type of Building Material	Very good	Excellent	Very good	excellent	excellent	Very good
Re-usability of building material	excellent	Excellent	Very good	excellent	Very good	fair
Principle 4: Intelligent limits						
Reduced impact of building footprints	Very good	Excellent	excellent	excellent	excellent	good
Preservation of site characteristics	Very good	Excellent	good	excellent	Very good	fair
Principle 5: Sense of place						
Building materials	Very good	Excellent	good	Very good	excellent	fair
Mode of construction	excellent	Excellent	excellent	excellent	excellent	good

Source: researcher, (2011)

Principle 1: Integration into Landscape = 90% of the buildings studied applied the principle of integration into landscape in their design and planning.

Principle 2: Bold Ecology = 80% of the buildings studied applied the principle in their design and planning.

Principle 3: Intelligent Construction = 90% of the cases studied applied the regenerative building materials and technology in the design.

Principle 4: Intelligent limits = 60% of the cases studied applied the principle in design and planning stages.

Principle 5: Sense of Place = 60% of the buildings studied applied the principle in design and planning stages.

The overall summary on the facilities studied in regards to the level of regeneration is illustrated below in figure 4.1. Analysis carried out on the case studies based on the application of the set principles of sustainable design has revealed that there is a certain degree of distinction on level of application between local and international case studies. Thus, it can be concluded that The CHH building, Oregon has the highest and Le Merridian Hotel, Nigeria has the lowest.

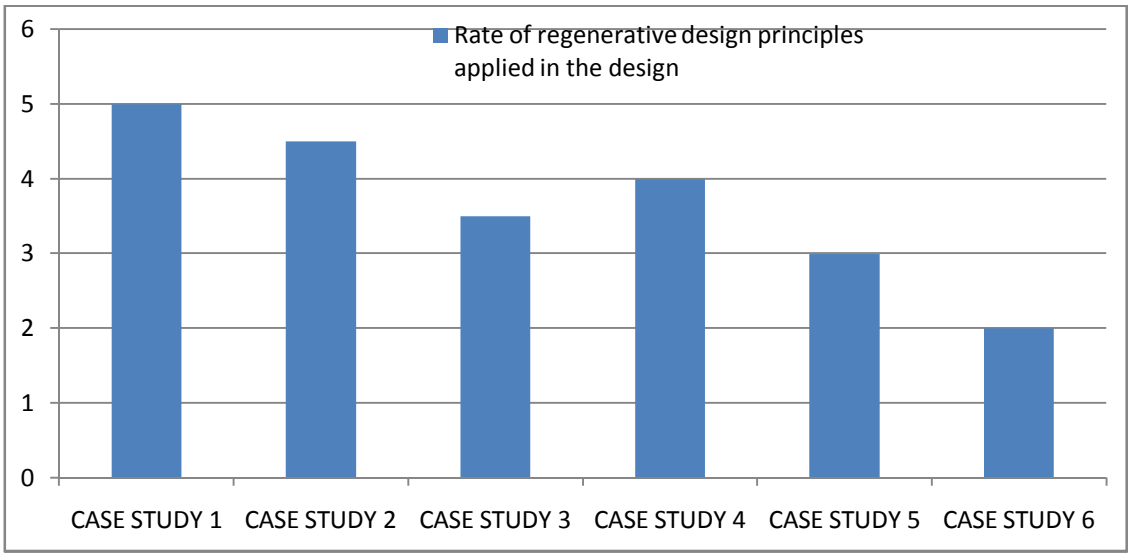


Figure 4.1: showing the applicability of regenerative design principles in the above case studies.
Source: researcher, (2011)

CHAPTER FIVE

FINDINGS AND DISCUSSSIONS

This chapter analyses, discusses the data collected and the result findings presented in the previous chapter. However, the data presented in the previous chapter was cumbersome, thus there is the need to summarize the result. Furthermore, attempts will be made to reference the literature review while summarizing the discussion and analysis to reflect a critical approach to analysis. From the critical analysis of data collected, the relationship between the facility type and research area will be identified and discussed in a broader context towards investigating the applicability of regenerative strategies and principles in the design of resort hotel. This will aid during the conceptual design stage where certain factors will be considered in determining the overall outcome.

5.1 INTEGRATION INTO LANDSCAPE

The integration into landscape in a regenerative design is not restricted to the use of only local/indigenous building materials and horizontal spread of building on site. It also involves certain features which includes; transforming data, knowledge, and insight collected from the site into architectural and landscape form, using nature for inspiration, as seen in Case study one where approach to the design was to harvest nature's "free" resources such as air, water and light and in the Environmental Park where the idea of the design comes from the construction of a united landscape which is able to link river, garden and Technological Park in a system of land architecture with a vocation deeply ecological and environmental. The designing of site and building form to be according to the natural terrain of the site as seen in case study two where the southern edge of the building roofline is held unusually low so that it appears to emerge from the landscape. Furthermore, the use of natural landscape elements and

the use of natural/biodegradable building materials as well as minimizing the human impact on the natural environment as earlier stated in the chapter two of this report. As seen in Case studies one, two, three and four respectively which depict this feature to a maximum level, with the building forms all go vertical with nothing less than ten floors with the exception of case study two; Steinhude Recreational facility. Also the vertical spread of the buildings ensured minimum disruption of site and enabling the preservation of site characteristics.

The transformation of data, knowledge, and insight collected from the site into architectural and landscape form, use of natural landscape elements and application of natural/biodegradable building materials i.e. wood, stone and thatch can be seen in all the six case studies. However, Case study two and four depict these features more. The use of green roof gardens and soft landscaping elements in all cases enhanced the harmony and relationship between the built form and the natural environment.

5.2 BOLD ECOLOGY

This involves the integration of environmental considerations into the planning of buildings and implementation of ecological systems that perform multiple functions which are regenerative and provide a positive net output. All the six Case studies were designed with environmental consciousness, some more than others. The use of recyclable building materials which are also less toxic, do little or no harm to the ecosystem, water efficient systems, recyclable energy sources such as solar panels and wind turbines and water treatment plants are evident in the design and planning. The Mauna Lani resort hotel is an example of a building with building integrated photovoltaic (BIPV) at its finest. As depicted in Case study one through the installation of a bioreactor on site, the CHH OHSU cleans 15,000 gallons of wastewater a day and also generates 2.1 million gallons annually in potable water savings.

The use of green roofs also illustrates bold ecology; Case studies one, three and four all employed the use of green garden these can be either extensive or intensive designs roofs for its properties. These are; to filter pollutants and heavy metals out of rain water, provides insulation and cooling of the building form reduce energy consumption and reduce storm water runoff and to filter pollutants and carbon dioxide out of air which helps to lower disease rates. All these attributes were harnessed by the building forms. However, the Centre for Health and Healing OHSU employed the use of both the intensive and extensive roof gardens.

Energy conservation schemes are a requirement for achieving regeneration successfully. This can be achieved by the provision of maximum day lighting, natural ventilation and passive solar design techniques in the building facility, ensuring that electrical or mechanical means are used only when necessary. Case studies two, four and five used glass to achieve natural lighting. As seen in case studies one with the central courtyard design, Songjiang and Mauna Lani hotels used the atrium concept to enable air flow freely and natural ventilation around the building facilities.

5.3 INTELLIGENT CONSTRUCTION

The choice of building materials and technology employed in all the case studies were governed by their availability, positive/negative effects to human and ecosystem, local contents, recyclable contents as well as efficiency in installations and durability. All the six Case studies employed the use of materials with recyclable content i.e. steel, glass, concrete and green materials which are durable as well as recyclable. The building materials employed in the interior of case study five was paints and finishes with low toxic substances, natural fiber furnishings, teak and canes which are readily available to that locality.

5.4 INTELLIGENT LIMITS

The preservation of site characteristics is a core of this principle. The proposal for the design of the Songjiang Hotel was accomplished with no disruption of site features. The building form was integrated in to the existing quarry, while using natural elements found on site for landscaping. All the six case studies with the exception of Le meridian Hotel had minimum/reduced impact of building footprints. Thus, allowing ground water recharge to take place on site. As seen in case studies two, three and four the potentials of the site were fully maximized and harnessed into the design to strongly harmonize the natural landscape and the building form.

5.5 SENSE OF PLACE

The type of building materials and landscaping elements adopted for construction could be used to achieve this goal. According to (Williams, 2007), the principle teaches us to make minimal changes to the natural system functioning, and to reinforce and steward those natural characteristics specific to the place. As seen in Case studies one, two, three, four and five, all the design in all cases integrated the presence of surrounding water bodies into their site planning and landscaping as well as the construction stages.

The aesthetic and beauty of the building is also an important variable for this principle. The Steinhude Recreational facility illustrates it in the design as the project aesthetically acknowledges the recreation/vacation culture of the island. The built front of the Environmental Park follows exactly the bend of the river on the site and the Songjiang Hotel design reflects the natural landscape of the quarry.

SUMMARY

This chapter covered the analysis of collected data presented in chapter four. Data collected were further analysed in sections, beginning with the summary and analyses of information gained from the case studies. In sum, the current scenario of the resort hotels in Nigeria was depicted by information gained from the observation and visual survey of the research area and facility while the documentation shed more light into the current status of the international Architectural/Engineering/Construction industry with regards to the implementation and subsequent adoption of Regenerative Architecture an all building types. The analysis further ascertained the applicability of these chosen five principles discussed in the earlier chapters of regenerative architecture in resort and hotel design. The use of these principles: integration to landscape, bold ecology, intelligent construction, intelligent limits and sense of place have been implemented and harnessed in resort as well as hotel design with successful outcomes as revealed by the case studies. The study further revealed the international view and status of implementing regenerative design approaches in the Architectural/Engineering/Construction industry.

CHAPTER SIX

DESIGN REPORT

This section of research describes the site, its features and the design proposal for the research facility with respect to the application of the findings in the previous chapter of regenerative design principles. This section will further highlight the design features and shed further light on how the principles of regenerative design has been successfully applied in the design and planning stages of the proposed resort hotel.

6.1 SITE SELECTION AND CRITERIA

According to the International Hotel and Restaurant Association (2005), the site must be compatible with the purpose of the proposed development and be suitable for building Choosing a viable site with natural attractive features is paramount to the development of a resort hotel so as to not only influence patronage but also for the infinite access to nature. Furthermore, to express the applicability of regenerative principles on a site level, certain features of interest should come into play on the site selection. Two sites were selected: site 1 is located at the new built up Kaduna Millennium City of Kaduna State and site 2 is located at the Gurara Falls region of Niger State. The following under listed criteria was used to weigh the suitability of each of the site and thus the most appropriate site was selected. They are:

i. Location/ Accessibility
ii. Access To Basic Amenities
iii. Size Of Site, Suitability& Availability
iv. Visual And Aesthetic Potentials
v. On Site Energy Resources
vi. Rate Of Degradation And Destruction Of Site

vii. On Site Natural Elements To Integrate Into The Design

Table 6.1: Site Assessment and Selection Criteria.

S/NO	CRITERIA	SITE 1	SITE 2	REMARKS
1	LOCATION/ ACCESSIBILITY	4	4	Although both sites are easily accessible, site 1 is more developed
2	ACCESS TO BASIC AMENITIES	4	3	Site 1 is closer to town and services
3	SIZE OF SITE, SUITABILITY & AVAILABILITY	3	5	Site 2 is more spacious and already allocated to a hotel development
4	VISUAL AND AESTHETIC POTENTIALS	2	5	Site 2 has a scenic view of the falls, 2 rivers , clay soil for water retention and undulating topography
5	ON SITE ENERGY RESOURCES	3	4	Site 2 has more abundance of water, timber, dense vegetation and rocks
6	RATE OF DEGRADATION AND DESTRUCTION OF SITE	3	5	Site 2 displays a higher rate if degradation i.e. flooding and leaching
7	ON SITE NATURAL ELEMENTS TO INTEGRATE INTO THE DESIGN	3	5	Site 2 possesses rocks,, trees , shrubs and lateritic formation
	Total	22	31	

Source: (Researcher, 2011)

The weighing scales adopted for the criteria assessment are: Excellent = 5, Very Good = 4, Strong = 3, Weak = 2, Very Weak = 1. However, from the above comparison it is obvious that site 2 will better support the development of a resort hotel with the application of regenerative principles.

6.2 SITE LOCATION

The site for the proposed resort hotel is located around the Gurara Falls in Bonu village of Gurara local government area of Niger State. The state is located in the Savannah region of Nigeria between latitudes 8o20'N and 11o30'N and longitudes 3o30'E and 7o20'E. It lies wholly with the physical and cultural zone of transition described as the "middle belt of Nigeria". The state is also bounded by Kebbi State to the north, Kwara State to the south, and Kaduna State and the Federal Capital Territory to the East (Udo & Mamman, 1993). Plate 6.1 below shows the map of Nigeria, highlighting Niger state,



Plate 6.1: Map of Nigeria highlighting the location of Niger State
Source: (www.google .com)

The location of the proposed site is at kilometre 69 along the Minna-Suleja road and the waterfalls site is 4km off the road. The villages that surround the proposed site are Bonu village 1.7km north-east; Padawa village 3km south; and Boru village 3.2km south-west of Gurara Falls. Plate 6.2 below shows the map of the location of the cut out proposed site highlighting the waterfall respectively.

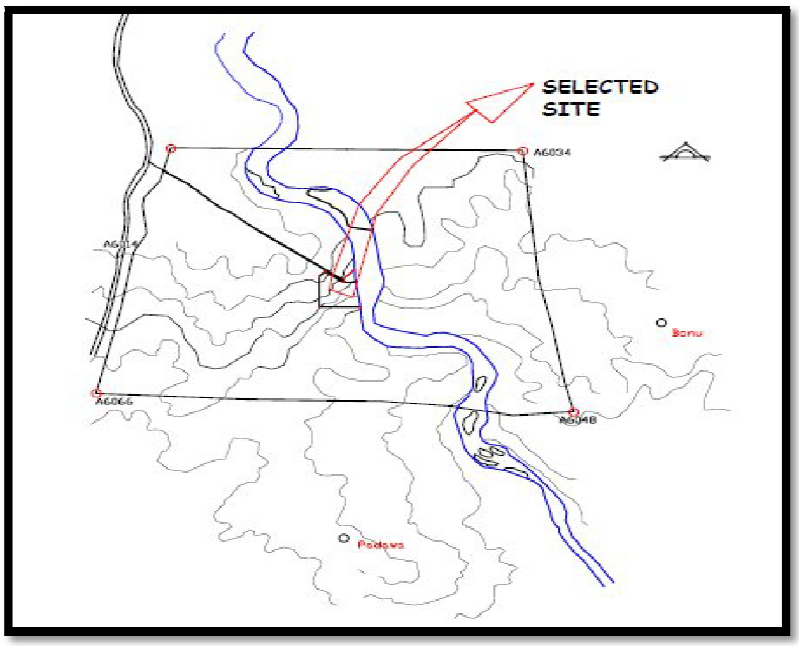


Figure 6.2: Map showing site for the proposed development
Source: (researcher's sketch)

6.3 SITE ANALYSIS

The factors that are analyzed in a site within the realm regenerative design are;

i. climate
ii. Soil and vegetation
iii. Topography and geology
iv. Visual and physical factors
v. Noise

6.3.1 Climatic Data

The climate of Niger State is typical of the guinea savannah with these attributes:

Temperature: the hottest months of the year are March and April with main daily maximum temperature of about 32oC for most of the year. There is a drop in the average minimum temperature to about 26oC during the peak of the rainy season from July to early September.

Rainfall: the rainy season lasts for seven months, from April to October in the south but decreases to six months in the north with a mean annual rainfall of between 1000mm to 1500mm.

Wind: the air masses that dominate the region are the southwest Monsoon which is prevalent during the rainy season and the dry dusty north-east winds that blow from the Sahara during the dry season.

Relative Humidity: the relative humidity at sunrise is 72% while it could be as low as 40% in the afternoon, resulting in a dual variation of 32% (records taken over 25 years). The values may be as low 20% in the afternoon in the month of January as compared to 71% in the afternoon in the month of July. This results in a seasonal afternoon range of about 50%. In January, the average early morning relative humidity is 31% and the value in July is an annual high of 96% giving a seasonal variation of 65%.

Sunshine and Cloud Cover: the amount of sunshine received depends on the season. The site lies in the tropics where sunshine is abundant but not very intense, because of the presence of the falls and the many trees, making a forest. During the dry season the sunshine received is more than is recorded in the wet season. The average duration of sunshine hours is between 5-7 hours daily. The longest period of sunshine is recorded in the months of November and February which have the clearest skies (Udo & Mamman, 1993).

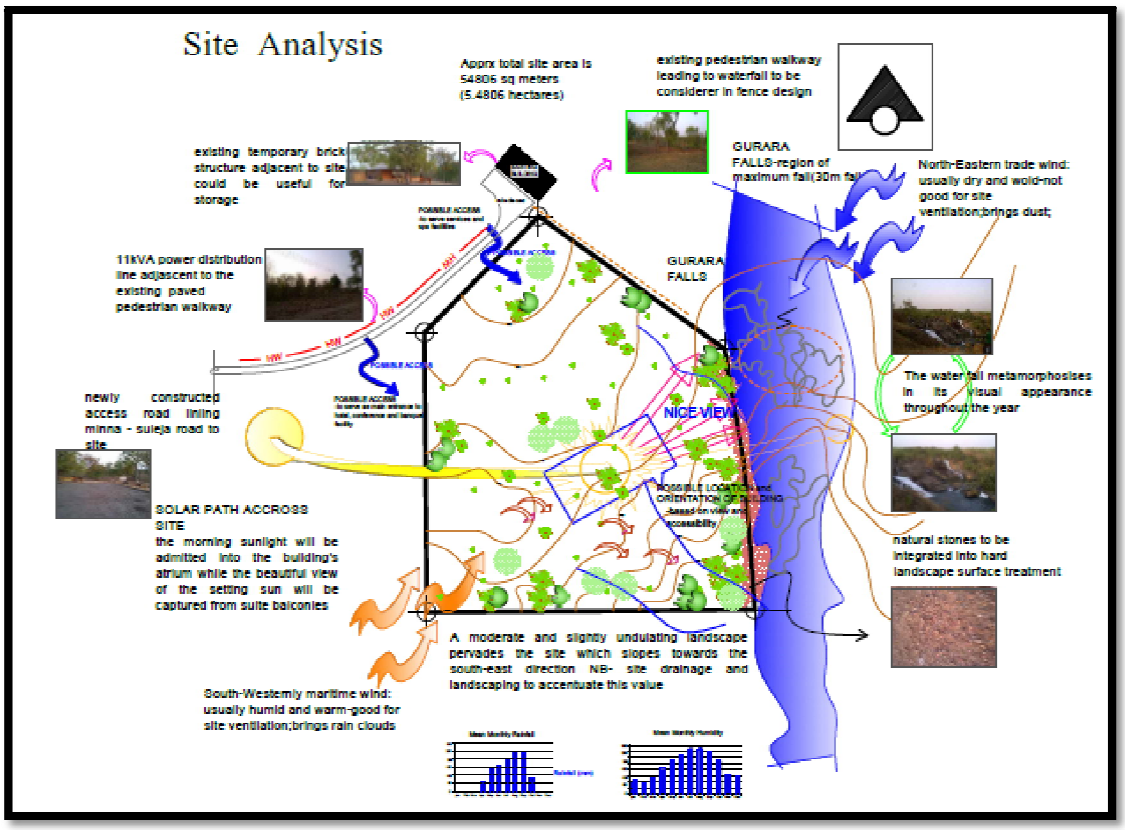


Figure 6.3: showing the site analysis of the site
Source: (researcher's sketch)

6.3.2 Soil and Vegetation

Niger State is located in the middle belt of Nigeria. This therefore implies that the state lies in the transitional zone between the forested South and the continental semi-arid grass plains of the North. The vegetation of the site has open woodlands, with densely clustered trees and elephant grass. The soil of the state bears a close relationship to its geology, since soils are derived from geological parent materials. The soils are usually deep, red and enriched with clay subsoil. For the greater part of the state, including the Gurara region, ferruginous tropical soil is predominant. The soil is generally permeable and the bedrock is 10meters below the surface (Udo & Mamman, 1993).

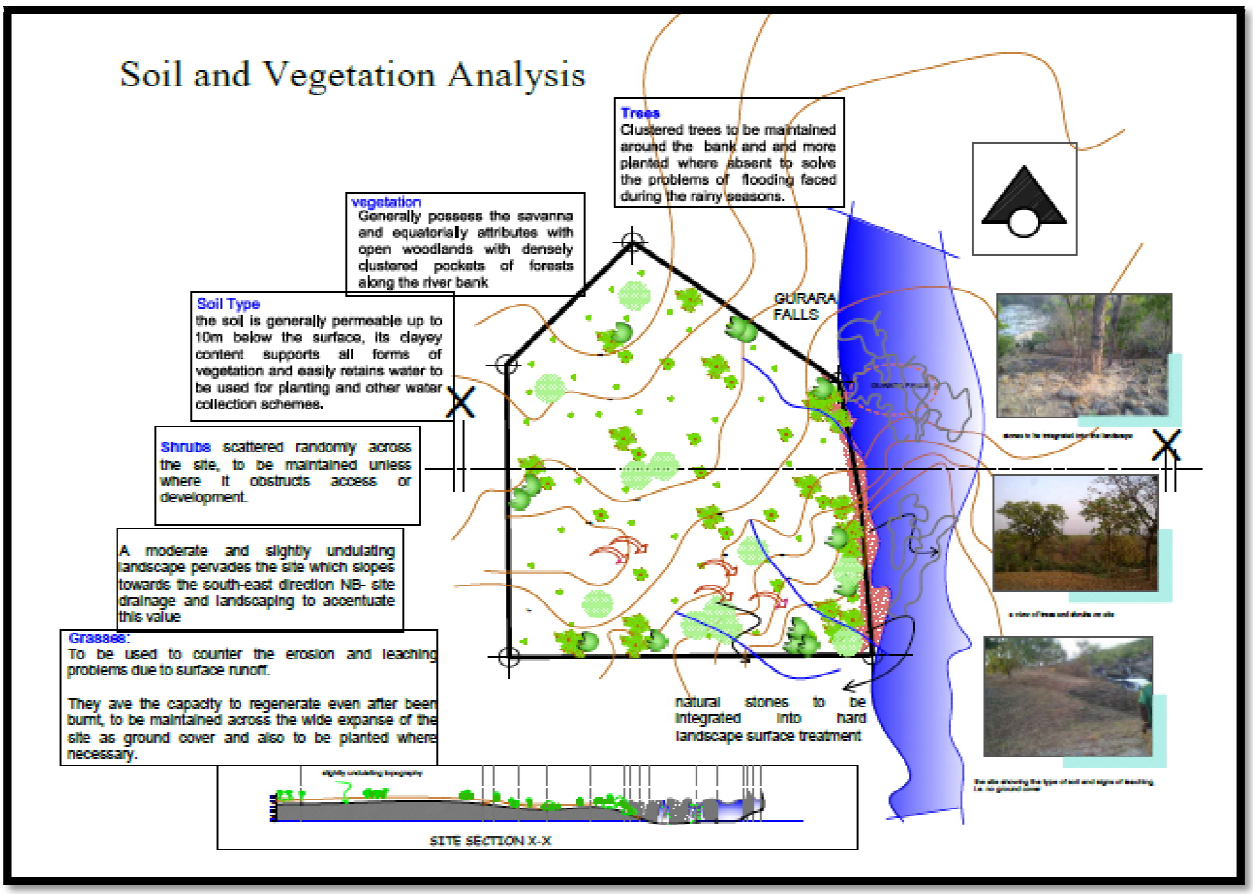


Figure 6.4: showing the site analysis on soil and vegetation of the site
Source: (researcher's sketch)

6.3.3 Topography and Geology

The area is lies on the lowlands within the Kebbi plains and the Niger-Benue trough. The topography of the region is rough low lying below 300meters above sea level. The topography consists of steep and gentle slopes including a few comparatively flat areas. The site has a gradient of 2.6% slope south-west and 3.1% slope south. Rocky outcrops dot the winding riverbeds which are made visible by low water volume during the dry season. Geologically, the state is covered by two main formations:

a) Sedimentary rocks, consisting of sandstones and alluvial deposits which cover the Niger trough and substantial parts of Lapai, Bida, Wushishi, Borgu local government areas.

b) To the north, on the other hand, the bulk of the state is underlain by basement complex rocks. The landscape of this part is characterized by granitic outcrops called inselbergs. These outcrops are common around Minna, Suleja, Shiroro, Mariga and Gurara local government areas (Udo & Mamman, 1993).

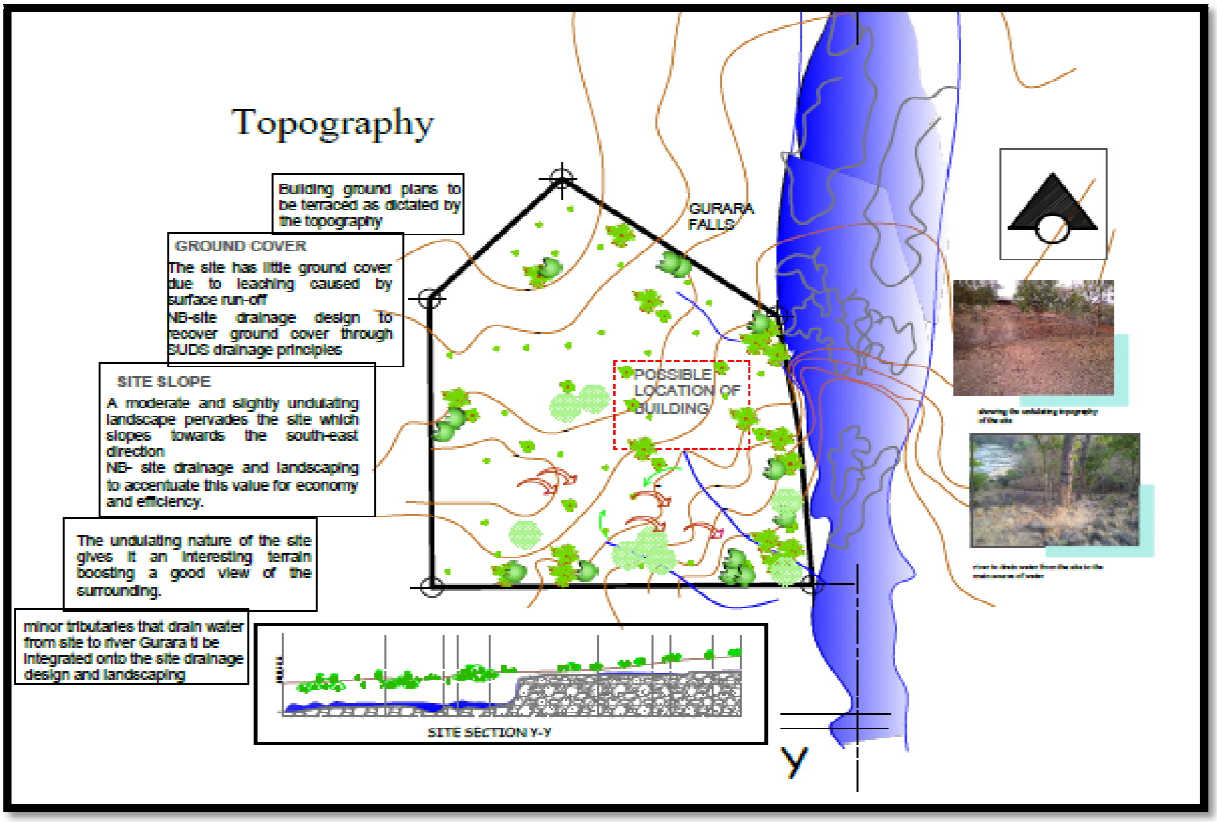


Figure 6.5: showing the site analysis on topography of the site
Source: (researcher's sketch)

6.3.4 Visual And Physical Factors

View: The site has many views attributed to it. However, the best view of the site is the water fall and the main facility will be designed to capture this view. The other point with good view

are the two natural rivers crossing the site, during the dry seasons the beach sand around the fall bank is visible, (as seen below in plates 6.1 and 6.2) to be as picnic grounds and other activities. The abundance of dense vegetation around the boundary lines of the site adds beauty to the scenery.



Plate 6.1: showing the view of the bank of the stream and also the lowest point of the water fall.
(Source: Researcher, 2011)



Plate 6.2: showing the beautiful scenery of the water fall
(Source: Researcher, 2011)

Access road: The main access road runs through-out the entire front parameter boundary of the site. It is a newly constructed access road linking minna - suleja road to site. It is tarred, undulating, and winding. The main access is to be tapped from the main road. All major structures are to be oriented towards the main road unless where disadvantageous.

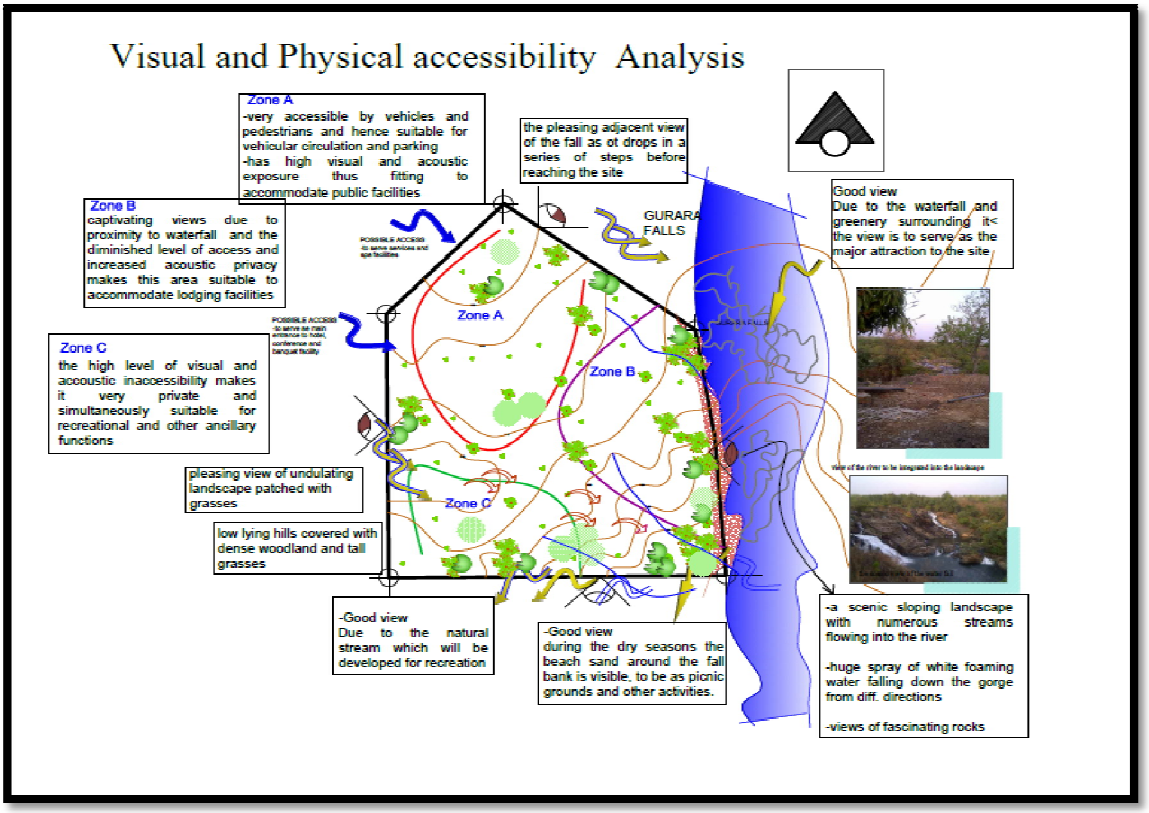


Figure 6.6: showing the site analysis on visual and physical accessibility of the site
Source: (researcer's sketch)

6.3.5 Noise

The major origin of noise is from the moving vehicles on the main road that extents to the site. Trees are to be planted close to these sources to buffer this effect. However, there is wanted sound of moving water of the water falls to be harnessed and incorporated into the design for

relaxation and Spa treatment. In planning, distance should be created between the main facilities and this region with proper site zoning analysis.

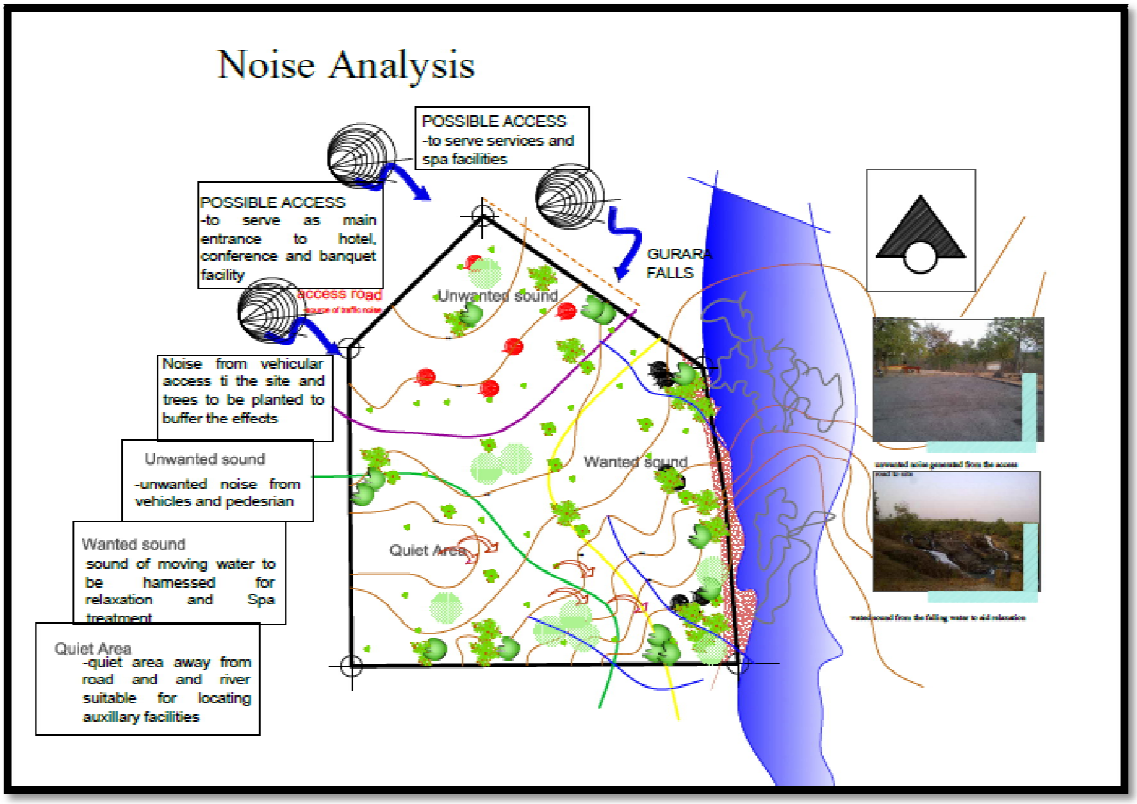


Figure 6.7: Showing the site analysis on sources of noise to the site
source: (researcer's sketch)

6.4 DESIGN CONCEPT AND DEVELOPMENT

The concept adopted for this project is the butterfly, which is governed by the principle of regenerative architecture as earlier discussed that every design should be inspired by nature. The approach adopted explores the use of its form which represents its physical outlook in terms of life cycle growth, character and shape. Here the choice is governed by the interaction and relationship between butterflies and nature. This means that there should be harmony between the building form and the surrounding landscape, this now makes the whole system

seem to function together as part of the same ecosystem resulting in a regenerative design. The figure 6.8 below illustrates the mutual relationship between the butterfly and the ecosystem.

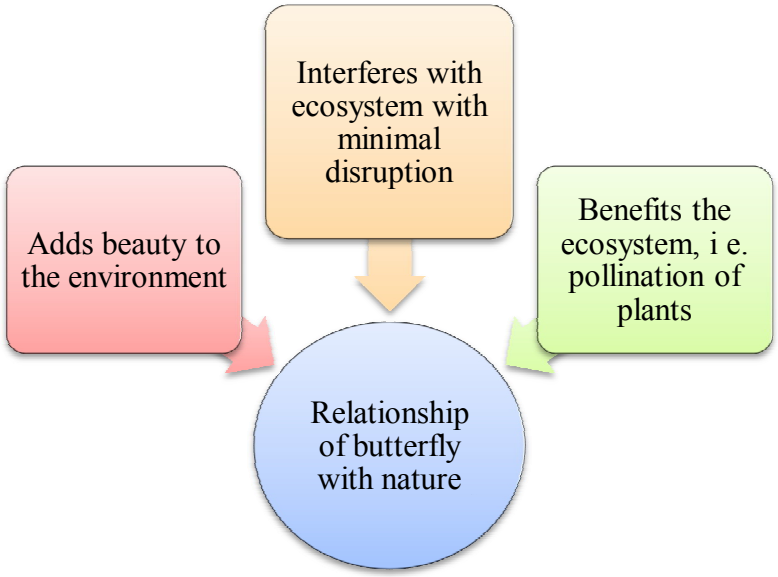


Figure 6.8: Showing the interaction between butterflies with nature.
source: (researcer's sketch)

The proposed structure imitates the life cycle of the butterfly which includes four stages, egg, larva, pupa and the adult i.e. metamorphosis. The planning and design will take the construction, occupancy and replenishing stages respectively. At the **construction stage**, the building materials used consume less energy, recyclable, are less/no toxic to the environment, and are durable. However the use of regional materials such as thatch, brick and mud will be adopted. At the **occupancy stage**, the building imitates the pupa stage, with the building through the conversion of solar energy into electricity/light with the use of photovoltaic panels, day lighting, passive design, high performance materials, thus reducing the amount of energy consumption. **Restoring stage**: at the adult stage, the butterfly is fully grown and it gives back to the ecosystem by pollination as well as beautifying it. So is the proposed

structure as its trying to mimic nature by providing the same kind of vista appeal and attraction, replenishing the deficiencies of the site.

The design concept as expressed above has been used as the guide to be reflected in the evolution and development of the different forms of planning concepts, which are;

i. Floor Planning concept
ii. Form concept

6.4.1 Floor Plan Concept

The floor plan of the proposed structure takes the shape of a flying butterfly with its wings spread as depicted in figure 6.9 below. The central open courtyard imitates the space between the spread wings, initiating natural ventilation and allowing circulation through the building. Hence, maximizing energy management schemes. The circular shape of the building provides good views of the water fall to be sighted by all occupants from any direction.

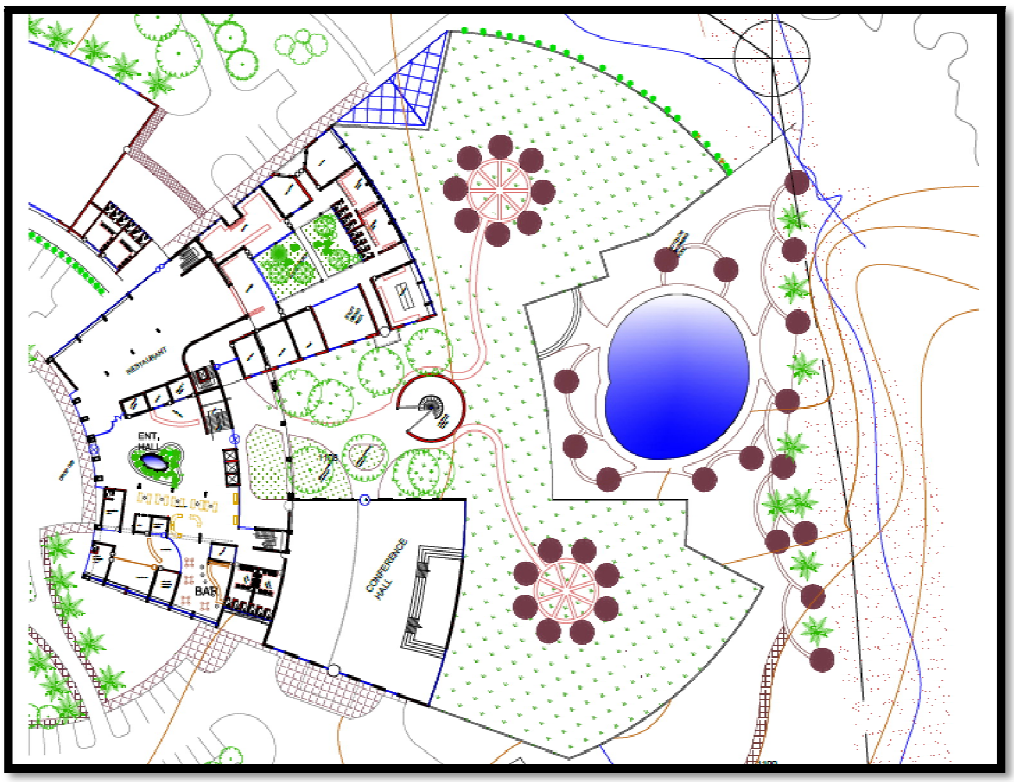


Figure 6.9: Showing a typical floor plan of the proposed site imitating a butterfly with its wings spread.
(Source: researcher's sketches)

6.4.2 Form Concept

The proposed structure takes the form of a perching butterfly, with the building hovering over the site using up less ground space as illustrated below in figure 6.10. The two wings make up the lodging units. One wing supports the photo voltaic solar panels for energy self sufficiency and the other holds glazing/glass. Thus, allowing maximum day lighting into the building.

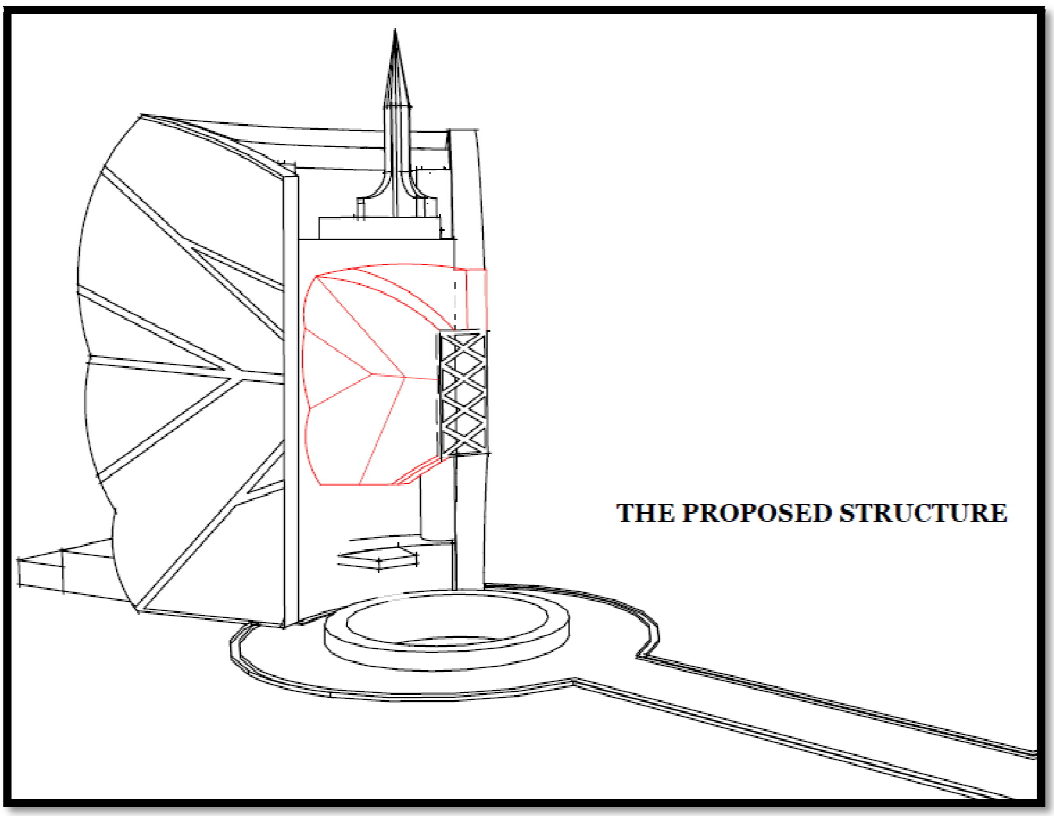


Figure 6.10: Showing perching butterfly expressed as the form of the proposed building.
(Source: researcher's sketches)

6.5 DESIGN FEATURES

The design features of the resort hotel will be described with respect to the spatial organization, design and how the Regenerative design principles mentioned in the chapter two of this thesis were applied in the resort hotel design. This is to more clearly enunciate the reasons for certain elements featured in the design of the resort hotel.

6.5.1 Brief Development and Schedule of Accommodation

For efficient functioning of the resort hotel several functions have been gathered and proposed as guided by the case studies. They are however grouped according to units organized to achieve a good functional relationship within the integrated whole. The fundamental spaces, but are not limited to:

i. Administrative offices

ii. Entrance lobby and reception

iii. Lounge/ waiting areas

iv. Rest rooms

v. Ordinary single suites

vi. Double suites

vii. Family suites

viii. luxury suites

ix. Presidential suites

x. Laundry

xi. Rooms services

xii. Kitchen

xiii. Scenic lifts and service lifts

xiv. Parking spaces

Other facilities include:

i. Conference hall to seat minimum 500 guest

ii. Restaurant and bar

iii. Games room

iv. Shops

v. Sauna and spa

vi. Staff changing facilities

vii. Outdoor recreational areas, swimming pools, water front spots

The table 6.1 below shows the bulk schedule of accommodation with the spaces required with respect to floor areas. This was derived from standards of basic hotel design.

Table 6.1 Bulk schedule of accommodation

ADMINISTRATIVE SPACES/OFFICES		
Space	**units**	**Floor area(m^2)**
Cashiers	1	$20m^2$
Accountant	1	$25m^2$
Accounts office.	1	$30m^2$
Conference room	2	$60m^2$
General Manager	1	$40m^2$
Secretary	1	$15m^2$
Assistant Managers	4	$20m^2$
Restrooms	4	$45m^2$
Computer services	1	$50m^2$
Board rooms	1	$20m^2$
General offices	4	$30m^2$
FRONT OF HOUSE/PUBLIC SPACES		
Space	**units**	**Floor area(m^2)**

Vehicular drop-off	2	100m^2
Entrance hall	1	120-150m^2
Reception desk	1	15m^2
Lounge	2	150m^2
Circulation Lobbies		250m^2
Shops	7	280m^2
Rest rooms		60m^2
Lifts and staircases		30m^2
Restaurant/outdoor dining	2	350-400m^2

BACK OF HOUSE/WORKER'S SPACES

Space	**units**	**Floor area(m^2)**
kitchen	1	130m^2
Stores	4	100m^2

Delivery Bay	1	25m^2
Service lifts		25m^2
Room service	1	15m^2
Laundry	1	180m^2
Circulation lobbies		300m^2
Changing rooms	2	40m^2
Maintenance offices	2	40m^2

ACCOMMODATION FACILITIES		
Space	**units**	**Floor area(m^2)**
Single suites	36	40m^2
double suites	36	60m^2
family suites	72	100m^2
Presidential suites	8	180m^2
Luxury suites	60	120m^2

Circulation lobbies		300m^2
OTHER FACILITIES		
Space	**units**	**Floor area(m^2)**
Conference hall	1	300m^2
Lounge Bar	1	150m^2
Game arcade	1	30m^2
Sauna and spa	1	450 m^2
Parking area		4000 m^2
Conference Parking	2	350m^2
Outdoor recreational spaces		

Source: (researcher's survey, 2011)

6.5.2 Regenerative Architectural Design Features

The regenerative architectural design features applied will be discussed with regards to the design principles they represent. These principles have already been discussed at length in the previous chapters. The features will be discussed primarily under the aspects used in the analysis of Data collection, as stated in the methodology, namely; site planning and

landscaping, spatial organization and design, energy sources and resources and lastly, the building materials adopted.

6.5.2.1 Site Planning and Landscaping

The first step ensured after a thorough site analysis as earlier discussed was to determine all buildable areas, green areas and mark out all necessary access and roads to and from the site. For aesthetics and economic, as well as ecological reasons, in order to achieve regenerative principles, the intent in developing the site was to replenish the degradation/environmental destruction of the site, minimize the disturbance of existing landforms and features while taking advantage of natural ground slopes and the microclimate of the site. Hence, it was possible to identify all the possible developments areas with respect to preferred zoning.

(a) Design with the slope

The site planning is such that the terrain is altered minimally by ensuring that the elements of the design are designed with respect to the gradient of the bearing ground. This is evident in the design of the spa facility which is placed at the basement following the natural terrain of the site (as seen below in figure 6.11) as well as the parking lots which is terraced to reduce the amount of excavation needed to provide for the requisite number of parking spaces. The designing of the site does not alter the drainage pattern of the site so as to prevent problems such as the clogging of water which would otherwise have been drained. The soft landscape elements are wholly native to the site.

The design considerations involved in a site of this nature are vast and variable. However in this design, certain slope design methods, and protective design elements have been employed. These methods are;

I. Terracing: to offer some stabilization for the slopes that are subjected to erosion form runoff of surface water, terracing has been applied to reduce the velocity of the water runoff and create a diversion into their collecting drains, by creating some ridges (terraces) along the plains.

II. The use of trees and retaining walls: around the bank of the water fall and also the boundary of the site to hold back the mass of water flooding into the site during the rainy seasons due to the slope gradient change. Dry stone retaining walls have also been used around the spa facility. This is because of the abundance of rocks on site, ease of construction, natural outlook and blend with the environment as sought for. There is an abundance of trees on and around the site boundaries which have been maintained throughout the site.

III. Application of soil binders: this is a natural means of stabilization of soil in which plants materials that inhibit or prevent erosion by providing aground cover and forming a dense network of roots that bind the soil. Since there is no ground cover due to leaching, this would provide a stable solution to the problem.

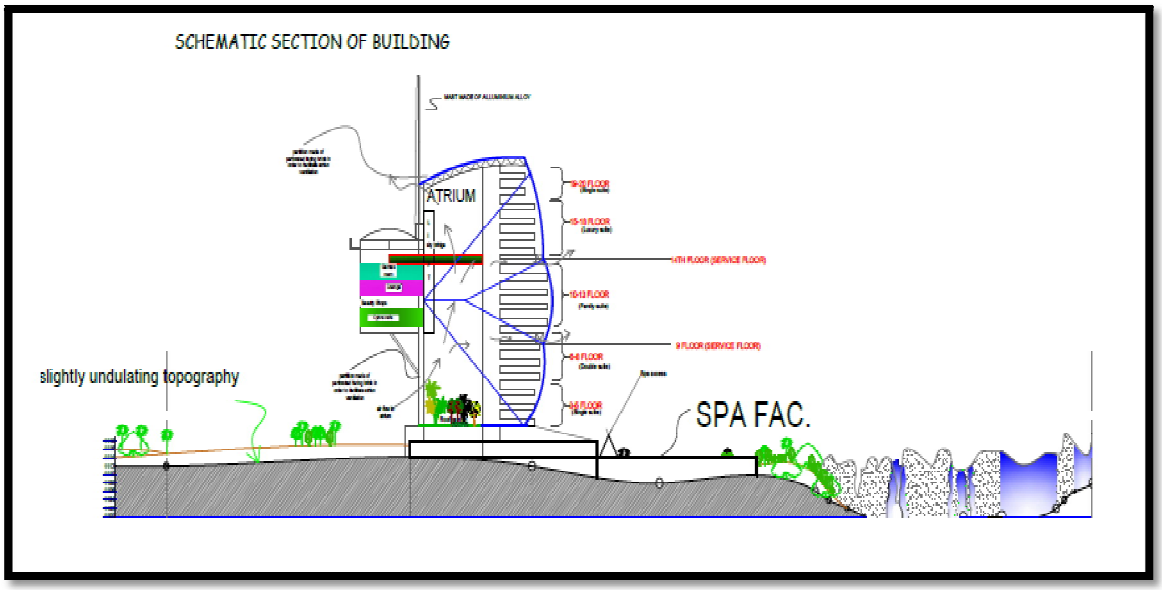


Figure 6.11: Illustrates the how the built form relates with the natural topography of the site
(Source: Researcher's sketch)

(b) Orientation of building

Orientation for sun and wind has been carefully considered. Most of the buildings have been positioned to capture the best of the much desired south west winds. Careful arrangement has also been made to ensure that none of the buildings fall into wind shadows which may hamper ventilation. The proposed resort hotel building was oriented with the longer sides along the east and west axis, with the rooms and suites faces the north and south. This allows for effective natural ventilation and good views without the problem of the setting and rising sun. This also prevents the penetration of the uncomfortable direct heat producing east and western solar radiation coming into the building and allowed the capturing of the sun rays by the use of photovoltaic panels and converting it to solar energy.

(c) Landscaping elements

This is an important factor in the design of such a facility as it helps in creating scenic and relaxation experiences. Trees and hedges are put in place to enhance the micro climate and environmental features within the resort. The calming influence of plants is very conducive by increasing a person's ability to concentrate. Emphasis is placed on ample provision of well landscaped environments to aid in relaxation and complement activities of the resort.

I. Pedestrian routes and paving: Stone paving were used for walkways to emphasize the use of natural materials and ensuring the development blends with nature.

   However, to reduce the ratio of hard surfaces on site some of the pedestrian routes are made of concrete grass type of paving. It is a flexible element that can be reused and recycled.

II. Trees and other forms of vegetation form an immediate layer between the earth's surface and the atmosphere thereby providing moderating effects on site climate. Therefore for these mediating effects that enhances thermal balances, shading, wind break, erosion control, leaching and aesthetics. Thus, trees are to be planted on site where necessary. Grasses were planted where necessary on site, vertiver grass has been chosen to provide the desired ground cover on site. It checks erosion, and has the capacity to regenerate even when burnt.

6.5.2.2 Spatial Organization and Design

This was pertinent in the arrangement of spaces to attain adequate functionality that does not jeopardize the objectives of the design towards achieving the regenerative design principles discussed in the earlier chapters. The following steps were carefully considered and implemented in the design.

(a) Zoning:

This checked for the effective placement of activities to flow conveniently within the site without any alteration to the desired concept. All spaces of much activity were placed within easy accessibility around the site, as well as considering avoiding overcrowding within a specific zone, making it affect other activities like the conference and the banquet halls. Recreational activities were placed to maximize the effect of the water body as seen below in figure 6.12, this include: outdoor sports, picnic area, play ground, gazebo huts for relaxation at the beach front, spa facilities etc. These were located towards the southern and western part of the site, closer to the bank of the existing streams and that of the water fall, while allowing for the integration of water spots recreation.



Figure 6.12: showing the zoning relationship of a typical floor plan with recreational facilities and the water front (Source: researcher sketch)

(b) Use of hanging and green roofs gardens

One of the elements of an effective regenerative architectural design is the use of roof gardens. The green roofs are reducing the peak run-off volumes to the storm sewer, helps in cooling the building, filter rain water and also designed to store a minimal amount of water to keep the soil saturated. This could be accessible or non- accessible. The proposed building has both extensive green roofs (and eco-roofs) and intensive green roofs (roof gardens), with a mixture of public and private accessibility. Both programmed for passive recreation, these rooftop gardens allow visitors, guests and staff to enjoy scenic views of the region, informal social interactions as well as organized gatherings and events. The roof gardens incorporate paths through lush plantings and benches for seating, offering fresh air and a green oasis. The

accessible intensive roof gardens include those found on the ground floor covering the spa facilities. This was implemented accordingly, as well as hanging gardens alongside all the balconies throughout the tower. However, the extensive garden design were used on the roof of the building, roofs of the 2nd floors and service floors respectively as shown below in figure 6.13.

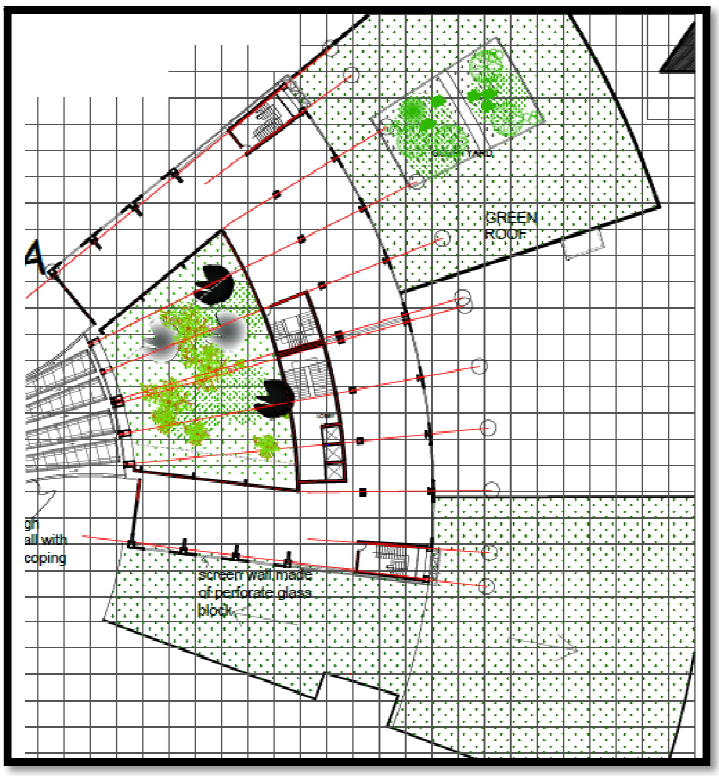


Figure 6.13: showing the use of both the extensive roof garden on the 2nd and 3rd floors respectively.
(Source: researcher sketch)

(c) Scenic lifts

One of the ways to which comfort, leisure and aesthetics can be appreciated is by having a good view the recreational facilities as well as surrounding elements. The use of scenic lifts to enhance good viewing was maximized in the proposed resort hotel. This was achieved by using translucent materials that allow for viewing but disallow the passing of solar radiation.

(d) Day Lighting

Natural light is available to all spaces in the design. The low emissivity glazing windows around the stair wells allow the flow of natural light into the building and lobbies. The design of the open courtyard also allows light to reach all areas of the main building. The direct rays also allow for planting of creeping plants i.e. climbers that creep above the courtyard, giving shade to the buildings at their inner core.

(e) Circulation

Conscious design efforts were made to separate pedestrian and vehicular traffic movement. The separation of back house from the front house was also done ensuring maximum functionality of all spaces. There is an inclusion of drop-offs outside the main building, spa facility, conferences and banquet halls were provided before parking which reduces traffic.

(f) Ventilation

The use of central courtyard design was implemented. This allows for effective passive cooling technique as well as good views of the surrounding landscape. The use of an extensive green roof in the courtyard with open spaces around each unit of the building plan allows for air flow in and out of the building effortlessly. The design allows wind to tunnel thought the building, thus artificial ventilation is optional.

6.5.2.3 Building Materials and Technology

Both the onsite and offsite building materials have been chosen to primarily be in tune with the principle of intelligent construction under regenerative design such as, biodegradable materials, conservation of natural resources, materials with low energy in use, green materials,

regional/local building materials, use of recycled materials, low embodied energy materials, renewable materials from a verifiable source, aversion from use of ozone-depleting chemicals, aversion from use of volatile organic compound materials and use of materials with low/no toxic con tents. These materials include:

Concrete: Because of its structural integrity and fluidity was used in the design. This was not extensively applied though, so as it does not contradict the design principles.

Stone: is the oldest sustainable building material, which is also abundant around the site and across the region and particularly blends with the environment as nature has it. Used for the construction of the walkways leading to the water front.

Titanium: Used as cladding material to achieve the wing effect of the building form. It is fast becoming a competitive building material. The building material was selected for its corrosion immunity, strength, durability and low maintenance cost. Physical attributes includes:

- Immunity to environmental attack: corrosion resistance results from its stable highly-adherent, protective surface oxide film.
- Low thermal expansion: Titanium's coefficient of thermal expansion is half that of stainless steel and copper and one-third that of aluminum. It is virtually equal to that of glass and concrete, making titanium highly compatible with these materials. Consequently, thermal stress on titanium is very low.
- Light weight: The specific gravity of titanium is 4.51 g/cm^3 - about 60% that of steel, half that of copper and 1.7 times that of aluminum. Being such a lightweight metal, titanium imposes lesser burden on structure. It is easily fabricated and permits ease of installation.

- Environmentally Safe: Due this its relative inertness in most atmospheres, titanium is considered environmentally friendly. It is 100% recyclable and the product of a renewable resource.
- Strength: In addition to having excellent mechanical strength (comparable to mild steel), titanium is durable and shock resistant. Its modulus of elasticity (a measure of strain rate) is half that of stainless steel. This means titanium is more flexible than other architectural metals during earthquakes and other periods of violent movement.
- Energy Efficiency: For a metal, titanium is an excellent insulator. Its thermal conductivity of 10 Btu/hr.-F°/ft. is very low (one-tenth that of aluminum) increasing a building's energy efficiency.
- Aesthetic qualities: titanium is available in its natural finish silver grey colour or it can be anodized to a spectacular range of colours.

Teflon: As a building material was used due to it has structural strength and flexibility. Though it is translucent it is able to exhibit a high energy radiation resistance and it helps keep the temperature of the surrounding down (Niger state has extreme high temperatures during the hottest months of the year).

Timber: It has been applied as the major interior building material in the accommodation units. The wood is to be coated with gypsums wool to mitigate fire hazards. It has also been used as landscape elements like benches and posts of some structures. In its natural form as wood has been incorporated into the landscaping of the site. Timber is a locally sourced material which is readily available. Borgu local government in Niger state, Nigeria is known for its quality timber production.

6.5.2.4 Energy Sources and Resources

Energy self-sufficiency of the design includes day lighting, natural ventilation, passive solar design, building automation, and high-performance materials. The major supply of services are water and electricity supply. On-site energy resources have been utilized to achieve an energy efficient design. However, to a great extent alternative energy needed to run the facility has been provided. The resort hotel has been designed to sustain itself. By the employment of green roofs which has been maximized to its full potential ,grey water system, on site water treatment plants and extensive use of photovoltaic cells have also been employed to attain alternative energy on site using the available on site resources of wind, water, and abundant sunlight.

a) Power supply

The 11kva power holding cooperation of Nigeria electric power line along the road that bound the site serves as potential power source to the resort hotel. Due to the erratic power supply experience around the site, a substation with power generating sets is provided. However alternative supplies will be via photovoltaic cells which were provided on the roof and on the walls of the building structures. The use of solar panels as alternative sources of energy will reduce the cost of energy bill as the design will thrive on energy supplied on site.

b) Water supply

At the lowest point of the entire site is the deepest part of the existing stream and water fall, and is to be utilized as water reservoir for domestic supply. This supply is to provide for even the neighboring settlements for sustainable coexistence. Alternative water supply for the facility will be through the recycling of Grey and rain water. These are alternative water

sources that can be used for non-potable uses. Using alternative sources of water collected on the site reduces the need for the extraction, treatment, and distribution of fresh mains water, reducing pressure on freshwater sources and energy use. In every cluster of buildings, rain and grey water would be collected in an underground tank, which would then be pumped to an overhead storage that performs the primary function of distribution to smaller gardens around the buildings and the lavatories.

c) HVAC system

To complement natural ventilation, a central air conditioning system shall be installed.

d) Telecommunication

Telephone line has been extended to the area and the source is Nigeria telecommunication commission. Intercoms will also be provided at sensitive facilities within the resort hotel.

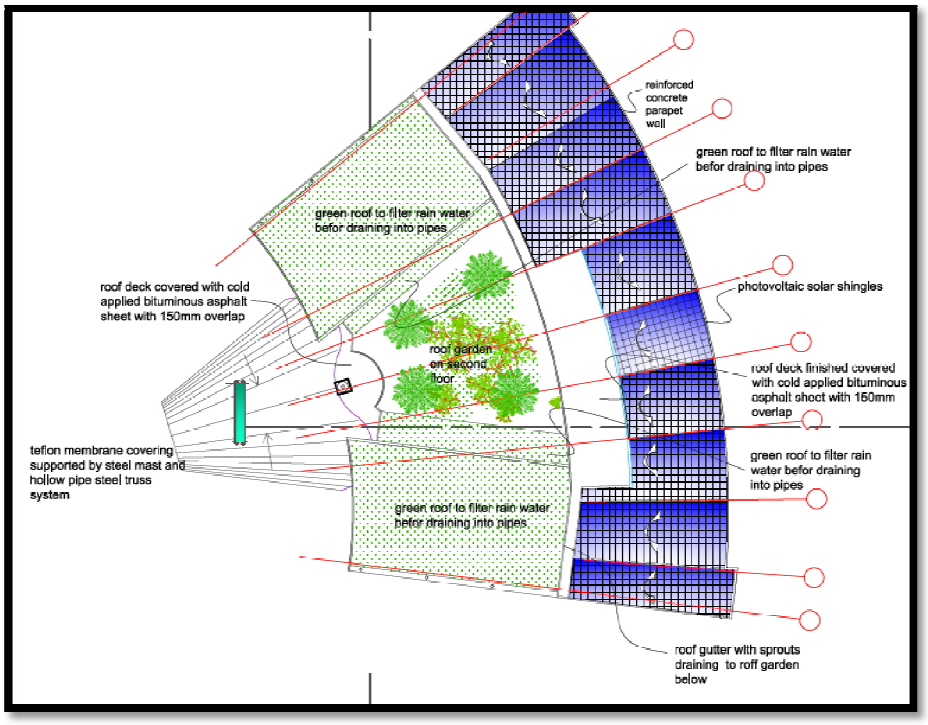


Figure 6.14: showing the use of solar panels on roof and water collection schemes from roof gardens (Source: Researcher's sketch)

CHAPTER SEVEN

CONCLUSION

This chapter presents the key research findings of the thesis report. The chapter shall be conducted in three sections. Section 7.1 will revise the research aim and objectives posed in section 1.3 of the report. Results from the previous chapters Data Analysis and Presentation will be further revised and summarized in order to provide a better understanding of the research findings. Section 7.2 will present an overall summary of the research study and Section 7.3 will provide recommendations based on the findings of this research and also elaborate on contributions of this research work to architecture.

7.1 KEY RESEARCH FINDINGS AND CONCLUSIONS

The overall aim of this research was to design a resort hotel that promotes harmony between human habitation and the natural world and to inquire into the viability of regenerative architecture as a contemporary means of achieving a more sustainable resort design. The research questions are:

a. To understand and provide a historical review of literature on regenerative architecture approaches covering it's concepts, principles, implementation strategies and subsequent adoption by the architectural industry.
b. To identify the regenerative architectural principles which are applicable to resort and hotel designs.
c. To study ways in which these principles have been applied in resort and hotel design
d. Propose a resort hotel for Gurara falls while applying the findings of the regenerative architectural design principles.

Objective One: The literature review provided an insight into previous approaches adopted towards improving the architectural standards in relation to the ecosystem. Such approaches include sustainability and green architecture amongst others. Although these models and innovations have been implemented with successful outcomes, they were found to be lacking in regards to their performance in actively healing the environment as well as ensuring net positive output. This new thinking emphasizes on co-evolutionary, partnered relationship between humans and the natural environment, resulting in a design that actively heals the ecosystem. The research study focused principally on regenerative architecture in relation to Resort Hotel design. Regenerative design is an approach that recognizes the damage that is occurring at an environmental level and replenishing the damage by treating the natural and built environment as equal partners, as this mutual beneficial relationship between these two will improve the natural environment. Literature highlighted the principles as well as strategies that govern its successful implementation. Literature shows that Regenerative Architecture is a reputable shift forward towards improving the environment. However, its adoption and implementation is still an ongoing issue in the construction industry.

Objective Two: It was deduced from the critical appraisal of Literature review in chapter two that not all the highlighted principles are suitable for the research facility. Thus, five out of the nine principles identified by Littman, (2009) were adopted. These are: integration to landscape, intelligent construction, bold ecology, intelligent limits and principle of sense of place. The choice was governed by the relationship between the research area and facility type. The findings identified and highlighted in the analysis done on data collected from the case studies support the choice of principles adopted. These findings further validated the arguments provided in the literature review regarding the numerous benefits of adopting

implementing regenerative architectural design as an approach that looks to the future of the natural environment.

Objective Three: The presentation and analysis of data collected highlighted on the application of regenerative design principles in conventional as well as resort and hotel design. The findings revealed various modes in which each principle mentioned in the previous section was achieved. Ranging from a design inspired by nature, use of green roof gardens, photo voltaic solar panels, wind turbines, storm water treatments, recyclable building materials to designing with the natural terrain/topography of any given site, just to mention a few. These findings further validated the arguments provided in the literature review regarding the numerous benefits of adopting implementing regenerative architectural design as an approach that looks to the future of the natural environment.

Objective Four: The last objective regarding development of a proposal for a resort hotel to be situated at Gurara Falls while applying the findings of the regenerative design principles was discussed in broader context in the chapter six of this thesis report. However, additional information on the proposed resort hotel will be in the appendix section. The findings from the literature review and the case studies were thus used in generating the design and strategic planning concept for the proposed facility.

7.2 RESEARCH SUMMARY

This study is centered on exploring regenerative design principles in the design of resort hotels as a means of harmonizing the natural systems and the built environment as well as safeguarding against the deterioration of the ecology and providing viable and economical means of replenishing the degradation. Review of relevant literature on the writings and works of prominent architects and theorists aided in the culminating of a set of principles on which

organic architecture is guided. The studies carried out in the course of this research have shown that energy self sufficient buildings and designs inspired by nature/natural forms do not harm the ecosystem; instead it offers a positive vision of replenishing the environmental degradation of the site.

Case studies were analyzed using general variables and specific variables directly related to the approach of regenerative architecture. This has clearly shown that the most important aspects of regenerative design in a resort hotel are stipulated on those outlined principles of regenerative architecture, with strong cases on issues of interaction of nature with the building form, renewable energy and conservation methods and use of intelligent building construction materials. However, it is evident from the research findings that the Nigerian production industry is lagging behind in the implementation and acceptance of regenerative design approaches in planning and design of the built environment. The lack of these considerations during the design and planning process has a crippling effect on the tourism industry and the hotel accommodation business. The situation is more complicated in the case of resort hotels; this is because guests do not only seek after comfortable hotel accommodation but also want an experience of living close to nature. Findings from the case studies and literature review were thus used in generating design and planning concepts for the proposed resort hotel.

The location and level of environmental deterioration (flooding and leaching) on the Gurara falls region makes it a hearty and viable site for the application of regenerative design principles in designing a resort hotel. The site is characterized by its undulating terrain, beautiful scenery, temperate climate, dense savannah vegetation. All these rich characteristics have been harnessed into the design and planning of the resort hotel. These favourable resources conspired to make it a potential tourist attraction. This research can serve as a guide

to fostering the relationship between the research area and proposed facility both in the country and the world over.

7.3 RECOMMENDATIONS

As earlier mentioned, the recommendations shall be made based on analyses and findings of the research on regenerative architecture in relation to resort hotels, the following recommendations are put forward:

i. It is a foremost recommendation that people in the architectural/Engineering/construction related industries should be enlightened about the concept of regenerative architecture. As stated earlier in the literature, there is a misconception about its theories and strategies. Even though it is a globally accepted topic in the world today, in most developing nations i.e. Nigeria inclusive, this concept is still not a mainstream issue in our local design and production industries. This can be initiated by formal education, organising conferences and forums where experts of industry, governing bodies and local authorities would often interact and brainstorm on its application as a best architectural/construction practice.

ii. There is the need for more enlightenment amongst hotel operators of the viability of regenerative hotel designing. In an intelligent stroke, the hotel owners enjoy the financial profitability of regenerative architecture and the long term ecological gains of engaging in sustainable design. Thus, resort hotels must thrive to a considerable degree on its on-site energy resources. This can be optimized by orientation and placement of building form on site, building material selection and engaging nature as in integral part of the designing and planning stages. Appropriate site selection thus comes into play when it comes to establishing resort.

iii. With an insightful application of the mentioned regenerative design features in resort hotel designs in Nigeria, it is possible that the tourism industry will become more viable since it the design will enhance the comfortable accommodation of tourists while not compromising the quality of the environment.

7.4 CONTRIBUTION TO KNOWLEDGE

i. There is always a unique and distinctive feature at every site. Thus, every design needs to be in response to the site features and the specific place that the architecture is generated for.

ii. Nature as inspiration is paramount in any architectural design. It is importance of designing structures that compliment the natural world. One of the ways nature can be duly appreciated is by having a really close contact with it.

iii. The approach of integrating the natural systems and built environment as equal partners in architecture is necessary in order to achieve a healthy ecosystem and ascertain the future of tomorrow. The benefits regenerative design principles are numerous and can be applied in any design stage.

iv. The proposed resort hotel was developed to serve as a guide for the implementation of regenerative principles in resort design with particular regards to Nigeria.

v. Resorts need to be energy self sustaining and promote harmony between the built form and the surrounding landscape to be truly regenerative and a living building.

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APPENDICES

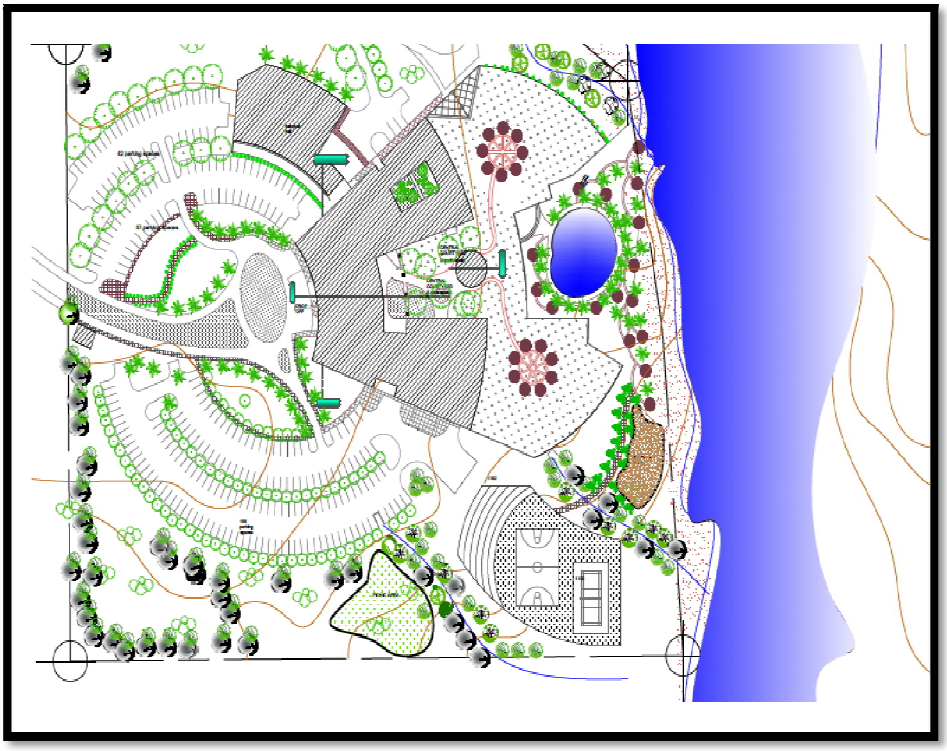


Figure 1: site plan

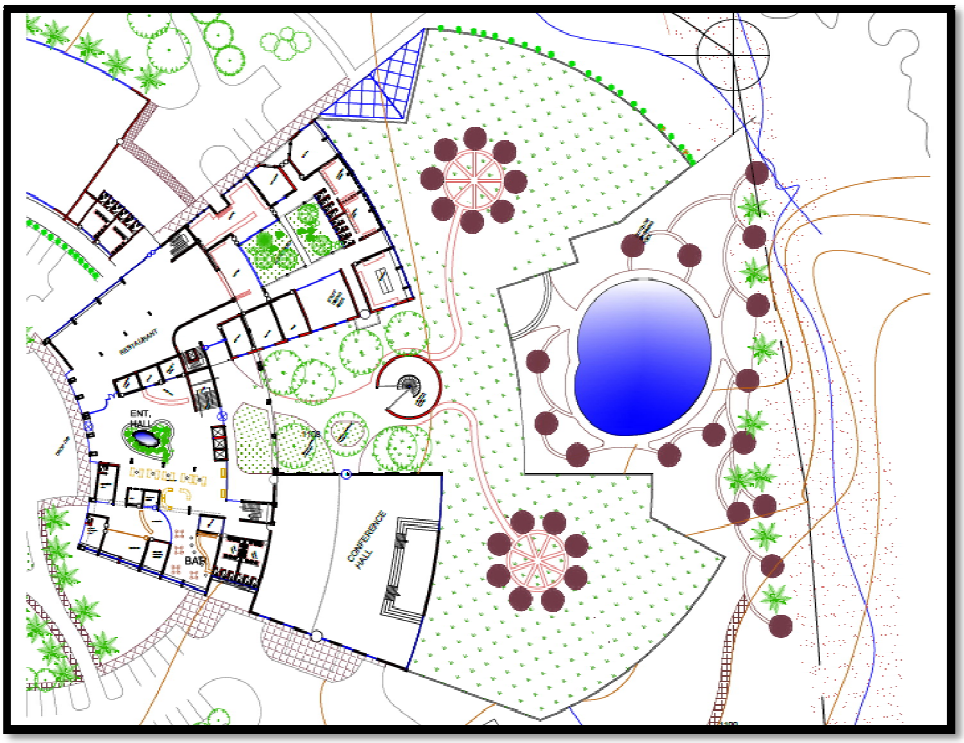


Figure 2: plan on site



Figure 3: Spa facilities in relation to the natural surrounding

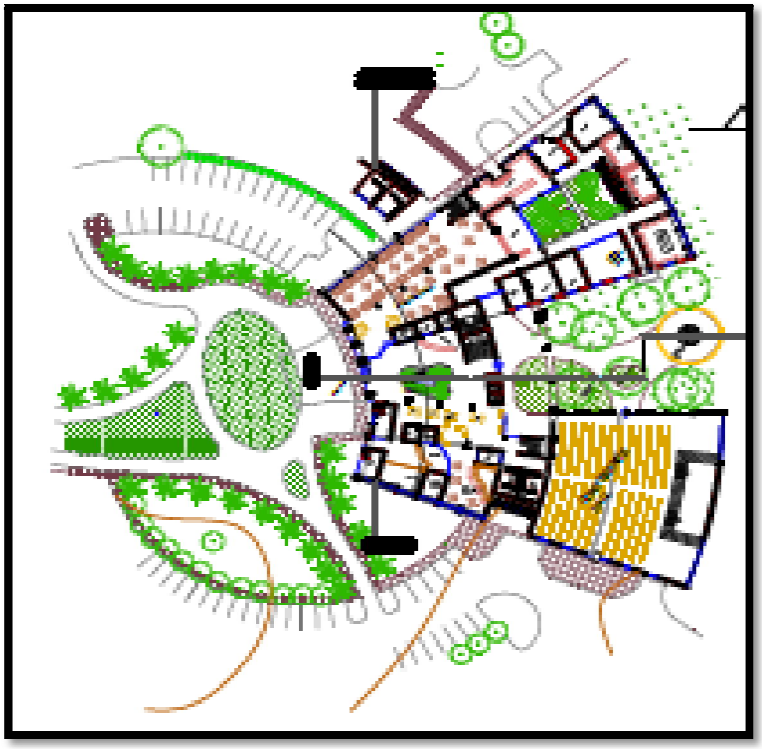


Figure 4: ground floor plan

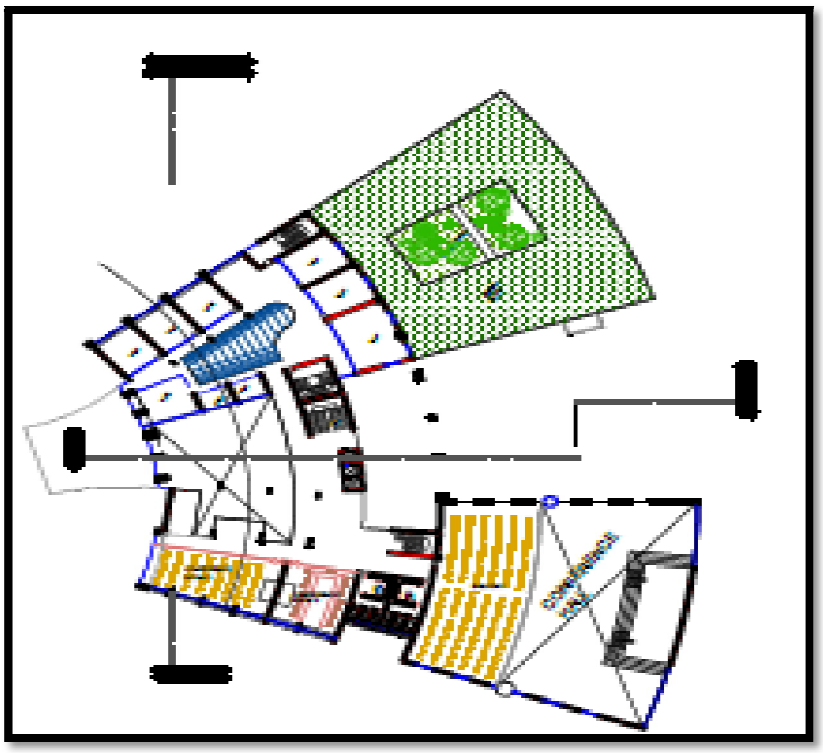


Figure 5: 1st floor plan

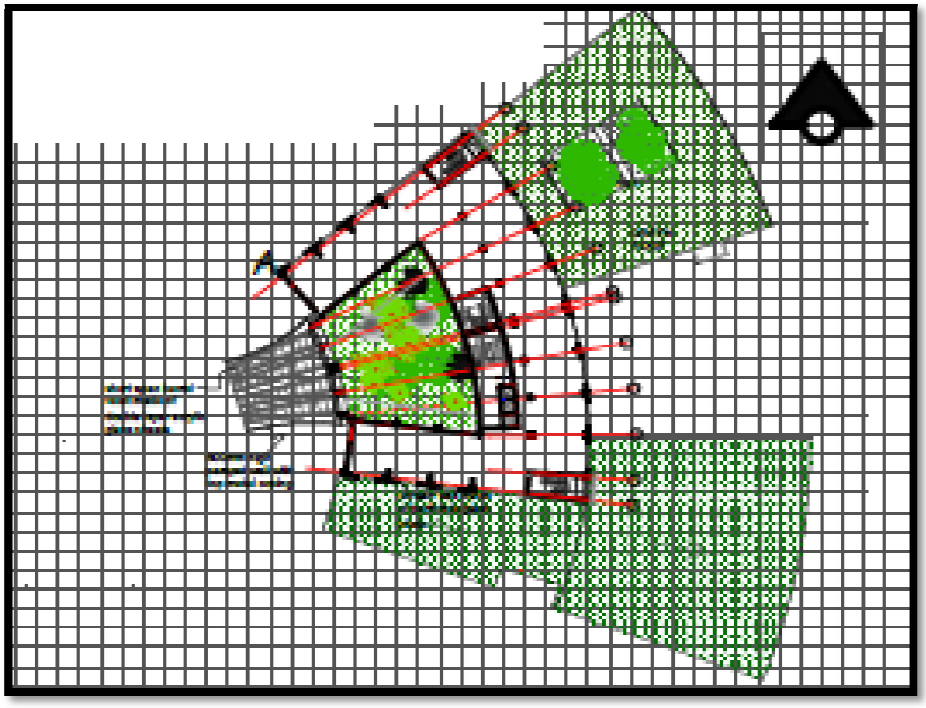


Figure 6: 2nd floor plan/service floor

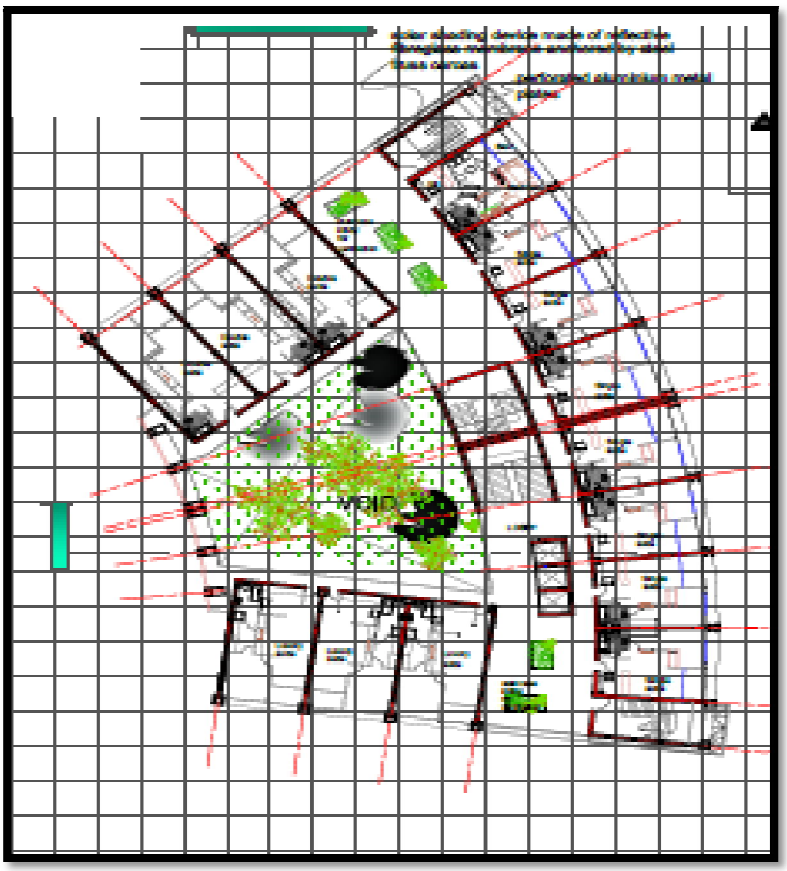


Figure 7: 3rd – 5th floor plan



Figure 8: 6th – 8th floor plan

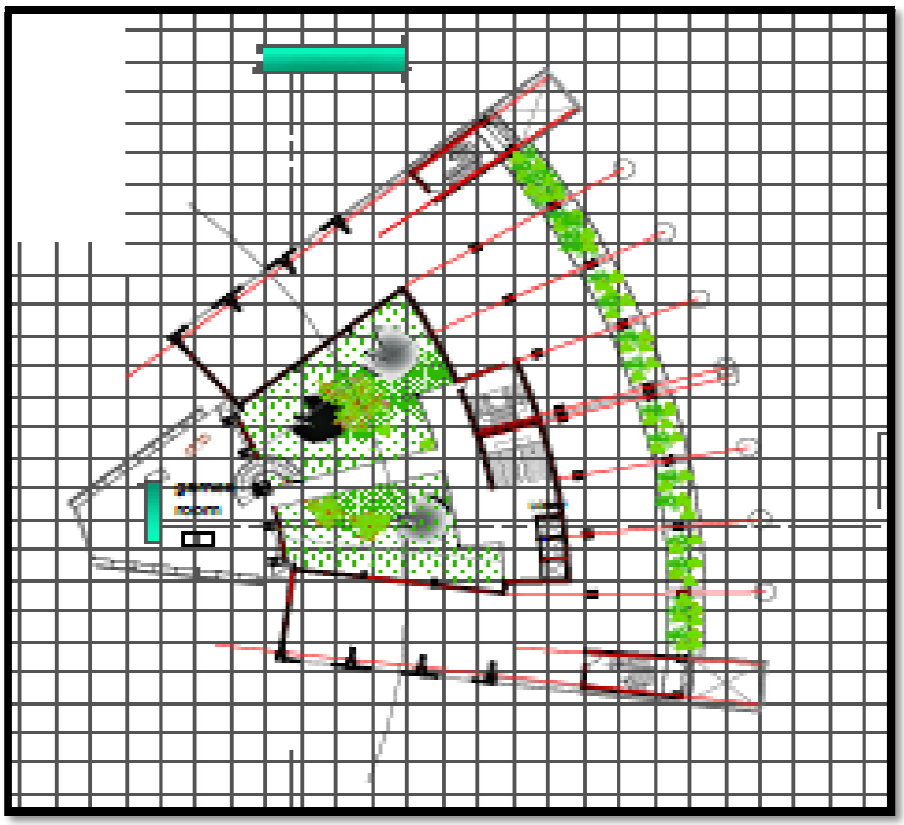


Figure 9: service floor/9th floor plan

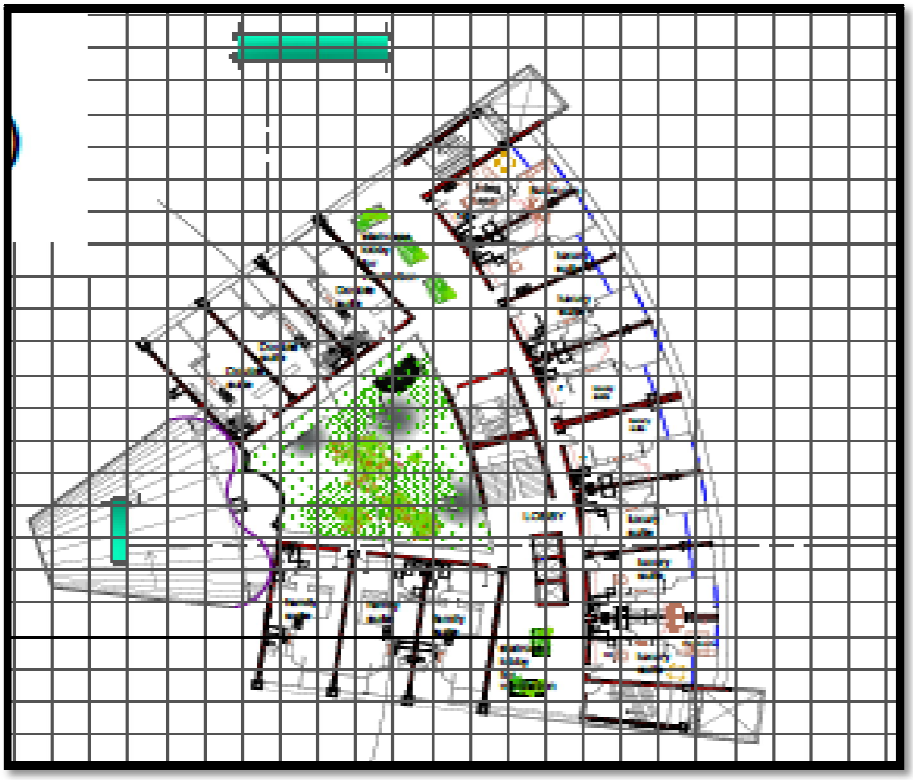


Figure 10: 10th-13th floor

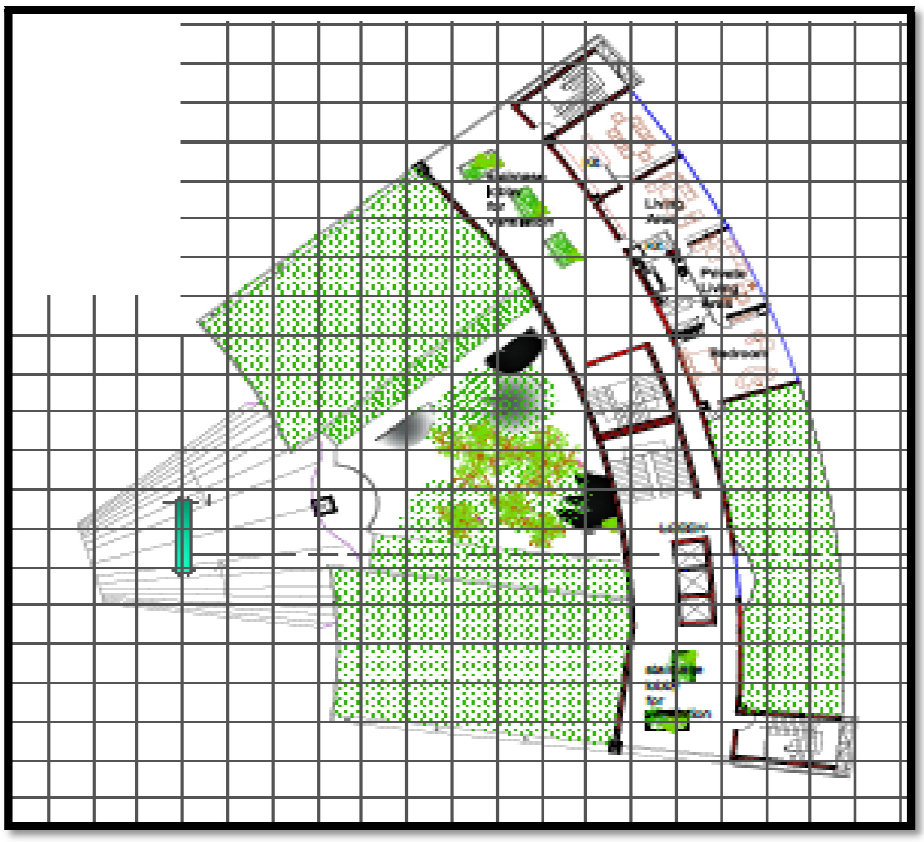


Figure 11: presidential suites

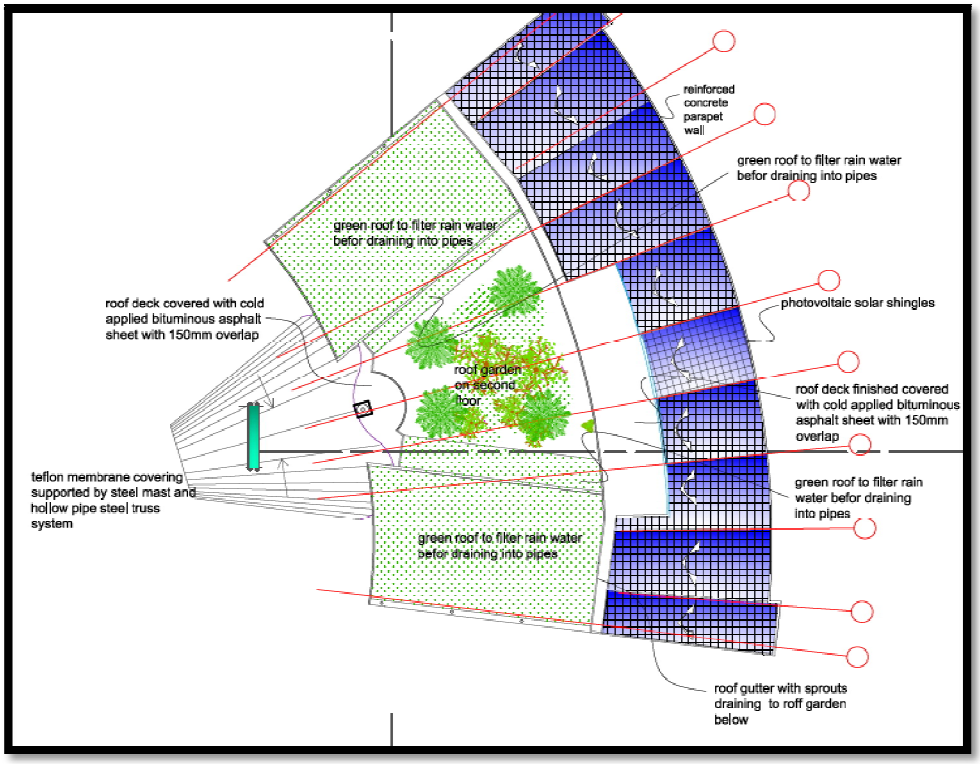


Figure 12: roof plan

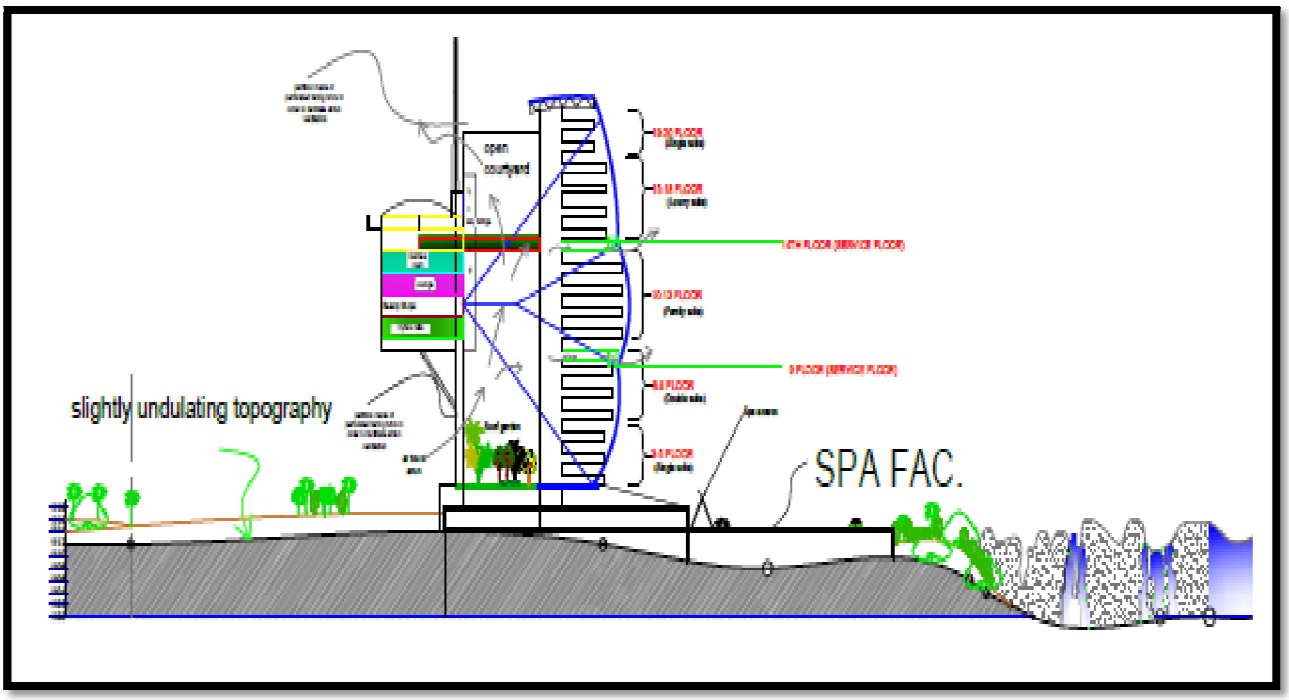


Figure 13: schematic section of building

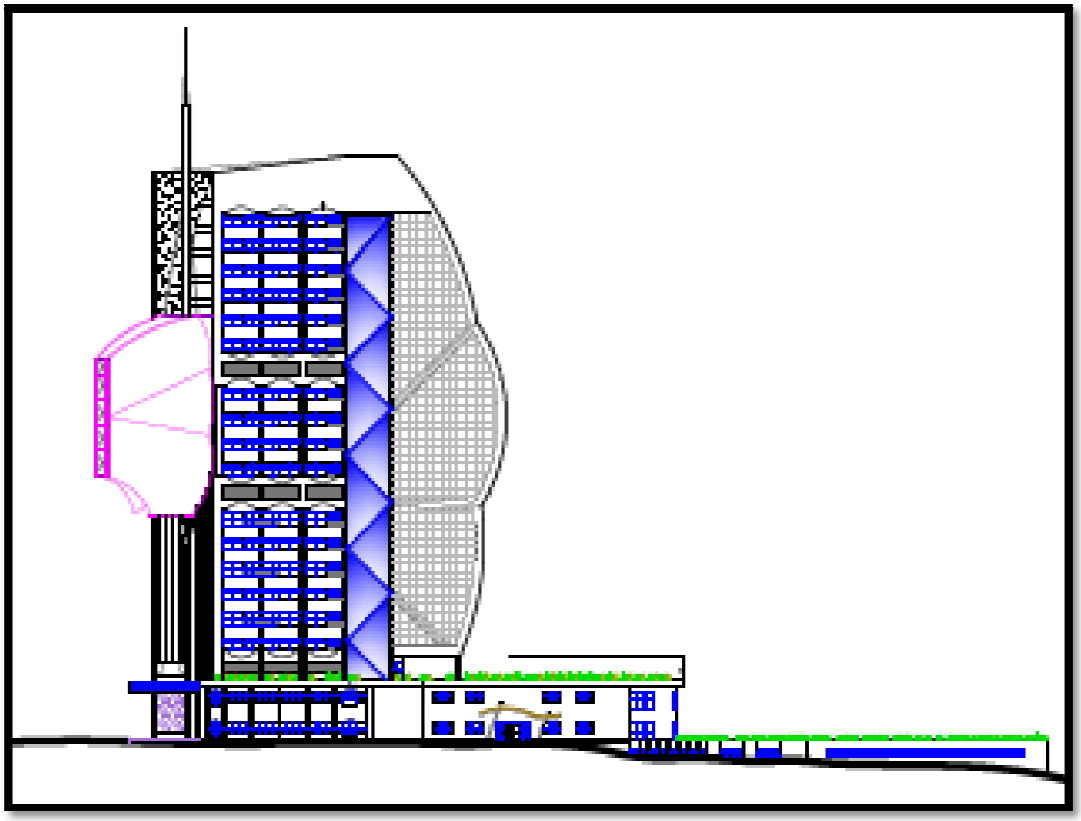


Figure 14: north view elevation

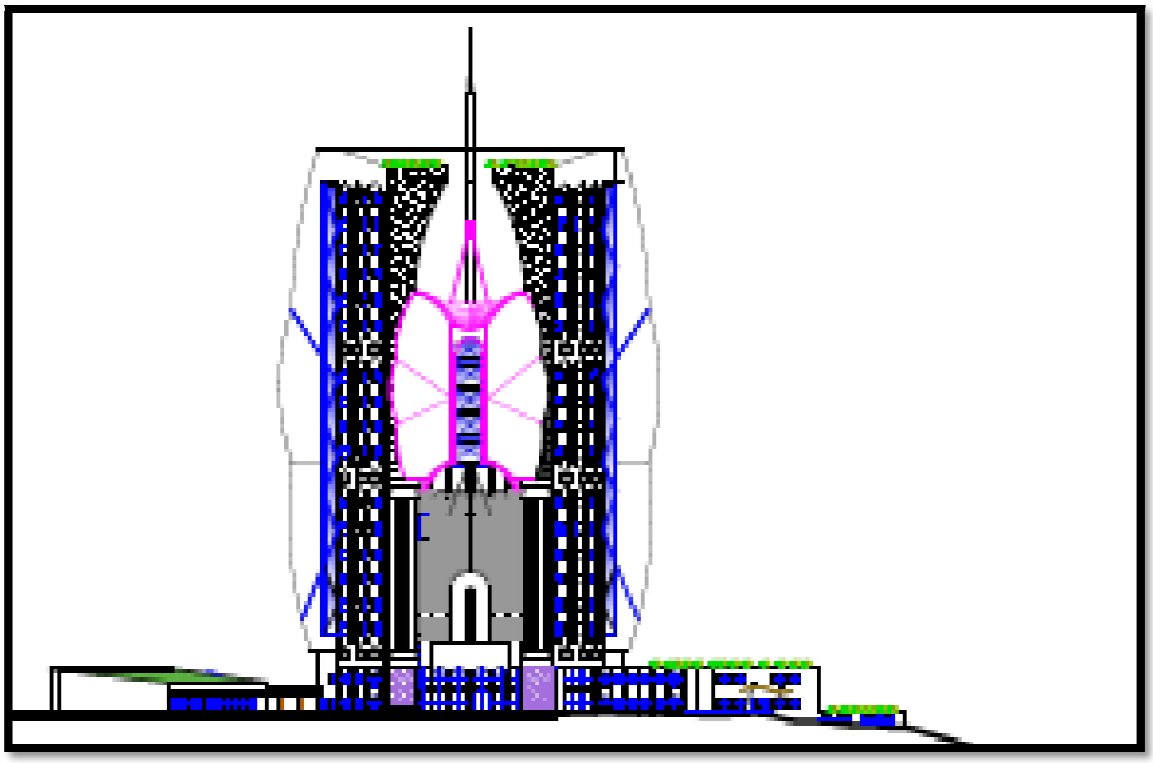


Figure 15: east view elevation

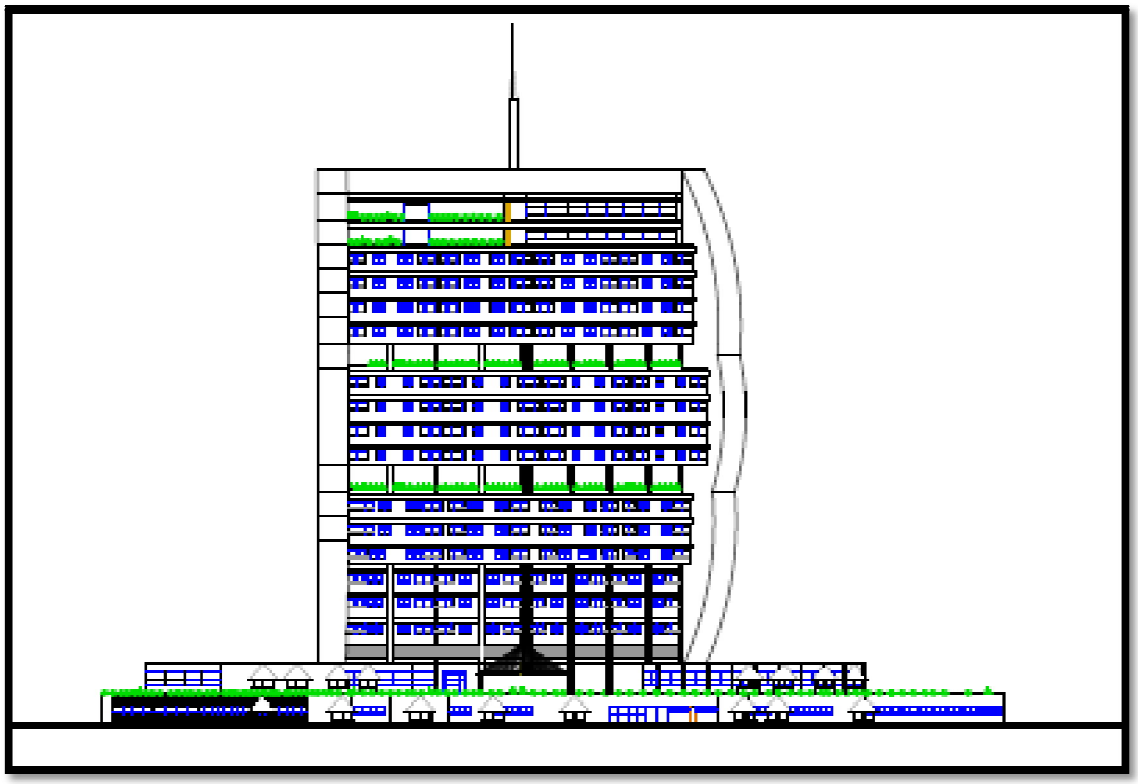


Figure 16: west elevation

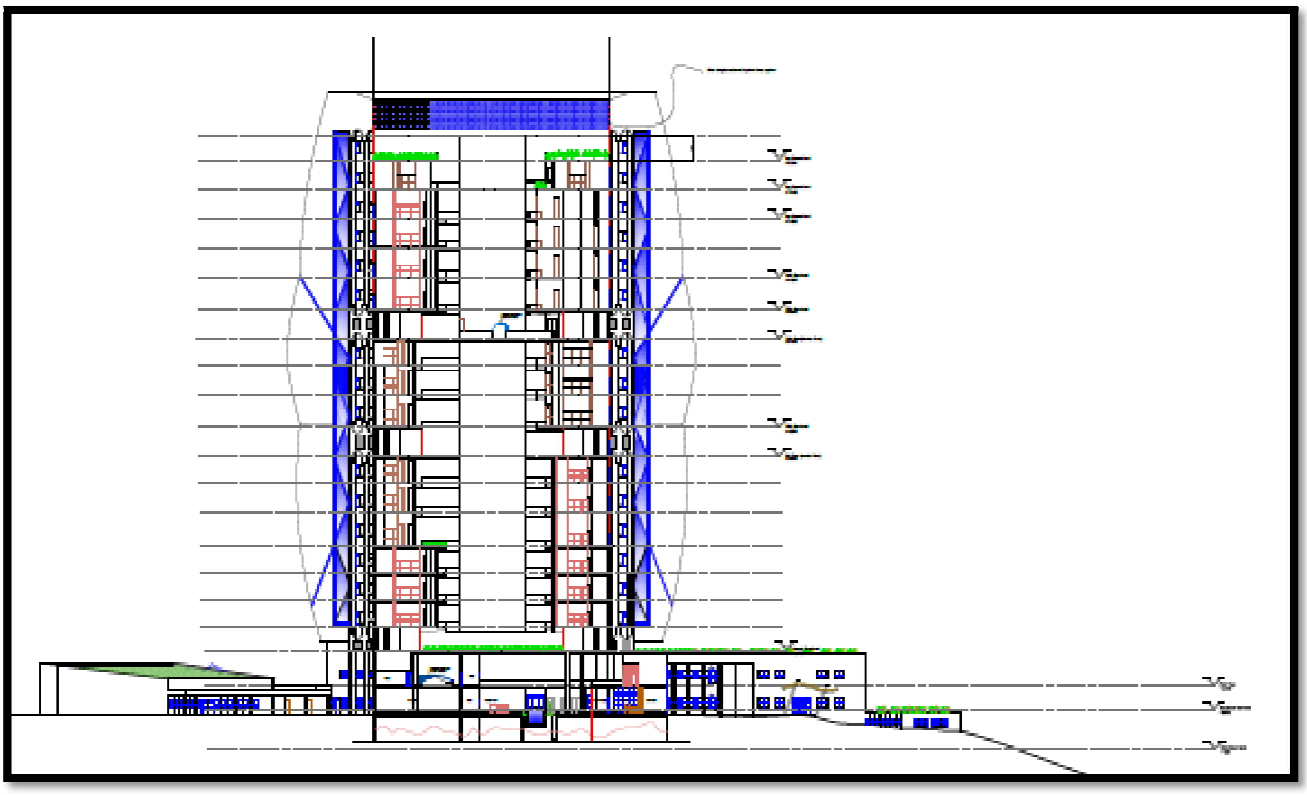


Figure 17: Section X-X

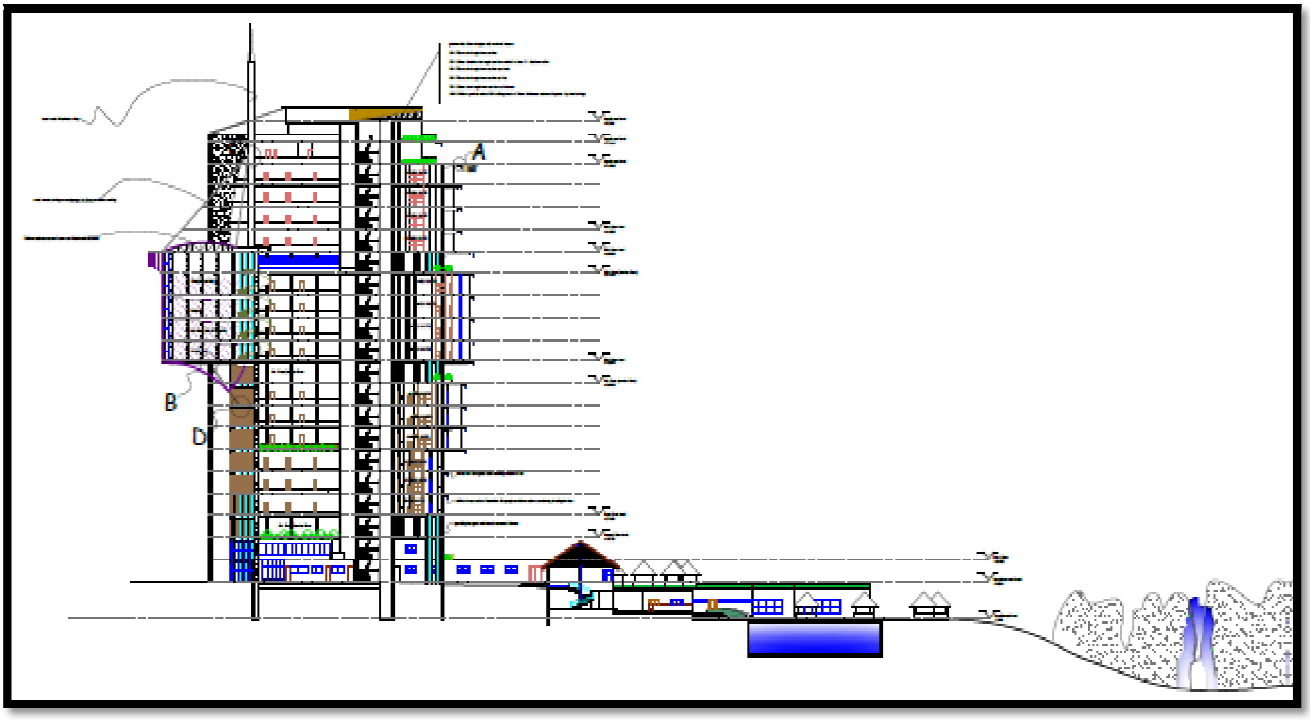


Figure 18: Section Y-Y



3D view



3D view perspective