EXPLORING REGENERATIVE ARCHITECTURE PRINCIPLES IN THE DESIGN OF OGUTA BLUE LAKE RESORT HOTEL, IMO

BY

Lucky Uzorchukwu OBIOHA, BSc (ABU ZARIA, 2011)

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DECLARATION

I, Obioha Uzorchukwu Lucky, department of architecture Ahmadu Bello University, Matriculation number **M.Sc/ Env-Design/ 7645/ 2011-2012** declare that this research work is prepared in the course of my research tasks for the award of Master of Science Degree in Architecture. This work is an original thesis report and has not been submitted in part or full for any degree in this or any other university. All quotations are indicated and the sources of information are specifically acknowledged.

Obioha Uzorchukwu Lucky.

……

November 2014.

CERTIFICATION

This thesis entitled "Exploring Regenerative Architecture Principles in the Design of Oguta Blue Lake Resort Hotel, Imo" meets the regulations governing the award of the Master of Science, M.Sc., Degree of Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

_____	_____
Dr. M. Abdulkarim Chairman, Supervisory Committee	Date
_____	_____
Dr. M. L. Sagada Member, Supervisory Committee	Date
_____	_____
Dr. M. D Ahmed Head of Department	Date
_____	_____
Prof. A. H Zoaka Dean, Postgraduate school	Date

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ABSTRACT

The effects of climate change and earth degradation in Nigeria is evident in flooding, damage to infrastructure around ecotones, deforestation, and loss of biodiversity. The built environment being the site for cultural and economic activities contributes greatly to environmental degradation, thus a key area to frontier sustainable development. The problem of Human-nature divide resulting from fragmentation of Human actions and intention to nature is blamed for unsustainable development, while increasing tourism activities poses threat to thriving of the ecosystem since it takes advantage of virgin environments. Understanding the negative impacts of man's activities entails reducing and reversing these impacts. Regenerative architecture is thriving among building science principles, attempting to solve rather than mitigate problems, while adding a positive impact to our degrading environment. Hotels and resort facilities now, acclaim green qualities, presenting a platform where regenerative architecture can be explored. The study is aimed at evolving a framework conforming to the principles of regenerative architecture for the design of sustainable resort hotels in South-east Nigeria; the objectives included identifying these principles, their level of reflection in the study area, peculiar features to the study area and limitations of its adoption in design of resort hotels and finally produce a design proposal. Literatures in the field of study are reviewed to develop the basic idea governing the proposed framework. The research methodology adopted is the case study approach to research; three foreign cases were sampled internationally which served as examples of regenerative architecture covered in literature review, while three local cases were purposively sampled in South-Eastern Nigeria representing the platform for the

research. Qualitative data was primarily obtained via visual surveys, observations, and interviews, and presented in checklists developed for the research; while secondary data was obtained from documentations. Data analysis was by descriptive and context analysis summarized in tables and charts. The findings of the study includes that regenerative architecture is still at infancy in South-Eastern Nigeria; tropical elements -rain fall, sunshine, and the native green lush are natural endowments of the region but have not been fully utilized in resort hotel designs; a framework is developed conforming to the principles, while limitation to success identified is the issue of luxury in the industry. A design proposal for Oguta Lake is developed, and the study finally recommends that bringing people to closer positive contact with nature will force them to consciously improve on it, also power and water needs within resort facilities can be met using tropical elements: while areas for further study includes exploring the principles in other regions of the country, and studying the performance of structures adopting regenerative architecture principles.

DEFINITION OF TERMS

Sustainable Development: Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It implies using renewable natural resources in a manner which does not eliminate or degrade them, or diminish their usefulness for the future generations.

Sustainable Architecture: Sustainable architecture is a general term that describes environmentally-conscious design techniques in the field of architecture. Sustainable architecture is framed by the larger discussion of sustainability and the pressing economic and political issues of our world.

Regenerative Architecture: This is an arm of environmental sustainability that seeks to place a nature-centered, as opposed to human-centered, system of values. It places emphasis on the needs of nature and views man in light of these needs.

Deep Ecology: Deep ecology is a contemporary ecological philosophy that recognizes the inherent worth of other beings aside from their utility. It emphasizes the interdependent nature of human and non-human life as well as the importance of the ecosystem and natural processes.

Ecotones: These are zones of transition between two ecosystems e.g., shoreline (land and water). It marks the meeting point of these two ecosystems.

Ecosphere: This refers to Planet Earth and all its life, the whole area of Earth's surface, atmosphere, and sea that is inhabited by living things.

CHAPTER ONE

INTRODUCTION

This chapter presents a preamble to the study. It gives an overview of the study area the ideas formulating the issue(s) at stake and the strong bases upon which this thesis study is centred, and therefore subsequently constitutes a major aspect of this thesis report.

1.1 Background To The Study

The depletion of the ozone layer (green-house effect) and the accompanying effects of global warming resulting from non-ecofriendly patterns of developments, resulted in the wake up call for humans to engage in earth friendly means of development otherwise known as sustainable development (United Nations Environmental Program (UNEP), 2008). In the 21st century, the world faces tremendous challenges, including economic crises, global warming, air pollution, poverty, poor health, and loss of biodiversity as a result of man's activities (UNEP Year Book, 2011).

Over the last hundred years, the process by which we create buildings have become siloed and disconnected from place (Nature) (Evans, 2012). However, sustainable development has been advanced as a means of reconciling human development with the earth's ecological systems. Ever since its emergence, sustainability has become a norm instead of an ideal, a journey instead of a destination (Organization for Economic Co-operation and Development (OECD), 2001). Evidence of these is seen in efforts being made to reduce the impact of the built environment on both living and non-living environment or at least achieve a level of neutrality (UNEP Report, 2009). This model of development tends to degenerate the Earth's resources on the long run, hence the need for a rethink, and embrace of a pattern or process of development that will go

beyond doing less harm and achieving neutrality, to contributing positively to the ecosystem (both living and non-living - humans inclusive) (Zari and Jenkin, 2009).

The built environment is the main site for cultural and economic activities. According to the International Energy Agency (IEA) existing buildings are considered to be responsible for more than 40% of the world's primary energy consumption (both embodied and embedded) and for 24% of total greenhouse effect (carbon dioxide emissions). The tourism industry is the fastest growing one in the world over (Ndu, 2012). It includes building types like hotels, parks, airports, and other resort facilities. Coastal tourism and recreation are important parts of this rapidly growing activity in the world. These building activities, if not carefully considered, ruin the beauty and integrity of their surroundings (place) (International Hotels and Restaurant Association (IHRA), 2005). The embrace of sustainable development in the tourism industry becomes imperative. This according to Oluigbo, (1998), follows the increasing interest of humans in pursuit of leisure, fantasy, escapism, recreation, enjoyment and closeness to nature.

Regenerative architecture as an offspring of the sustainability discourse however, recognizes the damage that is occurring at an environmental level. It identifies man's alienation to nature as the main cause of problems at this level, and therefore advocates the need for humanity to end the consideration of the natural and built environments as isolated entities but instead create a mutual relationship where the built environment acts to improve the natural environment (Pyke, 2011).

Regenerative architecture has two focuses; firstly, it 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 (Littman, 2009). Secondly, regenerative architecture majors on

treatment of the environment as an equal stakeholder in the design process. It is a practice that employs comprehensive understanding of natural and living systems in the design of a structure (Reed, 2007). Thus Regenerative design exists on the basis that everything we build has the potential for integrating the natural world (ecosystems) as an "equal partner" in the architecture.

Studies have shown that regenerative architectural practice has achieved a level of acceptance and prominence, as seen in the works of major proponents -Lyle and McDonough. In Nigeria, however, the practice could be considered closely tied to sustainable architectural practice because of the ideals it draws from sustainability. Studies by Rikko and Gwatau, (2011) shows that Most Nigerian traditional/regional architectures (south-eastern inclusive) incorporate place, nature, culture and utilize passive strategies plus sustainable materials and therefore possess regenerative quality. Resort facilities in these areas acclaim most of these qualities. Hence, with increased environmental issues, exploring the phenomenon in contemporary Resort Hotels in this area presents suitable case scenario following the alleged acclamation.

1.2 Problem Statement

The negative impacts of global warming and climate change are enormous. According to Adeyemo, (2012), many parts of Nigeria - South-East - inclusive, were not spared in the recent flood catastrophe that devastated many areas, and destroyed a lot of infrastructural establishments mostly around place Ecotones (zones of transition between land and water). Evidences have suggested that the prevailing global environmental degradation poses serious threat to sustenance of carrying capacity of the ecosystem (Daramola & Ibem, 2010). This have been blamed on, or attributed to the unsustainable patterns of developments embarked on by humans, which have little or no

environmental responsibility among which the built environment ranks highest (Daramola & Ibem, 2010).

As a key responsibility, Regenerative architecture place emphasis on the relationship of manmade structures to the natural world which according to Kellert, (2005), offers rich and most valuable physical and intellectual experience that architecture can show, but however is the aspect that has been neglected most by architectural scientists, critics and historians. One salient reason for this is the blindness of the contemporary world to everything that is not itself –mostly to nature.

Resort hotels and tourists facilities are not left out as they are examples of such developments that take advantage of natural place ecotones. IHRA, (2005) infers that the nature of planning, construction and running of most hotels and resort facilities contribute to environmental degradation because they run on unsustainable energy sources, generate lots of waste, waste water, and pollute the air which grossly contributes to greenhouse effect. This according to Evans, (2012) can be attributed to the disconnection from place or human-nature divide which evolved overtime following unsustainable development patterns.

Hence this thesis is focused on the abstraction, alienation or dissociation of man and the built environment to nature (place/ living systems) as well as potential ways of reducing environmental impacts resulting from this abstraction in design of resort hotels in south-eastern Nigeria while exploring regenerative architecture.

1.3 Research Questions

The research seeks to answer the following questions:

i. What features of regenerative design are suitable for achieving contemporary sustainable Resort Hotel architecture?

ii. How close do built designs of resort hotels in South-Eastern Nigeria come in realizing regenerative design principles?

iii. What practical limitations to success exist?

iv. What features of regenerative design are peculiar to the region?

v. How can the principles of Regenerative Architecture aid in the design and development of sustainable Resort Hotels in the area?

1.4 Aim And Objectives

1.4.1 Aim

The aim of this research is to evolve a framework conforming to the principles of regenerative architecture in the design of sustainable resort hotels, with South-Eastern Nigeria in view.

1.4.2 Objectives

The objectives set to achieve this aim are as follows:

i. To study the principles of Regenerative Architecture.

ii. To assess the ways of Reflection of this principles in the design of resort hotels in south-eastern Nigeria.

iii. To assess the Levels of application and limitation of this principles in the design of resort hotels in south-eastern Nigeria.

iv. To determine what features of regenerative design are peculiar to the region.

v. To demonstrate through design the implication of the adoption of these features of regenerative architecture in the design of resort hotels in the area.

1.5 Justification

The alarming rate of environmental impacts especially climate change and global warming resulting to flooding, damage to place ecology and loss of biodiversity, caused

by man's activities - of which the built environment is a significant contributor, calls for a rethink and embrace of a more earth responsible or sustainable pattern of development of built environment which will go beyond achieving neutrality with the ecosphere to contributing positively to actively healing the ecology of a place.

Hotels and resort facilities among other built environments, ranks as the most significant contributors to this phenomenon, following global growth in tourism activities mostly around ecotones. The abstracted nature of planning, construction and running of most hotels and resort facilities, and high resource consumption results in environmental degradation, than other building types (Rada, 1996 in Mitrakis, 2008 p18). There is therefore an urgent need to reduce the impact of buildings and structures on the natural world. Hence, sustainable building practices that are based on strong building science principles are becoming essential in contemporary building design. Regenerative architecture is one such practice advancing as an improvement on conventional sustainability discourse, hence, the need to explore its implications.

1.6 Scope Of The Study

This research is focused, but not limited to identifying regenerative design principles that will be an active tool in achieving a sustainable resort hotel development. It examines existing acclaimed resort hotels in South-Eastern Nigeria (hot humid climate or tropical rain forest) to identify regenerative design features, the level of exploration, limitations, and the implications when employed by planners and architects in developing the schemes of resort hotels in the area.

CHAPTER TWO

LITERATURE REVIEW

This chapter presents various literature examined on the history, foundations and development of regeneration, the discussions, arguments and trending issues regarding the subject matter as it relates to human-environment relationship and how they have helped in developing the theoretical framework governing the phenomenon under consideration. It presents a study of various authorities, proponents, principles, strategies, examples, and how they have contributed to framing the research area.

2.1 Environmental Sustainability

Environmental sustainability entails an earth friendly pattern of development. According to Stan, (2004), the model of environmental sustainability considering Eco-Centricity - is concerned with a nature centered system of value as against Techno-Centricity. In this (Eco-Centricity), however, the eco-system is seen as the core of every human activity, and hence, man is subjected to only exploring rather than exploiting nature.

Considering the growing need for tourism development and activities, Stan, (2004) argues that our built environment is conceived of and construct in the same abstracted manner with which we manage the natural environment and, as a result, it suffers the same degradation. Hence, our abstraction and alienation from both originates from a limited, resource driven understanding of the world. To move from this strictly utilitarian view of the world to an Eco-Centric worldview is a step towards addressing the basis of our society's rapidly dissolving relationship with the world around us (Stan, 2004). This follows the World Commission on Environment and Development (WCED) fundamental position on Environment and Development. The ‘environment’ is

where we all live; and 'development' is what we all do in attempting to improve our lot within that abode. The two are inseparable (WCED, 1987).

Many scholars have argued that the global environmental crisis results from our tendency to think and perceive in terms of a fragmentary (dualistic) paradigm (Wilber 2001; Bohm 2002; Capra 2004 in Smith *et al,* 2011). This paradigm -commonly known as the Cartesian paradigm- treats as fundamental the distinction between human (cultural) and non-human (natural) systems, while assuming that each has its own independent and generally fixed essence. Addressing this fragmentary paradigm however, sets the stage for the emergence of regenerative design.

2.1.1 Regenerative Design

Regenerative design is a relatively new term in the planning and design field. However, many of the core tenets of what is known as regenerative design today have been built upon the past works of planning and design professionals in the fields of ecological design and pattern literacy (Miller, 2012).

Regenerative design theories spring up from earlier concepts of sustainable development. A generally accepted definition of sustainable development is that given by WCED, (1987), which defines it as a 'development which meets the needs of the present without compromising the ability of the future to meet its own needs'. Sustainable development attempted to integrate environmental responsibility, social equity, and economic viability (Hodges, 2006). See Fig. 1 Below:

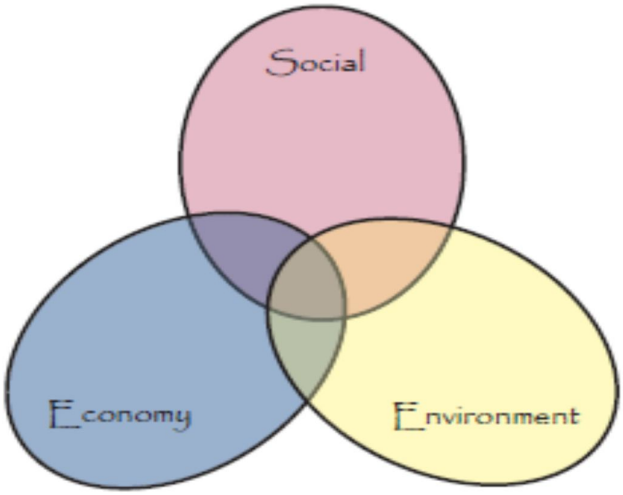


Figure 1: The three arms of sustainability (Source: Hodges, 2006).

The environment does not exist as a sphere separate from human actions, ambitions and needs, and attempts to defend it in isolation from human concerns have given the very word 'environment' a connotation of naivety in some political circles (WCED, 1987). This ideology of the Earth environment being distinct and infinite has affected the practice of sustainable development. According to Thrive design studio online blog, most sustainable design projects in an attempt to be ecological proved to be simply examples of conservation design. Most sustainable design efforts tended to remain very consumptive of energy and resources -that is to say- they remained linear and degenerative rather than regenerative. These are early attempts at designing with ecological principles; however, they served as stepping-stones between conventional approaches to design and contemporary regenerative design concepts and theories.

With the advent of Regenerative Design Principles however, many theorists and experts in the field (the likes of William McDonough, Robert Thayer, most importantly John T. Lyle, and many others) have shown that it is possible to design intelligently with nature such that the built environment participates as an equal partner with the surrounding Natural world. Hence their works have contributed to framing this phenomenon. Figure 2 below shows a transition from the traditional design and

development approach (considered Degenerative), through the booming Eco-Design (Sustainability or Eco-efficiency now the norm) to Regenerative Design (in which humans enhance ecosystems through participation as nature.

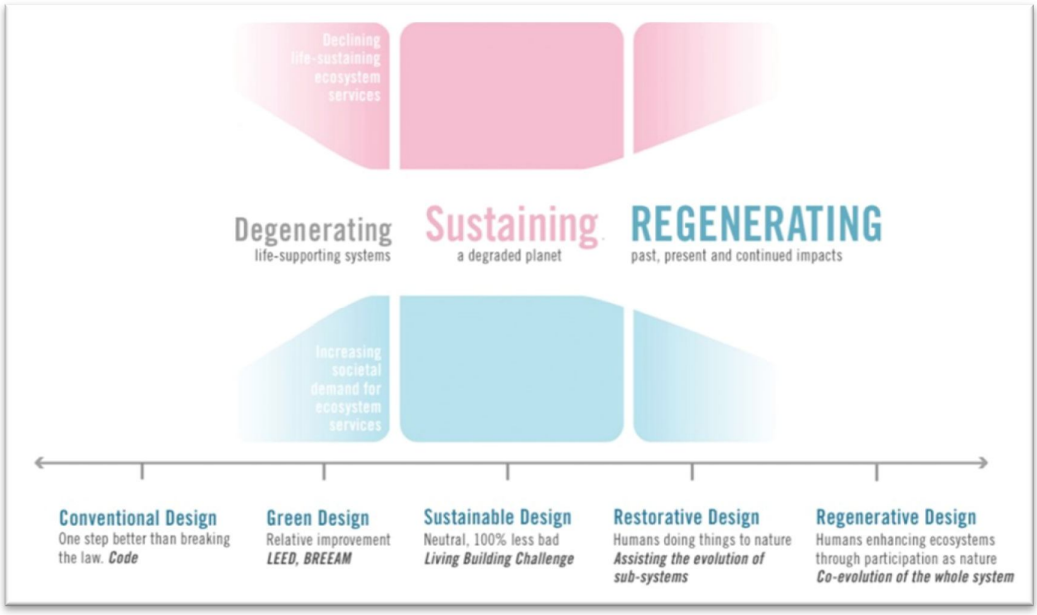


Figure 2: Transition from degenerating systems to regenerative systems (Source: http://www.urbanthriving.com/wp-content/uploads/2012/10/regendesign 22.jpg)

Regenerative design concept therefore is an approach that adopts techniques that goes beyond the conventional design and early sustainability ideology which are considered degenerative, to achieving a truly sustainable built environment which does more than being neutral, to contributing positively to the environment. This desirable drift -considering various UNEP Annual Reports (2008, 2009, & 2011) - is necessitated by the fact that most of the effects of degenerating systems or development processes are experienced at an environmental level.

Regenerative design strategies therefore cut across various design disciplines of which those that deal directly with the built environment are of highest significance. Architectural design is the focus here. Therefore priority is given to how its products (buildings), and users (people) relate with the natural world, and how they can act to improve their environs, and ecosystems surrounding it.

2.1.2 Regenerative Architecture

Regenerative architecture emerged from the principles of Regenerative design which according to Cole, (2012) is a group of approaches that support the co-evolution of human and natural systems in a partnered relationship. The regenerative - sustainability paradigm, as described by (du Plessis, 2012 in Mang & Reed, 2012), is emerging out of the transition from a 'mechanistic' to an 'ecological' or living systems worldview. The premise held by du Plessis and other proponents, is that; the radical changes required for Earth to 'remain fit for human habitation' cannot happen without this transition in worldview complex.

This supports Cole's statement that; it is not the building that is "regenerated" in the same sense as the self-healing and self-organizing attributes of a living system. Cole puts it that within regenerative development, built projects, stakeholder processes and inhabitation are collectively focused on enhancing life in all its manifestations – human, other species, ecological systems – through an enduring responsibility of stewardship. Thus, validating his idea that Regenerative design challenges the orthodoxy of current green building practice and the design tools that support it. One of his salient contributions to regenerative study is that a key aspect of regenerative design and development place emphasis on the specificity of "place" as a starting point for design and particularly the understanding of whole ecological and other systems where the project is located.

Regenerative design goes beyond sustainability; instead of trying to not damage the environment, it tries to improve the environment for future generations. Regenerative architecture looks at the site and the building as one complete entity. Damaging the site therefore directly damages the architecture. This is achieved by designing architecture that functions in a closed-loop system (Regenerative architecture, 2013). This means

that the building “harvests” all its own water and energy, and also eliminates all waste. Regenerative design looks at nature and the existing natural site for its direction (McHarg, 1992). This is because nature is the only true example of regenerative design. An example of this is the water cycle. First it rains; the water collects into rivers, streams, the ocean, etc., the water then evaporates back into clouds before raining back down. This completes one round of an endless closed-loop cycle in Nature (Regenerative architecture, 2013).

A human built system that mimics this, would typically take the flow model suggested by Hodges, (2006), which emphasize matching technology to need as a key to driving a regenerative economy. See figure 3 below.

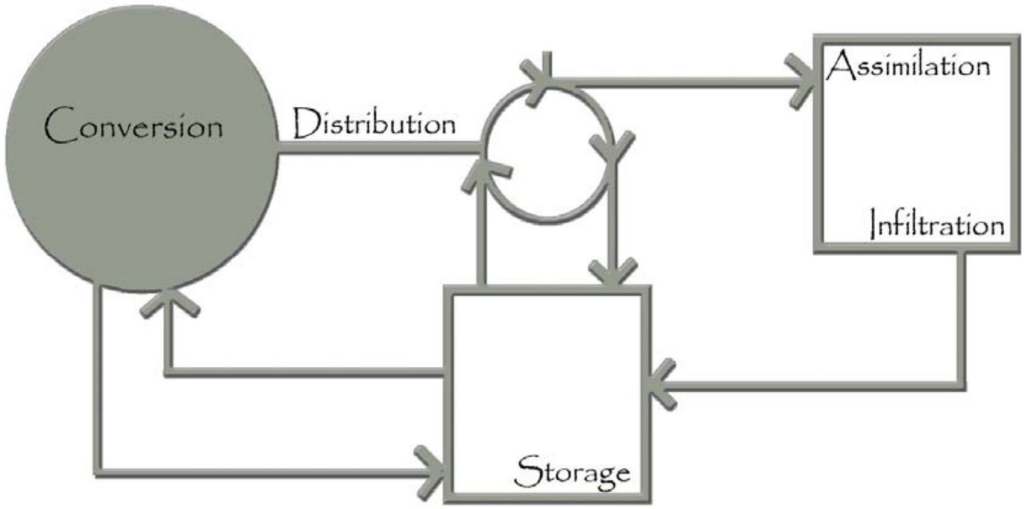


Figure 3: John Lyle’s Nature as Model (source: Hodges, 2006).

Figure 3 above shows a regenerative system that adopts human built technology to achieve the natural flow of materials, energy, and resources in constant cycles. Here these entities are assimilated, sorted, and stored and then converted to reusable forms which are re-distributed to the system, and the cycle continues.

A more contemporary definition of Regenerative Architecture is that it is a professional architectural practice that explores new possibilities for architecture and design in the contemporary world. Hence recognizing that the Earth's resources are

finite, it strives to build in a way that minimizes our impact, and seek to make environments that promote a meaningful and enduring relationship between people and place (Regenerative architecture, 2013). Regenerative architecture thus emerged as a result of the exclusive or distinct ideology of man and Nature which have been presented by early scholars.

One major cause of this alienation to nature identified by Kellert, (2005) has been how we design and develop our built environment. We have constructed our modern buildings, communities, and cities by excessively consuming natural resources, significantly transforming natural landscapes, producing enormous quantities of waste and pollutants, and disconnecting people from positive contact with nature. Also according to Kellert, (2005 pp. 2) 'The human built environment today consumes 40% of the world's energy resources, 25% of its freshwater resources, and 30% of its natural resources. Buildings further generate an estimated 20% of freshwater effluents, 25% of solid wastes, 40% of air emissions, 60% of ozone-depleting emissions, and 30% of greenhouse gas emissions'. This is the present state of affairs.

The relationship of manmade structures to the natural world is said to offer the richest and most valuable physical and intellectual experience that architecture can show, and it is the one that has been most neglected by architectural scientists, critics and sometimes, historians. There are many reasons for this. Foremost among them, perhaps, is the blindness of the contemporary world to everything that is not itself, to nature most of all -Vincent Scully, *Architecture: The Natural and the Manmade* (quoted in Kellert, 2005 p 90).

Regenerative architecture however, recognizes the damage that is occurring at an environmental level, it frontiers the need for ending the disconnect between the natural and built environment, and the need for humanity to stop considering the natural and

built environments as separate entities but instead create a beneficial relationship mutual in nature where the built environment acts to improve the natural environment (Pyke, 2011).

Considering current practice of sustainability, Reed (2007), opines that buildings can be worked on as autonomous, but only become meaningful and beneficial when understood as part of the living fabric of place. Speaking of living systems, it is important to make a distinction: because life evolves and is not static, we may never be able to restore something to its original condition but we can do better to improve it. The figure below shows the benefits of transitioning from a linear or degenerative system to a living systems approach with humans participating as nature. With conventional practice, there is little or no benefit at all. However benefits increase as we transition through green, sustainable, restorative, to regenerative systems.

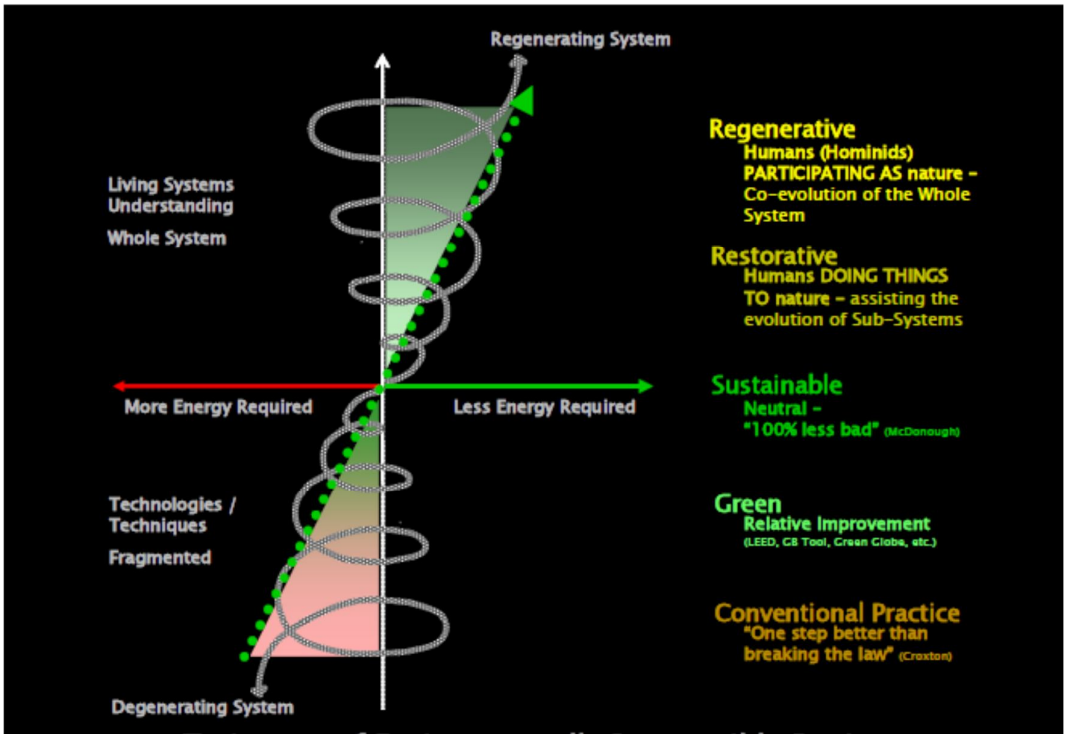


Figure 4: Trajectory of environmentally Responsive Design (Adopted from Regenesis and Integrative Design Collaborative (Reed, 2007)).

2.1.3 Fundamentals of Regeneration

Regeneration is about framing restoration as a whole - engaging the earth systems, the biotic systems, and the people of each unique place in a continuous dialogue of restoration and evolutionary development – a healing or 'wholeing' (Reed, 2007). The built environment also, as discussed, has wide ranging negative environmental impacts, including impacts associated with air quality, water and energy consumption, transport accessibility, materials use and management of waste. As the negative environmental impacts of some human activities become better understood, reducing and reversing these impacts is becoming more urgent (Rojstaczer *et al*., 2001, in Zari & Jenkin, 2010).

Regenerative design and development is more or less a recent phenomenon therefore many of its core tenets from which the principles emanate need to be understood. It is sometimes referred to as Cradle to Cradle design. This however informs us of the ideas of the scholars who have championed its course, and from what field's knowledge have been drawn and built on.

According to a group -Cradle to Cradle Products Innovation Institute (C2C PII), (2011), Cradle to Cradle Design draws on knowledge from the fields of environmental chemistry and material flows management -broadly termed as Industrial Ecology, and the fields of industrial and architectural design. Cradle to Cradle Design is based on the Intelligent Product System (IPS) pioneered by chemist Dr. Michael Braungart in 1986. In the early 1990s, Dr. Braungart and architect William McDonough expanded IPS by identifying the principles of Cradle to Cradle Design (C2C PII, 2011).

C2C PII, (2011), defined Cradle to Cradle –otherwise regenerative Design; as a revolutionary approach to the redesign of human industry based on the conviction that rigorous science and design can move human industry beyond simple concerns for

"sustainability" (often seen as a form of maintenance of current levels of performance while limiting destruction) toward a new positive paradigm where growth is good – science provides the physical laws and the data and design serves as the signal of human intention - Cradle to Cradle Design mirrors the healthy, regenerative productivity of nature, and thereby creates an industry that is continuously improving and sustaining life and growth.

Notably, Cradle to Cradle design hence turns contingent liabilities into assets. Figure 5 illustrates a continuous cycle in Nature, which represent a regenerative system.

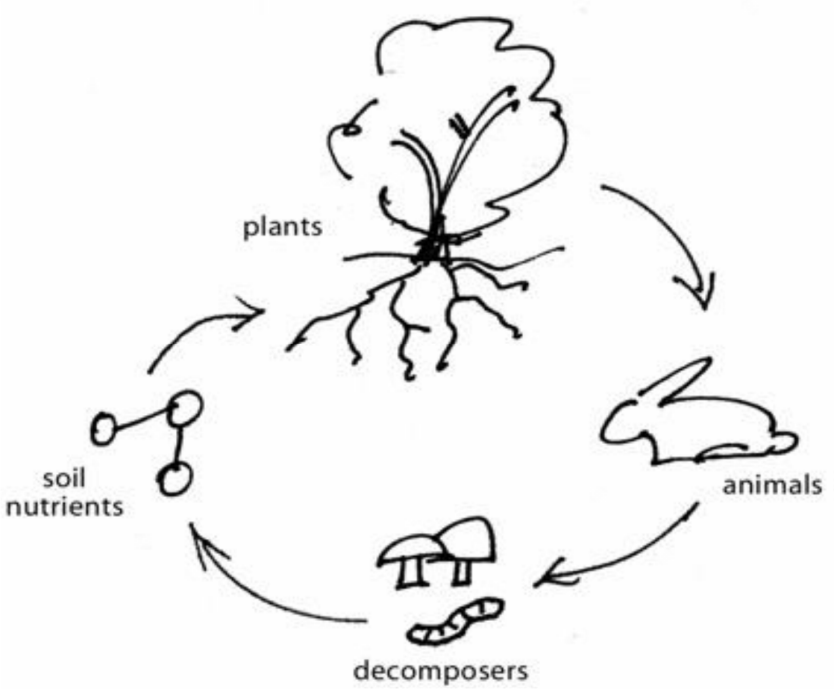


Figure 5: Continuous Natural food cycle (Source: Cradle to Cradle Products Innovation Institute (C2C PII), 2011).

Hence, Cradle to Cradle Design is a positive agenda, one that seeks a renewably powered world, full of safe and healthy materials that are economically, equitably, ecologically and elegantly deployed. It is an innovative approach to sustainability that models human industry on the integrated processes of nature's biological metabolism – its productive ecosystems – integrated with an equally effective technical metabolism,

in which the materials of human industry safely and productively flow within the two metabolisms in a fully characterized and fully assessed way.

Products are developed for closed-loop systems in which every ingredient is safe and beneficial – either to biodegrade naturally and restore the soil, or to be fully recycled into high-quality materials for subsequent product generations. Examples include electrical components, metal scrap, Earth materials and glass which can be fully used and reused (recycled). See Figure 6;

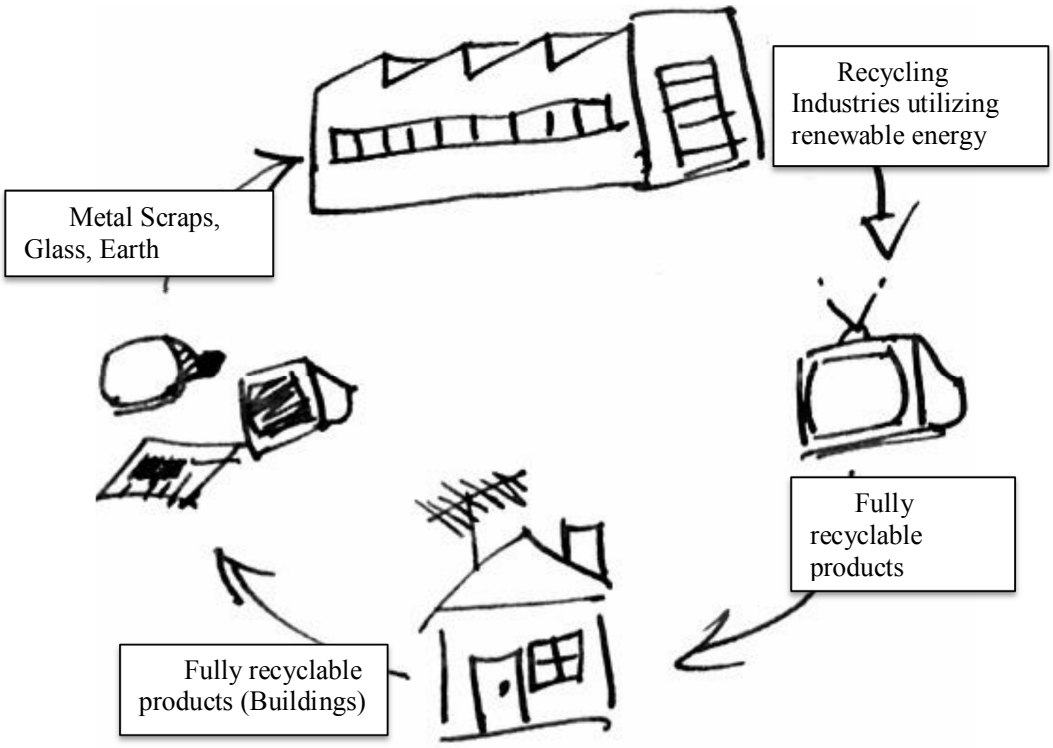


Figure 6: Continuous product cycle (Source: Cradle to Cradle Products Innovation Institute (C2C PII), 2011).

The ecology of regenerative systems or those living systems that sustain over time are based on cyclical patterns of resource use. When these cycles (air, water, food, energy, materials) symbiotically function with each other into a complex web of life, productivity is heightened to the extent that both nature and humans benefit beyond the capacity of either functioning unto itself (Fisk, 2008).

Subsequently, considering the built environment, Cole, (2012) have argued that; it is not the building that is "regenerated" in the same sense as the self-healing and self-organizing attributes of a living system, but by the ways that the act of building can be a catalyst for positive change within the unique "place" it is situated. Thus, giving credibility to Reed, (2003), earlier argument that to design regenerative systems we need to better understand both the bases of the regenerative capability of natural systems and how human systems can engage these systems in a manner that provides meaningful, useful, and health catalyzing interconnections.

2.1.4 Framing Regeneration: A Wilderness Based Checklist

Wells, (1982) presents a Wilderness-Based Checklist for Design and Construction which set the wilderness as the model for regenerative design. His ratings from 1969 show a wilderness to score a perfect 1500, while a suburban research lab would attain a negative score. See Appendix II and III respectively.

In 1999 however, the Society of Building Science Educators (SBSE) studied Wells checklist which they revised to reflect intellectual amendments that have affected sustainable design in three decades. The focus was to organize the checklist into site and building issues acknowledging John Tillman Lyle's idea that sustainable design is merely breaking even, while regenerative design renews earth resources. These issues should be regarded as continuous from the worst negative impact (up to 2200, on the left) to the best positive impact (up to 2200, on the right). See Figure 7:

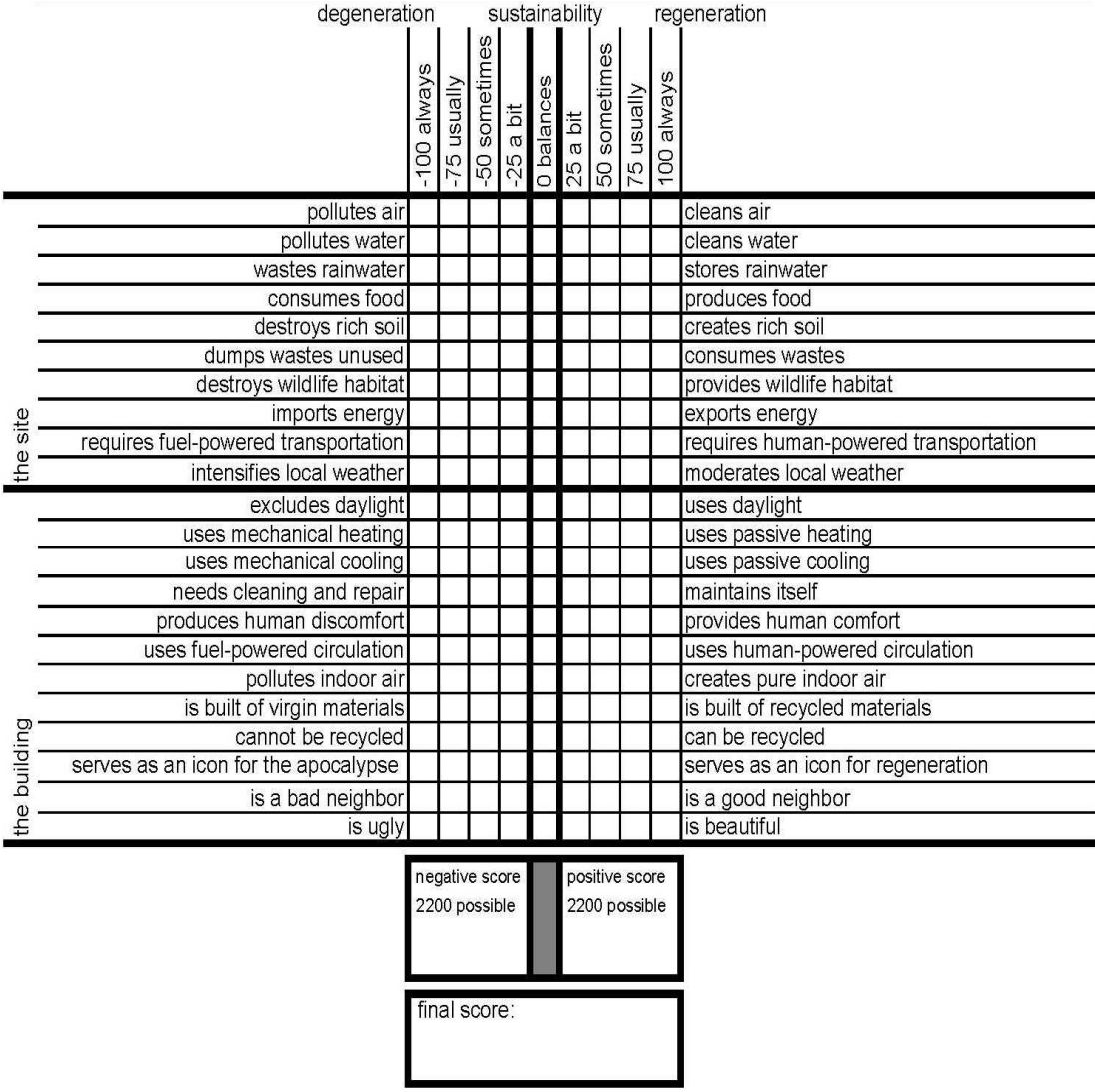


Figure 7: Wells Wilderness Based Checklist for Regeneration (Source: MLC Blog, 2011).

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 carbon dioxide, 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 homegrown food cannot be beat. A peach plucked from a fourth-level orchard is bound to be better than one that was trucked a thousand miles.

Destroys Rich Soil - Creates Rich Soil: Consider soil destruction through hardscape creation (the roof and pavement) and pollution. Topsoil is alive do not destroy it. 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 neighborhood. 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 do not 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 building's 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 effect.

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 daylighting 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 are forced to compromise, so compromise well. Underground buildings are ideal in this regard, hiding their skins from damaging elements. The more mechanical systems are installed in a building, the greater 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 (CO_2) and monoxide (CO). Choose non-VOC materials, finishes, and furnishings. Use indoor plantings to absorb CO_2 and create oxygen.

Built of Recycled Materials - Built of Virgin Materials: Consider materials used for paving, structure, finish, and furnishing. Use of recycled materials conserves the energy embedded and avoids the energy and resources needed for replacement materials.

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 neighbors. A bad neighbour hogs the sun in winter, sends run-off off site, intensifies neighbours climates, and causes glare, air pollution, and noise pollution.

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

2.2 Founding Principles Of Regeneration

William McDonough, a prominent architect who employed many of these concepts in his work developed set of principles called The Hannover Principles. They are design guidelines that were created for the World Exposition in Hannover, Germany in the year 2000. The Principles sprung up among the early regenerative concepts that emerged, showcasing the relationship between humans and the environment and the effects of building designs on thriving of Eco-System. In fact, they address the very essence of man's settlement and existence in nature.

2.2.1 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; and
- Understand the limitations of design.

Considerations here did not include other prominent factors as have been argued by other scholars (Kellert, 2005; and Van Der Ryn & Cowan, 1996). The principles of ecological design presented by Van Der Ryn & Cowan, (1996) however, recognized some of the factors considered missing. They displayed the importance of understanding place and designing the built environment to compliment Nature. This set of guidelines show the importance of integrating natural processes and systems, and argues that 'the more seamless these factors are integrated into the design, the less human activities will detract from the health of nature' (Littman, 2009: pp.13).

2.2.2 Principles of Ecological Design

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

Other guidelines included those presented by John and Nancy Jack Todd, referred to as Todd's Principle of Ecological Design. These guidelines were created with the priority of placing nature central to the design and decision making process. Here, nature becomes informative hence; the design is generated from it. The salient focus of this principle is that it contains three important criteria to cater for ecological and

regenerative design. These features are architecture, food production and waste management.

2.2.3 The Todd's 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; and
- Design should follow a sacred ecology.

Studies (Hodges, 2006; Littman, 2009; and Yahaya, 2012) have shown that these principles (Hannover principle, the ecological design principles by Vander Ryn & Cowan, and Todd) have a lot in common. Even though unique in specific ways, the basic similarity is the emphasis on 'Place' and the Local biosphere which the architecture is to be created for. Thus in all, considerations are given to these features as they form the basis for generating designs and architectural products which conforms to the phenomenon under study.

The above mentioned principles are not fully explicit as they form subordinates to the principles presented by the early proponents of regenerative architecture -the like of John Tillman Lyle a major proponent of regenerative architecture. He contributed to formulating the initial ideology behind the phenomenon. In 1994 however, in his Book 'Regenerative Design for Sustainable Development' he formulated six principles of regeneration. These are:

2.2.4 Lyles Principles of Regenerative Design

- 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; and
- Within renewal capacity

These principles are further simplified into specific ideas, which explain particular areas addressed by each. The following items explain these ideas.

2.2.4.1 Design with Effectiveness as end Goal

This primarily is concerned with making appropriate or good decisions, for human benefits alone recognizing that we are not distinct from the ecosystem and that what is good for us may not be for the rest of the system.

2.2.4.2 Design of Closed Loop System

This involves a system of continuous cycles where idea of waste is eliminated enforcing a continuous flow of materials. Referred to as cradle-to-cradle, this system (as studied by Dr. Braungart and architect William McDonough in the early 1990's (C2CPII, 2011)), in what is termed Integrated Product System (IPS) in industrial ecology presents a system in which energy and material use is optimized, waste is cut down such that those from one process becomes raw materials for the other.

2.2.4.3 Design to Integrate Human with Natural Processes

Nature in itself is known to replenish and self-replicate. Since humans are to be considered part of nature, it is necessary to redesign human processes to align with nature such that it reinforces, protects, and strengthens wherever possible.

2.2.4.4 Design with symbiosis between Different Elements

This entails designing systems that integrates linkages between various elements that would be interdependent or beneficiaries.

2.2.4.5 Design of Multiple Pathways

This implies various strategies aimed at a single goal. Nature is always a perfect example here. For example consider the ecosystem, hydrological cycles, etc., they are always in constant cycles having multiple means to the same goal.

2.2.4.6 Design within Renewal Capability

This will keep systems in check against excessive burden because any overloaded system degrades with time. Regenerative systems thus, must be designed such that they work within bearing or renewal systems capacity.

These principles as identified by J. T. Lyle are one of the earliest formulated. Lyle's theory of regenerative design focuses on the project and community scale and also, his work contains a balance of theoretical principles and practical approaches. However arguments have been that these principles focus solely not on architectural design, hence the need for modification. Following studies in regenerative architecture, Littman, (2009), presents the modified principles as follows:

a) Whole systems design integration;
b) Integration into the landscape;
c) Principle of Intelligent limits;
d) Principle of Concentration;

e) Principle of intelligent construction;

f) Principle of bold ecology;

g) Principle of community;

h) Experience of place; and

i) Principle of culture.

The above modified principles are more architecturally inclined, and therefore form the basis of this thesis report. Presented below is a breakdown of these principles as given by (Littman, 2009).

2.3 Principles of Regenerative Architecture

2.3.1 Whole Systems Design Integration

This principle embodies and describes the most crucial of guidelines among all. The first states, "All systems and entities are accounted for and incorporated into the overall system design" (Littman, 2009: pp.26). Which means that in the design process the site must be viewed as a whole system without preferential treatment of elements is more important to us and our needs. There are several needs to be accounted for within the system therefore the design process should be with the intention of operating within the whole without separating or overlooking of any member(s) of the whole system community of the given site.

The second guideline states that, "all systems are involved in communities of mutually supportive relationships" (Littman, 2009: pp.26). This guideline when followed will further strengthen the first in that each system element is to be comprehensively handled within the design, allowing for every relationship to strengthen the whole system. The whole system is made up of matrix of mutually supportive relationships within the system. One system will not exist without the mutual support of other system elements. An example of this is seen in a living roof

system well implemented. The roof comprises of local grasses and vegetation and provides a habitat for native species to thrive. The plantings, in turn, provide thermal insulation, storm water collection and purification and elimination of heat island effect among others.

The third guideline is the "principle of multiplicity". Here each entity of the system is expected to perform more than one function or meet more than one need within the system. For example fruit trees providing fruits in addition to sequestering carbon.

The fourth guideline is "Principle of Redundancy", which states that each need within the system is met with more than one solution. It is based on the fact that within natural systems there several solutions for the healthy operation of the system. Renewable energy sources and water cycles are implementable examples within regenerative architecture. In regenerative design it is necessary to implement minimum of two renewable energy sources to meet energy demand, hence strengthening the energy system, making it more reliable, efficient and beneficial.

2.3.2 Integration into the Landscape

This principle involves site analysis of the landscape, its natural elements and systems as foundations for generating the design. It describes the conversion of intangible data into tangible outcomes. Hence, architecture is specifically produced for the site when data collected from the site is transformed into architectural form.

The building and landscape integration create a new whole entity: this means that by designing via "whole systems design" and "integration into the landscape" there will be no disconnection between the building and the landscape, thus, creating an entity which incorporates both site and architecture.

The construction of the dwelling is naturally artificial or artificially natural: This that architecture is an artificial entity, as it is something that is imposed upon a

landscape. In regenerative architecture, the goal is to bridge gap between the artificial and the natural, thus synthesizing the relationship between the two.

2.3.3 Principle of Intelligent limits

Here, every program has minimum required limit, but has a potentially infinite maximum. The design seeks equilibrium for the program, and each material and space is maximized and integrated to its fullest potential for positive net input into the whole system. This is important in that it ensures equilibrium is met within the system, based on what is imposed upon the site. Intelligent limits hence, is to achieve equilibrium that is regenerative and without limiting the potential for regeneration within the system.

2.3.4 Principle of Concentration

This principle deals with space. Every element of the system is situated within relative location or locations on site. Although often neglected this spatial relationships between system elements can have enormous impacts on the overall systems operation. Each element is designed with relative location and the intention of maximizing the capability of the system, and its potential provisions to its counterparts. Thus, this principle concerns maximizing usable spaces within a site especially when the potentials are revealed through analysis. Also, It is important to remember that less can be more, it is important not to over program or under program a space, as our intervention may not always the best solution for a given site, system or space.

2.3.5 Principle of Intelligent Construction

This entails the construction of the architecture, the systems, and the site. Material efficiency is of high significance here, thus revealed by adopting durable materials, diverting construction waste from landfills, maximizing use of regional materials, use of Materials with recycled Content, using materials that reduce harm to people and the

environment and give the embodiment of "image" or expression of the design. Materials can tell a story about the design, the systems, the place and the users.

2.3.6 Principle of Bold Ecology

Bold ecology implies implementation of ecological systems that perform several functions, are regenerative and gives a positive overall output. It entails making nature visible while transcending our current perceptions of ecology. Thus, it means utilizing the benefits of ecological systems to us as well as to the whole system. The ecology provides us with shelter, sustenance and place as though we are embedded within it.

2.3.7 Principle of Community

Communities are either made of homogenous elements or 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. Without the existence of all other communities the distinction of one singular community would not be possible. Communities evolve on every level through their self-organizing nature which births systems. Larger Communities are composed of sub-sets of smaller communities that coalesce to form the system. Hence, each system and community can be disassembled to reveal the components that constitute their existence.

2.3.8 Sense of Place

This principle entails identifiable qualities and characteristics that are specific to any place. The experience is one that should be positive and driven by clear systemic form. Both communities and individuals should experience the place, and should tell a story. The experience of place reflects the intentions of the design and describes the regenerative nature of the system. A clear understanding of place translates in designs responding to solar and wind orientation on site, and the preservation of the natural

environment. It indeed shows that solutions grow from the unique cultural and physical characteristics of place, which are so often ignored by conventional designs.

2.3.9 Principle of Culture

This principle is manifested at all levels of scale and is present in every species, poly culture, structure and system. Cultural entities are constituents of a place and should be harnessed and celebrated in the design process. Every place tells a unique story and has its history embedded within it which through cultural expressions such stories are told. This expression is identified via pattern recognition during the place analysis process.

2.4 Framework For Regenerative Architecture

Several studies (Hodges, 2006, Littman, 2009, Miller, 2012, & Yahaya, 2012) have shown that the principles identified by Lyle, (1994), form the fundamentals of Regenerative Design. However Littman, (2009), argued that these principles seem more Ecological than architectural. Resulting to the modified version of these principles -as have been discoursed earlier, which relates directly with Regenerative architecture. Some of these principles have been adopted by Yahaya, (2012) in her work, however for this exploratory study in Regenerative architecture, the Nine Principles presented by Littman, (2009), (since architecturally inclined) is adopted based on suitability.

The table below summarizes Littman's nine principles of Regenerative Architecture.

Table 1: Nine Principles of Regenerative Architecture and Features

PRINCIPLES OF REGENERATIVE DESIGN	FEATURES

Whole systems Design Integration	• All systems and entities are accounted for and incorporated into the system • All systems are involved in communities of mutual relationships • Principle of multiplicity • Principle of redundancy
Integration into the Landscape	• Analysis of the landscape and its natural elements is the foundation and origin of/ for design • Dwelling and landscape integration creates a new unit/ whole entity • The construction of the dwelling unit is naturally artificial or artificially natural
Intelligent Limits	• Every given program has a minimum required limit, but potentially infinite maxima • The design reflects natural equilibrium of program • Each material and space is potentially maximized and integrated to its fullest potential positive net input into the whole system
Concentration	• Less is more • Each space is accounted for and is necessary • Flexible spaces/ programmatic duality
Intelligent Construction	• The system is constructed using natural and artificial processes • The construction is designed to maximize material efficiency • Each material is implemented to its maximum potential • The architectural image is embodied in construction and materiality
Bold Ecology	• Ecological systems are regenerative • Ecological production provides positive net output • Ecology embodies all natural elements and harnesses the artificial • Energy is transcendent • Ecology is image
Community	• Scale is irrelevant to the importance of an entity/ group • Support for the exchange of experience and social practice is embodied • All members of the community are participants in and influencers of the design
Sense of Place	• The image of the place formulates positive experience • The experience is driven by clear systemic form • The place is experience-able by the communities alike • The experience of the place is positive • The place describes story.

Culture	• The social history of the place is present in the design • The geological history is complimented and preserved • All present cultures are constituents of the place • Cultural permanence is accommodated • The quality of life for all cultures is enhanced by the design and intervention

The Nine Principles of Regenerative Architecture (Adopted from Littman, 2009).

2.5 Strategies For Regenerative Design

The strategies presented by the foremost regeneration proponent (John T. Lyle) are studied here, in order to achieve a regenerative design philosophy. The following twelve strategies for regenerative design were presented in his book "Regenerative Design for Sustainable Development". These design strategies encompasses the key principles discussed above, and therefore forms a core aspect of this thesis report.

2.5.1 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.

2.5.2 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.

2.5.3 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.

2.5.4 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. Managing the connectivity of the system to create the optimal outcome is equivalent to maximizing the system.

2.5.5 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.

2.5.6 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.

2.5.7 Providing multiple pathways

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

2.5.8 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. 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.

2.5.9 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. Regenerative design incorporates natural storage mechanisms and develops its own.

2.5.10 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”.

2.5.11 Shaping form to manifest process

In regenerative design (according to Lyle, 1994), technologies are more difficult to hide. 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” (Hodges, 2006: pp.4).

2.5.12 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 the government, such that policies favour its advancement. See Figure 8.

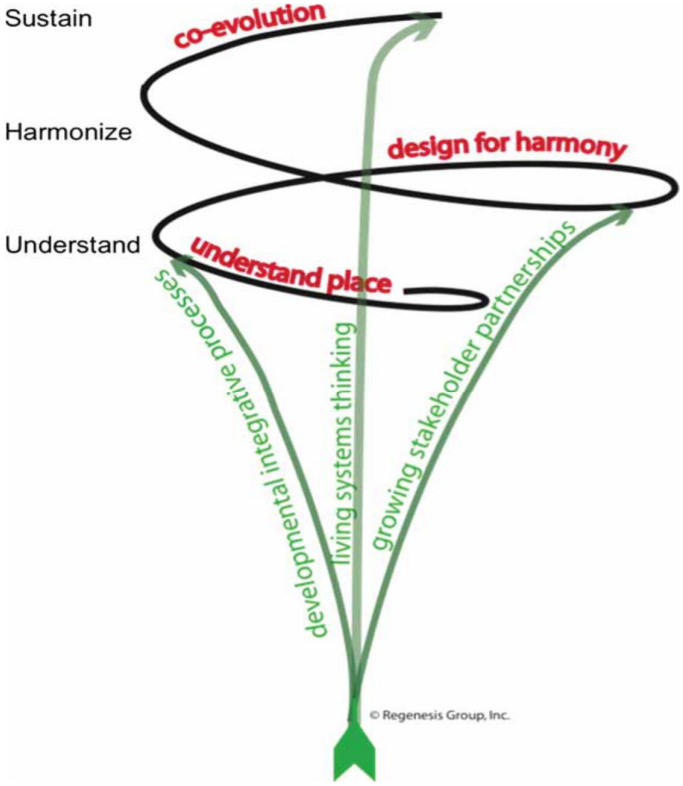


Figure 8: Regenerative architecture Framework that guides Regenesis for Regenerative design and development (source: Mang and Reed, 2012)

The figure above shows the whole systems approach or thinking which places emphasis on regeneration leading to co-evolution of humans and the built environment.

2.6 Regenerative Architecture In Practice

As a result of advancements in regenerative studies, in design and development, Cradle to cradle innovative institute, in year 2011 formulated a framework which contained requirements for the consideration of products for certification in three categories namely; Silver, Gold and Platinum. These requirements are as follows.

Cradle to Cradle for Basic or Silver certified product:

- Complete ingredient formulations for all materials used in the product;
- Recycled content and weight of all materials used in the product;
- Annual energy required for manufacture of product and source(s) of that energy;
- Water stewardship guidelines document; and
- Fair labour/corporate ethics guideline document.

The Cradle to Cradle Gold certified product requires the following additional requirement:

- Indoor Air Quality (IAQ) emissions data;
- Data demonstrating that final assembly/manufacture is at least 50% renewably powered;
- A complete water audit; and
- Documentation that a 3rd party social accreditation exercise is underway, or documentation that an internal social audit has been done.

The Cradle to Cradle Platinum certified product requires additionally:

- Data demonstrating that final assembly/manufacture is 100% renewably powered and that the entire embodied energy of the product is at least 50% renewably powered;
- Documentation describing innovative strategies employed to greatly improve water discharge quality or greatly reduce water use; and
- Documentation that a 3rd party social accreditation has been completed.

The Table shown below is an excerpt from the developed framework showing the detailed criteria for the assessment of various features or aspects of a building. The

information displayed shows the features partly among which are the material health, the material reutilization, and renewable energy use among others.

Table 2: Cradle to Cradle building assessment Framework

SUMMARY OF CRADLE TO CRADLE® CERTIFICATION CRITERIA				
	Basic	Silver	Gold	Platinum
1.0 Material Health				
All material ingredients identified (down to the 100 ppm level)	●	●	●	●
Defined as biological or technical nutrient	●	●	●	●
All materials assessed based on their intended use and impact on Human/Environmental Health according to the following criteria: ***Human Health:*** Carcinogenicity Endocrine Disruption Mutagenicity Reproductive Toxicity Teratogenicity Acute Toxicity Chronic Toxicity Irritation Sensitization ***Environmental Health:*** Fish Toxicity Algae Toxicity Daphnia Toxicity Persistence/Biodegradation Bioaccumulation Ozone Depletion/Climatic Relevance ***Material Class Criteria:*** Content of Organohalogens Content of Heavy Metals	●	●	●	●
Strategy developed to optimize all remaining problematic ingredients/materials	●	●		
Product formulation optimized (i.e., all problematic inputs replaced/phased out)			●	●
No wood sourced from endangered forests			●	●
Meets Cradle to Cradle emission standards			●	●
All wood is FSC certified				●
Contains at least 50% GREEN assessed components				●
2.0 Material Reutilization				
Defined the appropriate cycle (i.e., Technical or Biological) for the product and developing a plan for product recovery and reutilization	●	●	●	●
Well defined plan (including scope and budget) for developing the logistics and recovery systems for this class of product			●	●
Recovering, remanufacturing or recycling the product into new product of equal or higher value				●
Product has been designed/manufactured for the technical or biological cycle and has a nutrient (re)utilization score >= 50		●	●	●
Product has been designed/manufactured for the technical or biological cycle and has a nutrient (re)utilization score >= 65			●	●
Product has been designed/manufactured for the technical or biological cycle and has a nutrient (re)utilization score >= 80				●
3.0 Renewable Energy Use				

Certification Criteria/ Checklist (Source: Cradle to Cradle Products Innovation Institute (C2C PII), 2011).

Kellert, (2005) had earlier on argued that, McDonough and Braungart's early concept of ecological health (which recently got improved) needed to be extended to

include a greater emphasis on human experience, incorporating the recognition of how much people's physical and mental well-being depends on their contact with nature.

According to Kellert, (2005), prevailing approaches to conventional and even sustainable design rarely address the human need for nature as an integral dimension of people's well-being. Yet an ultimately successful approach to sustainable design and development must also produce a beneficial experience rooted in people's innate biophilic affinity for the natural environment. His argument is that bringing people closer to nature would arouse a conscious and beneficial relationship between man and his environment, thus causing him to improve it.

To study the built environment, its adverse environmental and health-related effects, Kellert focused on five broad categories of impact:

- Energy use and efficiency;
- Use of products, materials, and resources;
- Waste and its management;
- Indoor environmental quality; and
- Ecological and wildlife impacts.

From his findings however, he puts it that avoiding and reducing these impacts on natural systems and human health constitutes an immense technological, socioeconomic, and political challenge. Going by these studies, we can have regenerative architecture when our production output from the system is greater than the net input of resources into the system. This architecture, which is a new definition, entails a building producing a surplus of food, more clean water than it consumes, more energy than it consumes, and provides richer diversity than was before the structure became part of the system.

2.6.1 Case Studies of Regenerative Architecture

2.6.1.1 Case study One

BUILDING: John T. Lyle Center for Regenerative Studies.

ARCHITECT: John T. Lyle.

LOCATION: California State University, Pomona.

PROGRAM: Institutional + Residential

DESCRIPTION: The Center for Regenerative Studies (CRS) is based on the concept of building a functioning human ecosystem, incorporating human wants and needs into nature's patterns of energy and material flows/ processes of change (see plate I below). The mission of CRS is education, demonstration, and researches in regenerative systems for human life support in the context of a residential student community working with an interdisciplinary group and of faculty and scholars.





Plate I: & Plate II: Site Plan, and Elevation respectively, of John T. Lyle center for regenerative studies; integration of the building into the landscape (source: buildingdata.energy.gov/)

FEATURES: **Water:** The center was designed to use water resources as efficiently as possible. The image below shows a fully utilized pond supporting life in it.

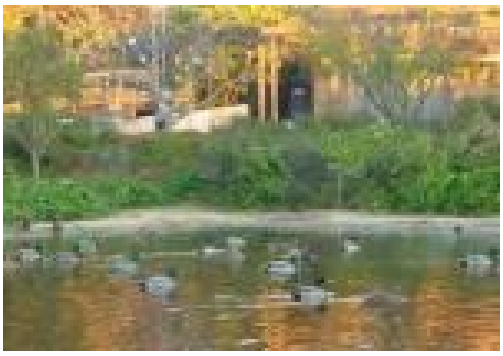


Plate III: Pond at CRS. Integration of life supporting water body on site (source: buildingdata.energy.gov/)

Roof: The roof tops are fitted with solar panels for power generation. It also has garden boxes for rain water harvesting. The sun is therefore used as an asset in the appropriate season, as can be seen in the plates below.



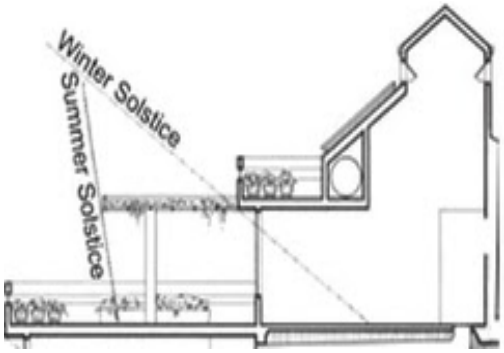


Plate IV: Solar Panels at Roofs (source: buildingdata.energy.gov/)

Plate V: Garden Boxes at Roofs (source: buildingdata.energy.gov/)

Food: Includes organic agriculture, and native plant community restoration. Onsite food production and constant cycling of Nutrients are among the active engagements in the center. See plate VI.



Plate VI: Food Production at CRS (source: buildingdata.energy.gov/)

Materials: The materials used for the construction of CRS are sourced locally, recyclable and therefore sustainable materials which do not degrade the environment. Wood is the main material used here.





Plate VII: Building Materials (source: buildingdata.energy.gov/)

Plate VIII: Building Materials (source: buildingdata.energy.gov/)

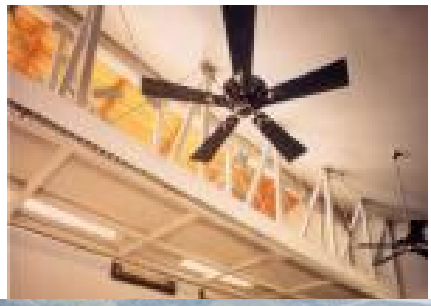




Plate IX: Energy Consumption (source: buildingdata.energy.gov/)

Plate X: Solar Energy Utilized (source: buildingdata.energy.gov/)

Energy Consumption: Passive solar building design and solar energy technology are adopted. There is deliberate use of simple electrical appliances (e.g. fans) to cut down or eliminate the need for air conditioning systems. Also there is use of natural daylighting to lessen the need for power consumption during the day.

SUMMARY

The building is designed to be an example to pioneer the course of regenerative design. Hence, it can be regarded as a conscious effort to improve human life, the site and the ecosystems surrounding it, following various sustainable and ecologically sensitive approaches. It incorporates the features of most of the regenerative architecture principles already identified in this thesis study. This will be summarized as follows:

Whole systems design integration: The idea of a functioning eco-system presents an architecture where separate units function as a whole (all the facilities function as one).

Integration into the landscape: The stepped design flows with the site terrain, and incorporates native flora and fauna on site.

Concentration: Design accounts for spaces provided while reducing buildings foot print on site.

Bold ecology: The design incorporates ecological strategies displayed in water reusability, renewable energy, passive solar design, and application of roof garden boxes.

Intelligent limits: The building is construct-of locally sourced building materials and labour while respecting and enhancing site local biosphere and vegetation.

Intelligent construction: The center features sustainable and reusable building materials which consist dominantly of wood.

Community: The design enhances communal living, while encouraging the existence of local biomes on site revealed in the pond provided on site supporting life.

Culture: This is less manifest in the design of the centre.

Sense of place: The design more or less reveals an architecture evolving from the site peculiar to region displayed in the use of wood.

2.6.1.2 Case study Two

BUILDING: Nanyang School of Art Design and Media

ARCHITECT: CPG Consultants

LOCATION: Novena in downtown Singapore, Singapore.

PROGRAM: Institutional (School)

DESCRIPTION: Nanyang Technological University (NTU) is a major research university in Singapore, and the School of Art, Design and Media is Singapore's first professional art school. The university's main 200-hectare garden campus, known as the Yunnan Garden campus, is in the south-western part of the island.

In May 2011, Nanyang Technological University received the Green Mark Platinum Award from the Singapore Building and Construction Authority (BCA) for adopting best practices in environmental sustainability. According to the master plan of the 200-hectare university campus, the site where the Nanyang Technological University School of Art, Design and Media (NTU-ADM) sits is a wooded valley which was to be left green. In order to keep to the original intention of the master plan, a habitat was carved from the limits of the valley, and the architects were faced with the challenge of creating a building into the challenging landscape. However some of the best architectures come from solutions to challenging sites and this is a clear example of such ingenuity. Plate XI below shows a clear flow and interconnectedness of site, while Plate XII shows the buildings integration into the landscape.

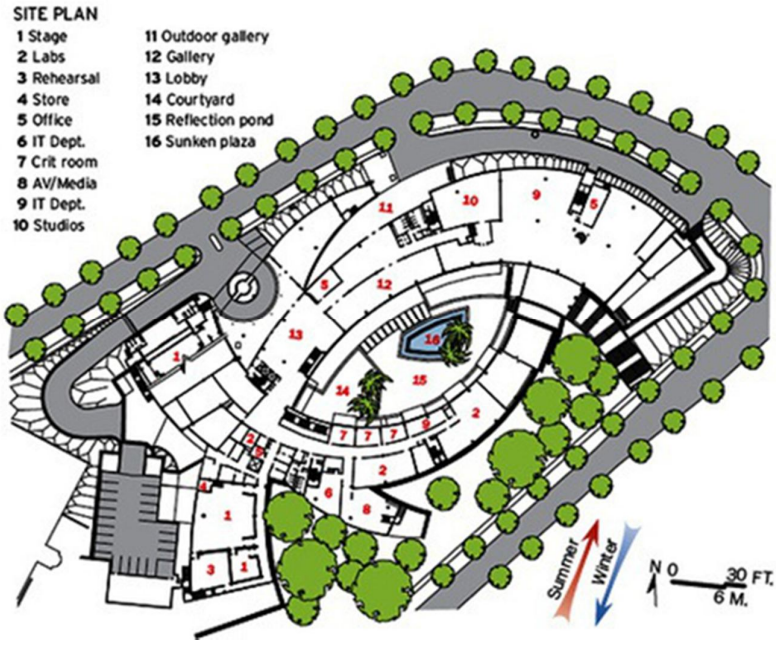


Plate XI: Site Plan of the NTU-ADM (Source: treehugger.com)



Plate XII: Integration into the landscape at NTU-ADM (Source: greenroofs.com)

FEATURES:

Water: The structure was designed to deliberately incorporate a central cascading pool capable of supporting life, and use water resources as efficiently as possible. Hence, it features rain water harvesting green roof system. This is shown in the plates below.



Plate XIII: Central cascading pool capable of supporting life forms at NTU-ADM (Source: greenroofs.com)



Plate XIV: Green roof communal space also for rain water harvesting at NTU-ADM (Source: greenroofs.com)

Roof: One of the highlights of this building is its curved turf roof, which being an engineered intensive green roofing system gradually rises from the limits of the site through an almost naturally appealing slope to the peak of the multi-level structure and then undulates back to blend with the site. It consist of heavily matted grass *(Zoysia Matrella)* normally used on golf courses, which withstands heavy downpour and features Rain water harvesting plus storm water control.

Vegetation and Food: The vegetation here includes Planted grasses mixed with native greenery to colonize the building and bond it to the site. Onsite food production includes fruit trees which are characteristics of the Island site.

Materials: Apart from the glass wall, the building is also cladded in natural forms, which include the off-form concrete walls and columns, cement-sand screeded floors and timber railings, which can be reused, hence, are recyclable. The plate below displays sections cut across the building showing the roof-site connection, levels, and details of structure and construction materials.

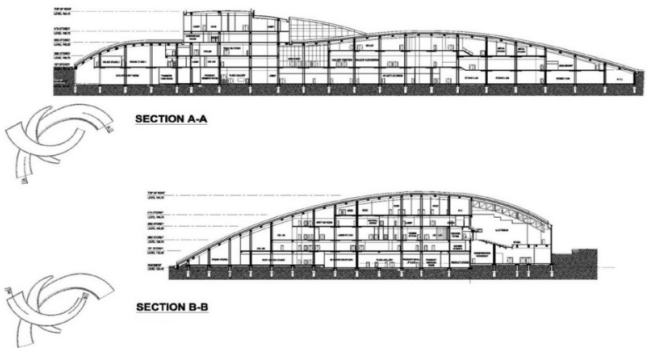


Plate XV: Construction materials displayed in Sectional views through the building (Source: greenroofs.com)

Energy Consumption: Because of the conscious and deliberate integration of the building into the site, accompanied by the intensive green roof system, the building energy demand for cooling is drastically reduced considering that the most of Singaporean Climate is hot and dry. However the authorities at the NTU plan to incorporate Photo Voltaic systems to cut down on energy use from the grid. Also there is use of natural daylighting to lessen the need for power consumption during the day through the extensive glass wall facade.

SUMMARY:

The building can be regarded as a deliberate and conscious effort to improve on the site even after its intervention, being a site that was to be left green. It incorporates the features of most of the regenerative architecture principles already identified in this thesis study. This will be summarized as follows:

Whole systems design integration: The school presents an architecture where all units comprising the building function as one single intertwined entity.

Integration into the landscape: The site for the project was originally intended to be left green. This however informed the conscious effort directed toward its incorporation and intertwining with the surrounding native landscape.

Concentration: Design accounts for spaces provided while reducing buildings foot print on site through green roofs providing additional spaces for other activities.

Bold ecology: The design incorporates ecological strategies displayed in water stewardship, passive solar design, and application of intensive green roof system supporting local vegetation.

Intelligent limits: The structure respects the limits of the site by gradually rising from one end and finally blending with the site environs. Hence, it respects and enhances site local biosphere and vegetation.

Intelligent construction: The school features sustainable and reusable building materials which consist of glass, off-form concrete walls and columns, cement-sand screeded floors and timber railings.

Community: The design enhances communal living, while encouraging the existence of local biomes on site via the intensive green roof spaces and the cascading life supporting pool provided on site.

Culture: This is less emphasized in the design.

Sense of place: The design also reveals an architecture evolving from the site peculiar to the region.

2.6.1.3 Case study Three

BUILDING: Songjiang Sci-Fi Hotel Songjiang District, China

ARCHITECT: Atkins Architects.

LOCATION: Songjiang District near Shanghai, China.

PROGRAM: Institutional (Resort Hotel)

DESCRIPTION: Songjiang Hotel named a five-star resort hotel incorporated within a beautiful water-filled quarry site 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 whose depth is put as 100 meters. The project competition award winning design proposal by Atkins Architects made proper reuse proposal for it. Plate XVI below shows the site planning and integration of the building into the site landscape.

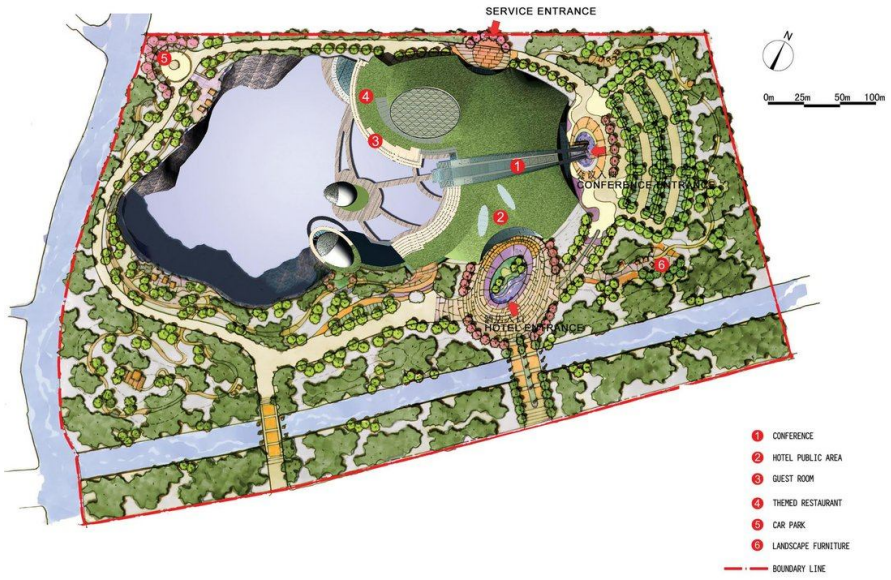


Plate XVI: Site plan of Songjiang hotel (Source: openbuildings.com)

FEATURES:

Water: The structure was designed to make good use of the pool of water contained in the abandoned hundred-meter deep quarry site displaying several waterfalls as water inlets into the large pool with two underwater levels housing a restaurant and guestrooms facing a ten-metre deep aquarium. Use of water resources is as efficiently as possible. It is capable of supporting life, and it features rain water harvesting to be used on site. This is shown in the plate below.



Plate XVII: Water management strategies at Songjiang hotel (Source: http://www.snegidhi.com/2009/21-8/cute-hotel.html)

Roof: The Roof goes about two levels above the ground level and is entirely covered with semi-extensive green roofing system. The Roof slope rises by 1 degree and is semi accessible. The limits of the site gradually extends through a naturally appealing slope to the peak of the double-level structure and then undulates back to blend with the rest of the site as seen in Plate XVIII below. The green roof apart from being a good energy resource also features water management.



Plate XVIII: Green roof of Songjiang hotel (Source: http://www.snegidhi.com/2009/21-8/cute-hotel.html)

Vegetation and Food: The vegetation here includes Planted grasses (semi-extensive, semi-accessible) green roof mixed with native greenery to harmonize the building and bond it to the site. Onsite food production includes fruit trees which are native characteristics of the quarry site.

Materials: Sustainability is an integral part of this project hence materials were carefully selected to comprise of recyclable and reusable building materials which includes natural stones which is characteristic of the local quarry site, concrete, steel, glass (as seen in the Plate below) and wood used in the interior finishes.



Plate XIX: Use of materials at Songjiang hotel (Source: http://www.snegidhi.com/2009/21-8/cute-hotel.html)

Energy Consumption: The hotel is covered with semi-extensive green roof, while the building uses geothermal energy for its electrical supply and heating. The quarry site also provides a good source of heat control and shelter from the elements. Since sustainability is integral to the design energy management strategies were adopted. The green roof would also keep the hotel cool in the summer and warm in the winter.

SUMMARY:

The building can be regarded as a deliberate and conscious effort of ingenuity directed towards the improvement of the site even after it has been abandoned. It generally displays the incorporation of the features of most of the regenerative architecture principles already identified in this thesis study. This will be summarized as follows:

Whole systems design integration: The Resort Hotel presents an architecture where all entities comprising the building function as a whole. This is shown in the interconnected movement or flow from the ground level into the quarry depth or base. This also shows in the conscious effort directed toward its intertwining with the surrounding native landscape.

Concentration: being an already exploited site, the design accounts for spaces provided while reducing buildings foot print on site through accessible semi-extensive green roof system.

Bold ecology: The hotel design philosophy was that of a green hill cascading down the natural rock face as series of terraced landscaped hanging gardens. Hence, it incorporates ecological strategies displayed in water stewardship, passive solar design, and application of semi extensive green roof system supporting and incorporating local vegetation.

Intelligent limits: The structure respects the limits of the site by the conscious attempt to improve deliberately an already degraded environment.

Intelligent construction: The Hotel features sustainable, recyclable and reusable building materials consisting of locally sourced natural stone, wood, concrete, steel and glass.

Community: The design enhances communal living, being an integral part of the design of a new city on the outskirts of Shanghai for 500,000 people called Songjiang Garden City, while encouraging the existence of local biomes on site and in the area.

Culture: The culture of the region is less pronounced in the entire scheme.

Sense of place: The design also reveals an architecture evolving from and peculiar to the quarry site.

2.7 Resort Developments

Kaiser and Helber (1978) in Ruby (2008) termed resort as inclusively, referring to an area where recreational attraction has been provided for tourist. It is a place used for relaxation or recreation. As a result people seek out a resort for holidays or vacations. A resort is distinguished by a large selection of activities such as; lodging, sports, entertainment, shopping, water sport, quad biking, archery fishing, picnicking etc.

A resort can commonly refer to two specific but similar places:

- Towns in which tourism or vacationing is a major part of the local activity but are usually not run by a single company (for example Aspen, Colorado)
- Vacation centres, usually run by a single company, which attempt to provide for all or most of a vacationer's wants while staying there (for example Walt Disney World Resort).

The term resort is sometimes misused to identify a hotel that does not meet the requirements of a resort. However, a hotel is frequently the central feature of a resort (Schroeder, 1998 in Ruby, 2008).

2.7.1 Classifications of Resorts

Huffadine (1998) cited in Ruby (2008) classified resorts into three main types. These have other subdivisions and can be further broken down. They include the resort market, resort destinations and the resort property.

2.7.1.1 Resort market

The resort market is a town or city consisting of many hotels that are oriented towards the major local amenity (Huffaadine, 1998, in Ruby 2008). Most of the resorts developed around the world today rely on the local basic amenities provided by the

town or city and not an individualised amenity for the resort itself, hence they have a symbiotic relationship with the area they are oriented in. Most of these resort markets often are equipped with many resorts which rely on the basic supply from the area for the smooth running of a wide variety of casinos, hotels, restaurants, entertainment and recreation. Resort markets quite often generate from small beginnings and become great locations, such an example is the Las Vegas, which started out as a casino and has evolved to be a great town of large tourist attraction.

2.7.1.2 Resort destinations

A resort destination is a resort that contains, in and of itself, the necessary guest attraction capabilities-that is to say that a destination resort does not need to be near a destination (town, historic site, theme park, or other) to attract its public. Consequently, another characteristic of a destination resort is that it offers food, drink, lodging, sports, entertainment, and shopping within the facility so that customers have no need to leave the facility once they arrive. Commonly these facilities are of higher quality than would be expected if one were to stay at a hotel or eat in a town's restaurants. Walt Disney World Resort and Aspen, Colorado are examples of this (Schroeder, 1998 in Ruby 2008).

Quite often, resort destinations are equipped with the least of five hundred rooms, have outstanding amenities and are usually conceptualised. For instance the self-contained concept evolved because resort markets increased when retaining guests within the complex. The resort geographic location is remote while the evolution in sports and amenities has attracted guests and increased the average length of stay. The number of conferences held in resort destinations has also grown (Huffadine, 1998, in Ruby 2008).

2.7.1.3 Resort Property

Usually resort properties are common in most parts of the world and are classified as smaller units which operate individually. It is a facility with one or two major amenities, not self-contained but an owner or a manager is at liberty to promote any hotel as a resort.

2.7.2 Types of Resort Hotels

1. **Beach Resort**: They are resorts that are located on or within a short distance from a major beach. Many beach resorts have activities that include snorkeling kayaking, scuba diving, para-sailing, and boating. Some even have their own on site beach, especially for guests.

2. **Tropical Resort:** They are located within tropical climates. A guest staying at a tropical resort will include year round warm and sunny weather.

3. **Luxury Resort:** It is an expensive vacation facility which is fully staffed and has been rated with five stars. It often boasts many visitor activities and attractions such as golf, watersports, spa and beauty facilities, skiing, natural ecology and tranquility. Because of the extent of amenities offered, a luxury resort is also considered a destination resort.

4. **Island Resort**: They are resorts located on an island. Resort amenities usually includes snorkeling, sun bathing, swimming, fishing, boating, parasailing, and kayaking, along with other types of water sports.

5. **Mountain Resort:** They are resorts located on or at the base of a mountain. Activities include downhill skiing, cross country skiing, snowmobiling, sight-seeing and more.

6. **Lake Resort:** They include any resort located directly on or very near a lake. Most travelers visit lake resorts to go boating, fishing, swimming, or water skiing.

7. **Mega Resort:** It is a type of destination resort which is of an exceptionally large size, sometimes featuring large scale attractions like casino, golf course, theme park, multiple accommodations etc. The hotels typically thought of as mega resorts owing to their immense size and complexity.

8. **Golf Resort:** They are resorts that cater specifically to the sport of golf, and include access to one or more golf course and or clubhouse. Golf resorts typically provide golf packages that provide visitors with all greens and cart fees, range balls, luxury accommodations and meals. Accommodation in the resorts may take the form of hotel like rooms or private spacious villas.

9. **Spa Resort:** It is a short term residential/lodging facility with the primary purpose of providing individual services for spa-goers to develop healthy habits. Historically many such spas were developed at the location of natural hot springs or sources of mineral waters. Typically over a seven day stay, such facilities provide a comprehensive program that includes spa services, physical fitness activities, wellness education, healthy cuisine and special interest programming.

10. **Ski Resort:** A developed recreational facility, usually on a mountain or large hill, containing ski trails and vital supporting services. Commonly a ski area has food, rental equipment, parking facilities and a ski lift system catering to the sports of skiing and snowboarding. It may offer an all-inclusive program that includes fitness classes, healthy cuisine, educational classes and seminars plus similar services to a beauty salon or a day spa. Guests reside and participate in the program at a destination spa against just visiting for a treatment or pure vacation. Some destination spas are in exotic locations or in spa towns.

11. **Pet-friendly Resort:** A resort that allows pets such as dogs and cats to stay in the rooms. Some pet friendly resorts do have restrictions on the size of the pet. Therefore, we highly recommend contacting either the owner of the timeshare or the resort to determine if any restrictions apply before buying or renting at a pet friendly resort.

12. **Theme Park Resort:** Book lodging at numerous timeshare resorts near major theme parks worldwide. Maps show distance from resort to major theme parks.

One of the objectives of this study is to propose Oguta Blue Lake Resort Hotel for Imo State Government. Hence the theme of Lake Resorts is adopted.

2.7.3 Classification and Grading of Resort Hotels

The East African Community (EAC) criteria for the classification of resort hotel are based on the star system of classification of hotels. The classification begins from one star and ends at five. Each category will be discussed taking cognizance of critical areas that affect their design and smooth operation.

2.7.3.1 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.

2.7.3.2 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) lettable 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.

2.7.3.3 Three Star Resort Hotels

For three star resort hotels, their location should be in close proximity to the main attraction to the area and offer easier accessibility, safety, comfort and tranquility. 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) lettable 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.

2.7.3.4 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 be 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) lettable accommodation units.

Furniture and 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.

2.7.3.5 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 will 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) lettable 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) less than 75 sqm, comfortably furnished, sound proofed and well maintained, should be 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 25sqm 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.

2.7.4 Classification by Nigerian Tourism Development Corporation (NTDC)

Hotels and similar establishments are classified by the NTDC according to a set of required minimum specifications. Each class is identified by a specific number of stars indicative of the degree of comfort provided. The number of stars relates to the different types of hotel. It reflects the range of facilities and the level of services provided.

1 Star: Hotels with good basic facilities and furnishings ensuring comfortable accommodation. Max service may be limited. This includes small private hotels.

2 Star: Hotels having higher standards of accommodation and more facilities providing good levels of comfort, meals and other amenities. This also includes private hotels and budget oriented accommodations.

3 Star: Well-appointed hotels with spacious, very comfortable accommodations, mostly with ensued bathrooms. Full meal facilities shall be provided as well as a range of amenities.

4 Star: High quality hotels, well equipped and furnished to a very high standard of comfort, offering a very wide range of services and amenities for guests and visitors.

4 **Star:** Outstanding hotels with exceptional quality accommodations and furnishing to the highest international standards of luxury providing impeccable services and extensive amenities.

2.8 Trends Of Regenerative Architecture In Resort Hotel Design

Studies have shown that modern day hotel and resort designs have begun to take on a holistic approach thus forming a paradigm in international tourism (Clarke, 2005). This trend advocates a development system integrating body, mind and spirit to create balanced, self-renewing and trainable tourism developments. This is as a result of the uprising ecological crisis that has become much evident in the world today. Traditionally, designs of resorts may tend to shy away from issues of sustainability and go on to exploring planning techniques, building methods and materials that were not sympathetic to the environment.

Clarke, (2005) identifies key design principles that aim at achieving a holistic approach of designing resort hotels. These principles seem to stir and promote the course of such designs that are environmentally friendly and sympathetic to the site while providing the user/ tourist with an experience of place, touch of nature plus recreation. These principles are described as follows;

2.8.1 Overall Sustainability

This ensures a strategic long-term thinking and planning of tourism projects, so as to protect the environment as well as local cultures and communities suffering degradation. This process helps to achieve reduced energy costs, higher property values, greater worker/ client's satisfaction, and easier access to permits and funds from government organizations.

2.8.2 Regenerative Design System

This design system –as have been studied- is one that draws man closer to nature by allowing tourism projects to become part of their environment (both natural and cultural) by utilizing locally sourced sustainable resources (food, water, energy,

materials, wastes) while creating systems that continue to evolve and self-replicate. Human-nature and nature-built environment relationship, combined with natural cycles of the sites local biosphere are key to success along with the preservation of the sites historic and cultural resource, in purity and integrity over the long term.

2.8.3 Service Philosophy

The delivery of service in the hotel and tourism industry is s key driver of the industries success, and usually relies on well trained and contented staff. Respect for the individual customs and traditions of staffs, is inherent in a well adopted holistic philosophy, alongside incorporation of needs within the hotel's ethics. More so a key goal is to incorporate locals in the management structure to teach the community how to create its own projects, and run them in the future (social sustainability).

2.8.4 Sanctuary Spas

This is 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, tended by locals.

2.8.5 Interior Design

Interior designs express the natural beauty of the site environment using unique materials such as wood, raw silks, natural linens and wool, and also colour, texture and sensitive lighting. Holistic designers creatively blend colour, harmony, balance, proportion and style, to give a unique environment with a great experience of place. Lighting design is to reduce energy consumption, by maximizing natural daylight and use low-energy lamps and simple fans.

2.8.6 Native Landscaping

Care is specially taken to ensure that local native landscape is preserved, and that the planting is in harmony with the existing greenery, and also regenerates, respecting the principles of permaculture. Passive ventilation is used anywhere possible, plus water-efficient appliances, and recycling of inorganic materials, as well as composting of organic materials, which are an integral part of the regeneration process.

2.9 Tourism Potential Of Oguta Blue Lake

Several studies (Ekpo, 2007; Nnaji et al, 2011) have revealed positive tendencies which suggest that Oguta Blue Lake can become a tourist destination. Nnaji *et al*, (2011) opines that for this to be effectively achieved within the nearest future there has to be a massive enlightenment campaign and support from the government in the development of tourist infrastructure in the area. This however is receiving immediate intervention following the state governments increased transformation agenda for the new face of Imo state.

The plate below shows a view of a beautiful scenario at the Oguta blue lake.



Plate XX: View of one of the inlets showing a Beautiful scene of Oguta Blue Lake's treasure (Source: imostate.gov.ng)

Oguta Blue Lake is identified as the largest natural hydrological feature in the State (Nnaji et al, 2011), and the second largest in the country after Lake Chad. The plate below shows the aerial view of the large Oguta Lake.



Plate XXI: Aerial view of the Large Oguta lake (source: www.imostateblog.com)

Oguta Lake is supposed to have originated from a natural depression around a region located within the equatorial rain forest belt with an average annual rainfall of three thousand one hundred millimeters (3,100 mm) but most of the rain forest has been replaced by oil palm plantations especially around the lake. This gradual extinction of native flora accompanied with dumping of urban waste and dredging of the lake for sand -among other factors, has necessitated immediate intervention, and therefore

gradual utilization of the tourism potential of the Lake. Several structures (the Oguta Lake of Treasure Conference Centre and the newly Renovated Oguta Blue Lake Motel) are among the few infrastructures which currently cater for tourist needs (Source: Imo state Blog).

The Oguta lake Motel alongside the 18 hole golf course is one of the earliest structures put up to encourage tourism in the state. It catered for a certain category of tourist or vacationers at one time but is presently inadequate considering the growing need for tourism in the state. Its design and construction however followed the ideas of the post war Scottish architects who planned the motel around the late seventies. These ideas may not conform to the more recent sustainability discourse. Also the recently completed Conference center stands alienated or unconnected to the landscape. Therefore considering these alienations and the anticipated massive infrastructural development which is to make the area a tourist destination, there is the need to indulge nature as the generator and equal partner in the architectures to be produced. Hence, suggesting a regenerative approach.

Oguta Lake currently receives about seventeen thousand (17,000) visitors who flock to the area for various reasons ranging from site seeing, to tours, to picnics, golfing, boating, fishing, recreation, meetings, conferences and lots more. The plate below shows the influx of tourists to the area which indicates its potential to become a famous tourist destination in Nigeria.



Plate XXII: Influx of Tourist at Oguta Blue Lake (Source: nitpng.com)

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 INTRODUCTION

This chapter discusses the various methods, strategies and approaches used in this thesis study. It also presents Data Collection Procedure. Data Collection Tools, Framework, checklist and also the chosen approach to data analysis are all discussed in this section.

3.1 Research Strategy

This refers to the ways in which a researcher intends to carry out a research. 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.

The choice of a research strategy is governed by different factors which dictate its suitability to the approach which is most appropriate to address the research questions. Multiple research strategies can be used referred to as mixed methods. In this case, however both surveys and case studies are suitable research strategies. Surveys relate to the present state of things at the time at which the data are collected (Denscombe, 2003). While case studies provide up-to-date information and allow for in-depth examination of events which can be used to contribute to knowledge (Oluigbo, 2010).

Several guiding conditions affect the choice or decision of a suitable research strategy. These include the type of research question posed, the extent of control an investigator has over actual behavioural events, and the degree of focus on either contemporary or historical events. For this research work, the methodology adopted is the case study research strategy because of its suitability. Also similar studies

conducted by (Hodges 2006; Littman 2009; Miller 2012 & Yahaya 2012) adopted the case study approach in their research hence, giving credibility to the approach.

3.1.1 Case Study

The choice of case study as a research strategy here is based on the exploratory or investigative nature of this research in obtaining reliable data in view of how a framework conforming to the principles of regenerative architecture can be evolved for sustainable resort hotel design in south-east Nigeria. Case study research strategy according to Oluigbo, (2010) 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 related to the study in question.

3.2 Research Techniques

This encompasses the various approaches or ways in which the research was carried out and the data collection or sourcing. Hence it contains the various instruments of data collection which were suitably adopted for the research.

3.2.1 Instruments of data collection

Some of the defining characteristics of case study methodology are; the use of multiple sources of data to capture the complexity of cases. Several instruments of data collection exist but for this research work the following tools were selected based on suitability:

i. **Visual survey:** This is a surveillance of physical features or descriptive report on static cases. Oluigbo, (2010) stated that Case studies in Architecture begin with documentation of the physical characteristics of the case.

ii. **Observation:** This entails documentation also of the physical characteristics of a case involving an activity.

iii. **Interviews:** Oluigbo, (2010) also presents that for interviews in architectural case study research, respondents may include: Architects and other members of the building industry; the client or owner, the users and even passive consumers of architecture (passers bye who make visual eye contact with the building).

iv. **Documentations:** Descombe, (2003) opines that documentations can be treated as source of data. It can be an alternative to questionnaires, interviews or observation. Documents sourced are mostly of written sources, and includes data collected from government publications and official statistics, newspapers and magazines, website pages, the Internet, articles, journals and books.

3.2.2 Procedure for Data Collection

The procedure for primary data collection involved visits to local case studies following pre-notification of scheduled visits to the resort hotels. Here instruments of data collection were actively utilized among this, visual survey and observation; which entailed guided tour round the facilities, observation of activity, and analysis of the architectural form, structure, features and landscape elements were carried out alongside taking pictures, sketches and notes. Furthermore interviews were scheduled with the resort hotels key informant(s) or manager(s) to determine their facility's reflection of regenerative architecture principles. The interviews were carried out in two sessions. First sessions were with the managers of each resort hotel visited or their representative, while the second sessions were with one notable custodian of culture in each resort area. Finally available documentations on cases studied were assessed on request constituting secondary research data. This included manuals, written documentations, and materials from hotels official websites. These buildings or built environments are later assessed based on the established field or study area criteria.

3.3 Research Population

The population of the study basically consists of Resorts in South-eastern Nigeria (Hot Humid Climate or Tropical Rain Forest) with study focus on Resort Hotels. The study was conducted in three Resort Hotels identified in the area, vis:

- Nike Lake Resort, Abakpa, Enugu;
- Oguta Lake Motel, Oguta, Imo state; and
- Le' Meridien Ibom Hotel and Golf Resort, Uyo.

3.3.1 Case Studies Selection Criteria

Following Studies by Veal, (2006) cited in Oluigbo, (2010) it has been shown that case study selection is comparable to sampling in a quantitative research and that cases were usually purposively selected. Based on this and other studies, Oluigbo, (2010) pointed out that 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 research were sampled purposely on three bases:

a) That they are built environments or buildings possessing features of Regenerative architecture;
b) That they are located within south-eastern Nigeria (Hot Humid Climate or Tropical rain forest); and
c) That they are resorts or resort hotels with features and characteristics denoting them as places for lodging, leisure or recreation.

Although one of the cases (Le' Meridien Ibom Hotel and Golf Resort) examined, is located in the South-south part of the country Geo-politically, it is however related climatically and in vegetation to the south-eastern part. Also, it is a popular acclaimed resort destination in the area.

3.3.2 Case Studies Assessment Criteria

Oluigbo, (2010) puts it that Case study research in Architecture goes beyond the documentation and description of the physical characteristics of the built environment hence, the findings and results gotten have to be assessed based on specific approaches addressing the research question(s) or issue(s) directly and out listing how the findings have been able to be of help to answering the research question(s).

Although the research questions which this research seeks to answer are as follows;

i. What features of regenerative design are suitable for achieving contemporary sustainable Resort Hotel Architecture?
ii. How close do built designs of resort hotels in South-Eastern Nigeria come in realizing regenerative design principles?
iii. What practical limitations to success exist?
iv. What features of regenerative design are peculiar to the region? and
v. How can the principles of Regenerative Architecture aid in the design and development of sustainable Resort Hotels in the area?

These (questions i – iv) are in the form of variables that sought to point out certain features as were identified in the visual surveys, observations and interviews, while the last question (v) is addressed by a design proposal

3.4 Variables of Study

The variables of this study are derived principally from the principles of regenerative architecture identified. These are;

a) Integration into landscape;
b) Whole systems (not isolation) design;
c) Intelligent limits;

d) Concentration/ aggregation;

e) Intelligent construction;

f) Bold Ecology;

g) Community;

h) Sense of place/ Experience of place; and

i) Culture.

3.4.1 Case Study Checklist

The features of the case study checklist, is based on the variables identified from the principles of Regenerative Architecture. This was developed from regenerative design principles and strategies studied in literatures, most notable are criteria and checklists presented by scholars in the field of study. Partly, this checklist for research in regenerative architecture is developed from the variables presented by Littman, (2009). This is adopted based on suitability and developed into the checklist/ assessment criteria used for carrying out this study. The table below is a typical representation of the case study checklist used for this study.

Table 3: Case Study Checklist

Principle 1: Whole Systems Design Integration					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Accountability of systems	• All systems (facilities) are accounted for and incorporated into the whole.				
b. Involvement of systems in the whole	• All systems (facilities) are comprehensively treated within design and incorporated in the whole.				
	• The whole system is constructed/ composed of collection (facilities) of mutually supportive relationships e.g.				

	living Roof which captures storm water and reduces heat island.				
c. Multiplicity of systems	• Entities perform more than one function (i.e. openings, roofs, walls, gardens etc.).				
d. Redundancy approach to solutions	• Needs within the system (energy, water etc.) are met with multiple sources (just like nature).				
Principle 2: Integration into Landscape					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Spread of building on site	• Vertical development.				
	• Roof gardens used extensively over the roofs.				
	• Use of onsite storm water treatment and ground water recharge.				
b. Working with site topography and native landscape elements	• Integration of native landscape with development.				
	• Letting nature inspire the design.				
	• Preservation of site characteristics (trees and natural features of site).				
	• The use of building elements that reflect local context.				
	• Treatment of landscapes as interdependent and interconnected.				
	• Use of forms inspired by nature.				
Principle 3: Intelligent Limits					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Reduced impact of building footprint.	• Minimal cover of site with impervious ground cover like asphalt and concrete paving to allow for ground water recharge.				

	• Limited employment and reduced dependence on mechanical systems.				
Principle 4: Concentration					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Space utilized	• Building footprint impact.				
	• Presence of useless/ redundant spaces.				
b. Activity zoning	• Spaces Have maximum impact on system (building's) operation.				
	• Each module is individually optimized.				
Principle 5: Intelligent Construction					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. 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 biodegradable materials in building interiors.				
b. Type of building material	• Use of local building materials like bamboo in cladding, etc.				
	• Use of durable materials.				
	• Adequate utilization of natural materials like the rocks and water bodies.				
c. Re-usability of building material	• Use of recyclable building material.				
Principle 6: Bold Ecology					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**

a. Minimal energy use reduction	• Use of day-lighting.				
	• Use of natural ventilation.				
	• Passive design elements.				
b. Source of water	• On-site sources.				
	• Harvesting, processing and recycling.				
c. Water conservation method	• On-site treatment.				
d. Renewable sources of energy	• Use of solar panels, wind turbines and bio-gas.				
e. Energy management methods	• Level of overdependence on mechanical systems to alter the climate.				
	• Natural conditioning techniques such as planting, green roofs etc.				
Principle 7: Community					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Homogenous entities	• Connectedness.				
	• Disconnectedness.				
b. Heterogeneous entities	• Connectedness.				
	• Disconnectedness.				
Principle 8: Experience of Place					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Building materials	• Use of complimentary local landscape elements.				

	• Use of resident building materials.				
b. 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.				

Principle 9: Culture					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Unique people or place culture	• Use of local cultural elements in design.				
	• Use of cultural elements of foreign origin in design.				
b. Other biotic cultures	• Consideration for local organisms				

Sample of Case Study Checklist (Source: Author, 2013)

As aforementioned, the above variables are developed from the principles of regenerative architecture studied from literatures, while the features are derived from the various strategies presented by scholars in the field. The remarks from the table represent the level of reflection or exploration of the features of each variable of the principles being examined under the cases studied. Here the remarks are made as follows:

Absent (Abs): An absent remark shows total absence of the feature under consideration;

Low: A low remark shows partial presence or difficulty in establishing presence of the feature;

Medium (Med): Medium remark indicates reasonable presence of the feature beyond Low; while

High (Hi): Indicates a conspicuous or obvious presence of the feature under consideration.

3.5 Data Analysis Procedure

Oluigbo, (2010) opines that analysis of case study research may be statistical and non-statistical, and includes descriptive analysis, visual analysis, comparative analysis, content analysis, and parametric and non-parametric statistical tests. He also states that discussion of case study analysis may be based on pattern matching, logical argumentation/explanation building and time series analysis among others.

Here, the analysis of data collected is based on descriptive accounts. Tables and charts are used for analyzing the obtained data, while Pattern matching is used to relate the features of cases studied, to what is expected from existing Regenerative architectural theory (Principles).

The description covers basically the areas below;

a. History and Background;
b. General Site planning and Landscaping;
c. Spatial organization and design;
d. Building form and Expression;
e. Materials, and technology; and
f. Services: Energy and energy source, and Water management strategies.

Facility profiles, tables of independent variables or checklists on the ways and level of reflection of regenerative architecture principles are used to capture better perspectives and understanding of the facilities studied for effective description.

3.6 Limitations

Several factors posed as challenges encountered during the undertaking of this research. These factors are not unforeseen however, and therefore were taken into cognizance while planning the approaches to data collection in the methodology of this research. A major challenge encountered was the difficulty in carrying out scheduled interviews with the Architects and planners of the resorts visited as most of the buildings were designed and constructed by foreign architects/ planners. Hence reliable information's were gathered from state government archive as all of the buildings visited are owned by the States, and operated by private organizations.

Another limitation is security concerns which posed a major challenge. Hence protocols had to be followed especially on access to facilities occupied by high profile individuals, which in a way influenced the programed time scheduled, and slightly the results of the study. Finally direct meeting with the managers of some of the resorts were not possible hence arrangements were made for online interviews with them, in addition to data gotten by interviewing some members of staff of such resort hotels.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.0 INTRODUCTION

This chapter covers the description and analysis of the cases studied. It presents data as it is obtained from the cases visited, studied and analyzed based on the established study area criteria.

4.1 Case Study One (Oguta Lake Motel, Oguta, Imo State)

4.1.1 Background

Oguta lake resort now Oguta Lake Motel is a property of Imo state government of Nigeria. In 1973, permission was granted by the East Central State to Messrs Ibru and Vaughan-Richard, architects and planners for the Oguta Lake Resort Project.

Oguta Lake and Golf Resort was established about 40 years ago by the colonial rulers as their exclusive getaway spot. During the Nigeria-Biafra civil war of 1967-1970, the Biafrans built a bunker with a tunnel that runs under the lake connecting both banks of the lake. This is preserved today as it's an important part of Oguta Lake's history and still attracts a lot of visitors.

Presently, the Resort has a holiday complex, which includes a golf course with 18 standard international holes, relic of war (mini bunker) constructed by the defunct Biafran Navy during the civil war, natural confluence of Oguta Lake and Urashi River, cruise boat services, Golf Club Bar House/Oguta Lake Motel for refreshment, lodging and feeding as well as mini-children's recreation park. The Oguta Lake resort at one time was run on lease by A.T. Michellete, a Port Harcourt based property agency until recently when the State Government took over.

4.1.2 General site Planning and landscaping

The planning of the site basically depicts the idea of the colonial architects whose design solutions were based on perceived immediate building need for an exclusive getaway spot at that time. However there is a general display of understanding of design concepts and considerations for tropical regions in this design. This is evident in the staggering of the single-banked terraced blocks (as seen in plate XXIII below) to allow for solar shading from sunrise and sunset, and appropriate ventilation of the interior of the building. Vegetation on the site suggests a cleared site onto which the design was implanted. The vegetative cover within the premise of the resort include fruit trees and others which are partly of foreign origin, as against the native palm trees and fruit trees peculiar to this rain forest region.



Plate XXIII: The site planning, building form and organization (Source: www.imostateblog.com).

4.1.3 Spatial organization and design

The design of the structure basically portrays passive design strategies, the idea adopted outright because of the climatic consideration of the site location. This is seen in the staggering of the building pattern such that preceding blocks provide solar shading for the succeeding ones. Also openings for lighting and ventilation are provided

on either side (north and south) of the single-banked structure. The buildings are arranged around an open space (see Figure 9 and plate XXIV below) with golf club bar, restaurant and mini conference facilities at central location relatively opposite to the main entrance to the resort.

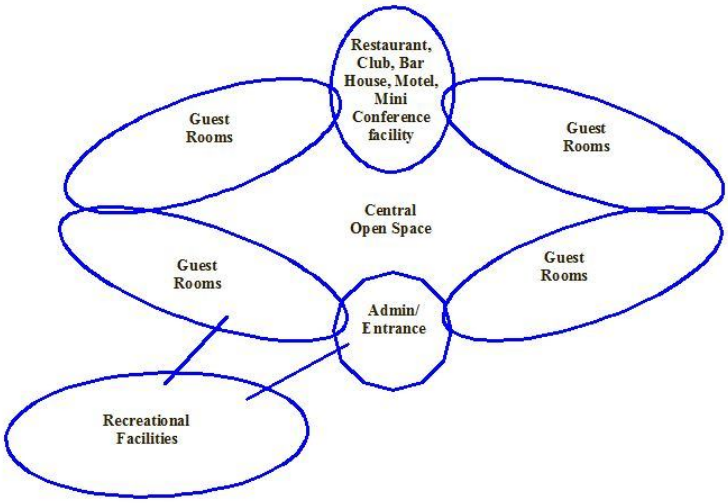


Figure 9: Spatial Relationship of Oguta Lake Motel (Source: Author, 2013)



Plate XXIV: Admin block and main entrance of the motel building (Source: www.imostateblog.com).

4.1.4 Building form and Expression

The building form suggests the ideas of the colonial rulers who planned it. It is that of immediate need for a motel. No single significant cultural expression is attached to

the building. Rather climatic factors were at the center of consideration. Below is a view of a typical unit in the staggered building block, and typical sections showing its features.



Plate XXV: Typical Single unit in the motel (Source: Authors Field Work, 2013).

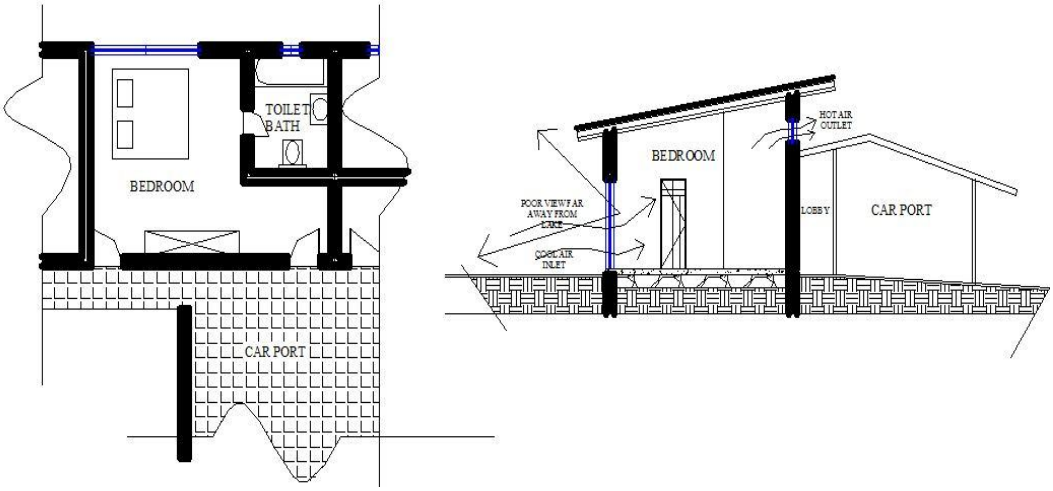


Figure 10: Layout and Section of Typical Single unit in the motel (Source: Authors Field Work, 2013).

4.1.5 Materials and technology

The dominant materials used for this structure are concrete, steel and glass. Concrete is manifested in the form of sandcrete block walling, structural columns and beams, and walkways. Sandcrete blocks used, were produced on site utilizing the

abundance of sharp sand sourced directly from Oguta Lake. Aluminum sheets and wood made up the roof construction, while steel served structural purposes both in reinforced concrete and steel support columns in garages and hand rails (as seen in plate XXVI below). Wood is also used as interior décor. Soft landscaping (green cover) was adopted in lawn areas (see plate XXV above). The construction of the project features foreign contracted workmanship combined with direct labour sourced locally.



Plate XXVI: Dominant building materials at Oguta lake resort (Source: Authors field work, 2013).

4.1.6 Services: Energy and energy sources

The facility runs on a standby 350 – 500KVA Diesel engine power generator as the source of the electric power. Power from the national grid is seen to be unreliable following the epileptic nature of supply. There is no renewable source of energy seen in any manifestation.

4.1.7 Services: Water and management strategies

The main source of water to the facility is an onsite bored hole from where water is pumped and stored in overhead water reservoir. This is sometimes distributed to the surrounding dwellings around the motel. Also there is no rainwater harvesting, and management strategy present. Hence following high annual rainfalls, flooding is

pertinent in the area. Large volumes of foul water are emptied into the lake. The plate below shows the residual effect of flooding in the area following poor water management strategies.



Plate XXVII: Residual effects of flooding (Source: Authors Field Work 2013).

Table 4 Assessment of extent of reflection of regenerative Principles

Principle 1: Whole Systems Design Integration					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Accountability of systems	• All systems (facilities) are accounted for and incorporated into the whole.		✓		
b. Involvement of systems in the whole	• All systems (facilities) are comprehensively treated within design and incorporated in the whole.		✓		
	• The whole system is constructed/ composed of collection (facilities) of mutually supportive relationships e.g. living Roof which captures storm water and reduces heat island.	✓			
c. Multiplicity of systems	• Entities perform more than one function (i.e. openings, roofs, walls, gardens etc.).		✓		
d. Redundancy approach to solutions	• Needs within the system (energy, water etc.) are met with multiple sources (just like nature).	✓			
Principle 2: Integration into Landscape					
Variables	**Features**	**Remarks**			

		Abs	Low	Med	Hi
a. Spread of building on site	• Vertical development.	✓			
	• Roof gardens used extensively over the roofs.	✓			
	• Use of onsite storm water treatment and ground water recharge.		✓		
b. Working with site topography and native landscape elements	• Integration of native landscape with development.		✓		
	• Letting nature inspire the design.			✓	
	• Preservation of site characteristics (trees and natural features of site).		✓		
	• The use of building elements that reflect local context.	✓			
	• Treatment of landscapes as interdependent and interconnected.		✓		
	• Use of forms inspired by nature.			✓	

Principle 3: Intelligent Limits						
Variables	**Features**	**Remarks**				
		Abs	**Low**	**Med**	**Hi**	
a. Reduced impact of building footprint.	• Minimal cover of site with impervious ground cover like asphalt and concrete paving to allow for ground water recharge.				✓	
	• Limited employment and reduced dependence on mechanical systems.		✓			

Principle 4: Concentration						
Variables	**Features**	**Remarks**				
		Abs	**Low**	**Med**	**Hi**	
a. Space utilized	• Building footprint impact.		✓			
	• Presence of useless/ redundant spaces.		✓			

b. Activity zoning	• Have maximum impact on system (building's) operation.			✓	
	• Each module is individually optimized.		✓		
Principle 5: Intelligent Construction					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. 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 biodegradable materials in building interiors.		✓		
b. Type of building material	• Use of local building materials like bamboo in cladding, etc.	✓			
	• Use of durable materials.				✓
	• Adequate utilization of natural materials like the rocks and water bodies.			✓	
c. Re-usability of building material	• Use of recyclable building material.		✓		
Principle 6: Bold Ecology					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Minimal energy use reduction	• Use of day-lighting.			✓	
	• Use of natural ventilation.			✓	
	• Passive design elements.			✓	
b. Source of water	• On-site sources.		✓		
	• Harvesting, processing and recycling.	✓			

c. Water conservation method	• On-site treatment.	✓			
d. Renewable sources of energy	• Use of solar panels, wind turbines and bio-gas.	✓			
e. Energy management methods	• Level of overdependence on mechanical systems to alter the climate.		✓		
	• Natural conditioning techniques such as planting, green roofs etc.		✓		

Principle 7: Community					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Homogenous entities	• Connectedness.		✓		
	• Disconnectedness.			✓	
b. Heterogeneous entities	• Connectedness.		✓		
	• Disconnectedness.				✓

Principle 8: Experience of Place					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Building materials	• Use of complimentary local landscape elements.		✓		
	• Use of resident building materials.		✓		
b. 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.		✓		

Principle 9: Culture					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Unique people or place culture	• Use of local cultural elements in design.	✓			
b. Foreign people or place culture	• Use of cultural elements of foreign origin in design.			✓	
c. Other biotic cultures	• Consideration for local organisms	✓			

(Source: Authors Field Work, 2013).

4.2 Case Study Two (Nike Lake Resort Hotel, Abakpa, Enugu State)

4.2.1 Background

Nike lake resort hotel is a property of the government of Enugu state. On 6th February, 1988, the resort hotel was officially commissioned by the late military head of state Lt. General Sani Abacha during the tenure of office of Colonel Robert Nnaemeka Akonobi as the military governor of the then Anambara state. However, presently the facility is managed by the renowned African Sun Hotels limited.

By design, the lake resort provides lodging and recreational services to a variety of vacationers. The lodging services provided includes one hundred and seventy five standard suites, nine executive suites, two diplomatic, and one presidential suite. The recreational services provided for are; pool, in house Gym, basketball court, table tennis and lawn tennis, while additional side attraction includes the bush bar.

4.2.2 General Site Planning and landscaping

The planning of the site generally depicts the idea of the architects whose design solutions at the time were centered on perceived need for an exclusive relaxation spot for the high profile and top ranking government officials, while at the same time

meeting predicted needs of future vacationers. Here, there is incorporation of the Nike Lake, which is the major natural site feature. Artificial landscape elements provided compliments the various facilities for recreation in the resort. The main building spreads out in three directions horizontally (as seen in plate XXVIII below), and up to three floors vertically (see plate XXIX below), housing various indoor facilities with lodging taking prominence. There is a deliberate use of soft and hard landscaping. Natural stones are exposed as landscape features, while vegetation on the site is moderate comprising few vegetative cover, Fruit trees, grass lawns, and palm trees which are of local origin.



Plate: XXVIII: Site planning and Landscape of Nike lake Resort Hotel (Source: Google Images, 2013).



Plate: XXIX: The resorts' recreational facilities (Source: Authors field work, 2013).

4.2.3 Spatial organization and design

The building consists of several services catered for, following the various facilities provided. At the ground floor, business units/ in house shopping exist alongside bar, restaurant, banquet and conference facilities, and outdoor recreational facilities. The upper floors house various suites up to the third which are double-banked, and provided with different views some towards the Lake others to the Cityscape. The figure below shows the spatial relationship of the various arms of the hotel structure.

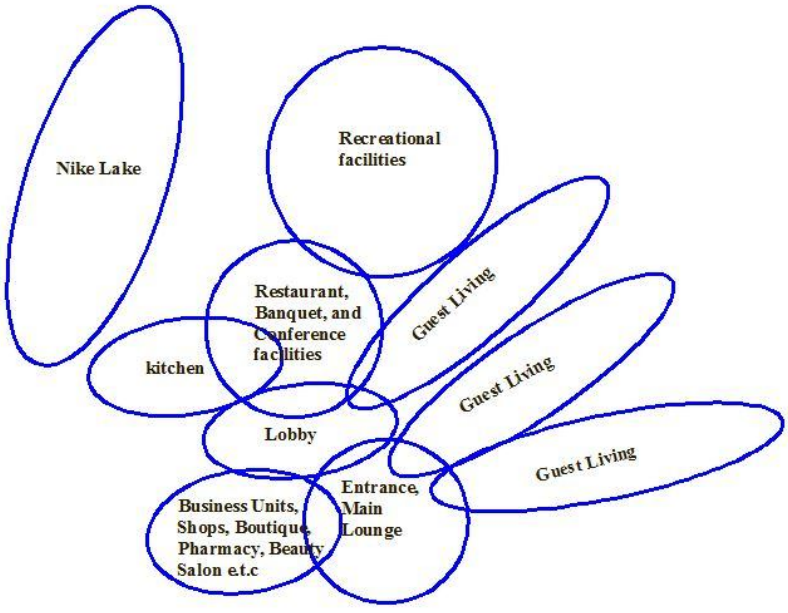


Figure 11: Spatial Relationship of the Nike Lake Resort Hotel (Source: Author, 2013)

4.2.4 Building form and Expression

The main building is a magnificent concrete structure which spreads outwards horizontally in three main directions, and vertically upwards up to three floors (see figure 12 below), housing the in house guests and hotels facilities. The building was raised to signify strength and wealth of the region following ideas of the then military government. This manifests in the use of exposed full length exterior facing columns in the facade. See plate XXX below. However in as much as the resort adds to positive image of the state, no significant local expression can be attributed to the building in form or in structure, but for the services offered and facilities provided.



Plate XXX: Building Facade and its Elements (Source: Author, 2013).

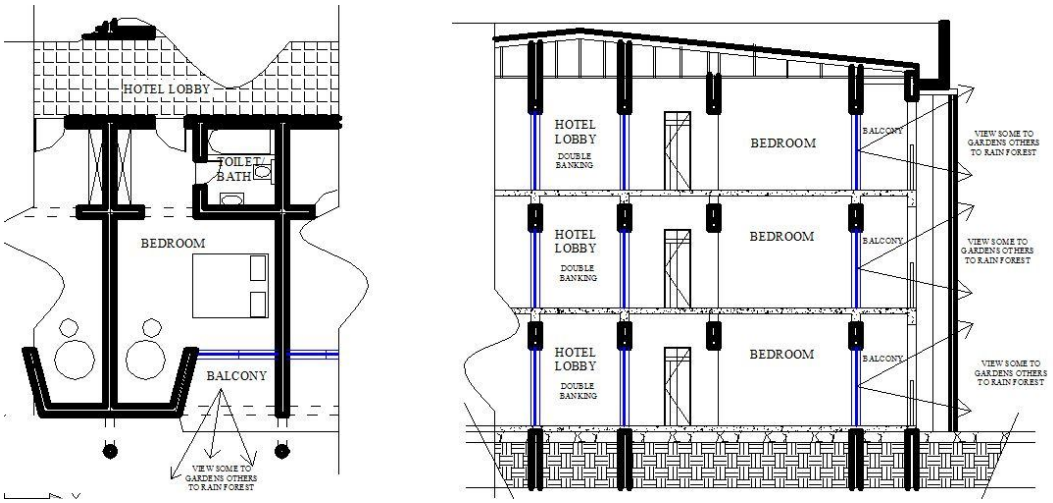


Figure 12: Layout and section of typical single unit at Nike Lake resort hotel (Source: Author, 2013).

4.2.5 Materials and technology

The main construction material used is concrete, steel, glass and wood. Concrete used is in the form of concrete block walling, structural concrete columns, beams and slabs reinforced in steel. Glass is used in openings while wood is used in the roof trusses and as a major ingredient of the interior décor, as seen in plate XXXI below.



Plate XXXI: Use of wood as a major component of the interior décor (Source: Authors field work, 2013).

Burnt earth bricks are applied as wall tiles around the entire exterior lower corner of the building. Natural stones are applied as landscape elements as seen in the plate below.



Plate XXXII: Materials employed in the building and landscape (Source: Authors Field Survey, 2013).

4.2.6 Services: Energy and energy sources

Nike lake resort hotel runs on dual dependency partly on the power supply from the national electric grid and almost totally on the diesel engine power plant installed on site (see plate XXXIII below). There is no use of renewable source of energy. However, simple electrical appliances (e.g. fans) are provided in addition to Air Conditioners (AC), to cut down over dependence on AC's for cooling.



Plate XXXIII: Diesel engine plant on site (Source: Authors Field Survey, 2013).

4.2.7 Services: Water and management strategies

The main source of water to the facility is an onsite bored hole from where water is pumped and stored in overhead water reservoirs. As seen in the plate below.



Plate XXXIV: Overhead water reservoir (Authors Field Survey, 2013).

This is distributed to the building and facilities around the hotel as the main source of water, to meet the demand for water. Also there is no rainwater harvesting, and management strategy present. The basic strategy employed involves use of constructed drainages and culverts which carry and empty large volumes of storm water into the town's mainstream after every downpour.

Table 5 Assessment of extent of reflection of regenerative principles

Principle 1: Whole Systems Design Integration					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Accountability of systems	• All systems (facilities) are accounted for and incorporated into the whole.			✓	
b. Involvement of systems in the whole	• All systems (facilities) are comprehensively treated within design and incorporated in the whole.			✓	
	• The whole system is constructed/ composed of collection (facilities) of mutually supportive relationships e.g. living Roof which captures storm water and reduces heat island.		✓		
c. Multiplicity of systems	• Entities perform more than one function (i.e. openings, roofs, walls, gardens etc.).		✓		
d. Redundancy approach to solutions	• Needs within the system (energy, water etc.) are met with multiple sources (just like nature).	✓			

Principle 2: Integration into Landscape					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Spread of building on site	• Vertical development.			✓	
	• Roof gardens used extensively over the roofs.	✓			
	• Use of onsite storm water treatment and ground water recharge.		✓		
b. Working with site topography and native landscape elements	• Integration of native landscape with development.		✓		
	• Letting nature inspire the design.			✓	
	• Preservation of site characteristics (trees and natural features of site).		✓		
	• The use of building elements that reflect local context.	✓			
	• Treatment of landscapes as interdependent and interconnected.		✓		
	• Use of forms inspired by nature.			✓	
Principle 3: Intelligent Limits					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Reduced impact of building footprint.	• Minimal cover of site with impervious ground cover like asphalt and concrete paving to allow for ground water recharge.			✓	
	• Limited employment and reduced dependence on mechanical systems.		✓		
Principle 4: Concentration					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**

a. Space utilized	• Building footprint impact.			✓	
	• Presence of useless/ redundant spaces.		✓		
b. Activity zoning	• Have maximum impact on system (building's) operation.				✓
	• Each module is individually optimized.			✓	

Principle 5: Intelligent Construction					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. 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 biodegradable materials in building interiors.			✓	
b. Type of building material	• Use of local building materials like bamboo in cladding, etc.	✓			
	• Use of durable materials.				✓
	• Adequate utilization of natural materials like the rocks and water bodies.			✓	
c. Re-usability of building material	• Use of recyclable building material.		✓		

Principle 6: Bold Ecology					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Minimal energy use reduction	• Use of day-lighting.			✓	
	• Use of natural ventilation.		✓		
	• Passive design elements.		✓		

b. Source of water	• On-site sources.		✓		
	• Harvesting, processing and recycling.	✓			
c. Water conservation method	• On-site treatment.	✓			
d. Renewable sources of energy	• Use of solar panels, wind turbines and bio-gas.	✓			
e. Energy management methods	• Level of overdependence on mechanical systems to alter the climate.			✓	
	• Natural conditioning techniques such as planting, green roofs etc.		✓		

Principle 7: Community					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Homogenous entities	• Connectedness.			✓	
	• Disconnectedness.		✓		
b. Heterogeneous entities	• Connectedness.		✓		
	• Disconnectedness.			✓	

Principle 8: Experience of Place					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Building materials	• Use of complimentary local landscape elements.			✓	
	• Use of resident building materials.		✓		
b. 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.		✓		
Principle 9: Culture					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Unique people or place culture	• Use of local cultural elements in design.	✓			
b. Foreign people or place culture	• Use of cultural elements of foreign origin in design.			✓	
c. Other biotic cultures	• Consideration for local organisms		✓		

(Source: Authors Field Work, 2013).

4.3 Case Study Three (Le' Meridien Ibom Hotel And Golf Resort, Uyo, Akwa Ibom State)

4.3.1 Background

Le' Meridian Ibom Hotel and Golf Resort is rated as a four star resort hotel. Ritson Golf Design were appointed in 2002 as golf course architect consultants to Glen Kemp to design a new 18 hole, par 72, championship standard golf course of over 7,000 yards for Le' Meridien Ibom Hotel Golf Resort for the Ministry of Industry, Tourism and Commerce in Akwa Ibom State, Nigeria. The hotel was opened in December 2007, following the Golf Course opening in March same year by Colin Montgomerie, Retief Goosen and Nancy Lopez and is now a premier location for top golf professional tournaments in Nigeria.

Le' Meridien Ibom Hotel is situated on a hilltop ridge, with spectacular views over the surrounding rainforest stretching to the mountains of Cameroon. The hotel and Golf resort is located along Nwaniba road, Uruan, Uyo, Akwa Ibom state, Nigeria. The main facility is a storey building hotel with 163 Rooms and 26 suites. The resort is about 45 minutes' drive from Umuahia, 90 kilometers from the Calabar Airport and 160 kilometers from the Port Harcourt Airport, It is owned by the Akwa Ibom state government but presently managed by the Le Meridian Group, known also as Starwood Hotels.

4.3.2 General site Planning and landscaping

The resort is nestled on a hilltop amidst a palm- tree forest, with efforts directed towards its incorporation to the rain forest landscape in an ecologically friendly manner. Because of the location of the resort, there is deliberate incorporation of the facility into the surrounding natural landscape greenery. The facility consists of a large built up area, spreading horizontally in various directions and a single storey vertically (See Plate XXXV and XXXVI). Le' Meridien has one hundred hectares of tropical garden, a fitness and health club, outdoor children's and adult pools, two Jacuzzis, four standard tennis courts and one hundred and one squash facilities. The garden also adds to the relaxing atmosphere of the complex with a Gazebo overlooking the palm tree forest.

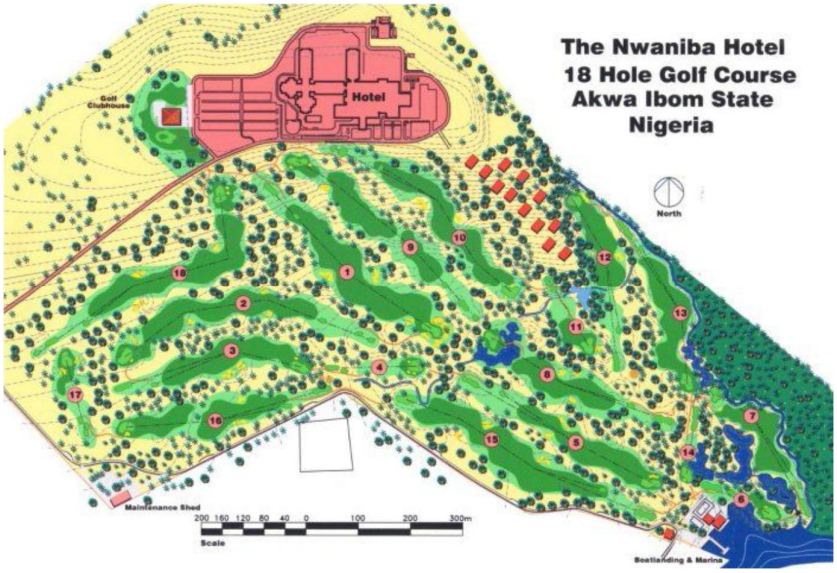


Plate XXXV: Overall Site Planning and landscape of the Le' Meriden (Source: http://Le Meridien hotels.com/photo_gallery.htm)



Plate XXXVI: Built up area, Site Planning and landscape of the Le' Meriden (Source: Google images, 2013).

4.3.3 Spatial organization and design

The facilities here are organized based on function. There is the engineering department located at one end of the site. Conference and banquet facilities exist as integrated parts of the structure at ground level alongside business facilities. The facility also consist of 1 Chinese restaurant and 2 bars, a Business Centre, beauty salon, 3 shops all in-house, and Outdoor swimming pool and Jacuzzi 18-hole golf course with club

house, Fitness Centre, Sauna, 2 tennis courts, 2 squash courts, a Heliport, 11 meeting rooms, and a herbarium.

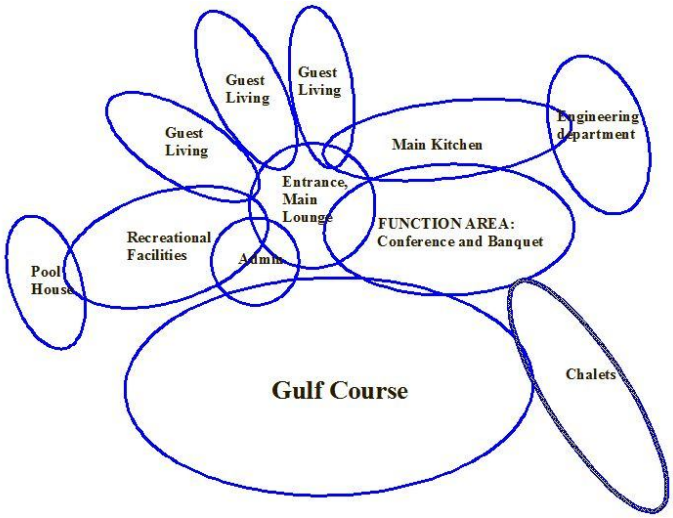


Figure 13: Spatial relationship of the Le 'Meridien Resort (Source: Author, 2013)

4.3.4 Building form and Expression

Le' Meridien Ibom Hotel and Golf Resort is a magnificent concrete structure amidst hilltop of a tropical rain forest. The structure is zoned into several areas integrated in the same entity. The building has terraced rooms and suites (see Figure 11 below), some overlooking the natural greenery, while others the landscaped courtyard (as seen in plate XXXVII below). Within the building, several areas (Accommodation, conference, fitness, bar, dining/ restaurant, are interconnected making up the large edifice both in form and structure. The resort is known mostly for the services provided. Also no significant local expression can be attributed to the building in form or in structure but for the acclaimed services.



Plate XXXVII: Terraced rooms overlooking the landscaped courtyard (Source: Authors field work, 2013).

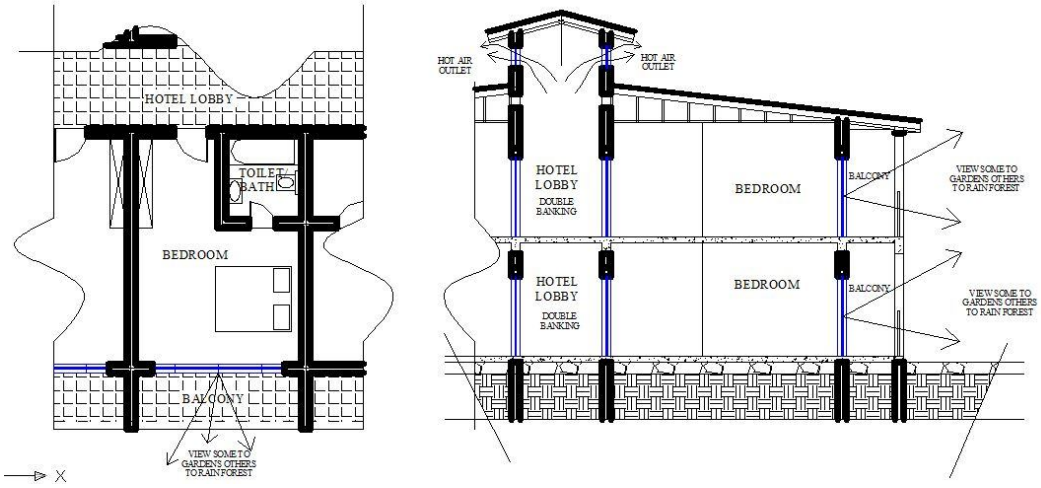


Figure 14: Layout and section of typical single unit at the Le meridian hotel (Source: Author, 2013).

4.3.5 Materials and technology

The building materials used in the Le' Meridien consists dominantly of concrete, steel and glass for the main building. Wood is used mostly in the roof construction, and as interior décor. Outdoor gazebos (see plate XXXIX) exist which are of local building materials (Bamboo and thatch roof). Also the dominant roofing material is corrugated Aluminum finished sand blast (see plate XXXVIII below).



Plate XXXVIII: The dominant building materials used at the Le' Meridien (Source: Authors Field Work, 2013).



Plate XXXIX: Gazebos and landscape materials used in the garden at the Le' Meridien Ibom Hotel (Source: Authors Field Work, 2013).

The landscaping consists of a mixture of soft and hardscape. The soft-scape consists of green lawns, hedges, shrubs and trees of both local and foreign origin. While the hard-scape consist of asphaltic roads, tiled concrete walkways and interlocking stones, as can be seen in the plate below;



Plate XL: Mixture of soft and Hard Landscape at the Le' Meridien Ibom Hotel (Source: Authors Field Work, 2013)

4.3.6 Services; Energy and energy sources

The main source of electric power to the resort is a heavy duty diesel engine power generator. Power from the national grid is sometimes utilized but this is not depended on as it is usually unstable. The plate below shows a view of the heavy duty power generator with its exhaust emitting gaseous substances into the atmosphere.



Plate XLI: Power plant at the Le' Meridien (Source: Authors Field Work, 2013).

4.3.7 Services; Water sources and management strategies

The main source of water here is an onsite bored hole, from which water is pumped to the reservoir. An onsite water treatment plant exist which is used to treat water collected from the building, for use in various facilities of the resort hotel, except portable water. There is also rain water collection scheme for watering flowers. The

image below shows the onsite water treatment plant used for treating waste water, to be reused in the facility.



Plate XLII: The Onsite water collection and treatment plant (Source: Authors Field work, 2013).

Table 6 Assessment of extent of reflection of regenerative Principles

Principle 1: Whole Systems Design Integration					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Accountability of systems	• All systems (facilities) are accounted for and incorporated into the whole.			✓	
b. Involvement of systems in the whole	• All systems (facilities) are comprehensively treated within design and incorporated in the whole.				✓
	• The whole system is constructed/ composed of collection (facilities) of mutually supportive relationships e.g. living Roof which captures storm water and reduces heat island.			✓	
c. Multiplicity of systems	• Entities perform more than one function (i.e. openings, roofs, walls, gardens etc.).		✓		
d. Redundancy approach to solutions	• Needs within the system (energy, water etc.) are met with multiple sources (just like nature).		✓		
Principle 2: Integration into Landscape					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**

a. Spread of building on site	• Vertical development.		✓		
	• Roof gardens used extensively over the roofs.	✓			
	• Use of onsite storm water treatment and ground water recharge.			✓	
b. Working with site topography and native landscape elements	• Integration of native landscape with development.				✓
	• Letting nature inspire the design.			✓	
	• Preservation of site characteristics (trees and natural features of site).				✓
	• The use of building elements that reflect local context.		✓		
	• Treatment of landscapes as interdependent and interconnected.			✓	
	• Use of forms inspired by nature.			✓	
Principle 3: Intelligent Limits					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Reduced impact of building footprint.	• Minimal cover of site with impervious ground cover like asphalt and concrete paving to allow for ground water recharge.		✓		
	• Limited employment and reduced dependence on mechanical systems.		✓		
Principle 4: Concentration					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Space utilized	• Building footprint impact.			✓	
	• Presence of useless/ redundant spaces.		✓		

b. Activity zoning	• Spaces Have maximum impact on system (building's) operation.				✓
	• Each module is individually optimized.			✓	
Principle 5: Intelligent Construction					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. 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 biodegradable materials in building interiors.			✓	
b. Type of building material	• Use of local building materials like bamboo in cladding, etc.		✓		
	• Use of durable materials.				✓
	• Adequate utilization of natural materials like the rocks and water bodies.			✓	
c. Re-usability of building material	• Use of recyclable building material.			✓	
Principle 6: Bold Ecology					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Minimal energy use reduction	• Use of day-lighting.				✓
	• Use of natural ventilation.			✓	
	• Passive design elements.		✓		
b. Source of water	• On-site sources.		✓		
	• Harvesting, processing and recycling.		✓		

c. Water conservation method	• On-site treatment.			✓	
d. Renewable sources of energy	• Use of solar panels, wind turbines and bio-gas.	✓			
e. Energy management methods	• Level of overdependence on mechanical systems to alter the climate.		✓		
	• Natural conditioning techniques such as planting, green roofs etc.			✓	

Principle 7: Community					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Homogenous entities	• Connectedness.			✓	
	• Disconnectedness.		✓		
b. Heterogeneous entities	• Connectedness.		✓		
	• Disconnectedness.			✓	

Principle 8: Experience of Place					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Building materials	• Use of complimentary local landscape elements.				✓
	• Use of resident building materials.		✓		
b. 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.		✓		

Principle 9: Culture					
Variables	**Features**	**Remarks**			
		Abs	**Low**	**Med**	**Hi**
a. Unique people or place culture	• Use of local cultural elements in design.		✓		
b. Foreign people or place culture	• Use of cultural elements of foreign origin in design.				✓
c. Other biotic cultures	• Consideration for local organisms		✓		

(Source: Authors Field Work, 2013).

4.4. Data Analysis

As a result of the analysis/ evaluation of data gathered from the various cases studied based on the extent of reflection of the features of regenerative architecture principles, a degree of variation on the levels of reflection exists among the cases studied. Following this, a scaling system is developed to better show the levels of reflection of each case, in comparison to the other cases. The scaling system adopted is as follows:

Ratings = Excellent; Good; Fairly good; Fair; and Poor. Below is a breakdown of the criteria for the assignment of each scale factor to the variables of each Principle, following the evaluation of the features of the variables studied.

Excellent: An excellent rating shows that all the feature(s) of the variable being considered have high remarks from the case study assessment criteria;

Good: A good rating shows that the feature(s) of the variable under consideration have medium remark(s) or a combination of high and medium remark(s) from the case study assessment criteria;

Fairly good: A fairly good rating shows that the feature(s) of the variable under consideration have a combination of medium and low remark(s) from the case study assessment criteria;

Fair: A fair rating shows that the feature(s) of the variable under consideration have low remarks from the case study assessment criteria; and

Poor: A poor rating shows that the features of the variable under consideration have either absent remark(s) or a combination of absent and low remark(s).

Various other obtainable combinations also results in the scaling system adopted and are therefore described as below:

Note that '> symbol', implies 'greater than', while '< symbol', implies 'less than'.

A > 50% Low ranking + <50% Absent ranking = Fair Remark

While > 50% Absent ranking + <50% Low ranking = Poor Remark

A >50% Medium ranking + <50% Low ranking = Fairly Good Remark

While >50% Low ranking + <50% Medium ranking = Fair Remark

A >50% High ranking + <50% Medium ranking = Excellent Remark

While >50% Medium ranking + <50% High ranking = Good Remark

It is important to note however that the goal of regenerative architecture tends towards an excellent remark.

For features/ variables tending towards positive attainment, supportive Rankings are employed. While for those tending towards negative attainment, unsupportive or negative Rankings are used. The supportive Rakings are the aforementioned above. i.e Poor; Fair; Fairly Good; Good; and Excellent. While unsupportive Rankings used are: Worst; Bad; Fairly Bad; Fair; and poor, progressively from the worst rank to the best rank.

Table 7: Summary of case studies reflection of the principles of regenerative architecture.

CASE STUDIES / PRINCIPLES	CASE STUDY ONE: OGUTA LAKE MOTEL, OGUTA, IMO STATE	CASE STUDY TWO: NIKE LAKE RESORT HOTEL, ABAKPA, ENUGU STATE	CASE STUDY THREE: LE'MERIDIEN IBOM HOTEL AND GOLF RESORT, UYO, AKWA IBOM STATE
PRINCIPLE 1/ Variables	**WHOLE SYSTEMS DESIGN INTEGRATION**		
a. Accountability of systems	Fair	Fairly Good	Fairly Good
b. Involvement of systems in the whole	Fair	Fairly Good	Good
c. Multiplicity of systems	Fair	Fair	Fair
d. Redundancy approach to solutions	Poor	Poor	Fair
PRINCIPLE 2/ Variables	**INTEGRATION INTO LANDSCAPE**		
a. Spread of building on site	Poor	Fair	Fairly Good
b. Working with site topography and native landscape elements	Fair	Fair	Good
PRINCIPLE 3/ Variables	**INTELLIGENT LIMITS**		
a. Reduced impact of building footprint.	Fairly Good	Fair	Fair
PRINCIPLE 4/ Variables	**CONCENTRATION**		
a. Space utilized	Fair	Fairly Good	Fairly Good
b. Activity zoning	Fairly Good	Good	Good
PRINCIPLE 5/ Variables	**INTELLIGENT CONSTRUCTION**		
a. Building materials	Fairly Good	Fairly Good	Fairly Good
b. Type of building material	Fairly Good	Fairly Good	Fairly Good
c. Re-usability of building material	Fair	Fair	Fairly Good
PRINCIPLE 6/ Variables	**BOLD ECOLOGY**		
a. Minimal energy use reduction	Fairly Good	Fairly Good	Fairly Good
b. Source of water	Fair	Fair	Fair
c. Water conservation	Poor	Poor	Good

method			
d. Renewable sources of energy	Poor	Poor	Poor
e. Energy management methods	Fair	Fair	Fairly Good
PRINCIPLE 7/ Variables	**COMMUNITY**		
a. Homogenous entities	Fairly Good	Fairly Good	Fairly Good
b. Heterogeneous entities	Fairly Good/Bad	Fairly Good/Bad	Fairly Good/Bad
PRINCIPLE 8/ Variables	**EXPERIENCE OF PLACE**		
a. Building materials	Fairly Good	Fairly Good	Good
b. Mode of construction	Fair	Fairly Good	Fairly Good
PRINCIPLE 9/ Variables	**CULTURE**		
a. Unique people or place culture	Poor	Poor	Fair
b. Foreign people or place culture	Fairly Good/Bad	Fairly Good/Bad	Good/Bad
c. Other biotic cultures	Poor	Fair	Fair

Summary of case study assessment sheet (Source: Researcher, 2013).

From table 7 above, the following deductions are made.

Principle 1: All the cases studied show various ways of reflection of this principle. However, two cases -Nike Lake Resort and The Le' Meridien, show greater reflection of the principle, with the later having the greatest.

Principle 2: All the cases show a level of integration into the landscape. However, Oguta lake resort motel show least integration while The Le' Meridien show highest integration.

Principle 3: Main structure at one of the cases -Oguta Lake Resort, is the least spread on site with fairly good limits, while the others -Nike Lake and The Le' Meridien spread over large areas with fair limits in relation to the ecology.

Principle 4: The concentration of the main facilities at the cases studied, in relation to the area around the site shows that most of/ all the cases are fairly concentrated on site. However, Oguta Lake Resort shows a fairly less concentration.

Principle 5: The Le' Meridien show a fairly good intelligent construction when compared to the other cases –Oguta Lake Resort and Nike Lake Resort which show a fairly good but slightly lower intelligent construction.

Principle 6: The Le' Meridien show a fairly good bold ecology in comparison to the other cases whose average rating sum up to being fair.

Principle 7: All the cases show a fairly good sense of community with related entities, but fairly bad sense of community to unrelated entities.

Principle 8: The study shows that Oguta Lake Resort ironically has a fairly good but least experience of place, while the Le' Meridien offers a higher experience of place.

Principle 9: All the cases studied show a poor adoption of the cultural elements of their unique places/ location, and a higher or fairly bad adoption of foreign cultural elements. However, The Le' Meridien and Nike Lake Resort show a fair consideration for biotic cultures, while Oguta Lake Resort has the least consideration.

Furthermore, a number of deductions have been made from table 7 above to further analyze the data obtained. This is represented by the figures given below. The values used do not have quantitative attachment but are adopted for illustrative purposes and therefore represents the following;

0 = Poor Remark;

1 = Fair Remark;

2 = Fairly Good Remark;

3 = Good Remark; and

4 = Excellent Remark.

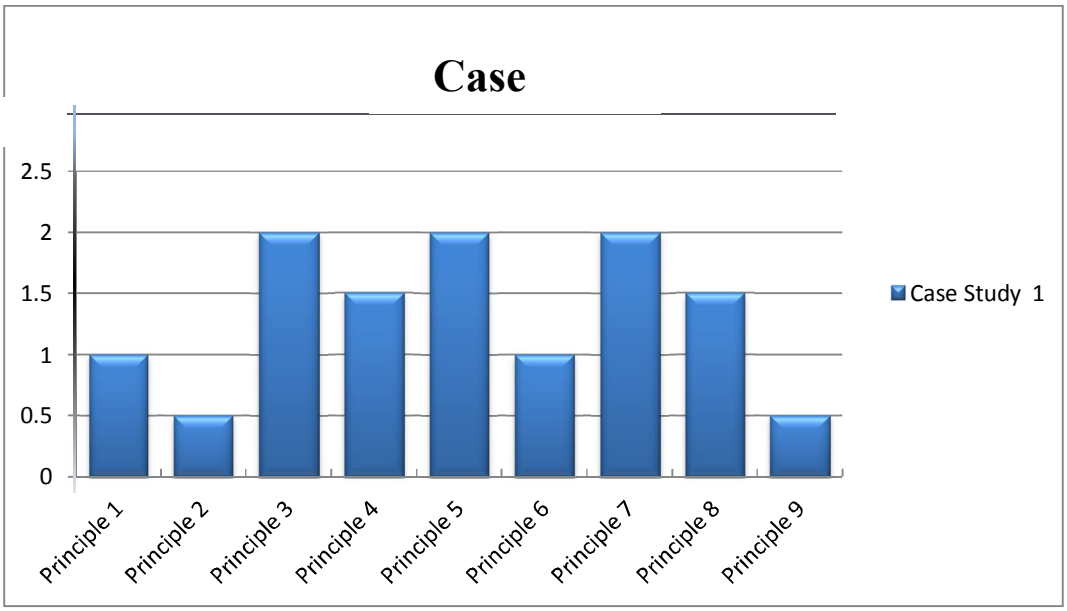


Figure 15: The level of reflection of regenerative architecture principles by case study 1 (Source: Author, 2013).

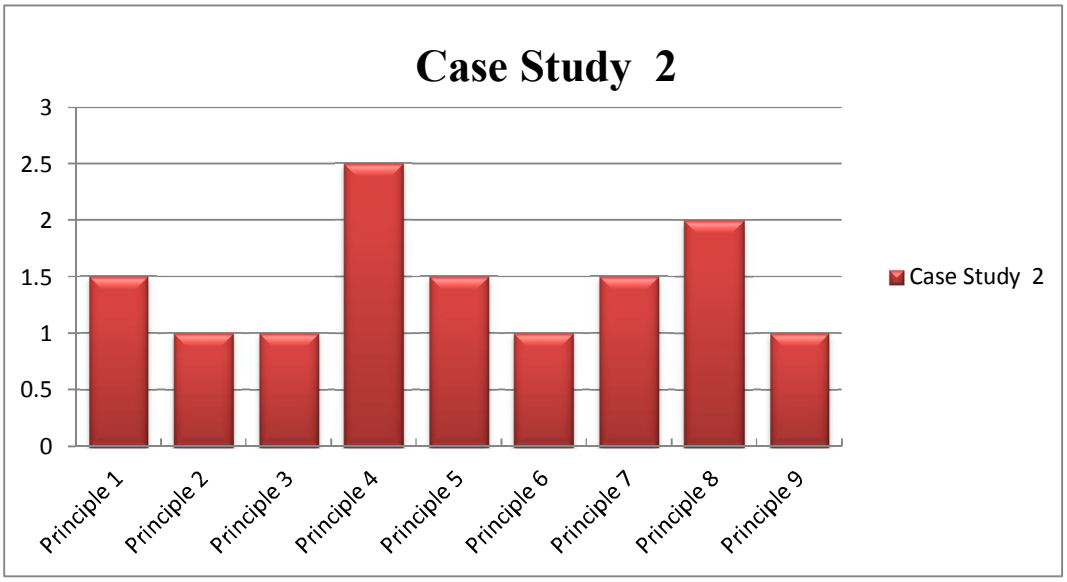


Figure 16: The level of reflection of regenerative architecture principles by case study 2 (Source: Author, 2013).

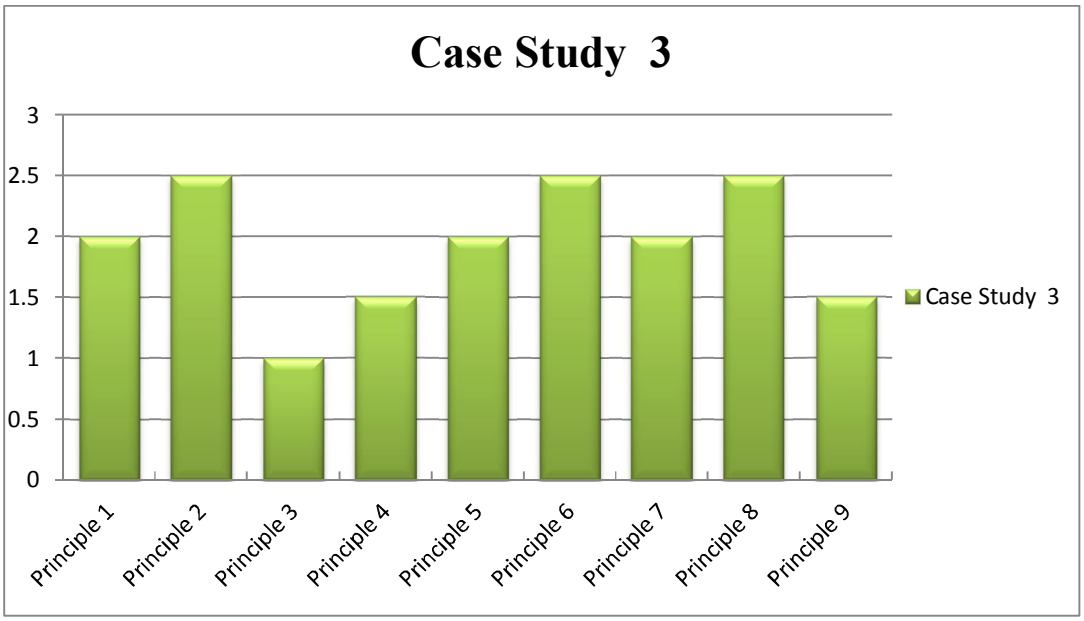


Figure 17: The level of reflection of regenerative architecture principles by case study 3 (Source: Author, 2013).

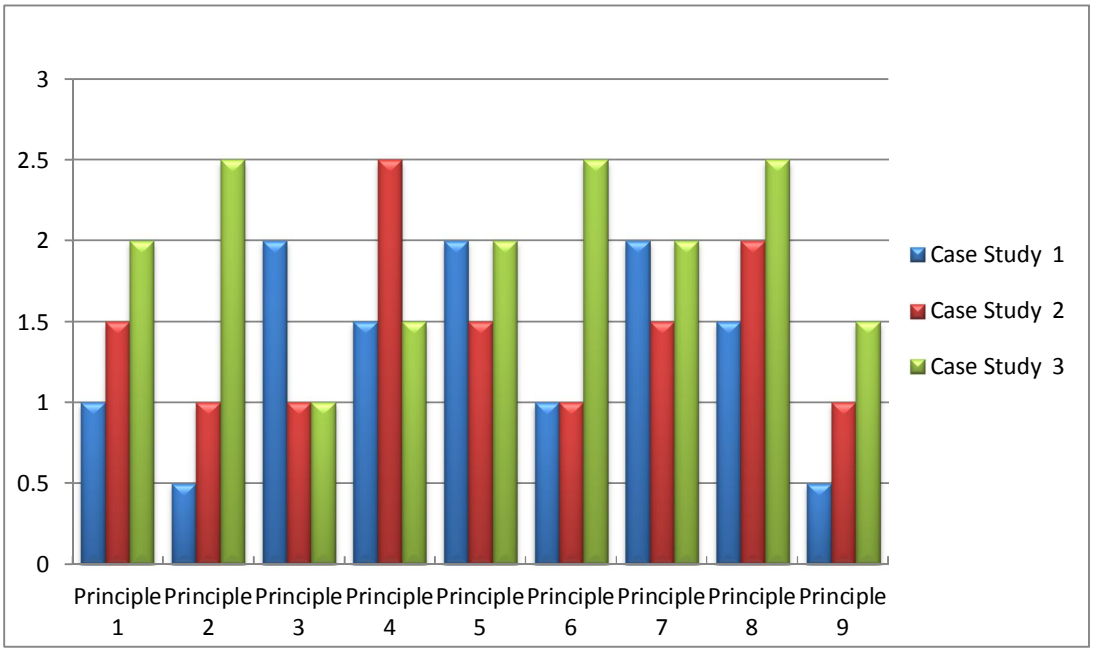


Figure 18: Comparison of the levels of reflection of regenerative architecture principles by the cases studied (Source: Author, 2013).

CHAPTER FIVE

FINDINGS AND DISCUSSION

5.0 INTRODUCTION

This chapter contains the discussion of findings from the preceding chapter(s). It presents regenerative architecture principles identified from literatures and developed into the framework for this research. It therefore highlights the findings from study, and how they help in answering the research questions posed in chapter one.

5.1 Overall Findings

5.1.1 Findings from checklist for visual surveys and observations

The checklist captured the level of reflection of the feature(s) of the variable(s) of each principle considered separately. In the previous chapter, data obtained from the checklists for each of the cases, were presented and later analyzed in other to give a coordinated body of knowledge regarding the position of these cases while leading further to an understanding of the implications of the phenomenon in real live scenario. The overall findings here include the following:

Regenerative architecture is yet at infancy in South-eastern Nigeria because all the cases show a low incorporation of the features of regenerative architecture;

Choice of location or siting of one of the cases -Le 'Meridien Ibom Hotel and Golf Resort, amidst hilltop of tropical green lush- shows that location could be a major influencer of the success of regenerative architecture;

Sustainable initiatives can help reduce resource use as seen in water management/ treatment at the Le meridian Hotel, while its absence results to environmental deterioration as seen at Oguta lake motel;

Bringing people closer to, positive contact with nature causes them to improve on it. This is seen in the embankments created along the shores of the Nike Lake at Nike lake resort hotel and also in the greening of deforested areas at the Le Meridien hotel while the disconnection featured at Oguta lake results in neglect of the Lake shorelines to deterioration arising from erosion and Human activities.

Building materials if well considered could contribute to sustainable built environment, while adding value to the building-environment relationship as seen in the use of native natural materials at the Le Meridien, and use of natural stones at Nike Lake. The absence will imply a reduced value of building-environment relationship.

5.1.2 Findings from structured interviews

The data obtained here basically include the facility profiles, sustainability initiatives, operations, frequently used facilities, most unused facility, peak and off-peak periods, materials and resource-reuse in the facility, energy sources and resources, water management strategies, nature of waste and disposal system, which have been reflected in the previous chapter. The findings however include the following:

The older facilities were only based on perceived immediate need for getaway spots hence human need was put first as against care for the environment.

Most of the resort hotels have barely adopted regenerative initiatives in their planning, construction and operation.

The hotel with the highest popularity in the study area shows a greater integration of regenerative initiatives.

The most unused facilities are those without direct or visual contact with nature. This included the rooms and recreation park at Oguta lake motel sited far away from the main site feature (the lake), while suites overlooking the lake at Nike lake hotel and the rain forest at the Le Meridien have recorded frequent preference of use.

Bringing people closer to positive contact with nature by way of the built environment causes a conscious improve on it as have been seen in the use of stone embankment's to mitigate silting at the Nike lake hotel. Also the Le Meridien has adopted some thriving vegetation of foreign origin to complement for lost or deforested vegetation within the hilltop.

There is overdependence on unsustainable sources of energy and resources as seen in the diesel powered plants featured in all the cases, and an outright absence of renewable sources.

The location of one of the cases within hilltop of tropical rain forest (integrated into nature) creates a cooler building cutting down energy demand for cooling the structure, also the passive strategies adopted at Oguta motel have resulted in a little lesser demand for unsustainable energy for cooling.

5.2 Discussion Of Findings

Discussion of findings here is basically to show how the research questions have been answered. The following presents the research questions and attempts to answer them.

Question I. What features of regenerative design are suitable for achieving sustainable Resort Hotel development?

In order to address this question rigorous and in-depth study and research into regenerative architectural design and principles have been carried out presenting the nine architecturally inclined principles of regenerative architecture identified. The features of these principles have been presented also in chapter two of this thesis report (see Table 1 chapter two) where the principles are out listed alongside their architectural features in a tabular form. As the main aim of this research is to develop a framework conforming to the principles of regenerative architecture for the design of

sustainable resort hotels in south-eastern Nigeria, a framework indicating the architectural features of these principles and how they relate to the planning, construction, and running of resort hotels have been developed. See figure 13 below.

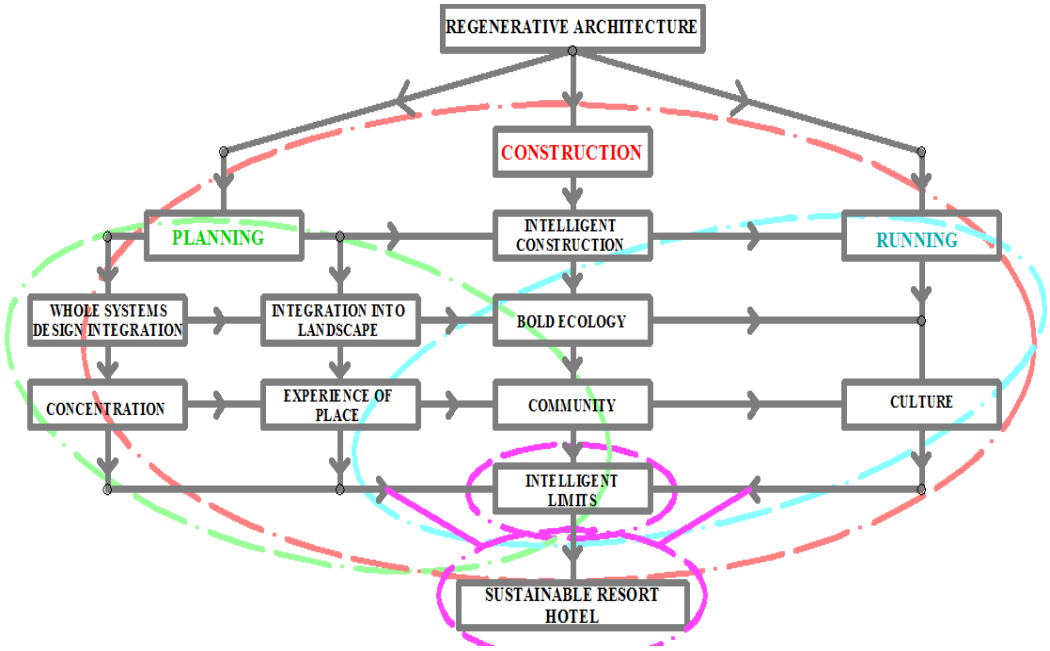


Figure 19: Regenerative Architecture framework for design of Sustainable Resort Hotels (Source: Author, 2013)

The goal of regenerative architecture is to arrest damage to nature by harmonizing the built environment with nature surrounding it. Hence the developed framework for resort hotel design is organized in circles at all stages of planning, construction and running of the facility in such a way that needs of the system are meet reasonably within the system as to operate within the limits. This in design terms can be explained as utilizing nature as the generator of the design, the material of the design, the builder of the design, and the operator of the design.

Question II. How close do built designs of resort hotels in South-Eastern Nigeria come in realizing regenerative design principles?

The data presentation chapter of this thesis report has given in-depth analysis of data collected from case studies in a bid to address this question. It gave a vivid

description of the levels of reflection of regenerative architecture principles both qualitatively and graphically. The study revealed that features of regenerative architecture have been applied in small patches amounting to an overall below average reflection of the principles bearing in mind that the goal of regenerative architecture is an excellent remark which is to harmonize with nature.

Question III. What practical limitations to success exist?

One consistent theme throughout the resorts visited was the issue of luxury in the industry. The hotels tend to have a preset luxury image of themselves and attempts to protect it at whatever costs. Also the nature of guests occupying these facilities has been those seeking maximum comfort and recreation hence resulting to the hotelier's adoption of several techniques, equipment's and strategies to achieve this satisfaction which mostly have not been sympathetic to nature. Some of these included the epileptic nature of power supply to the facilities from the grid resulting to the over dependence on unsustainable sources to meet power needs which mostly runs for 24 hours. Next is the nature, quantity and quality of water required in the facilities coupled with the insufficient supply from the grid which has forced hoteliers to provide clean water at all costs. Also inadequate knowledge and technologies for water and waste treatment/ management or its total absence have resulted to incessant waste disposal as have been observed at the shores of Oguta Lake, and the emptying of polluted waste water into Oguta Lake, and the Nike Lake.

Question IV. What features of regenerative design are peculiar to the region?

The scope of this study was basically contained within South-eastern Nigeria or the tropical rain forests or the warm humid climate. Apart from regenerative architecture features identified generally, rainfall and sunshine are the most peculiar to the area which have also shaped the geography of the region. These elements hold great

potentials but have not been fully incorporated into resort hotel designs here. The amount of rain fall averages about 2100mm and lasts for greater part of the year while the dry season is shortly experienced between December and February which corresponds to the harmattan period prevalent in Nigeria. Thus water needs within the facility can be greatly addressed by designing systems for harvesting rain water for use alongside treatment of grey water for non-portable use.

Sunshine also holds great potential for the generation of solar energy but has not been harnessed in resort hotels here. Therefore power needs within resort facilities can be greatly met by utilizing already popularizing solar energy systems available today. Tropical green lush and existing water bodies are also abundant in the region and holds great potential as energy and natural resources adoptable in resort hotel designs.

Passive design strategies are also particular of this region made manifest in single banking of rooms with openings for air inlet at windward and air outlets at leeward sides of a building hence reducing energy demand for cooling the structure.

Question V. How can the principles of Regenerative Architecture aid in the design and development of sustainable Resort Hotels?

To answer this question, a design proposal utilizing the framework developed from this study for the design of sustainable resort hotels conforming to the principles of Regenerative Architecture have been generated for Oguta Lake to serve as an example for South-eastern Nigeria.

CHAPTER SIX

DESIGN REPORT

This chapter gives concise information about the design proposal. It is an attempt to answer the last research question via demonstration of architectural design. It contains the site location details, site analysis, site zoning, site planning, design considerations and philosophy/ concept, accommodation schedules, and regenerative design principles and strategies demonstrated on site and in the design of Oguta Blue Lake Resort Hotel.

6.1 The Site and Environs

Oguta Lake is situated in Oguta Local Government Area of Imo State, in South-Eastern Nigeria; a region characterized as warm humid climate or tropical rain forest. The figure below displays series of maps narrowing the broad Nigerian context to Oguta.

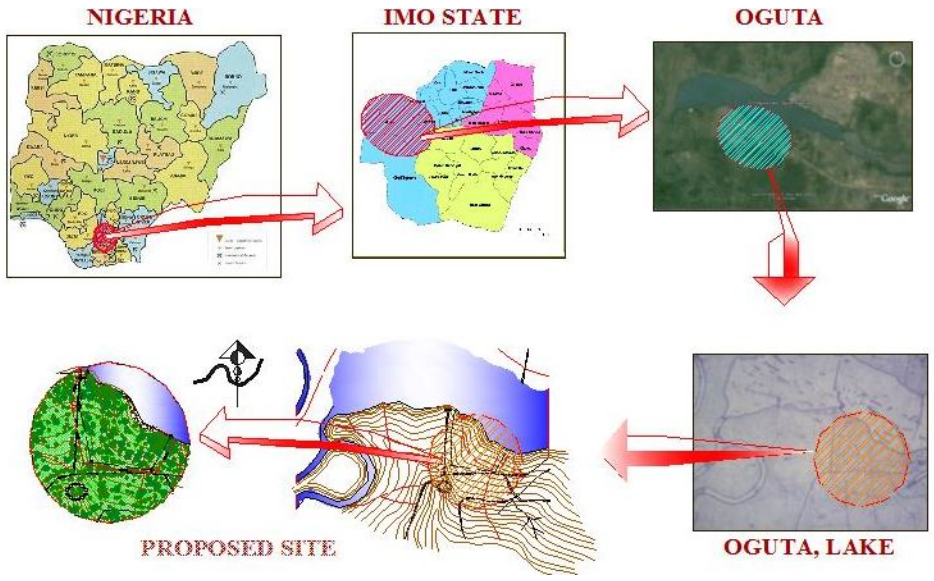


Figure 20: Location of the Site (Source: Author 2013)

Oguta is made up of Oguta I, II and III sited around the lake as can be seen in plate XLIII below.

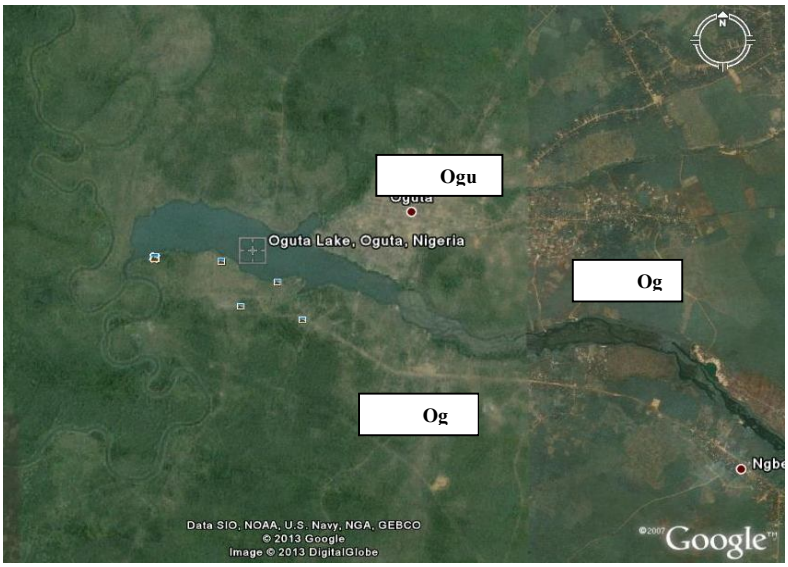


Plate XLIII: Oguta and Environs (Source: Google images, 2013)

Oguta I is the traditional Centre of the town, located at the East Bank of the lake, Oguta II is on the South Bank of the lake, the area mapped for recreation housing the Golf course, Kalabari beach and some European Trading firms as well as their Quarters, while Oguta III is on the North bank of the Lake and is separated from Oguta I by the Okposha Inlet. Oguta II also like Oguta III offers a pleasing view of Oguta Blue Lake, as it is called or Ogbuide. Oguta Lake is the second largest fresh water in Nigeria after Lake Chad. No brine, no smarting in the eyes and no harmful creatures. It is surrounded with evergreen environs of the poetic beauty and can be regarded as the Premiere Tourist Attraction of the state.

6.2 Site Location

Oguta Lake is located in a low-lying (elevation < 50m) platform. The lake precisely lies between latitudes $5^0\ 41^1$ and $5^0\ 44^1$ North and longitudes $6^0\ 45^1$ and $6^0\ 50^1$ East in the equatorial rainforest belt of Nigeria. The site chosen for this design demonstration is located in Oguta II (the area mapped for tourism activities). It's almost around the South-Western part of Oguta Lake adjoined to the existing 18-hole golf course and

offering a pleasant view to the scenic Oguta Lake and Natural green lush. The plate below is a reproduced blue print image of the site location at Oguta II showing its proximity to the lake and the existing bounding access routes.

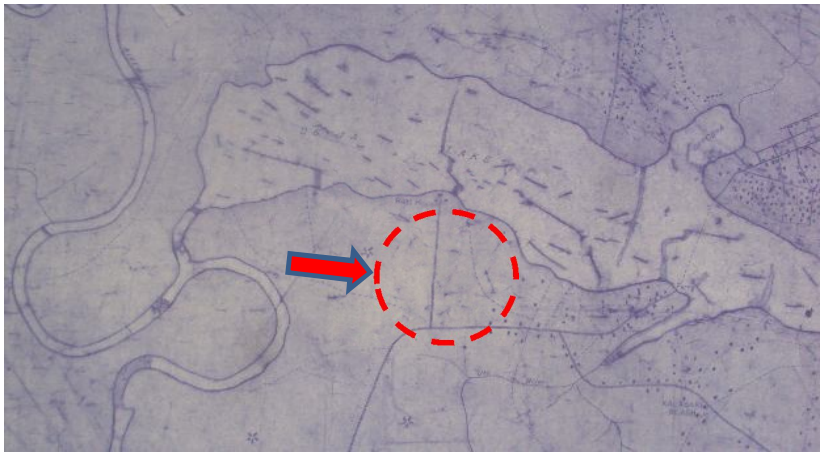


Plate XLIV: Site Location at Oguta II (Source: Author 2013)

6.3 Site Analysis

Factors to be analyzed for an effective regenerative architectural development include: climate; topography and geology; vegetation; and visual factors.

6.3.1 Site climatic analysis

Oguta falls under the equatorial rain forest region of Nigeria characterized by high annual rainfall; this could be up to about 2100mm at peak periods which are mostly around August/ September. The Humidity of the region is relatively high due to its proximity to the Atlantic Ocean. The climate is warm and humid while the prevailing wind movement is the North-East Monsoon winds prevalent around December and February also corresponding to the dry/ harmattan period in Nigeria and South-West Monsoon winds which dominates most part of the year. Considering the site however, the site micro climate is influenced by its proximity to the large Oguta Lake as a result the major air movement over the site is the Land and Sea breeze phenomenon common

to coastal regions. The proposed building form is shaped to take advantage of this air movement to facilitate natural ventilation in the structure.

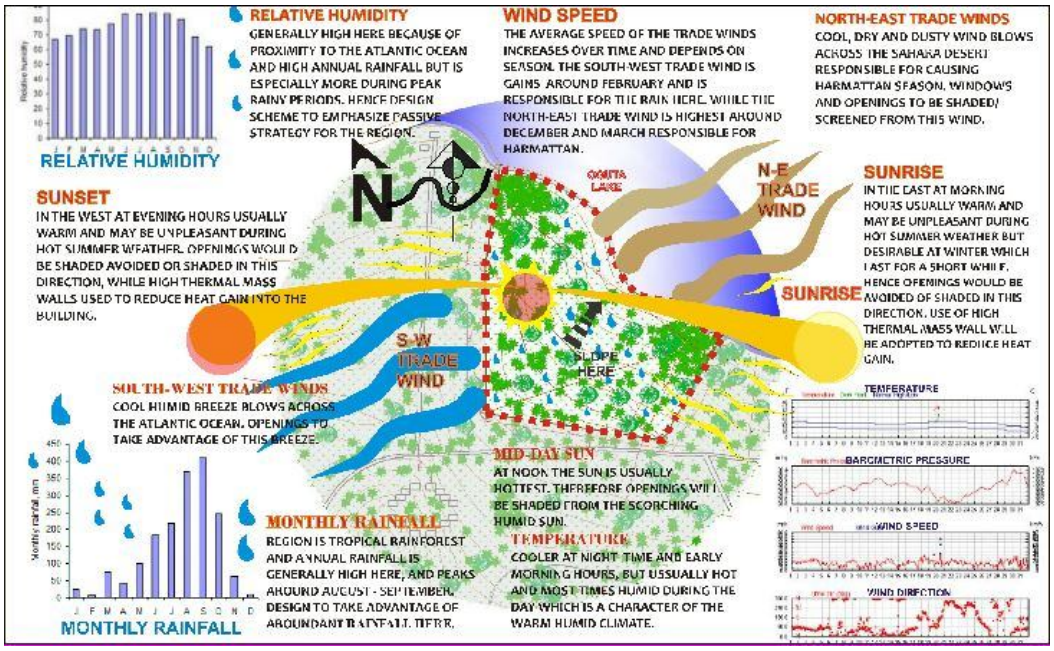


Figure 21: Site Climatic Analysis (Source: Author 2013)

6.3.2 Site Geology and topography

Oguta Lake lies within the Benin Formation. The Benin Formation consists of continental sands with lenses of clay/shale and some isolated units of gravel, conglomerate and sandstones suggesting a type of foundation that would locate the rocks beneath. The gradient of the site also tends towards the Lake, with every 30m horizontal distance corresponding to about 500mm – 1000mm height difference and terminates with a steep slope at the shores. The figure below is a contour sketch map of the site showing height differences and nature of soil and degrading site areas around the lake shores.

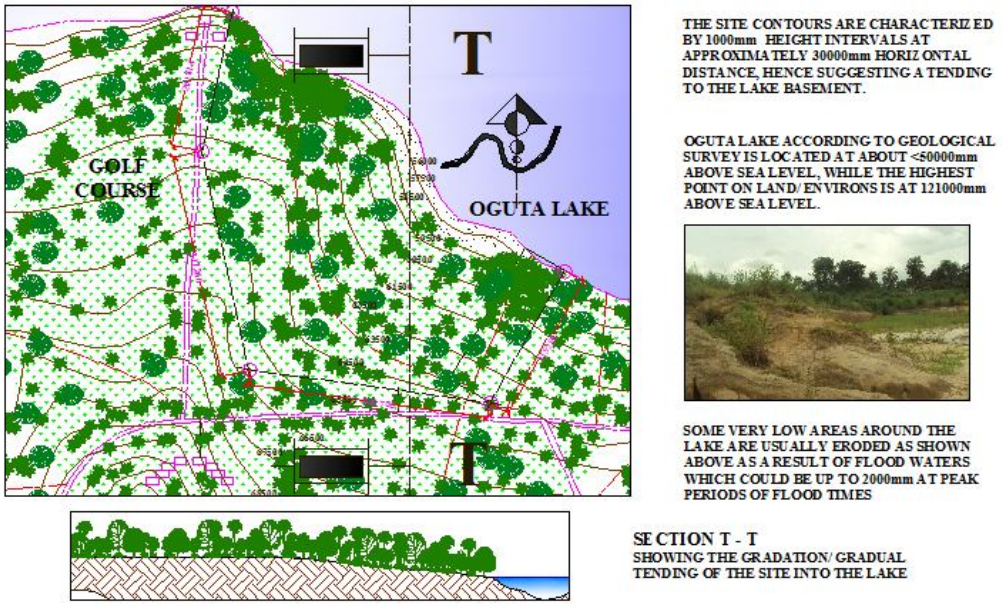


Figure 22: Site Contour Map (Source: Author 2013)

6.3.3 Site vegetation

Oguta is situated in the equatorial rainforest belt of Nigeria referring to a closed, permanently green, broadleaved forest, typical of tropical rain forest areas. This is the most luxuriant type of tropical forest and offers optimum conditions for plant growth. However, because of human activities, most of the native rain forest vegetation has been replaced by palm plantation mostly around the lake. See plates below showing the tropical green lush typical of the region. The proposal takes advantage of this feature.





Plate XLV: Site Vegetation ***Plate XLVI: Site Mangrove Vegetation***

6.3.4 Site views

The visual analysis of the site presents various pleasant scenic views, and the best adoptable views are those overlooking the lake. In the proposed scheme, balconies of suites take advantage of the visual access to the lake and green lush creating positive visual contact with nature. The plates below are some of the visual access from the site.





Plate XLVII: Site View of the lake ***Plate XLVIII: Site View of the green lush***



Plate XLIX: View of the site from the Lake

6.4 Regenerative design effort, features and Strategies emphasized in the scheme

6.4.1 Site Planning

The Site planning adopts the regenerative architecture framework developed from this research. Several analyses were carried out to determine the best area for development they included; Site zoning (by function and views), Ecological

considerations, Site resource reuse, Site drainage pattern, and site management concept. See figures below.

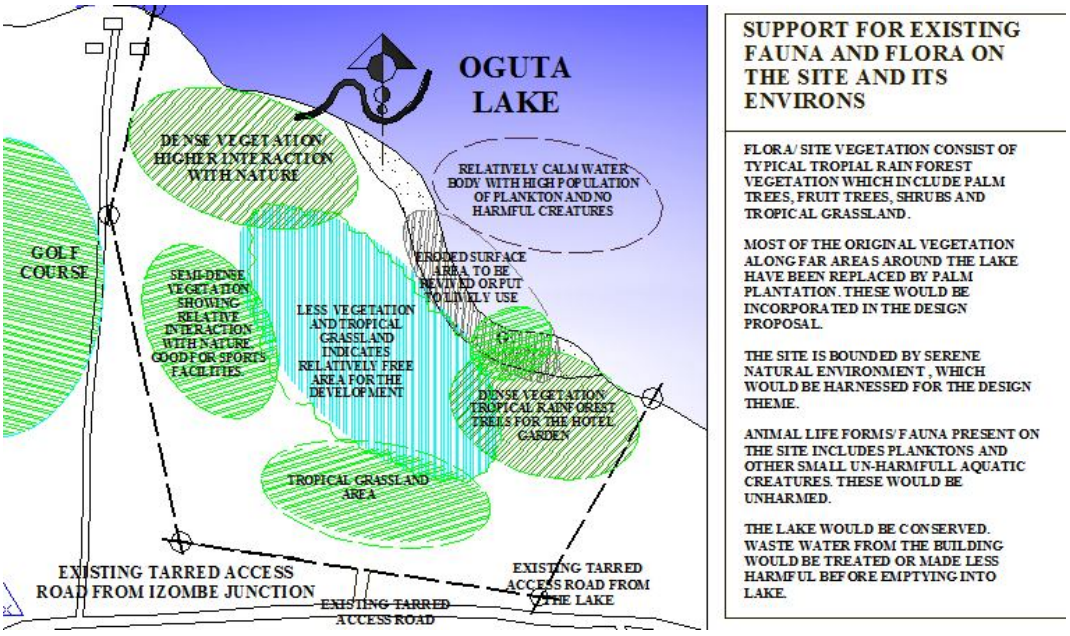


Figure 23: Site Ecological considerations (Source: Author, 2013)

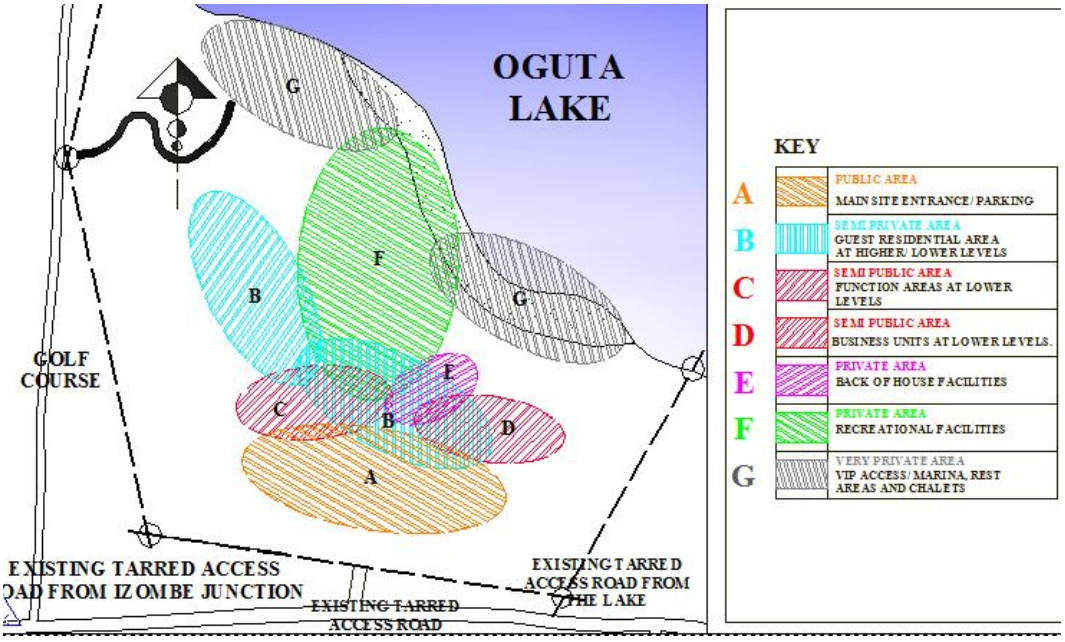


Figure 24: Site zoning by function (Source: Author, 2013)

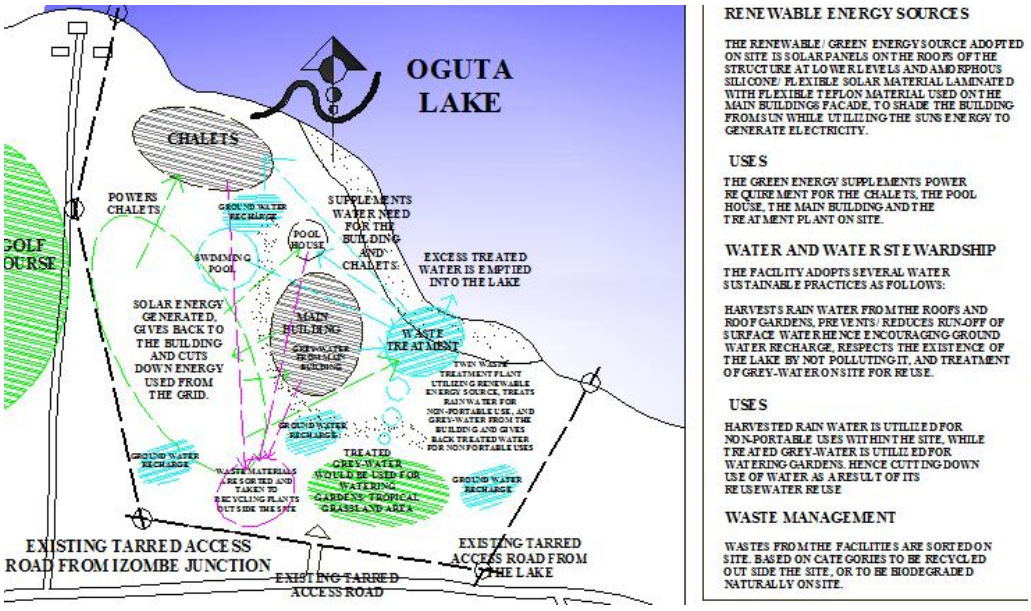


Figure 25: Site resource reuse diagram (Source: Author, 2013)

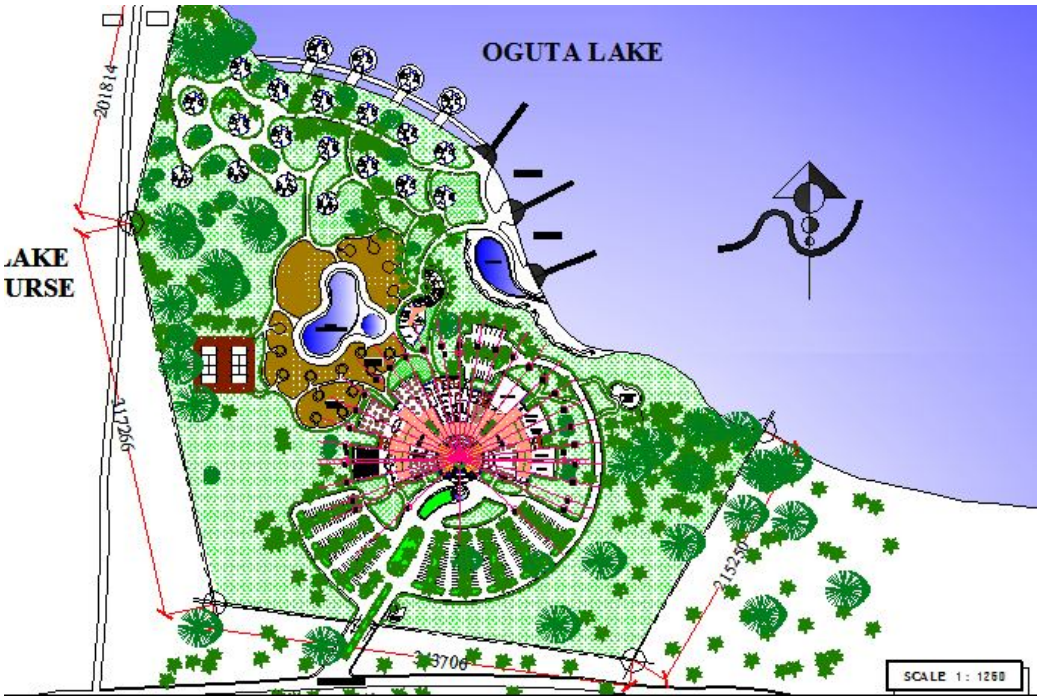


Figure 26: Site Planning and Landscaping (Source: Author, 2013)

The Analyses carried out shown in the figures above were to ensure effective implementation of the developed regenerative architecture framework corresponding to the principles of regenerative architecture in practice. At the planning stage, all the principles are considered to be of high significance to create a design that will be

sympathetic and help heal the environment. On site however, emphasis was on less damage to local biosphere, use of native landscaping and interaction with nature.

6.4.2 Design Philosophy

The goal of regenerative architecture is to harmonize the built environment with nature, drawing inspiration from nature's cyclical pattern of water, energy, materials and resource flow. Nature is said to exist in curves thus regenerative design adopts this knowledge, knowing that the built environment is not regenerated like living systems do, but by the form and processes of its planning, construction and operation.

6.4.3 Design concept

The concept for Oguta Blue Lake Resort Hotel is derived from (Ripples and Ripple Effect) a phenomenon commonly attributed to the sites major feature which is the lake (water body). The figure below display the various transformations leading to the main buildings final form which also affects the form of smaller supporting facilities on site.

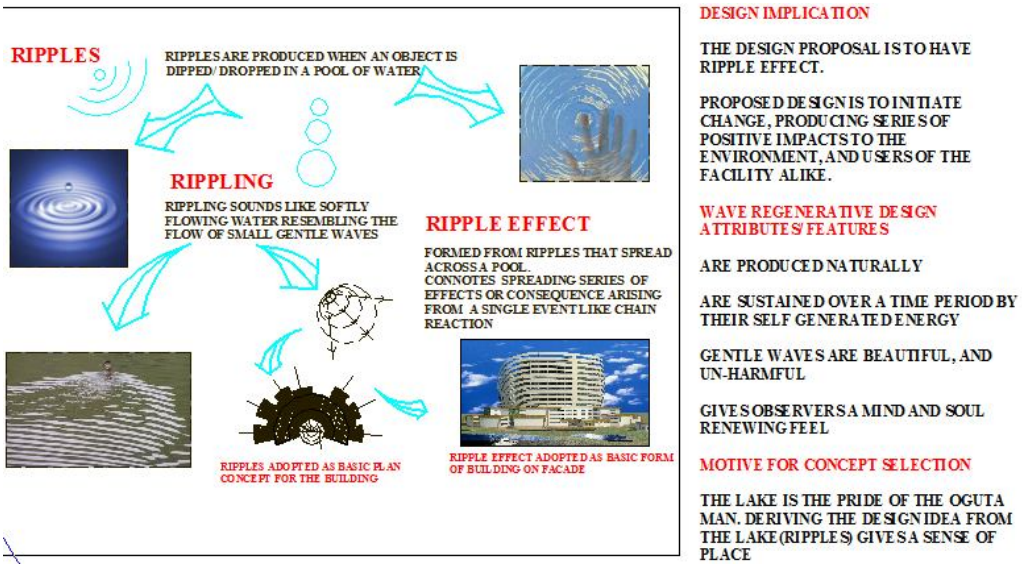


Figure 27: Design Concept development (Source: Author, 2013)

The lake is the pride of the Oguta-man corresponding also to a natural site feature from which regenerative architecture draws inspiration, giving the design a sense of

place and seeing nature as its generator. Just like Ripple effect, the resort hotel is to be a single event that will bring about series of positive events (other sustainable buildings) that will help heal and make the region a renowned tourist destination as projected by the state government.

6.4.4 Building form and expression

The form of the building is such that it reflects various regenerative architectural strategies adopting the elements identified from research as the peculiar regenerative architectural features of South-Eastern Nigeria. This elements are; Rainfall, Sunshine, air movement and the tropical green lush. Culture is displayed in user experience.

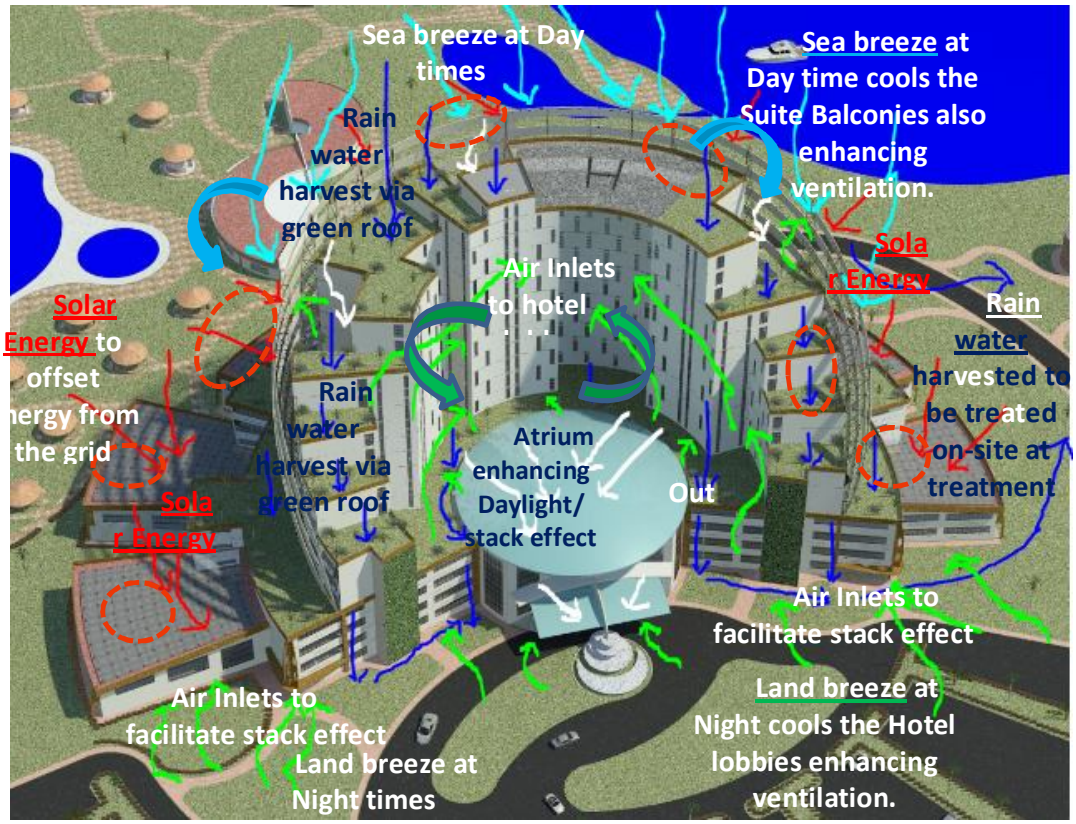


Plate L: Building Form (Source: Author 2013)

6.4.5 Building Orientation

The analyses of Oguta Lake and its environs revealed major factors which potentially influenced the proposed buildings orientation. These included the solar path

(East and West axis), the prevalent wind direction (North-East and South-West axis) and contact with the main feature of the area (Lake). However, the analysis of the site chosen for this design proposal showed slight peculiar variation because of its proximity to the Lake (large water body). The prevalent wind movement is the Land and Sea Breeze phenomenon, also the site overseas the lake in the North hence the buildings orientation is such that it provides good visual contact/ access to the lake, while minimizing the effect of solar radiation and allowing for free air movement within the building.

6.5 Design brief

6.5.1 Brief development

To develop the brief for the proposed Oguta Blue Lake Resort Hotel, feasibility studies were carried out on the average tourist visit to the lake area, the nature and type of tourists and the average number of visitor's per-annum. From available statistics, Oguta Lake receives about 17000 visitors annually who flock into the area for various reasons ranging from site seeing, to tours, to picnics, golfing, boating, fishing, vacation, recreation, meetings, conferences and lots more. This figure is on the rise since year 2012. It implies an average monthly visit of about 1500 visitors and about 50 potential visitors per day who seek abode. Studies from literatures have revealed that for a hotel or resort to operate, there must be at least 50% occupancy for any number of rooms provided since room rates/charges are based on this idea. The proposed resort hotel features about 115 rooms of various types, and 21 chalets, representing more than 100% of the daily visits to cater for future increase and various categories of guests.

6.5.2 Schedule of accommodation

The accommodation schedule is produced comparing the space areas of facilities with standards from literatures and those obtainable from case studies conducted on similar facilities. This is shown in the table below.

Table 8: Schedule of accommodation

S/N	Category/ Spaces	Square Areas/ square meter (Sqm)		Quantity
		Area Required (Sqm)	Area provided (Sqm)	
	MAIN BUILDING Front of House Facilities			
1	**Administrative Areas**			
	Front Offices	0.4sqm/person	0.6sqm/person	5
	Offices			13
	Staff Areas/ Lounge	0.9sqm/person	1.0sqm/person	2
	Changing Rooms			2
	Hotel operations	1.2sqm/person	1.5sqm/person	2
	Conference Room			1
	Conveniences	0.8sqm/person	1.0sqm/person	8
		0.9sqm/person	1.0sqm/person	
		1.2sqm/person	1.5sqm/person	
		1.2sqm/person	1.4sqm/person	
2	**Accommodation Spaces**			
	Ordinary Single Suites	21sqm	30sqm	36
	Superior Double Suites	24sqm	36sqm	32
	Executive Suites	40sqm	56sqm	32
	Deluxe Suites	30sqm	60sqm	14
	Presidential Suite	-	-	1
3	**Function Areas**			
	Conference Hall	1.2sqm/person	1.5sqm/person	2
	Banquet Hall			1
	Meeting Rooms	1.5sqm/person	1.6sqm/person	2
	Night Club			1
	Conveniences	1.2sqm/person	1.4sqm/person	16
		1.5sqm/person	1.6sqm/person	
		1.2sqm/person	1.4sqm/person	
4	**Business spaces**			
	Rentable shops	12-40	40-60	6
	Exhibition	40	50	4
	Conveniences	1.2sqm/person	1.4sqm/person	16

		n	n	
5	**Indoor Recreation**			
	Indoor Games/booth	1.8sqm/person	2.0sqm/person	2
	TV Games Room	1.2sqm/person	1.4sqm/person	5
	Back of House Facilities			
6	**Catering Services**			
	Kitchen	0.8sqm/person	1.2sqm/person	2
	Restaurant	1.8sqm/person	2.0sqm/person	1
	Specialist/African Dishes	2.0sqm/person	2.2sqm/person	1
	Bars	1.6sqm/person	1.8sqm/person	1
	Bakery/ Pastry	0.8sqm/person	0.8sqm/person	2
	Coffee Café	1.4sqm/person	1.6sqm/person	5
	Conveniences	1.2sqm/person	1.4sqm/person	8
	POOL HOUSE			
7	**Fitness and Recreation**			**1**
	Fitness/ Health Club	1.6sqm/person	1.6sqm/person	1
	Spa	0.8sqm/person	0.8sqm/person	1
	Massage Room	8.0sqm/bench	8sqm/bench	1
	Gym	1.0sqm/person	1.2sqm/person	1
	Changing rooms	0.8sqm/person	1.2sqm/person	6
	CHALETS			
8	**Two Bedroom**			**13**
	Bedrooms	12sqm	16sqm	26
	Living Rooms	16sqm	20sqm	13
	Kitchen	9sqm	12sqm	13
	Dining	9sqm	12sqm	13
	Toilets and Baths	1.2sqm/person	1.8sqm/person	26
9	**Three Bedroom**			**8**
	Bedrooms	12sqm	16sqm	24
	Living Rooms	16sqm	20sqm	8
	Kitchen	9sqm	12sqm	8
	Dining	9sqm	12sqm	8
	Toilets and Baths	1.2sqm/person	1.8sqm/person	24

SITE AUXILIARY FACILITIES				
	Gate house/ Security	1.2sqm/person	1.4sqm/person	1
	Treatment plant			1
	Swimming pool	40sqm	60sqm	2
	Tennis court	-	-	2
	Gazebo	120sqm	120sqm	14
	Bush bar	9sqm	9sqm	2
	Marina	1.8sqm/person	1.8sqm/person	3
	Lake side rest areas			2
	Guest Parking	-	24sqm/ boat	200
	Car hire service parking	1.5sqm/person	1.8sqm/person	56
	Admin parking space			24
	Back of house delivery area	15sqm/ car 15sqm/car 15sqm/car 40sqm	15sqm/car 15sqm/car 15sqm/car 50sqm	4

Schedule of accommodation (Source: Author 2013)

6.5.3 Spatial organization and design

Layout and Zoning: The arrangement of the facilities on site follow the evolved site zoning and layout developed conforming to regenerative architectural principles and strategies already highlighted. The spatial arrangement (both horizontally and vertically) within the main building conforms to the basic design concept adopted for the design (Ripples on plan and Rippling effect on the facade). The provision of spaces adopts regenerative architecture principles regarding whole systems design integration and concentration, as seen in the ground floor plan below, and appendix III other floors.



Figure 28: Ground floor plan (Source: Author 2013)

Circulation: The pattern of movement on site is such that pedestrian is separated from vehicular circulation (see site plan). As part of effort to increase human-built environment relationship, guest vehicular access is terminated at the front of house, while pedestrian circulation continues with emphasis on interaction with the surrounding nature (green lush and the lake). Within the facility, proper activity zoning is ensured which included clear separation of the back of house from the front of house facilities. Horizontal movement is via lobbies while vertical movement is via stairs and lifts, within the building worker areas are screened from guest areas to avoid interference of the guest experience.

Daylighting and Ventilation: To emphasize daylighting in the building, several passive strategies were adopted these included use of atrium, skylights, and single banking. The singly banked accommodation tower allows openings on the free sides of the building which are utilized for daylighting and cross ventilation. Also, the atriums aid in ventilating the building interior, thus allowing cool breeze via inlets at lower levels cooling the building interior spaces, and expelling vitiated air via vents at higher levels as shown in figure 29 below.

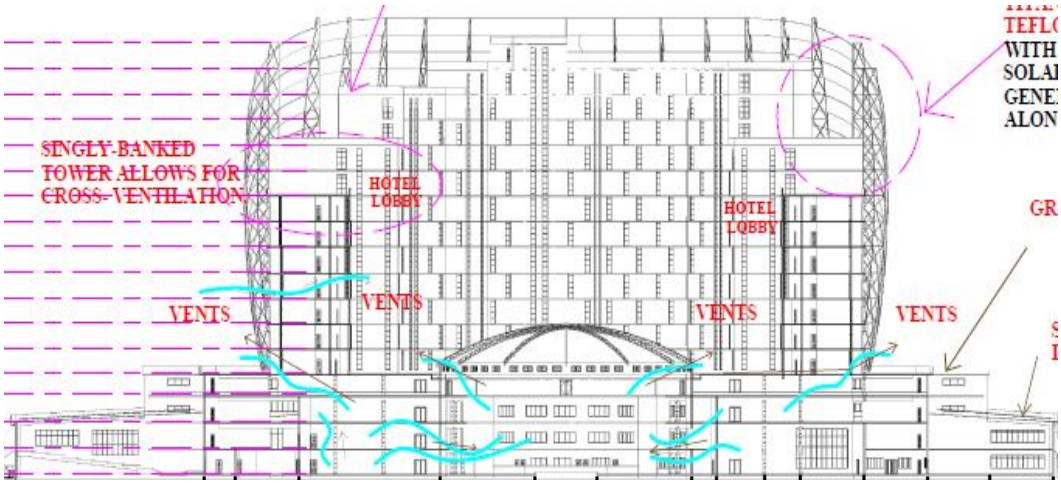


Figure 29: Passive strategies adopted in the building (Source: Author 2013)

6.5.4 Building materials and technology

The selection of materials for use in the scheme is to emphasize overall sustainability which is the goal of regenerative architecture. Materials with less negative impact on the environment or having recyclable content have been adopted for the entire scheme. These include:

Natural stone: Natural stone is employed for use onsite around the lakes shorelines. This is to embank the shorelines to arrest the effect of rise in water level (flooding) and dredging of the lake. It is also used as the material for walkways within the pedestrian circulation areas on site.

Off-form concrete: Concrete is applied minimally for its structural benefits and integrity also it can be recycled. The type of concrete specified at the sub-structure is off-form for the pile foundation system suitable for the main building structural stability while formed concrete is employed for super-structure support system.

Mud Bricks: This material is employed in the chalets and Gazebos for its thermal properties and green qualities.

Timber: Timber is used for both its structural and aesthetic quality. Structurally it is employed as the basic roof support system for the smaller facilities on site (the chalets, gazebos, and gate house). The aesthetic quality of wood is employed as the basic element of the interior décor in suites, chalets and other facilities suggesting strong interior quality.

Titanium: Titanium is employed to reduce the use of steel on the entire scheme, this is because of its several qualities which includes; light weight, strength and durability, energy efficiency, environmentally safe and aesthetic quality. Titanium is applied in the atriums support system and the support system for the composite Teflon-amorphous Silicone solar material lining the building façade.

Teflon: Teflon is also known as PTFE (polytetrafluoroethylene) belonging to a family of modified copolymers which ETFE (ethylenetetrafluoroethylene) also belongs. This material(s) possesses several qualities which makes it a suitable material for sustainable construction. These includes; its light weight, flexibility, durability, green quality (recyclable), resistance to elements of weather (wind and up to 270^0C temperatures), self-cleaning property and ability to span large areas and heights with little supporting. Teflon is applied in atriums to reduce glass use, and on main building façade as a composite solar material, laminated with amorphous silicon which generates solar energy alongside shading the building from the elements and giving the façade its form.

Glass: Glass in use possesses several green qualities since it is recyclable. It can be employed as the major element in buildings permitting daylighting and creating visual contact with the environment. This however is not without the effect of accompanying solar radiation hence the type of glass employed is the low-e glass. See figure 30 below.

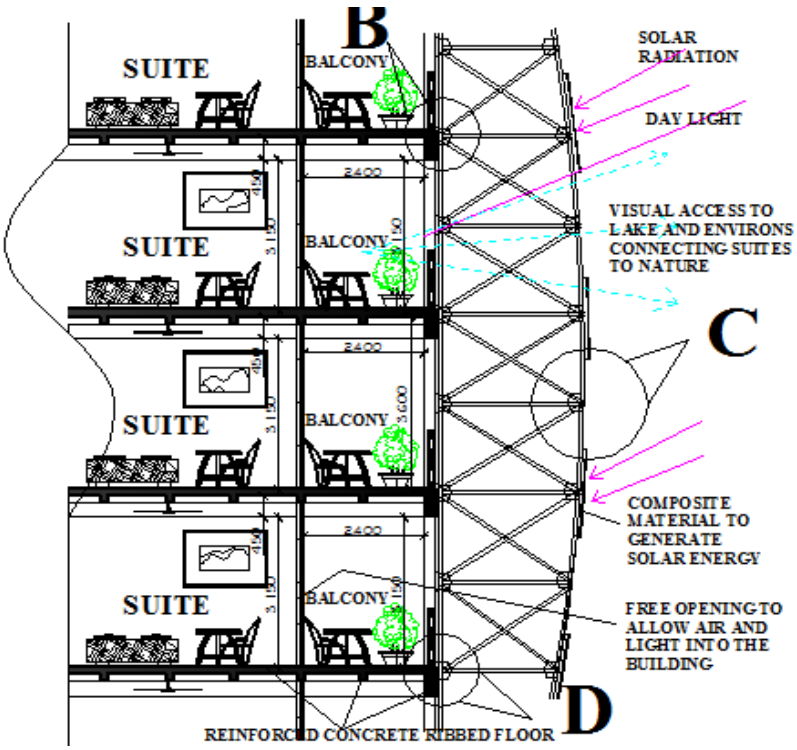


Figure 30: Daylighting and Ventilation within the building (Source: Author 2013)

6.5.5 Aesthetics

From this thesis study, luxury and image has been identified as the major limitations to successful implementation of sustainability in resort hotels, hence for the proposed Oguta Lake Resort Hotel, a blend of luxury and sustainability is created utilizing regenerative features and strategies. The building form is such that it incorporates sustainable features and strategies with strong aesthetic quality. Plate LI below shows the approach and rear views of the resort hotel. See Appendix III (East and West elevations) for more views.



SOUTH ELEVATION



NORTH ELEVATION

Plate LI: Façade design (Source: Author 2013)

6.5.6 Services: Energy sources and resources

In order to reduce energy consumption, the facility is sited amidst tropical green lush in a serene environment. Hence the location -harbouring green vegetation, alongside adopted passive strategies already discussed reduces energy demand for

cooling the structure. Also because of the site replacement concept adopted, semi-intensive green roofing system is employed on the stepping roof alongside green walls to both cool the structure and harvest rain water while replacing lost ground on site. See figure 31 below showing the site replacement concept adopted in the design. Details of the green roof is given in Appendix III.

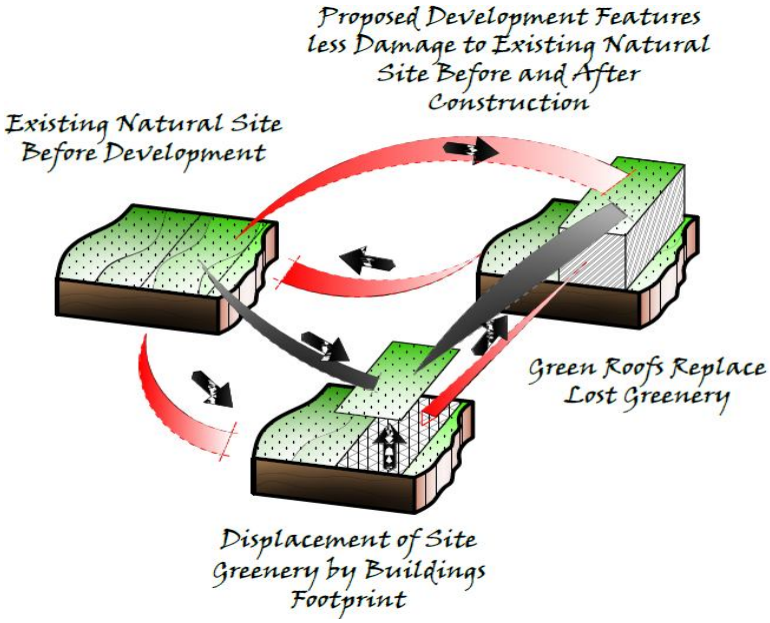


Figure 31: Site ground replacement concept (Source: Author 2013)

Power supply: It has been identified from the research that Power needs within the facility can be meet by utilizing the free sunshine available in the area. Hence the composite solar energy system on the building facade already discussed, alongside solar panels at lower roofs will augment power from the Grid to meet energy needs within the facility.

Water supply: The research also revealed that water needs within tropical rain forest region can be meet by designing systems that can collect the abundant rainfall available. Hence in addition to water from the grid, the facility features several rain water harvesting schemes and water management strategies. This is via roofs, roof gardens and ground water recharge techniques. Harvested rain water is stored in

underground cistern and treated by an on-site solar powered treatment plant alongside treatment of grey water for non-portable uses.

Details of the overall design and sketches are provided at the appendix of this report.

CHAPTER SEVEN

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter presents a conclusion of the whole research work. It itemizes the basic elements of the research findings in summary, the overall conclusion of the study, the recommendations of the study, contributions to knowledge and area for further research.

7.1 Summary Of Findings

i. The phenomenon of Regeneration holds great prospects in the region under consideration.

ii. The resort hotel with the highest reflection of regenerative architecture principles in the study area, shows that:

   a. The phenomenon is still largely under explored; yet
   b. Such resorts perform better when assessed on the regenerative architecture framework.

iii. Older Resort hotels show lower reflection of the phenomenon, while newer resorts show higher reflection meaning a gradual adoption of sustainability;

iv. Rainfall and sun light are major assets of the region but are not fully utilized in resort hotel designs;

v. Water management and reusability are still at infancy;

vi. There is over dependence on unsustainable materials, and energy sources;

vii. Buildings negative impact to the ecosphere is high; Native vegetation and site features are not fully utilized in these resorts.

viii. Elements of place culture are not fully represented in the designs; and

ix. A major limitation to success is the issue of luxury in the industry.

7.2 Conclusion

The study has been able to establish a framework confirming to regenerative architecture principles adoptable in resort hotel design in the region considered in this study. It has identified features of the variables of these principles and their implications in resort hotel design. As a key contribution to knowledge, it has identified regenerative architecture features peculiar to the study area adoptable in resort hotel design. It has also identified a major limitation to the successful implementation of regenerative architecture, and finally a conscious design effort aimed at demonstrating the findings of this study has been developed as the proposed Oguta blue Lake Resort Hotel.

7.3 Recommendations

The study recommends that bringing people closer to positive contact with nature will force them to consciously improve on it, while nature-inspired design would facilitate ending the human-nature divide identified as the major cause of environmental problems. Also power and water needs within resort facilities can be met using free natural tropical elements.

7.4 Area For Further Study

The study has identified areas in which further inquiry in regenerative architecture can be made. They include: The performance of structures utilizing regenerative architecture principles, and also the study could be conducted in other climatic/ geographic regions within the country to identify regenerative architecture features peculiar to these region(s) which could be adopted in resort hotel design.

7.5 Contributions To Knowledge

i. Establishing regenerative architectural design principles for use in South East Nigeria; and

ii. Demonstration of these principles in the design of Oguta Blue Lake Resort Hotel.

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APPENDIX I

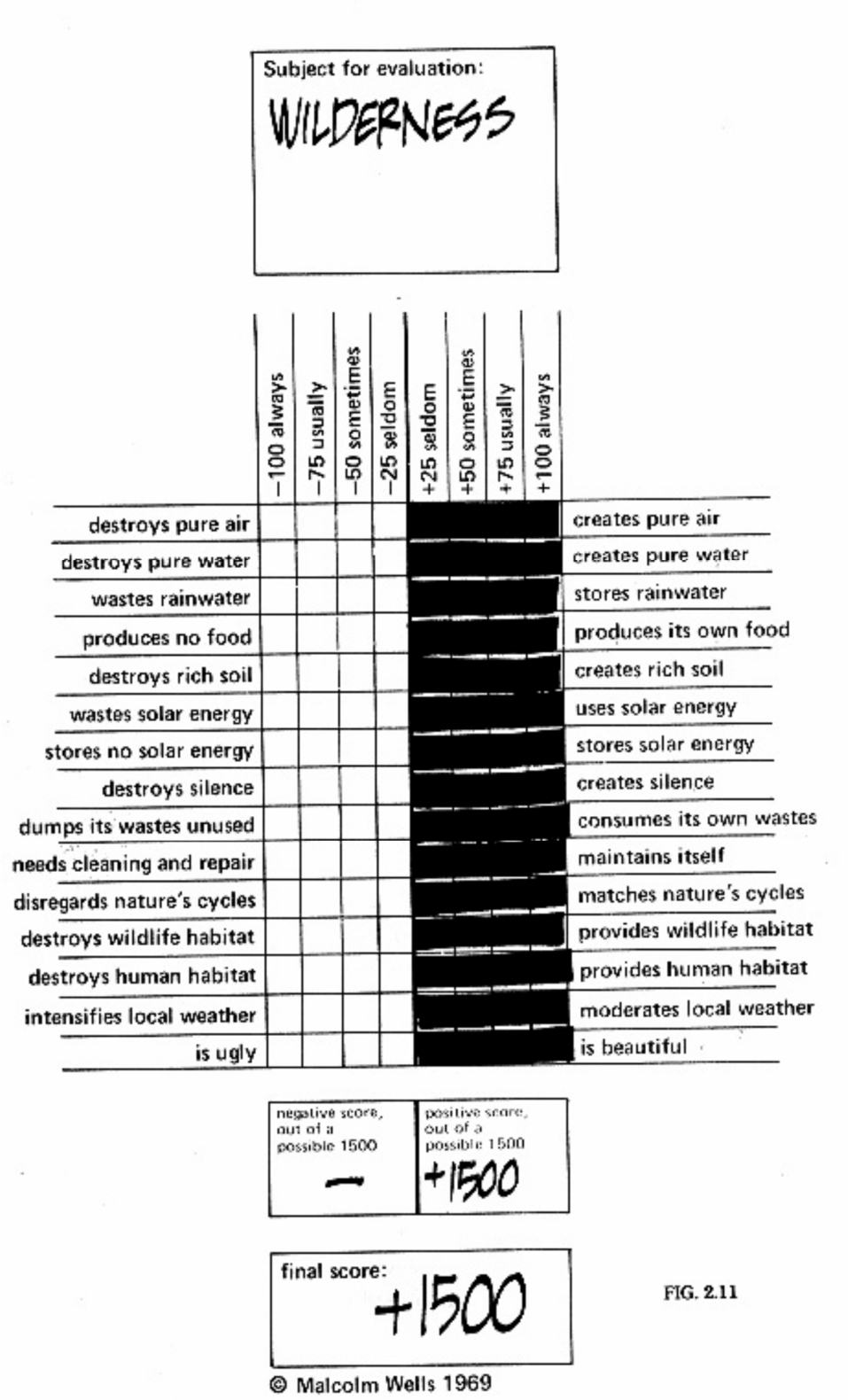


FIG. 2.11

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APPENDIX II

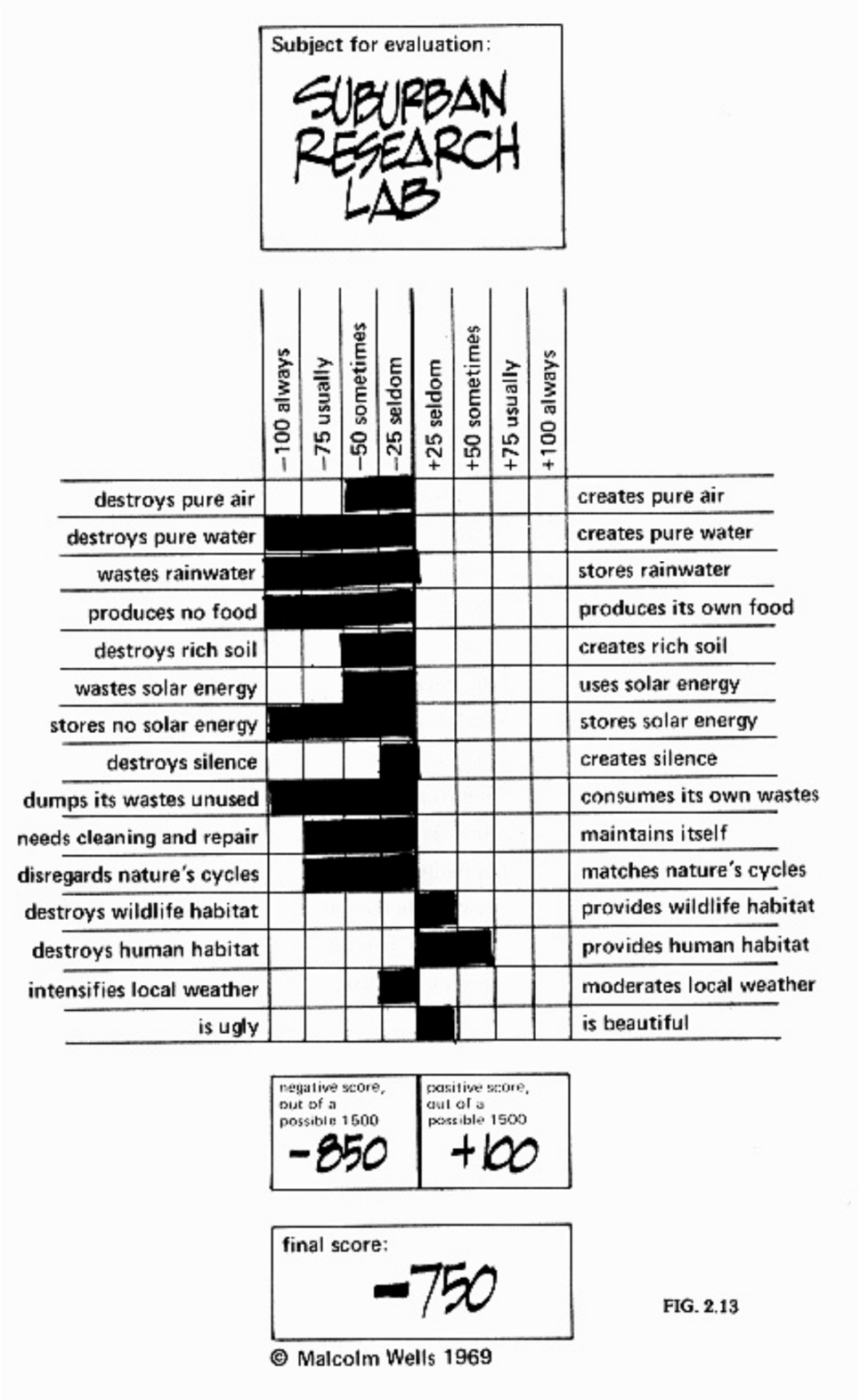
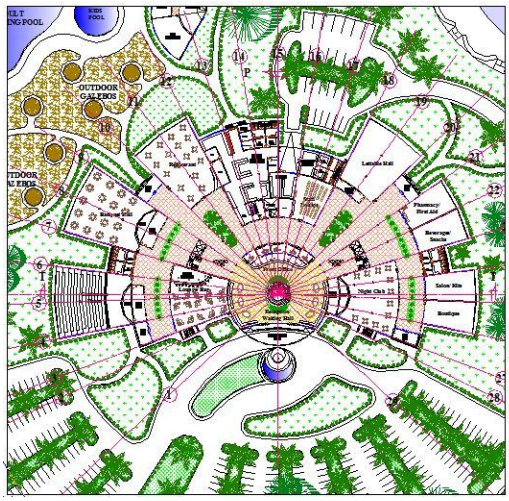
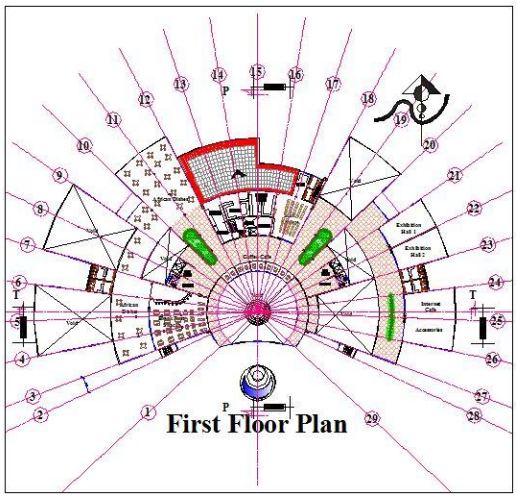


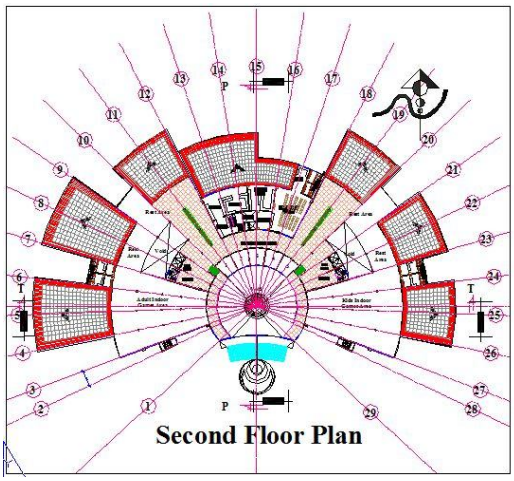
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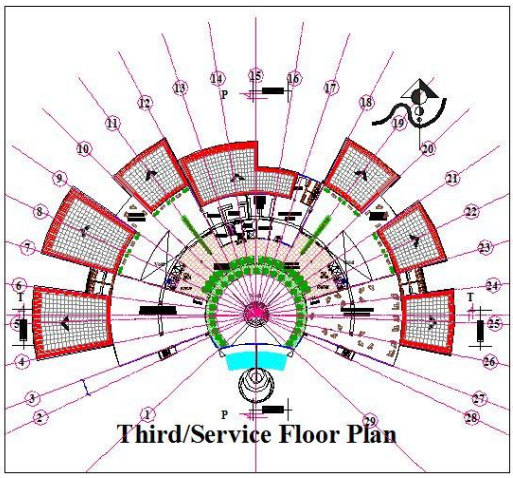
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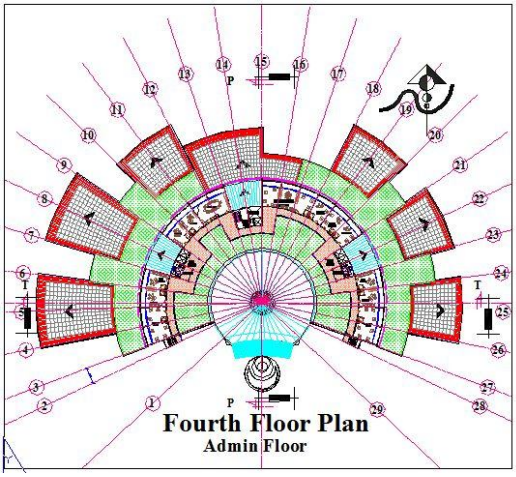
MAIN BUILDING

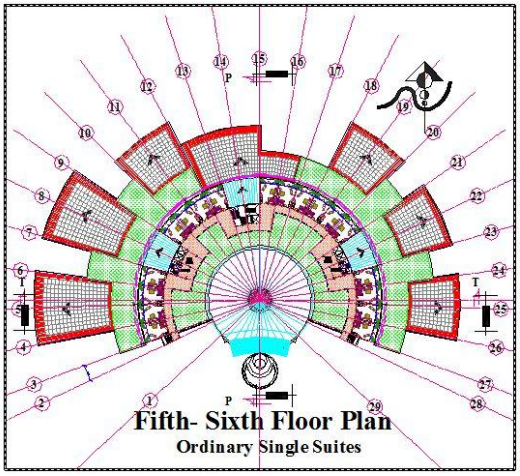


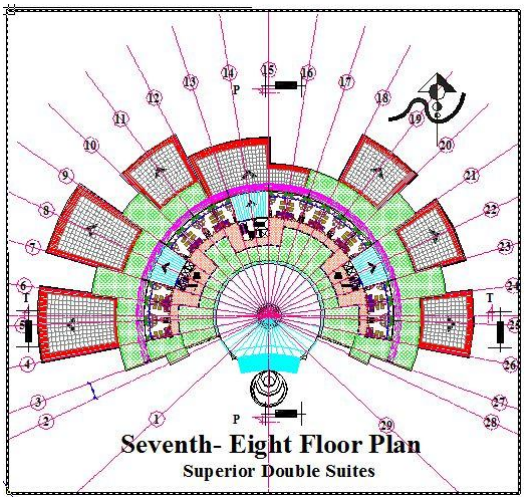


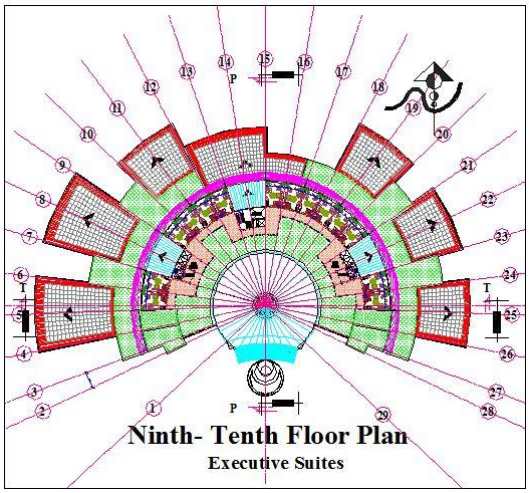


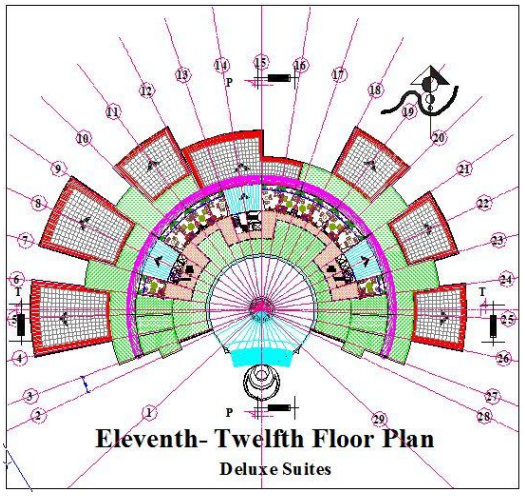


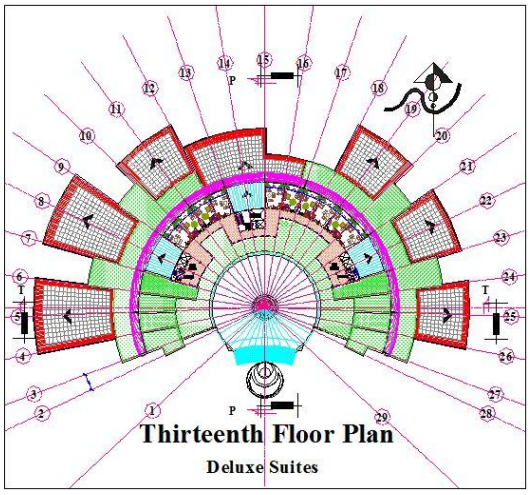


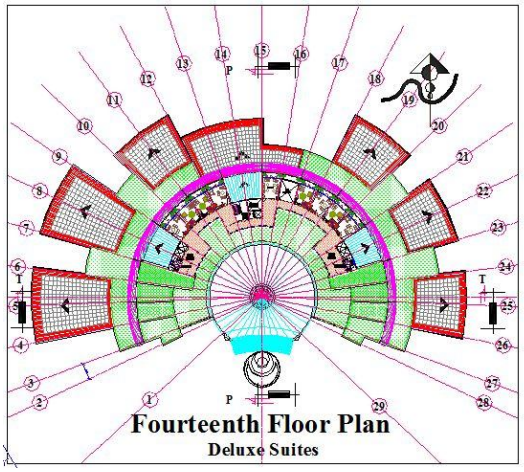


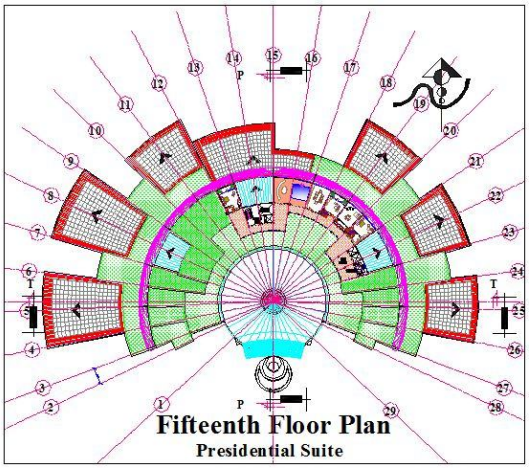

Seventh- Eight Floor Plan
Superior Double Suites

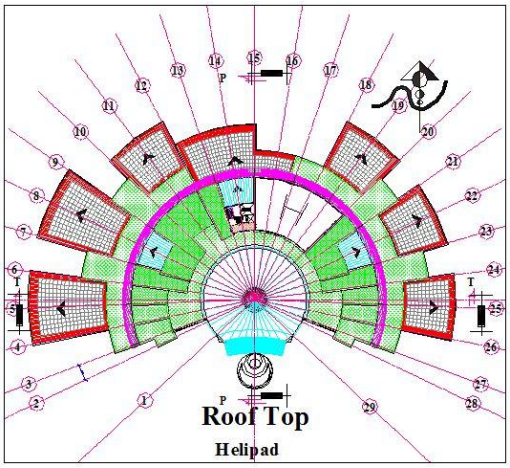

Ninth- Tenth Floor Plan
Executive Suites

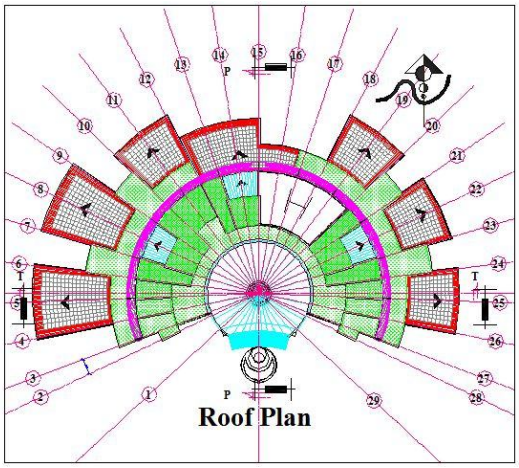

Eleventh- Twelfth Floor Plan
Deluxe Suites


Thirteenth Floor Plan
Deluxe Suites


Fourteenth Floor Plan
Deluxe Suites

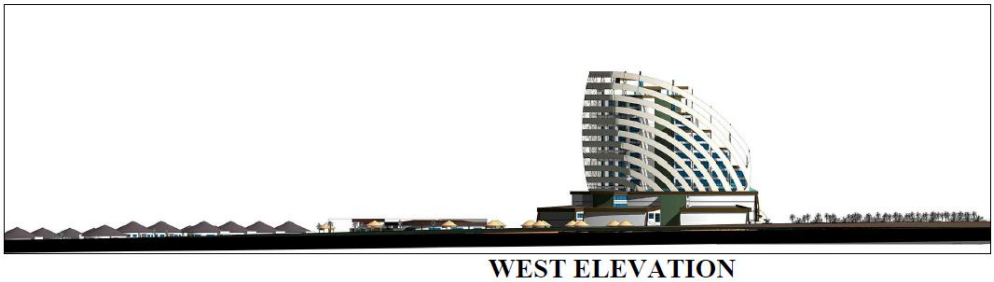

Fifteenth Floor Plan
Presidential Suite





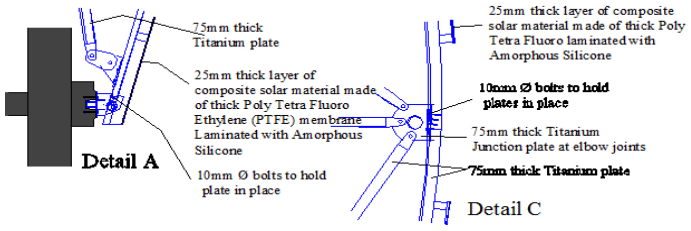


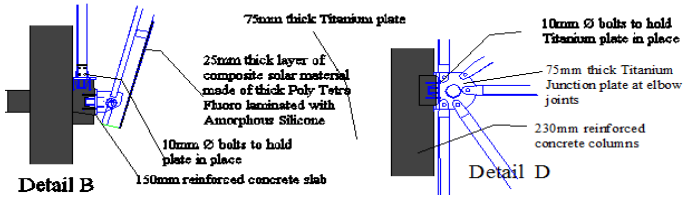
EAST ELEVATION



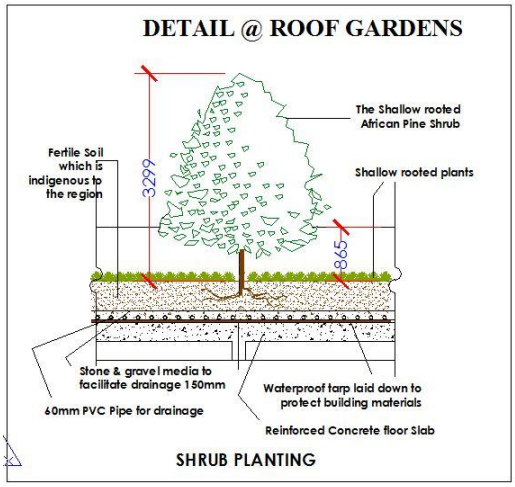
WEST ELEVATION

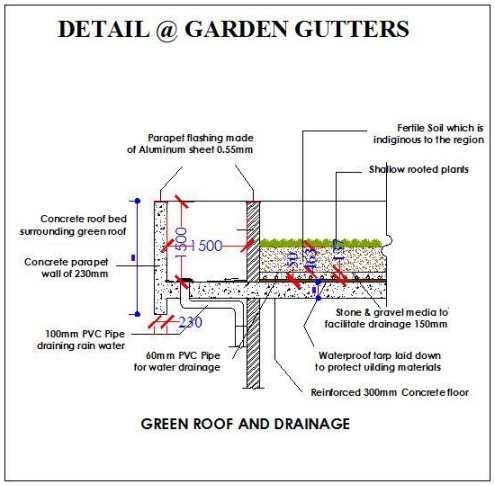
FRAMEWORK SUPPORTING COMPOSITE SOLAR MATERIAL



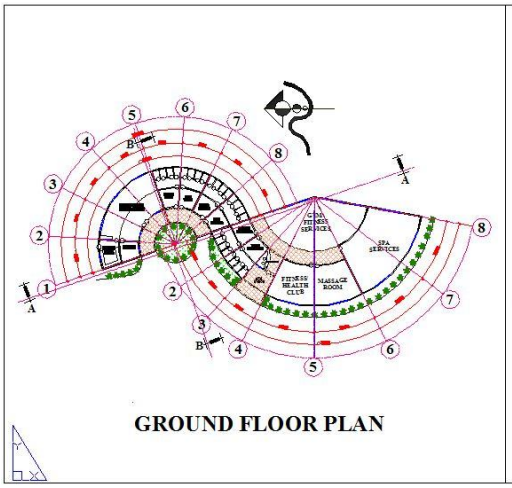


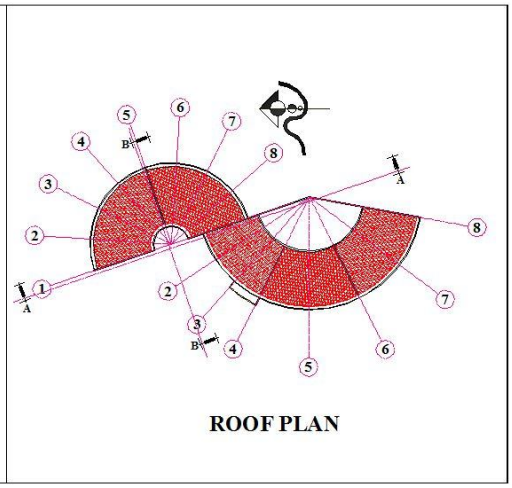
ROOF GARDEN

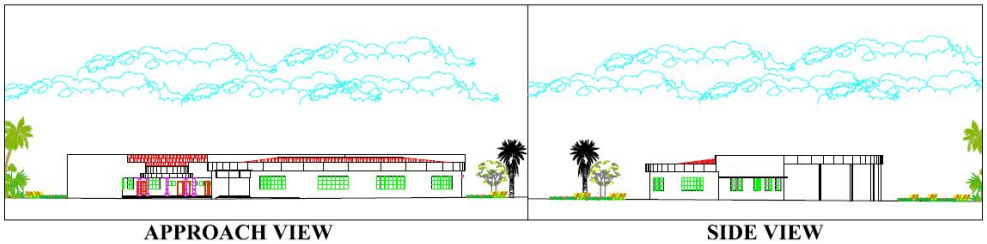


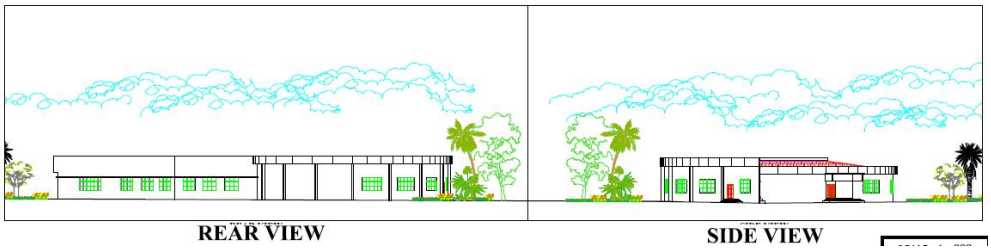


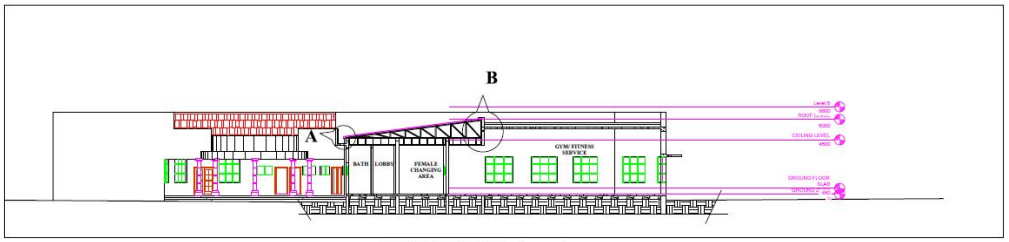
POOL HOUSE



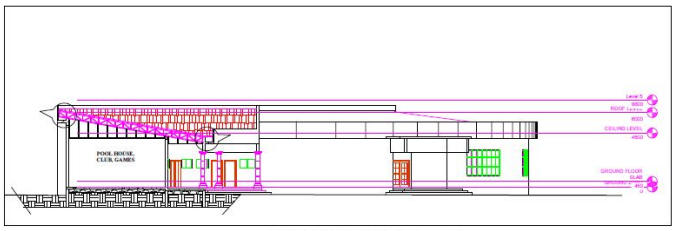






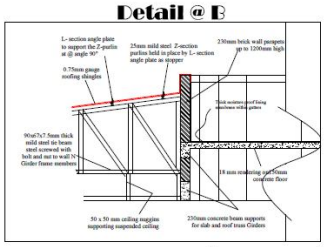


SECTION A - A



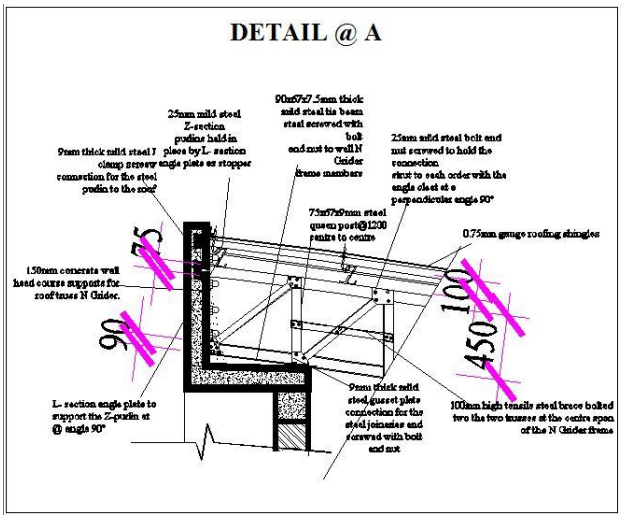
SECTION B - B

Detail @ B

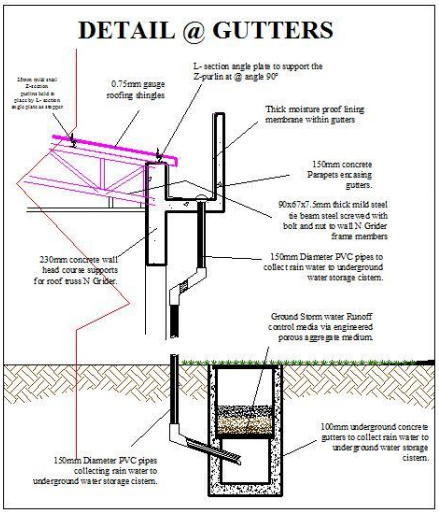


SCALE: 1 : 100

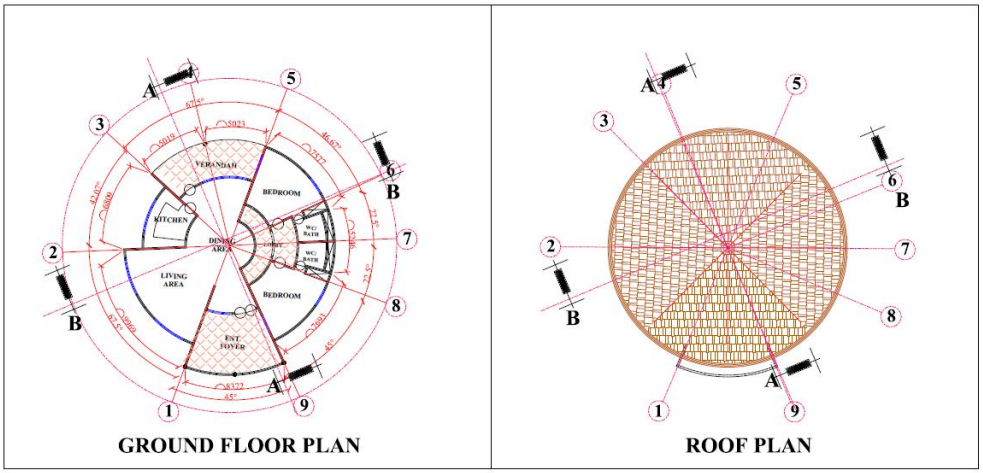
DETAIL @ A



DETAIL @ GUTTERS



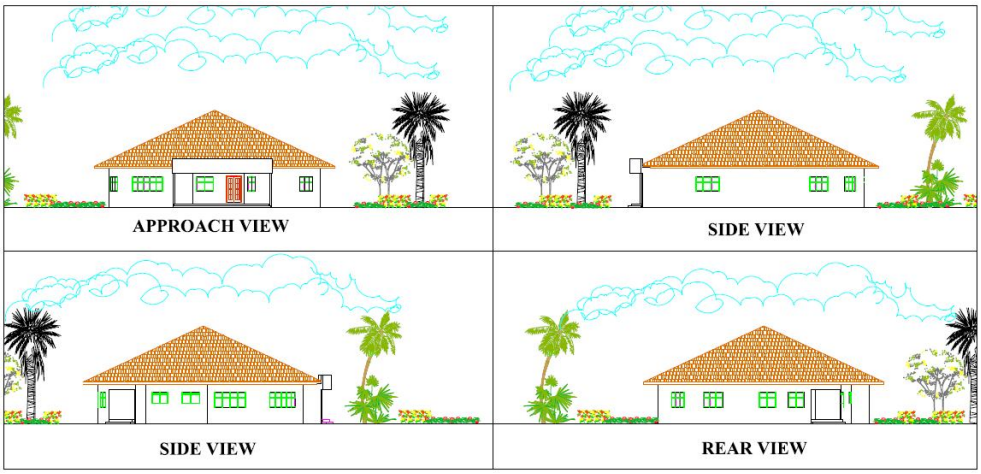
2 BEDROOM CHALETS

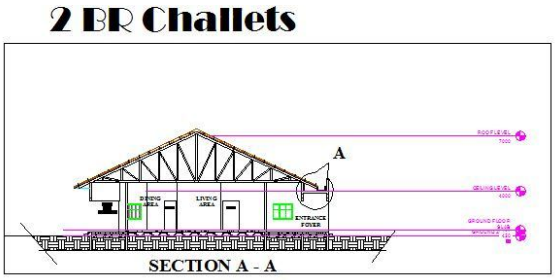


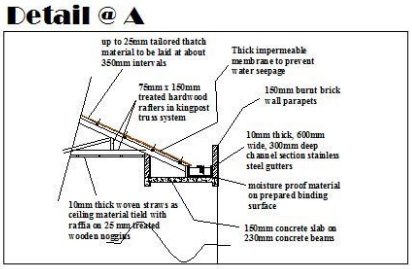
GROUND FLOOR PLAN

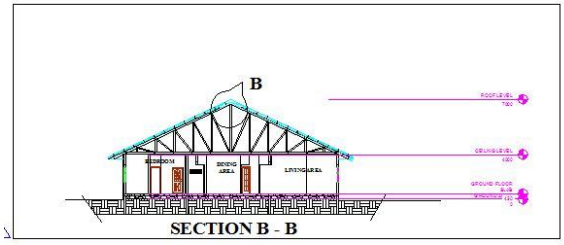
ROOF PLAN

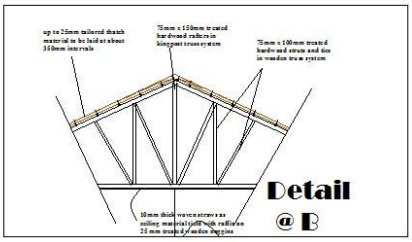
2 BEDROOM CHALETS ELEVATION











3D VIEWS



