APPLICATION OF BIOPHILIC DESIGN FEATURES IN THE DESIGN OF

VESICO-VAGINA FISTULAE (V.V.F.) CENTRE IN GUSAU,

ZAMFARA STATE.

BY

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AHMADU BELLO UNIVERSITY, ZARIA

NIGERIA

September, 2014

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Department of Architecture,

Faculty of Environmental design,

Ahmadu Bello University, Zaria. Nigeria

September, 2014

DECLARATION

I, Na-umma Umar Maru hereby declare that this research work presented is carried out by me under the supervision of Arc. S. M. Lukman and Dr. M. D. Ahmed and has not been presented for the award of any other degree. All sources of materials used have been duly acknowledged.

NA-UMMA UMAR MARU **DATE**

CERTIFICATION

This thesis **Application of Biophilic Design Features in the Design of Vesico-Vagina Fistulae (V.V.F.) Centre Gusau, Zamfara State** by Na-umma Umar Maru meets the regulations governing the award of the degree of Masters of Science in Architecture of Ahmadu Bello University Zaria and is approved for its contribution to knowledge.

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DEDICATION

This thesis is dedicated;

To my late brother, guardian and teacher,

Who gave it all to me, but did not live to take any of it back.

His Royal Highness

Late Alhaji Ibrahim Na-umma (MON)

Emir of Maru

To my mother, loving wife and children

To Alhaji Yahaya A. Hassan

For giving me, all the encouragement to be an Architect

and accommodation throughout my studies.

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ABSTRACT

Vesico-vagina fistulae (VVF) is a medico-socio problem for women which is often associated with stigmatisation and rejection by the society. Such type of patients need to be treated, rehabilitated and reintegrated back into the society in an environment that not only provides the basic medical opportunities (healing of the body), but also provide the much needed psychological healing (healing of the mind and soul). This is crucial aspect in recovery and rehabilitation process and this can only be achieved by adopting a design strategy that will seek to create spaces that communicate to the mind and soul of its users.

This research explores Biophilia and biophilic design features in an attempt to identify those that can be applied to the design of vesico-vagina fistulae centre and similar facilities. Case studies methodology was adopted for the research by identifying three VVF centre in Katsina, Birnin Kebbi and Sokoto.

The findings suggest that, using certain biophilic design features in healthcare and rehabilitation environment helps in the recovery and rehabilitation process. such aspects of biophilic design features includes; natural lighting, natural ventilation, local materials, natural forms, site features, ecological design approach, natural materials and natural processes. The thesis concludes that though biophilia is a new design theory not well known and practiced in developing countries, more research need to be done on the subject in an attempt to improve on how best to use in Africa. Recommendations were made on how best to utilise the advantage of biophilic design in health care facilities as a matter of policy from government.

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CHAPTER ONE

1.0. INTRODUCTION

1.1.0. BACKGROUND OF STUDY

Humans like any other species, have been shaped by the forces of evolution. Evolutionary accounts has it that for vast majority of human existence, certain features of natural landscape provided the basic resources necessary for individual and group survival chief among them; water, shelter, sunlight, animals, vegetable food, building materials, vista and fire (Grinde and Patill, 2009; Taylor, 2007). Primitive builders were able to discern those qualities and to reproduce them in their buildings, they consistently used forms and materials that effectively moderate prevailing climatic conditions, use indigenous materials that are natural and little. For most of human history they predominantly built this way, using local materials extensively, building houses according to their real needs and in harmony with the diurnal and seasonal cycles. Humans were then aware of the weather, the seasons and the flora and fauna in our local environment and they live happy and healthy (Dillon, 2008; Kellert, 2005). The pattern and approach to the design of our built environment changes immediately after the industrial revolution with technological breakthroughs when man started taming the environment, creating spaces that separate people from beneficial contact with natural environment, leaving vast majority to spend most of their times in buildings lacking daylight, fresh air, and exposure to nature. This lead to stress related diseases and other social illnesses. (Heerwegen, 2008). In recent years alternative design and development approaches were introduced, commonly referred to as ‘’sustainability or green’’ designs that focuses on minimising the adverse effects of the built environment on nature, but underscore the need to re-establish positive connections between nature and humanity in the built environment (Yudelson, 2007). Recent advancement in our understanding of natural systems, coupled with a growing understanding of the subtle neurological and physiological functions associated with contact with

nature, have allowed us to identify strategies to increase social interaction, psychological and physiological wellbeing, economic gains, improve productivity, and strengthen the social fabric of communities. This evolutionary hypothesis was later confirmed by health and psychological research that contact with nature in the built environment is beneficial to man. The idea for bringing back the evolutionary affinity of man to natural word was termed Biophilia. The concept of biophilia implies that humans hold a biological need for interaction with nature on physical, mental, and social levels, and that this connection affects our personal well-being, productivity, and societal relationships. Biophilia has many applications that help transform mundane settings into stimulating environments; whether one is engaging with nature by walking through a park, by interacting with animals, or simply by having a view of greenery from home or place of work. Biophilic design as one of the most recent reconnection theories incorporates organic life into the built environment in an essential manner. Extending this logic, the building form, articulation and textures could themselves follow the same geometry found in all living forms. Biophilia can be incorporated into the home through strategies such as the simple addition of indoor plants or large well- placed windows that provide visual connections to the outdoors, design a building with porches, covered walkways, patios or decks that provide access to the outdoor, local views, natural materials, large plants, water and natural light as well as ventilation, fences, gazebos or gliders in the backyard to create different outdoor spaces to enjoy and create an extension of the interior. These outdoor activity areas can include spaces for play, relaxation, meditation and dinning, in order to promote a connection to the daily and seasonal changes in the natural world.

In Biophilia the design balances human needs with the value and considerations of natural environments and incorporates aspects and qualities of those elements into architectural design. This serves to reinforce man's instinctual connection and relationship with those systems thus creating places imbued with emotional experiences, enjoyment, pleasure, interest, fascination and

wonder (Kakunak, 2006). Biophilic design nurtures these relationships through the use of biophilic design features: natural ventilation, natural lighting, natural forms, natural materials, water features, prospect & refuge and ecological ethics and wellness. These features can be applied as methods for developing a design, as well as evaluating a design or built project. Incorporating these elements into built environment produce an ethical architecture that is beautiful, and sustainable, this simultaneously restores the health of the ecosystem and that of the human beings who inhabit them. Biophilic design recognizes the inherent human need for nature together with sustainable design strategies to create environments that truly enhance life (Stewart-Pollack, 2006).

General contact with nature has been found to promote recovery from stress and disorder (Kellert, 2005). Certain plants and habitats; gardens, seashores, hot springs, mountains, and deserts, have long been associated with stress-relieving and even curative effects. The presence of flowers and other aesthetically appealing vegetation has also been linked to calming and healing effects on the sick and disabled (Heerwegen, 2008; Yudelson, 2007).

Biophilic design features can best be applied in health and rehabilitation centres design due to the healing and relieving effect of nature on the sick and stressed. Vesico vaginal fistulae is an abnormality that is mostly as a result in tearing during child birth, when this occur in women it makes it difficult for them to control urine and sometimes faeces. The continuous urine leakage causing bad odour in gatherings result in social stigma and consequent neglect of the victims, economically the victims cannot work because they are shunned by the society, rejected by their families and abandoned by their husbands. Other problems include childlessness, secondary infertility and unaffordable costs of repair. Psychosocial problems of the patients include depression, loss of husband's affection, and loss of libido, divorce and rejection by the society. Those lucky out of the unfortunate victims are usually treated and rehabilitated for reintegration back into the society as productive members of the community. For an effective vesico-vaginal

fistulae centre that provided not only the needed medical services but also the much need healing potentials of nature in an environment that speaks to the minds and souls of its users, biophilia is the best option for such a facility. The centre provides among other things the repairs and treatment of Vesico-Vagina Fistulae (VVF) cases, rehabilitation of the treated patients and training them with a skill that can support them when reintegrated back into the society as productive members, and providing training and awareness on the menace of V.V.F. as a preventive major.

1.2.0. STATEMENT OF PROBLEM

Contemporary buildings like health care institutions are required to fulfil a complex role of aesthetics, physical, social and mental functions. Health care environments are expected to provide and offer holistic healing services to both the body and soul. Healing in this context is the improvement of the overall well being that incorporates the physical (physiology) as well as the mental (psychology). However what is offered in our health care institutions is the healing for the body neglecting the healing of the mind and soul. This is one of the crucial aspect in recovery and rehabilitation processes and this can only be achieved by adopting a design strategy that will seek to create spaces that communicate to the mind and soul of its users. Modern Architects have come to exclusively and effectively neglect the evolutionary connections humans have with nature by imposing an artificial meaning on the built environment, contradicting physical and natural processes, and thus create buildings and cities that are inhuman in their form, scale, and construction (Kellert, 2005). Occupants of built environments do not want simply to work, play, eat, or sleep in a functional building; they want to be inspired, invigorated, comforted, and reassured by their surroundings, they want spaces that speak to their soul, make them more comfortable (Almusaed, 2011). Health care institutions are high-stress environments for patients, visitors and families, and healthcare professionals alike. Integrating nature into healthcare facilities not only

helps in the recovery and rehabilitation processes but also make the environment more lively, enjoying, friendly, humane and interactive (Molthrop, 2012).

1.3.0. AIM AND OBJECTIVES

1.3.1. AIM

The aim of the thesis is to explore biophilic design features and develop a design strategy for the design of vesico-vagina fistulae (V.V.F.) centre.

1.3.2 OBJECTIVES

The objectives of this thesis are to:

1. Explore the biophilia hypothesis and concept as it applies to Architecture.
2. Study the Biophilic design features and their applicability in the design of a Vesico- vaginal fistulae centre.
3. Propose a design of Vesico- vaginal fistulae treatment and rehabilitation facility applying the Biophilic design features.
4. Design building that connects the users and environment in a beneficial relation.
5. To provide an architectural piece that seeks to re-establishes the evolutionary connection people have with nature.

1.5.0. SIGNIFICANCE OF STUDY

Women have in recent years comes to play an outstanding roles in diverse sectors of the society and contributed immensely in the nation building. Despite the numerous contributions and achievement women made to the growth and development of our dear nation, problems and sets backs are being faced by these women through reproductive and maternal health problems,

especially victims of Vesico-Vagina Fistulae (VVF). V. V. F. is a major public health problem in Nigeria, one of the maternal morbidities; the situation being more evident in the Northern part of the country. Prevalence estimations range from as low as 100,000 to as much as 1,000,000 cases. The incidence is estimated at probably 20,000 new cases a year. With approximately 2,000 - 4,000 fistula repair surgeries being carried out yearly, the problem is aggravating progressively (National Foundation on Vesico-vaginal fistulae [NF-VVF], 2003). Recent maternal mortality estimates by the World Health Organization, (2008) indicates that there are half a million maternal deaths worldwide each year, and that 99% of those deaths occur in developing countries, with slightly more than half of those deaths occurring in sub-Saharan Africa. Nigeria counts for 40% of the worldwide fistula prevalence (Health Research for Action [HERA], 2009). These abnormalities hindered their participation in the everyday activities due to unpleasant complication it brings. Considering the fact that women are the backbone of any society as child bearers therefore, plays an important role in the continuity of the human race. Vesico vaginal fistulae patients need to be treated, rehabilitated in a humane environment and re-integrated back into the society. Therefore the need to provide for a modern, humane and befitting treatment and rehabilitation facility that will provide the much needed services cannot be over looked. In summary the research will help the society in the following ways;

1.5.1 Provide a guide to the usage of biophilic design features in hot dry climate

1.5.2 Provide for an ethical architecture that is beautiful, and sustainable and have a sense of place

1.5.3 Give the patients of VVF an environment that offers the natural appeal and affection they lose from the society.

1.5.4 Reducing the number of abandon young mothers that faces rejection and disownment from the society by preparing them to face the challenges of life and re-integrate them back into the society as productive members of the community.

1.6.0 SCOPE AND LIMITATIONS

This research work will explore the features of biophilic design and identify those that can be applied to the design of VVF centre. The scope will cover all aspects of biophilic design as it applies to VVF centre and will not focus on the study of controlling VVF, but to address the design issues using biophilic design features in enhancing healing and social environments. This relatively straightforward objective is, however, extraordinarily difficult to achieve, given both the limitations of our understanding of the biology of the human inclination to attach value to nature, and the limitations of our ability to transfer this understanding into specific approaches for designing the built environment. The scope shall be limited to those aspects of biophilic design that is rooted in passion for life and nature in creating humane healing and social environment.

CHAPTER TWO

2.0.0. LITERATURE REVIEW

2.1.0. THE BIOPHILIC DESIGN HYPOTHESIS

The term biophilia was first introduced by Erich Fromm, and was considered as a psychological orientation towards what is alive and vital, and is the converse of necrophilia. However, in the mid 1980s Harvard biologist E. O. Wilson introduced the biophilia theory, which suggests that human beings thrive in nature and suffer in its absence "Biophilia is the innately emotional affiliation of human beings to other living organisms" – E.O. Wilson, 1984. In the nineties of the 20th century the interest in biophilia culminated in the publication of the book the Biophilia Hypothesis (Kellert & Wilson, 1993). Some research has shown that buildings that connect people to nature support healthier human well-being and higher cognitive performance.

Biophilia implies affection for plants and other living things, Biophilia may be described as a vague preference for having a natural environment as a consequence of our evolutionary history. Although in a literal sense, biophilia can be understood as the 'love for life', it is evident that not all life or life-like processes elicit positive reactions. Traditional examples are snakes and spiders, which are known to cause aversive or phobic reactions in humans. In essence, the biophilia hypothesis states that (modern) humans have:

(a) An emotional affiliation with life and life-like processes, and

(b) This affiliation is engrained in our genetic makeup.

2.2.0. THE CONCEPT OF BIOPHILIA.

Early humans depended on their surroundings for both natural resources and for enabling the establishment of community. For thousands years our ancestors live the majority of their lives in the open natural landscape depending on nature for their basic needs like sunlight, water, shelter,

food, vista and fire. We evolved from the natural world leaving behind caves and open savannah to move into man-made environment in which we control the elements. It was based on this notion that Edward O. Wilson introduced the term biophilia in his book, ‘’Biophilia (1984)’’, which suggested that there is an instinctive bond between human beings and other living systems. Biophilia is a design philosophy based on evolutionary theory and supported by both psychological and health researches that human needs an ongoing connection with nature just as we need food and regular exercise to flourish as a result of our evolutionary history (Taylor, 2007). The underlying concepts in biophilic design include:

- Looking beyond survival to well-being,
- Building on "primitive preferences" and connections to nature,
- Designing for the senses as well as the body.

Biophilic design concept is an outgrowth of two theories that explain how natural systems affect human physical and mental well-being:

1. Organic (or naturalistic) design fostering various benefits people derive from their tendency to value nature (design with forms, shapes and materials that mimic natural feature and processes). See plate 2.1.
2. Vernacular (or place-based) design, enables a satisfying connections to the place where people live and is defined here as buildings and landscape features that foster the distinctive culture and spirit of a place (design that connect people and nature to particular cultural and ecological setting).

Writer David Pearson as quoted by Kellert, 2005 describes biophilic architecture as “rooted in a passion for life, nature, and natural forms, full of the vitality of the natural world with its biological forms and processes.” He summarises biophilic architecture thus:

• Inspired by nature,

• Unfolding, like an organism, from the seed within,

• Existing in the "continuous present",

• Following natural flows, flexible, and adaptable,

• Satisfying social, physical, and spiritual needs,

• Growing out of the site,

• Celebrating a spirit of play and surprise.



Plate 2.1: Wright's Fallingwater, Pennsylvania.

Source: Kellert (2009).

Stephen R. Kellert, 2005 adopted a list of nine values which he suggest reflect a range of physical, emotional and intellectual expressions of biophilic tendencies to associate with nature. While it is difficult to capture briefly the substance of these nine values, definitions provide a starting point.

I. **The Utilitarian value: -** The material benefit that humans derive from exploiting nature to satisfy various human needs and desires.

II. **The Negativistic value**: - Feelings of aversion, fear, and dislike that humans have for some natural elements, processes or forms.

III. **The Dominionistic value: -** The desire to subdue and control nature for human benefits and enjoyment.

IV. **The naturalistic value: -** The many satisfactions people obtain from the direct experience of nature.

V. **The Ecologistic-scientific value: -** The systematic study of the biophysical patterns, structures, and function of nature.

VI. **The Aesthetic value: -**Primary emotional response of intense pleasure at the physical beauty of nature.

VII. **The Symbolic value** The tendency for humans to use nature for communication and thought.

VIII. **The humanistic value: -** The capacity for humans to care for and become intimate with animals.

IX. **The Moralistic value: -** The right and wrong conduct toward the nonhuman world, the ethical values attached to nature.

X.

2.2.1. ELEMENTS OF BIOPHILIC DESIGN

Judith Heerwegen, 2005 developed a list of biophilic building features that make up the biophilic design elements. These elements are the qualities of the Biophilic design principles which make the biophilia a unique design approach, from sustainability/ green architecture concepts.

Table 2.1 Elements of Biophilic Design.

SN	KEY DIMENSION	QUALITIES/ ATTRIBUTES
1	Prospect (ability to see into distance)	• Brightness in the field of view(windows, bright walls) • Ability to get to a distant point for a better view • Horizon/sky imagery (sun, mountains, clouds) • Strategic viewing conditions • View corridors
2	Refuge (sense of enclosure or shelter)	• Canopy effect (lowered ceilings, screening, branchlike forms overhead)
3	Water (indoors or inside views)	• Glimmer or reflective surface (suggests clean water) • Moving water (also suggests clean, aerated water) • Symbolic forms of water
4	Biodiversity	• Varied vegetation indoors and out (large trees, plants, flowers) • Windows designed and placed to incorporate nature views • Outdoor natural areas with rich vegetation and animals
5	Sensory variability	• Changes and variability in environmental colour, temperature, air movement, textures, and light over time and spaces • Natural rhythms and processes (natural ventilation and lighting)
6	Bio mimicry	• Designs derived from nature • Use of natural patterns, forms, and textures • Fractal characteristics (self-similarity at different levels of scale with random variation in key features rather than exact repetition)
7	Sense of playfulness	• Incorporation of decor, natural materials, artefacts, objects, and spaces whose primary purpose is to delight, surprise, and amuse
8	Enticement	• Discovered complexity • Information richness that encourages exploration • Curvilinear surfaces that gradually open information to view

Source: Adapted from Kellert (2005).

2.2.2. ATTRIBUTES OF BIOPHILIIC DESIGN

Biophilic design attributes are elements and qualities of the physical environment that connect people to the physical, psychological, and cognitive benefits derived from direct, indirect or symbolic experiences with nature. We prefer these natural attributes in part because they literally bring buildings to life physically through the use of design strategies and materials, and symbolically through an understanding of deeply rooted affiliations, associations, and meanings. Biophilic design attributes include: dynamic natural light, natural ventilation, access to open and/or moving water, frequent opportunities for spontaneous interaction with nature, sensory connections to nature, complexity and order, mystery, prospect and refuge, fundamental natural forms, and local natural materials (Kellert, 2005; Taylor, 2007; Pollack, 2006).

2.2.21. Dynamic natural light (rhythmical living light, patterns of brightness and shadow, sparkle).

The most significant difference between our experience of natural light and artificial light is that natural light is constantly changing in direction and intensity. The overall rhythm of sunlight

moving from day to night and from season to season reveals and highlights colours, patterns, and textures; subdues and constantly changes them, then reveals them again in an entirely new way. Changing patterns of brightness and shadow, sparkle and reflection capture and redirect our attention, helping to relieve stress and mental fatigue.

2.2.22. Natural ventilation (movement of air, changes in air temperature, airborne scents).

The movement of fresh air through a space changes everything. It alters our perception of temperature, changes a static environment into one of subtle movement, and brings the world into our homes through scents carried on the breeze. The orientation of the home provides

Cross ventilation in all critical spaces through windows, doors, and operable skylights through which fresh air can circulate.

2.2.23. Access to open and/or moving water (visual, acoustical, symbolic qualities).

Water is one of the most evocative, universally shared symbols of life and a powerful biophilic attribute. We are instinctively drawn to water as a source of survival, as well as for aesthetic and recreational pleasure. In addition to human beings historical patterns of habitat selection that have always favoured living near the water, some of our most cherished and revered buildings, such as Frank Lloyd Wright's Falling water, use water as a primary design element.

2.2.24. Frequent opportunities for spontaneous interaction with nature (free-flowing movement between interior and exterior spaces, visual or physical access to wildlife).

Biophilic design views the site and building as a series of exterior and interior spaces woven together in a tapestry, by integrating the natural elements of the site into the form of the architecture itself, we experience the unique relationships between interior and exterior from multiple perspectives as we move from space to space within the home. Visual and physical barriers between indoor rooms and outdoor spaces dissolve into a mosaic of inside-outside spaces. Both distant views and views of nearby nature are important to this experience. Distant views link us to the greater natural order of the site, while nearby nature links us to the intricacies and immediate sensory pleasures of the site.

2.2.25. Complexity and order (relationship of variety and intricacy within underlying natural patterns of order).

Diversity and intricacy abound in the natural world, from micro to macro, nature's almost infinite variety provides environments for all species to live, learn, and thrive. But what makes it all work are underlying natural patterns of order that hold the diversity, variety, and intricacy together to maintain coherence. Natural patterns of scale and proportion, balance and harmony, novelty and familiarity, help us to organize and make sense of the complexity of the natural world.

2.2.26. Mystery (enhances the desire to explore, discover, and learn from the complexities of nature).

The relationships of complexity and order found in natural environments often take on the quality of mystery, defined by environmental psychologists Rachel and Stephen Kaplan as, "Something in the setting that draws one in, encourages one to enter and to venture forth, thus providing an opportunity to learn something that is not immediately apparent from the original vantage point".

2.2.27. Prospect and refuge (strategic viewing conditions from a position of safety and security).

From the first crude shelters of our earliest ancestors to the most advanced, modern built environments available today, our homes have always been chosen and designed to provide primarily a place of protection.

2.2.28. Fundamental natural forms (bio mimetic models, fractals, natural progressions of scale, rhythm, proportion, repetition, symmetry, gradients).

Biophilic design views nature as the ultimate design model. Nature's forms, geometric progressions, and patterns are studied and translated into the forms, progressions of scale and proportion, and patterns of the building and interiors.

2.2.29. Local natural materials (connect the site to the building and interior spaces).

Biophilic design emphasizes using natural materials native to the site and surrounding to create sensory connections between the built and immediate natural environments.

2.2.3. PRINCIPLES OF BIOPHILIIC DESIGN

There are five essential principles of biophilia which can be applied to architecture either for the purpose of guiding the development of the design as well as evaluating its merits: Affiliation and Affinity, Wellness, Bio centric Ethics, Prospect & Refuge and Homeostasis (Dillon, 2008; Kellert, 2005). These principles relate to the elements of building design, some more strongly than others. The biophilic principles are all strongly connected, just as there is truly no clear line between each

of the building elements, each affects and interacts with the others, working together to form a cohesive whole. Addressing a single building element or biophilic principle individually, as if within a vacuum, cannot result in a successful design. The whole system, biophilia and building together, must be considered, developed and function together, like a living organism.

2.2.31. Affinity and Affiliation: - There are four basic levels of affiliation for developing biophilic affinity. These four levels of affiliation are Contact, Association, Views and Proxy. While each level of affiliation can develop biophilic affinity, the more personal and immediate the affiliation, the stronger the psychological and emotional connections will be. Affinity consists primarily of emotional connections which cause humans to attach value to some item. Contact is the most immediate level of affiliation which occurs when we associate with elements to the point where they enter our personal space, including physical contact. Such affiliation is more powerful due to the intensity of sensation caused by the physical closeness of the item which involves senses of touch and smell.

2.2.32. Wellness: - People who have had more exposure to the environment are healthier in a broad range of ways. They are less likely to have mental illnesses, develop attention deficit disorders, suffer from excess stress, which causes additional health issues and are less likely to be obese or overweight, which causes even more health problems.

2.2.33. Bio centric ethics: - Ethics are the theoretical or philosophical concepts behind morality. Environmental ethics begins essentially with the issue of instrumental value versus intrinsic value. In other words, should environmental ethics consider the needs of the ecosystem because of the relationship that humans have with the environment and the consequences to us for the damage done to the environment. Or, on the other hand, is there an intrinsic value to the natural environment outside of what it means to us as humans?

2.2.34. Prospect and refuge: - Human beings naturally seek high ground and shelter for protection and in order to get a better view of our surroundings. The comfort and relaxation we feel looking out over a vista is an aspect of a human survival trait, not simply a matter of aesthetics. The concept of prospect & refuge is the most directly applicable biophilic principle in Architectural terms.

2.2.35. Homeostasis: - Homeostasis is defined as "a relatively stable state of equilibrium or a tendency toward such a state between the different but interdependent elements or groups of elements of an organism, population, or group". The natural world exists naturally in a homeostatic, largely self-corrective state. Removing elements from that natural cycle or ignoring the cycle entirely can throw the entire system out of balance and makes the return to homeostasis much harder. In biophilic design, homeostasis becomes important as a concept for reconnecting humans to the natural cycles which we evolved from.

2.3.0. BENEFIT OF CONTACT WITH NATURE.

A large body of research has confirmed the hypothesis that, contact with nature can lead to increased mental health and psychological well-being (Dillon, 2008; Kellert, 2005; Yudelson, 2008). Many studies have found that contact with actual rather than representational nature has the most consistent and powerful therapeutic effects. Several scientific studies also report that the presence of plants in hospitals and the exposure of patients to therapeutic gardens can produce symptom-relieving benefits (Grinde and Patill, 2009). Some investigations have found that patients generally prefer vegetation in their hospital rooms, attesting to its comforting and healing effects (Kahn, 1997). Further investigation reported that contact with nature in hospital rooms, views of the outside, and exposures to gardens were among patient's most widely stated health care preferences (Kellert, 2005). This follows the trend of the application of biophilia concepts to interior design in hospitals as administrators have witnessed patient's positive responses to nature. In addition,

scientific Studies have shown that including gardens in healthcare design has a restorative effect for both staff and patients, whether in a concentrated garden setting or dispersed throughout the building. Natural forms provide an oasis for relief from the stress inherent within the healthcare system (Heerwegen, 2008). To determine the benefits of experience with nature, it is essential to determine the types of contact we have with the natural environment. The contact is not limited to only a natural environment or landscape but could include the simple notion of nature. According to Kellert (2005) there are three types of contact we can have with nature: Direct, Indirect and Symbolic.

2.3.1. Direct contact: - Involves immediate experience with natural processes such as hiking through a forest, swimming in a stream or mountain climbing. Direct contact usually involves a person immediately within a natural environment.

2.3.2. Indirect contact: - Involves some kind of human intervention or control such as mowing a lawn, viewing an aquarium or gardening.

2.3.3. Symbolic contact: - Does not require any physical contact with natural processes or organic life forms. It involves a symbolic or metaphoric encounter such as depictions of landscapes in art or photographs or the use of organic patterns and forms in either decoration or architecture.

According to environmental psychologists contact with the natural environment can have a psychologically restorative effect on people. Restorative environments whether they be in the context of nature or the built environment, incorporate elements that function therapeutically by reducing cognitive fatigue and alleviating stress. These environments provide opportunities for rest, recovery, contemplation, and isolation (Dillon, 2008). The positive effects from contact with nature or natural views have proven to be greatest when people are experiencing high levels of stress or are confined to situations like hospitals, prisons and work environments. In this case frequent direct, indirect or symbolic contact with nature continues to have a positive physical and psychological

effect on human well-being. Kellert, (2005) identifies four benefits of contact with nature in built environment;

- Nature tends to correlate with physical activity which obviously promotes health.
- Nature activities often imply socialisation in form of walking in group, sitting in a park with friends, building social network.
- Nature offers temporary escape from every day routine and demands.
- To what extent interaction with nature can have an appreciable impact on the mind.

These benefits of contact with nature can be explained further in three ways (Grinde and Patill, 2009),

- The air may be healthier in that it contains less air pollutants and more humidity.
- Plants may emit fragrance that humans find pleasant or react to in various ways.
- Visual experience of plants makes difference in that nature appears to have qualities useful for stress relief, mental restoration, and improve mood simply by consciously or unconsciously pleasing to the eye.

2.4.0. BIOPHILIA, HEALTH AND WELL- BEING

If through evolution certain natural landscapes have promoted and supported human survival and reproductive success, then it can put forth that such landscapes nurture the human physiology and promote a sense of emotional well-being. Humankind does not merely have a preference for natural landscapes, they are also important to our physical and mental health. Numerous studies have shown that regular exposure to natural elements is highly beneficial to mental health, particularly stress reduction (Kahn, 1997). Immersion in natural environments is even more beneficial. Physically, patients recover faster when exposed to images and elements of the natural environment

both before and after surgery (Dillon, 2008). Researchers have consistently found that people with access to nearby natural settings are healthier than other individuals. (Grinde and Patill, 2009).

Encouraging and enabling connections is highly beneficial both emotionally and physically. Perhaps more importantly, this detachment between humanity and our natural environment has led to apathy towards the effects of our actions on the biosphere which, creates greater environmental problems by isolating the community from our natural surroundings, we place our mental and physical health at risk (Dillon, 2008). Nature is beneficial to all regardless of age, race, gender, or ethnicity. Contact with nature has been found to promote recovery from stress and disorder. Certain plants and habitats have been associated with stress-relieving, curative effects, calming, healing effects on the sick, and disposure of patients to therapeutic gardens can produce symptoms relieving (Bender, 2007; Dillon, 2008).

During their stay in a healthcare institution, patients require different forms of social interaction, in fact, this is also about being able to regulate the interactions, they should have the possibility to choose between being alone and socializing, and the type of interaction. Generally, social interaction offers people relaxation and distraction; it stimulates and, gives people support (Netherland Board for Healthcare Institutions [NBHI], 2008). Several bodies of research have reported that the sight and sound and other sensory experience of nature can reduce stress and tension as well as foster recovery among patients suffering from clinically diagnosed disorders. One impressive study conducted by environmental geographer and psychologist Roger Ulrich and his colleagues focused on patients recovering from gall bladder surgery. The patients were randomly assigned to one of two types of hospital recovery rooms: one with a window view of trees and vegetation, the other with a view of a brick wall. Patients with the out- door views had significantly better recovery rates, more positive responses to treatment, and substantially less need for medication than those who saw only the brick wall. The researchers reported: “Patients with the

nature window view had shorter post-surgical hospital stays, fewer minor post-surgical complications, and received far fewer negative evaluative comments in nurses' notes. Ulrich and his colleagues conducted a similar study in Sweden of 160 patients recovering from heart surgery. This time the patients were randomly assigned to three types of recovery rooms: the first with pictures on the wall of water and trees, the second with abstract wall art, and the third with only blank walls. The researchers observed significantly less anxiety and fewer demands for strong pain medication among the patients who had pictures of water and trees. By contrast, the highest stress levels occurred among the patients whose walls were decorated with abstract art. In another study of Swedish psychiatric patients, Ulrich and his colleagues again exposed patients to representational artwork, with one group viewing pictures of flowers and an appealing landscape while the other group saw abstract art. The patients with the nature art demonstrated more positive effects; the patients who viewed the abstract art showed more negative responses, and some normally nonaggressive patients even attacked and smashed the pictures.

2.5.0. NATURE BASED ELEMENTS, FORMS AND PROCESSES

2.5.1. Nature Based Elements: - This element includes representations and simulations of the natural world often found on building facades and within interiors these shapes and forms are: botanical motifs; trees and columnar supports; animal, shells and spirals, egg, oval, and tubular forms; arches, vaults, and domes; shapes resisting straight lines; simulation of natural features, biomorphic; geomorphic; and bio mimicry (McGee, 2012) see plate 2.2.

2.5.2. Fractals: - Fractals are shapes that have organized complexity and human beings connect physiologically and psychologically to structures embodying organized complexity more strongly than to environments that are either too plain, or present disorganized complexity. The varieties of mathematic proportion and repetition, information, patterns, and spatial connections found in this

element add connections to natural occurring patterns in the interior environment, as represented in plate 2.3. The shapes in this façade draw on foliated patterns and fractal geometries encountered in nature.



Plate 2.2: Art nouveau interior by August Endell, Elvira house, Munich 1897

Source: Kellert (2005).

2.5.3. Nature Forms and Processes: - Nature is always on the move. Sun, clouds, water, tree leaves, grasses all move on their own rhythms or with the aid of wind. Judith, 1995 assert that certain kinds of movement patterns may be associated with safety and tranquillity, while others indicate danger. Movement patterns associated with safety show "Heraclitean" motion that is a soft pattern of movement that "always changes, yet always stays the same." Examples are the movement of trees or grasses in a light breeze, aquarium fish, or the pattern of light and shade created by cumulus clouds. In contrast, movement patterns indicative of danger show erratic movement and sudden change, such as changes in light and wind associated with storms, or birds fleeing from a hawk (Kellert, 2005). The emphasis here is the incorporation of properties of element found in

nature into the built environment, rather than the representations or simulations of environmental shapes and forms.



Plate 2.3: New York City building façade.

Source: Kellert (2005).

2.6.0. BIOPHILIA BASED DESIGN

Nature is our guide to balance and harmony. Nature based design draw upon the innate intelligence found in nature; when plants turn their leaves to the sun light, when a bird sits on eggs and ultimately, when our body knows how to heal itself. Three pillar concepts serve as the tenets of biophilic design: Nature in the Space, Natural Analogues, and Nature of the Space.

2.6.1. Nature in the Space: - Refers to the incorporation of plants, water and animals into the built environment. Examples include potted plants, water features, aquariums, and courtyard gardens, as well as views to nature from the inside of a building. The prevalence of the courtyard in traditional architecture is a good example of our early attraction to incorporating nature directly into our built environment. These direct connections to nature especially dynamic nature that incorporates movement produce the strongest biophilic reactions.

2.6.2. Natural Analogues: - Are one degree of separation away from true nature. Natural Analogues are materials and patterns that evoke nature and are characterized by four broad types:

3. Representational artwork,
4. Ornamentation,
5. Biomorphic forms, and
6. The use of natural materials.

Pictures of trees and water, building elements that mimic shells and leaves, furniture with organic rather than geometric shapes, and visible wood grain fall under the umbrella of natural analogues.

2.6.3. Nature of the Space: - A similar concept, refers to the way humans respond psychologically and physiologically to different spatial configurations. As mankind developed in the savannas of Africa, our species existence among low-growing grasses clusters of shade trees, and broad vistas have yielded a modern day affinity for similar landscapes in indoor and outdoor environments (Kellert, 2005). In fact, our innate preference for open spaces does not extend to just any open space; physiological research indicates that our bodies react most positively to savannah like settings with moderate to high depth and openness.

2.7.0. BIOPHILIC DESIGN FEATURES

These are the sum total of all the attributes, elements and principles of biophilic design that can be applied to architecture in the design of built environment to create a building that is not only sustainable in terms of energy efficiency, material and environmental conservation but also reconnect its users to the natural potentials of the environment around for the health and well being of the users. They are those qualities of biophilia which give a unique approach to the design of built environment. The biophilic design features can be summarised thus;

2.7.1 NATURAL LIGHTING AND VENTILATION.

- **Natural lighting: -** The source of natural light is the sun which provided warmth and light, as well as information about time of the day. Bright daylight has medicinal properties, it entrains circadian rhythms, enhances mood, promotes neurological health, and affects alertness. (Heerwegen, 2008). As sunlight passes from the eye to the brain, it affects the entire body from the spine to the pituitary gland, which depends on light for growth. All colours is light, light is energy, and energy affects every cell of the body. For centuries, scientists have known that people depend on sun for physical well- being. The sun catalyzes many metabolic processes, and when we lack exposure to sunlight, some metabolic pathways sit dormant, reducing our ability to burn fat and expel toxins (Huelat, 2008). Research in hospital settings shows that patients in bright rooms recover more rapidly from illness, show reduced pain levels, take fewer strong analgesics, and stay in the hospital fewer days than patients who are in more dimly lit rooms located in locations where nearby buildings block sun penetration (Dillon, 2008; Kellert, 2005). The benefits of sunlight can be experienced in even brief walks outdoors on a sunny day or through design of spaces that integrate daylight and sun into the interior without jeopardising the thermal comfort of the interiors as seen in plate 2.4. This office building innovatively includes light, water, and vegetation in a deep building interior, purportedly resulting in enhanced worker comfort, morale, and productivity.
- **Natural Ventilation: -** Building ventilation is necessary for supporting life by maintaining acceptable levels of oxygen in the air, to prevent carbon dioxide (CO2) from rising to unacceptably high concentrations and to remove odour, moisture and pollution produced internally. Thermal comfort condition of an interior space depend on how well ventilated the space is. In architectural design the knowledge of microclimatic elements is important in design for natural ventilation: wind and local breezes, sun and shadows, humidity and vegetation can

strongly contribute to the thermal well-being of the inhabitants. If these elements are manipulated by the creativity of the architect they often inspire new architectural shapes.



Plate 2.4: Genzyme Building, Cambridge, Massachusetts.

Source: Kellert (2005).

2.7.2 NATURAL MATERIALS.

Architectural design and development of built environment that utilises materials and technology that are locally sourced either around the site or within the locality. Such materials are usually recyclable or renewable and does not cause too much damage to the ecosystem, that contains symbols of nature can often produce highly appealing and powerfully experienced places, drawing strength from an instinctual human emotional and intellectual proclivity for the natural world. This experience is only one example among many of how often we infuse the organic into interior and exterior settings to produce places of special power and meaning.

2.7.3 VIEWS AND PROSPECTS.

Proxy affiliation occurs when we're not actually experiencing a natural environment or elements, but rather are exposed to impressions of one through some imitation such as a painting of a landscape, pine scented candles or audio of sounds of natural environments such as thunderstorms, walks through the woods,

Closely connected with the subjects of daylight and nature is having a window with the possibility of a view.

- **Views of nature: -** Window with the possibility of a view into the natural setting of the site. Reliable and consistent research shows that particularly natural views have a positive psychological effect, may have a healing effect, and reduces stress.
- **Visual distance: -** A visual corridor from a position of security that providing visual access to a distant view of the vicinity of the area.
- **Windows positioned to frame views of nature: -** The ability to view a landscape from a window can form strong biophilic connections. Indeed, such conditions have been shown to be very beneficial, such as with stress reduction among employees or hospital patients (Taylor, 2008).

2.7.4 NATURAL FEATURES.

Traditionally the building style tends to evolve over time to reflect the environmental, cultural and historical context of the place.

- **Respect for site: -** Land in a community is the basic concept of Ecology, for that land to be loved and respected is an extension of ethics. An environmental practice is right when it tends to preserve the integrity, stability and beauty of the biotic community, it is wrong when it tends

otherwise. (Dillon, 2008). Designing the environment with little or no disturbance of the natural ecosystem of the area is the most humane approach to the planning and construction of a particular environment.

- **Water features: -** Access to water was and remains critical for man's survival; one cannot discuss the healing aspect of nature without emphasis on water, water makes up 71% of the earth. We think of water in nature as being rivers, lakes, and ponds but it is also rain, ice, snow and fountains. Rain droplets mixed with sunshine give us a rainbow, the symbol of hope. Water has been associated with cleanliness and hygiene (Huelat, 2008). Water is an element of nature that also delights, we are attracted to the sound of water, its gentile trickle, it's bubbling or waves, all are said to have a calming effect and feeling of regeneration of spirit. For this reason water features have often been a focal point of healthcare facilities. Biophilic design incorporate water feature in indoor environments in form of pools, spas, fountains, ponds, stream and aquariums. Baths, spas and medicinal healing have long linked water to healing. From pre-history healing spring to modern day health spas, water and cleanliness have increase general health conditions of people (Huelat, 2008).
- **Land forms and vistas: -** High ground gave early humans views of the surrounding area which allowed them to keep watch for dangerous predators as well as passing prey. Natural feature of the site provides scenery for admiration especially when the site has a variety of features like undulating terrain, trees, rocks, and water bodies. Designing with the topography of the site, makes the building another component feature like an outgrowth not an imposed structure.
- **Vegetation and greening: -** Vegetation here can be in form of landscape, tress, garden, roof garden, flowers and shrubs. Green plants effectively purify the environment, absorbing carbon dioxide and releasing oxygen, they release moisture, preventing aridity. Plants filter toxins and other pollutants that can be harmful to humans when inhaled (Dillon, 2008). Garden can bring

all natural elements together allowing us to interact directly with nature. Garden provide an opportunity to interact freely with nature and afford the aesthetics of nature that can be experience through sunlight, viewing trees, and listening to the sound of water or bird songs, the combination of these and other elements can have a powerful enticement in an environment whether outdoors or indoors. Grasslands provided the best views and trees with high canopies provided shade without obstructing the all-important views of the surrounding landscape. Incorporating plant materials into the interior can have fascinating effects on the users as can be seen in plate 2.5, a typical savannah feature, such as discrete trees, a water-element, wide and open views, topographical opportunities to overlook the setting.



Plate 2.5: A shopping mall

Source: Joye (2007).

2.7.5 NATURAL FORMS, SHAPE AND PROCESSES.

Incorporating the shapes and forms of nature into the design of the built environment has also been called “biomorphic” architecture. Philosopher Yannick Joye defines biomorphic architecture as “designs whose shapes are similar to the formal grammar of living things.” Examples of biomorphic architecture include both stylized imitations of living organisms like plants and animals and more subtle simulations that reflect the structural properties encountered in the natural world like the replicated patterns and shapes of shells and leaves. Biomorphic design has been linked to the inherent human affinity for natural forms that when successfully expressed can enhance human physical and mental well-being (Kellert, 2005). Architectural design that contains symbols of nature can often produce highly appealing and powerfully experienced places, drawing strength from an instinctual human emotional and intellectual proclivity for the natural world. This experience is only one example among many of how often we infuse the organic into interior and exterior settings to produce places of special power and meaning plate 2.6 shows how the sculptural qualities of light can be combined with a highly organic space.

It is the thought that by designing and building from nature, by mimicking its beauty and harmony, the built environment will be more conducive and sympathetic to the human body, mind and spirit (Pearson, 2001).

- **Building form and layout: -** Planning the building form and articulation to follow natural order of complexity and misery.
- **Design derived from nature: -** Design that grows out of site, emanating from the seed within following natural pattern and processes.
- **Use of natural pattern, form and texture: -** Fundamental natural forms, natural pattern and processes are a source of inspiration in biophilic design; it defined and shaped the built environment in harmony with nature.



Plate 2.6: San Francisco, Hotel lobby.

Source: Kellert (2005).

2.8.0. BIOPHILIA IN HOT DRY CLIMATE

2.8.1. HOT DRY CLIMATIC REGION

This region is situated in two belts at latitudes between approximately 15° and 30° North and South of the equator. Its main characteristics are the very long hot summer season and a cooler winter season, and the great temperature difference between day and night. In the hot season the air temperature rises quickly after sun rise up to a mean maximum well above 40°C, with a recorded maximum of 58°C, at night time the temperature falls by about 20°C. In the cool season the mean maximum lies at about 30°C and falls at night by about 10°C to 20 °C or more, according to altitude. The relative humidity is below average, and varies between 10% and 55%. In the coastal areas, this, together with the high temperature, makes the climate very uncomfortable (Stoll and Evstratov, 1987). Precipitation is scarce, irregular and unreliable. The sky is mostly clear, with some haze in the coastal regions, allowing a very strong solar radiation during the daytime. A

considerable release of the heat stored during daytime takes place in the form of radiation toward the cold night sky. The winds which vary greatly are usually caused by thermals created by humidity and temperature differences. During the daytime they are often strong and violent with a tendency to evolve to sand or dust storms. In the coastal regions a regular wind pattern exists, blowing landward from the sea during the daytime and seaward at night (Stoll and Evstratov, 1987). The climate of hot-dry zones is in general characterized by high temperatures (40°C - 50°C in summer), with sharp variations in both diurnal and seasonal temperatures; and precipitation which is scarce, irregular and unreliable, but may nevertheless cause severe floods. Cold winds and dust/ sandstorms prevail in winter. The solar radiation intensity is high and enhanced by the radiation reflected from the ground. The air humidity is low and this climate is generally healthier than that of warm-humid areas (Stoll and Evstratov, 1987).

2.8.2. BIOPHILIA AND CLIMATE

The strength of biophilic architecture is that it blends buildings into various settings so that there is a natural harmony between climate, architecture and people. The main goal of climatic design, on a macro and micro level, is to reduce uncomfortable conditions created by extremes of heat and dryness. Not only is cooling needed; passive heating may also be needed in winter and during cold nights. Protection is required from the intense radiation from the sun, ground and surrounding buildings, from dust, sandstorms and insects. Clay and sand are the prevailing kinds of soil in hot dry climate as such adequate measures has to taken when planting trees, shrubs and flowers close to buildings because watering changes the moisture content of the soil which can cause a differential settlement of the structure.

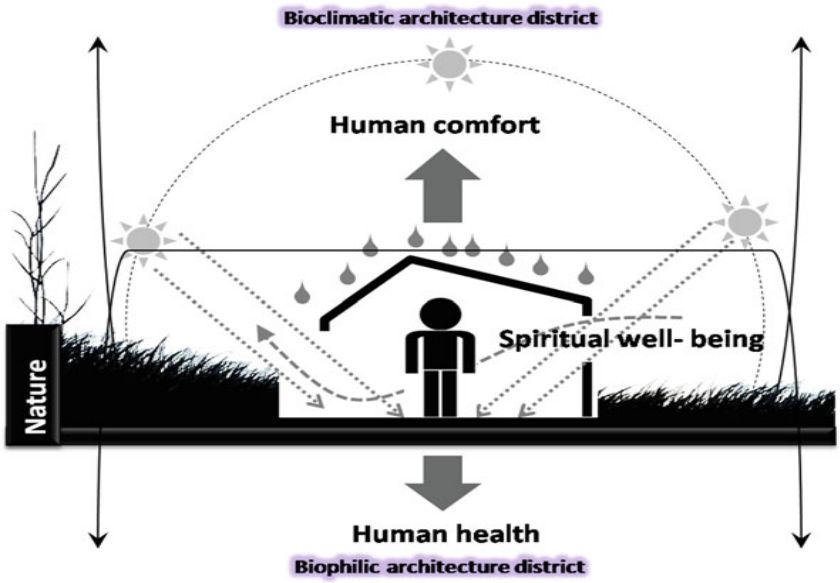


Figure 2.1. The interaction between the biophilic and bioclimatic architecture concepts

Source: Almusaed (2011).

2.8.3. BIOPHILIA APPLICATION IN HOT DRY CLIMATE

Primitive builders consistently used forms and materials that effectively moderate prevailing climatic conditions, indigenous materials and natural forms. For most of human history this has been the predominant way of building, using local materials extensively, wasting very little and living very close to the natural environment around us, very much conscious of the weather, the seasons (diurnal and seasonal cycles) in our local environment to degrees well beyond what we are today (NBHI, 2008). A high ambient temperature, low humidity and violent solar radiation, often accompanied with heavy winds, markedly complicate the application of biophilic design in hot dry climate, but with clear and concise planning biophilia and bioclimatic architecture can be married together as in plate 2.7. The concept of biophilic design emphasizes the necessity of maintaining, enhancing and restoring the beneficial experience of nature for human beings through the practices of architecture, engineering and landscape architecture through careful and deliberate use of resources both, technical, environmental and human. Before industrialization, the process of

building applied the principles of biophilic design as a matter of course, including integration with the natural environment, use of local materials and patterns from nature, and connection to the local culture and heritage bearing in mind the climatic challenges and opportunities.

2.9.0. BIOPHOBIA OR NECROPHILIA (NEGATIVE EMOTIONS)

At first blush, biophilia would seem to mean something like love of nature or at least something that accentuates a positive affiliation. Yet most proponents of biophilia agree that people at times find nature unlikable and unfriendly, if not threatening and harmful, and that such negative affiliations comprise a part of biophilia (Kahn, 1997). Various environmental psychological studies show that the physical environment influences both the people and their moods, i.e. how people feel (NBHI, 2008). Poisonous snakes and spiders often frighten people. So do grizzly bears, mountain lions, and other large predators. Mosquitoes are nuisances, at best, bogs and swamps can seem unappealing, precipices scary, dark woods forbidding. Thus, while there does appear to be evidence for special feelings for nature, some are negative rather than positive. One of the negative emotions that the environment can arouse is crowding. This refers to the negative consequences of excessive social or spatial density, which creates the sensation that there is not enough room available (Kahn, 1997). Even if we agree that people have an affinity for nature, it would seem equally clear that people have an affinity for human artefacts, people enjoy looking at cityscapes from a distance, enjoy visiting specific buildings, can spend lavish amounts of money buying cars, polishing them, and looking at them. People spend hours each day watching television or within the World Wide Web, garnering information, computer chatting, playing games. This has made the Wilson definition of biophilia as both positive and negative affiliations as most appropriate aversions.

Similarly, it could be said that humans have aversions to standing in front of moving cars, guns, and certain other human artefacts. Thus, the critic might say, the biophilia hypothesis reduces to the

following proposition: People affiliate sometimes positively, negatively, and/or neutrally with things natural and human-made, outside of their own bodies, and including their own bodies. In turn, the critic might argue, such a proposition becomes almost a tautology (Kahn, 1997).

2.7.0. VESICO-VAGINA FISTULAE

2.7.1. VESICO-VAGINAL FISTULAE (V.V.F.)

Vesico-vaginal fistulae is an abnormal pathological communication between the urinary bladder and the vagina resulting in tearing during child birth, when this occur in women it causes inability to control urine and sometimes faeces, this makes it difficult for the victim to interact normally, because of stigmatization they faced from the society, making them outcast as a result of isolation. The victims are usually abandoned by their husbands and family leaving them all alone to their problems (Kabir, Iliyasu, Abubakar, and Umar, 2003). The plight of these unfortunate victims can be so devastating and dehumanizing that even when they are cured after surgery some of them never regain their self esteem and as such shun social life. Vesico-vaginal fistula is not an uncommon condition; it gives rise to multiple socio-psychological problems for women usually of younger age. It can be prevented by improving the level of education, health care and poverty (HERA, 2009).

Historically, the lesions seen today are similar to those observed in Egyptian mummies. The earliest reference dates back to 1550 BC in the Kahun papyrus from Egypt. Avicenna also described it almost a thousand years ago as "preventable but incurable". However, Marion Sims first successfully treated the condition more than 130 years ago. Vesico-vaginal fistula was seen widely in Europe and America until the beginning of the twentieth century. It is pertinent to note that vesico-vaginal fistula was common throughout the world before the twentieth century. (NF- VVF, 2003). According to a report VVF is considered a major public health problem in Nigeria, with the

prevalence rate on the increase because of rising poverty and declining quality of maternal care. For each maternal death, 10 –20 other women are left with permanent disabilities, including VVF. Fistula patients came mostly from poor subsistence farming backgrounds.

2.7.2. CAUSES OF VESICO-VAGINAL FISTULAE (V.V.F.)

It is a condition that arises mostly from trauma sustained during child birth or pelvic operations caused by interplay of numerous physical factors, social, cultural, political, and economic situation of women.

It can be caused by injury to the urinary tract, which can occur accidentally during surgery to the pelvic area, it can also be caused by a tumour in the vesico-vaginal area or by reduced blood supply due to tissue death (necrosis) caused by radiation therapy or prolonged labour during childbirth. Numerous factors contribute to the development of VVF Obstructed labour in developing countries.

a. Non availability of health care

Few women are attended by qualified health care professionals or have access to medical facilities during childbirth; their obstructed labour may be protracted for days or weeks.

b. Socio-cultural Factors

Poor socioeconomic development is the basic underlying factor responsible for maternal ill-health, including the prevalence of obstetric fistulae.

c. Economic Factors

The single most important economic factor contributing to the prevalence of VVF is poverty, especially in rural areas. Women with fistulae come almost exclusively from poor families and communities.

d. Early age of Marriage and Child Birth

Girls are given in marriage at very young ages in some cultures, often before or during the process of puberty and childbearing are seen as an indicator of the attainment of "married woman" status. This helps to explain why vesico-vaginal fistula (VVF) sufferers are often very young girls.

Tahir and Roohi, (2009), assert that surgical procedures cause V.V.F. in two ways;

Category 1; Injury caused to the bladder during obstetric operations performed within the formal/modern health care system, such as the hospital.

Category 2; Forms of surgical procedures that may lead to vesico-vaginal fistula (VVF) in non formal/modern health care system like cultural practices are;

I. Female circumcision
II. The Gishiri cut
III. Angurya: traditional practice in which tissue is removed from the vagina by traditional surgeons for the treatment of coital pain, infertility, obstructed labour and goitre,
IV. Congenital injuries
V. Insertion of caustic materials into the vagina.

The condition has many causes with variation depending on the social and educational status of People; notable among the causes are pressure necrosis following prolonged obstructed labour, Trauma during operative delivery, infections and irradiation necrosis from treatment of cervical Carcinoma. The problem of VVF in Northern Nigeria has been found to be associated with young girls who are denied skilled maternity care despite their high risk pregnancies. Other factors contributing to the high incidence of VVF include illiteracy, poverty, ignorance, home delivery, non-utilisation of antenatal and intrapartum medical facilities and the habit of performing traditional

episiotomy - “Gishiri cut” by untrained traditional birth attendants, husband dominance and severe deprivation and neglect.(Kabir, et al., 2003).

2.7.3. EFFECTS OF VESICO-VAGINAL FISTULAE (V.V.F.)

Vesico-vaginal fistula is a disease with tremendous socio-economic and health implications and consequences. The uncontrolled urine leakage causing bad odour in gatherings result in social stigma and consequent neglect economically the victims cannot work because they are shunned by the society. Other problems include childlessness from loss of viable foetus from pregnancy associated with VVF, secondary infertility, vaginal stenosis by fibrosis and bands, amenorrhoea, high and unaffordable costs of repair and elective caesarean section among those who get pregnant later. Psychosocial problems of the patients include depression, loss of husband’s affection, divorce and rejection by the society. Thus, VVF could be responsible for many serious problems, which can cripple the patient especially with respect to inability to bear any more children despite the young age of these patients. VVF patients suffer physically, emotionally and socially. The medical and social consequences of the disease amount to agony and unqualified tragedy of its unfortunate victims while the disease is largely preventable and curable. A fistula patient suffers from much more than a hole in the bladder, her whole person is damaged. It is important to understand the full impact of the damage to the physical and mental well-being of the patient. They are considered to have brought shame and dishonour to themselves and their families, and where they manage to avoid not being divorced by their husbands they quite often lose any form of support and affection from their husbands, the social marginalization meted to these victims result in low self-esteem, feeling of rejection, depression, stress, anxiety, loss of libido, to the point that some thought of suicidal attempts (NFVVF, 2003).). According to Dr. Sambo’s report, (2008), many of the VVF victims are young girls of productive ages between 10-18years, and dwell in rural areas where there

is little or no access to health services. It is a well known fact that VVF is associated with medical and psychological complications that are responsible for many serious problems, which can cripple the patients especially with respect to inability to bear any more children; the impact may be felt more when one considered that bearing children is highly valued in our society.

2.7.4 VESICO-VAGINAL FISTULAE IN NIGERIA

Nigeria is a federation of 36 states and Federal Capital Territory. Below state level there are 774 local government areas. Nigeria has a population of 149 million (July 2009 estimate of National Population Commission [NPC]) and a population growth rate of 1.99%. The life expectancy at birth is for females 47.7 years and for males 46.1 years (2009 estimate NPC). Despite the country's relative oil wealth Gross Domestic Product per capita is about U.S. Dollar1.418, and poverty is widespread. A worsening trend of the poverty situation is observed over the last decade as shown in table 2.2 below.

Table 2.2. Nigeria, Percentage of population living below poverty line of less than one dollar/day.

Year	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
%	**34.1**	**45**	**45**	**60**	**60**	**60**	**60**	**60**	**90**

Source: adopted from Health Research for Action, (HERA) 2009.

By its magnitude, VVVF is a major public health problem in Nigeria which is termed as one of the maternal morbidities; the situation being more evident in the Northern part of the country. Prevalence estimations range from as low as 100,000 to as much as 1,000,000 cases, with an estimated at probably 20,000 new cases a year (NF-VVF, 2009). Nigeria counts for 40% of the

worldwide fistula prevalence. In 2003, United Nations Population Fund (UNFPA) and partners launched a global Campaign to End Fistula with the goal of making obstetric fistula as rare in developing countries as it is in the industrialized world. The Campaign has two components:

- It supports national programmes to eliminate fistula,
- It provides global and regional support in the fight to end fistula.

The campaign focuses on three key areas: **prevention, treatment and rehabilitation**. Two Ministries are involved in Fistula programming in Nigeria, both at Federal and State levels: the Ministry of Health, responsible for the areas of prevention and fistula treatment, and the Ministry of Women Affairs and Social Development, responsible for the rehabilitation and reintegration of the unfortunate victims back to the society as responsible and productive members. The Federal government sets overall policy goals, coordinates activities, ensures quality and training, as well as implements sector programmes such as immunization and coordinates the affairs of the university teaching hospitals, while the state government manages the various general hospitals and the local government focus on Primary Health Care (PHC) facilities. Fistula management and care was part of the UNFPA fifth Nigeria Country Programme (CP) 2003-2007. It was included within the Reproductive Health (RH) sub-programme. By its magnitude, VVF is a major public health problem in Nigeria, the situation being more evident in the Northern part of the country. Prevalence estimations range from as low as 100,000 to as much as 1,000,000 cases. The incidence is estimated at probably 20,000 new cases a year. With approximately 2,000 - 4,000 fistula repair surgeries being carried out yearly, the problem is aggravating progressively. Nigeria has a long-standing history of fistula repairs, one of the pioneers of gynaecological surgeon on VVF surgery is Professor J.B. Lawson, the first professor of gynaecology at the university college hospital Ibadan. Another pioneer in this field is Professor Una Lister; she was also a founding member of the department of obstetrics and gynaecology of the university college hospital Ibadan, after which she

moved to Zaria in the late 60's, and subsequently to Maiduguri in 1980. She has an international reputation for her expertise in VVF repair. For a long time, these were a few islands of fistula repair services in an ocean of needs. The acceleration of interventions and large scale activities started with the arrival of Dr Kees Waaldijk in Katsina in 1983, a plastic surgeon from the Netherlands. He came primarily to repair the leprosy patients but quickly devoted his energy exclusively to fistula repair and training. In 1986, the national council of women societies, Kano state, constructed a VVF theatre in Kano through assistance from ford foundation. In 1989 an integrated programme was developed that combined training, community awareness, skills development and health education. Income generating activities and literacy were organised for girls in the rehabilitation hostel. Dr. Kees Waaldijk comes from Katsina twice a week to operate. This centre was named Laure fistulae centre in Murtala Mohammed Hospital Kano and serves as a national training centre for doctors and nurses. In the early nineties the National Foundation on VVF was created with Dr. Kees Waaldijk as the leading surgeon.

2.7.4 VESICO-VAGINAL FISTULAE IN ZAMFARA STATE

The story of vesico-vagina fistulae activities by the government in Zamfara state is different from that of the national level as the state government identify VVF as a maternal morbidity since its creation in 1996. This led to the establishment of a dedicated VVF centre in 1997 by the pioneer military administrator Col. J. B. Yakubu, the Centre became operational in 1998 and named after the wife of the Military Administrator, Faridat J. B. Yakubu VVF centre Gusau. The centre comprises of a functional clinic for repairs of VVF cases and a rehabilitation facility within the same environment. Many VVF patients were admitted, repaired and rehabilitated by the centre free of charge through a programme that is jointly sponsored by the Zamfara state government and United States Agency for international development (USAID), those that received skill training

were assisted by the Zamfara state government with equipments and some little cash to start up their trained business. However with the establishment of federal medical centre in Gusau the state capital the only state general hospital was taken over by the federal government as the take-up facility for the Federal Medical Centre and Faridat J.B. Yakubu VVF centre was converted into a full pledged state specialist hospital with VVF as a unit in the hospital in 2001. The state government proposes another site for the new VVF facility but could not establish any till today, as such VVF treatment and rehabilitation programme was meted with setbacks as there is no dedicated facility to carter for such cases.

2.7.4. TREATMENT OF VESICO-VAGINAL FISTULAE (V.V.F.) PATIENTS

Vesico-vagina fistulae can be treated and patients return to normal life in the society, the treatment for vesico-vaginal fistula is surgical, many VVF centres in the country offer surgeries and rehabilitation services for the VVF patients and the results has been fruitful with tremendous success. Treated patient needs to stay in hospital for recovery before moving to the rehabilitation facility, where they will be trained a trade skill that will help them sustain themselves economically when re-integrated back into the society. Early diagnosis and appropriate treatment is required to help the patient, proper surgical approach and technique ensures success of surgery. Postoperative care of the patient is equally important to avoid surgical failure (Ridder, et al, 2008). There are many approaches to fistula surgery but both approaches had similar cure rates and hospital stays. Once the fistula has been closed, the vagina is then repaired, when this has been done, a vaginal pack is placed, and the urinary catheter is left in situ. The following day, the vaginal pack is removed and the patient is encouraged to mobilize and eat. The bladder is left on continuous free drainage for 10-14 days. The patient has to be drinking to ensure adequate irrigation of the bladder and draining to ensure that the catheter is not blocked. If the catheter does become blocked and the

repair ruptures, this may often be rectified by continuous prolonged catheter drainage. By ensuring an empty and relaxed bladder, the sides of the defect may come together and heal, but this can take as long as 4 weeks to occur in normal situations. The success rate is about 70% in such cases, less if the defect involves the urethra.

2.7.5. REHABILITATION OF VESICO-VAGINAL FISTULAE (V.V.F.) PATIENTS

Rehabilitation is rarely included in the curriculum of public health, medical schools or other parts of the education system. This hampers the strengthening of disability and rehabilitation projects and activities. Rehabilitation is an essential component of the health care systems for people with disabilities; it includes "all measures aimed at reducing the impact of disabling and handicapping conditions and at enabling the disabled and handicapped persons to achieve social integration" (World Health Organisation, 1981). Rehabilitation is a long process which ideally starts from the onset of recovery from surgery, it involves helping the patients to recover optimal functions during illness, preventing undue loss of physical and mental functions, counselling and support services for social integration. It is usually the work of social workers and psychologists who are specially trained on social behaviour and attitudinal characteristics of people. Rehabilitation centres for vesico-vaginal fistulae patients are social institutions that provide support services in form of training, skill acquisition, education, information and socio-business orientation to VVF repaired patients making them ready and equipped to re-integrate back into the society as responsible members of the society. The centres usually provides accommodations and all other support services free to trainees and at the end of the programme a soft loan is advance to the trainees to enable them start a new life and be self supportive.

CHAPTER THREE

3.0 RESEACH METHODS AND METHODOLOGY

3.1.0. INTRODUCTION

The purpose of this chapter is to present the theoretical assumptions underpinning this research, as well as to introduce the research strategy and the empirical techniques applied. The chapter defines the scope and limitations of the research design, and situates the research amongst existing research traditions in information systems.

1.2.0. RESEARCH DESIGN

Research design refers to the methods, techniques, procedures and steps taken for data collection and analysis (Ngu, 2004). It is also a framework for the conduct of the research even before the data was collected; research design normally defends not only on the type of research but also on the purpose of the research. As an exploratory research, the research incorporates an emergent design, understanding develops and evolves through the research process and each data collection and analysis activity informs subsequent data collection and analysis activity. This study requires flexibility to respond to the researcher's evolving understanding and to pursue new avenues of inquiry as needed. As the research approach is exploratory and focuses on discovery, therefore study did not begin with a set of hypothesis to test, instead it collected data through a variety of techniques and sources in order to identify and characterize important categories, dimensions and interrelationships in the phenomenon.

The theoretical assumptions underlying this research come from the qualitative tradition, which deals in interpretation of contemporary situations. The research strategy adopted was to conduct multiple case studies in different locations. An architectural research endeavour usually revolves

around case study research. A case study is an empirical enquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Zainal, 2007; Dashti, 2008). The research methodology will involve a qualitative method of data collection and analysis, this method will be used to generate both primary and secondary data from field survey, interviews, case studies, study of published and unpublished literature with a view to getting the general overview of the research.

3.3.0. POPULATION OF STUDY

For the purpose of this research a population is the theoretically specified aggregation of survey unit about which forms the basis of analysis and from which the samples are actually selected (Ngu, 2004). The population of study was deliberately chosen to give the research a multiple source of data collection. The population for the study for this research work covers the entire North West geopolitical zone of Nigeria owing to the fact that they share similar socio-cultural and climatic identities.

3.4.0. SAMPLING METHOD

The sampling technique chosen for this study is purposive sampling. The type of sampling used for the selection of the case studies deliberate sampling base on the following:

1. Vesico-vaginal fistulae facilities.
2. Climatic similarities
3. Socio-cultural similarities.

3.5.0. INSTRUMENTS OF DATA COLLECTION

To capture complexity of cases the use of multiple sources of data collection was used. In order to achieve the research goal, the following instruments of data collection were used as listed below:

3.5.1 Photographs

Photographs were taken of relevant case studies to ascertain the features of biophilic design they posses as well as the extent, to which they were applied.

3.5.2 Sketches

Sketches were made of some parts of the selected case studies. These sketches showed the spatial organization of the area under study and the neighbouring features for analysis.

3.5.3 Notes

Notes are in form of field forms outlining the variables of biophilic design as it apply to a vesico-vagina fistulae centres and some other health building types.

3.5.4. Participant observation

Physical observation by the researcher was conducted to take notes of activities within the facility so as to get acquainted with the setting and the data obtain was used in the study.

3.5.5. Oral Interviews

Interviews provide a way of collecting information and finding out about things that cannot be directly observe. Oral interviews were conducted with both workers and patients in the selected case studies and other professionals from health and welfare establishment. Interviews provide a broad context to view the biophilia as a design concept by both the researcher and the respondents.

3.5.6. Review of related literature

The study of previous researches and documentations on the phenomenon helps to intimate the researcher on the scope and limitations of his predecessors in the field, and to establish a research gap upon which this research will build up.



Figure 3.1:- Sources of data collection

Source: Adapted from Samuel (2010).

3.6. PROCEDURE OF DATA COLLECTION

The procedure of data collection embrace various techniques used for data collection in research such as visits to some selected existing VVF centres at various pre- selected locations within the chosen geopolitical zone, field surveys, and personal interviews. A reconnaissance survey of within and around the site as well as some selected similar facilities was conducted to get acquainted to the study environment for better results. Analysis of the collected data on the visual survey and observation was based on the descriptive accounts as observed and noted through the instruments of data collection. The three selected local case studies were visited, taking visual notes of their architectural features paying more attention to biophilic design features. These buildings were then evaluated on the created check list/ field forms.

3.7. CASE STUDY ANALYSIS CRITERIA

The case studies were purposely selected on the bases of being vesico-vagina fistulae centres on one hand and as buildings possessing features of biophilic design elements in their design.

The case studies have been analysed based on five aspects;

i. The physical characteristics of the environment;
ii. The activities afforded by the place.
iii. The social interactions associated with the place.
iv. Descriptive analysis as vesico-vagina fistulae centre.
v. Analysis as buildings with biophilic design features.

3.8. VARIABLES OF STUDY

The variables of study are those characteristics which the research sought to utilize as a unit of differential in the data collection process. The variables were chosen to assess their utilization and impact on the buildings under study.

3.8.1 Natural lighting and ventilation

- Orientation of buildings in relation to climate
- Placement of windows to capture dynamic natural light
- Large operable windows on opposite wall to provide cross ventilations.

3.8.2 Local natural materials.

- Local materials
- Sense of place
- Modern materials.

3.8.3 Views and Prospect.

- Views of nature
- Visual distance
- Windows positioned to frame views of nature.

3.8.4 Natural features

- Respect for site
- Land forms and vistas
- Water features
- Varied Vegetations, landscaping and facade greening.

3.8.5 Design with natural forms, shapes and processes

- Building form and layout
- Design derived from nature
- Use of natural patterns, forms and textures

CHAPTER FOUR

4.0. DATA PRESENTATION, RESEACH FINDINGS AND DISCUSSIONS

4.1.0. CASE STUDY SELECTION CRITERIA

The selection criteria for the case studies on this research were based on purposively selected building types that satisfy the following criteria;

1. The building selected must be a vesico-vagina fistulae centre.
2. Most fall within the study area, sharing similar climatic characteristics.
3. Most be within the geopolitical area under study sharing similar socio-cultural affiliations.

Each case study was analysed based on individual general documentation under the identified biophilic design features (variables of study), the essence of the documentation was to analyse each and consider to what extent the biophilic design features are utilised in creating a humane healing environment.

4.2.0. VARAIBLES OF STUDY

These are the features of biophilic design which were considered as a study checklist for the case studies and all the analysis were based on these features listed below;

4.2.1 Natural lighting and ventilation

- Orientation of buildings in relation to climate
- Placement of windows to capture dynamic natural light
- Large operable windows on opposite wall to provide cross ventilations.

4.2.2 Local natural materials.

- Local materials
- Sense of place
- Modern materials

4.2.3 Views and Prospect.

- Views of nature
- Visual distance
- Windows positioned to frame views of nature.

4.2.4 Natural features

- Respect for site
- Land forms and vistas
- Water features
- Varied Vegetations, landscaping and facade greening.

4.2.5 Natural forms, shapes and processes.

- Building form and layout
- Design derived from nature
- Use of natural patterns, forms and textures

4.3.0. CASE STUDIES

4.3.1 CASE STUDY ONE: – BABBAR RUGA FISTULAE CENTRE KATSINA

4.3.11. **Facility Name**: - Babbar Ruga Fistulae Centre.

4.3.12. **Location:** -- Babbar Ruga Katsina Sate.

4.3.13. **Year Of Construction**: -- 2003

4.3.14. **Architects**:-- Katsina State Ministry of works, Katsina.

4.3.15. **Client/ Sponsor**: --- Katsina State Government, now Federal Government of Nigeria.

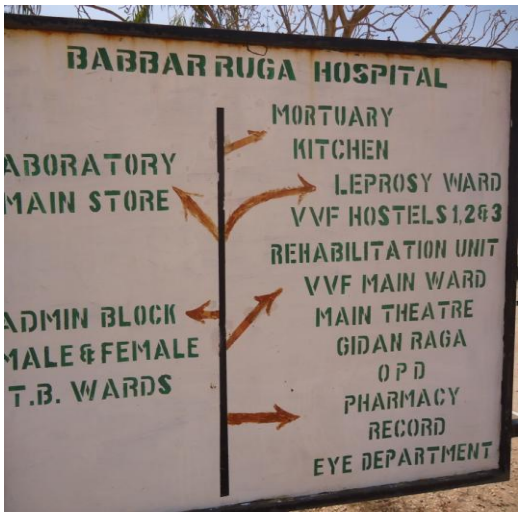




Plate 4.11A- Way finding chart **Plate 4.11B- Gate to Babbar Ruga centre**

Source: Researcher's fieldwork (2012).

4.3.16. **Architectural Design**: --- The facility is a single storey building comprising mainly of sandcrete block, concrete, aluminium roof, doors and windows. The Architecture of the facility is a combination of colonial and modern architectural elements. The general planning and layout of buildings are individual blocks units connected by covered walkways and scattered parking spaces.

4.3.17. **Facilities Available**: -- Babbar Ruga fistulae centre provides a range of services that are divided into four units each administered by a unit head, which includes;

- The vesico-vaginal fistulae counselling, treatment and training centre;
- Rehabilitation centre;
- Leprosy centre and
- Tuberculosis centre.

4.3.18. **Use of Biophilic Design features: -** Some of the biophilic design features were considered as case study checklist and are analysed below, to measure the level of its utilisation.

I. **Natural Lighting and Ventilation: -** Natural ventilation with the aid operable windows on opposite wall providing cross ventilation.



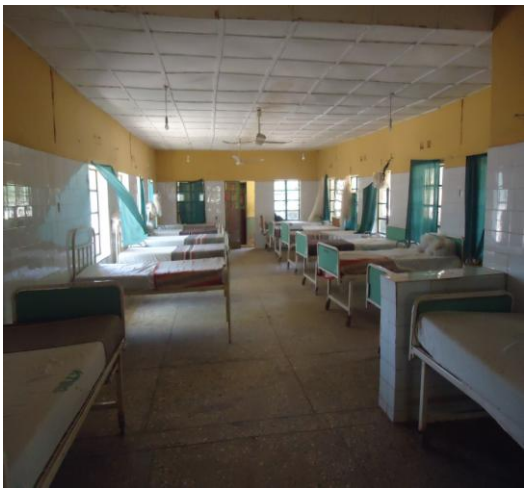


Plate 4.12A- Knitting workshop **Plate 4.12B- Post operative ward**

Source: Researcher's fieldwork (2012).

II. **Natural Materials:-** All the materials used from the building fabric to finishes are modern materials that are in no way vernacular or organic





Plate 4.13A – Patients waiting **Plate 4.13B – Corridor- Modern materials**

Source: Researcher's fieldwork (2012).

III. **Building Form and Layout: -** The general building forms consist of linear pattern of isolated blocks of buildings connected in some place by covered walkways. The layout of the buildings within the site is a scattered layout of the buildings placed haphazardly not respecting any planning pattern.





Plate 4.14A- Rectilinear shape of buildings **Plate 4.14B- Scattered layout**

Source: Researcher's fieldwork (2012).

IV. Environmental Features: - Trees are planted in somewhat disperse and unorganised order creating a bushy like surrounding.





Plate 4.15A- Bushy natural setting **Plate 4.15B- Organised landscaping**

Source: Researcher's fieldwork (2012).

V. **Natural Forms and Shape: -** Even though the building form does not in any way follow any natural system, there are some natural shapes used in the interiors of the buildings especially in the post operative patient's ward, use of curvilinear forms like arches.

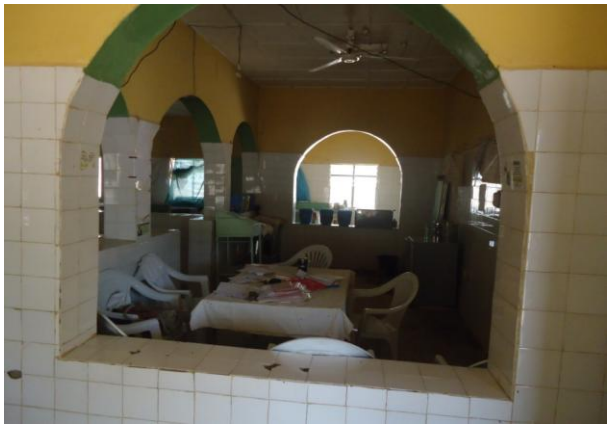


Plate 4.16 – Use of curvilinear shapes in patient's ward

Source: Researchers fieldwork (2012).

VI. Views and Prospects: - Apart from good cross ventilation and lighting in all the wards, the openings provide a good view window of the surrounding scenery.



Plate 4.17 – Patient's ward, windows providing views and prospects

Source: Researcher's fieldwork (2012).

VII. **Landscaping and Facade greening: -** Planned landscaping and facade greening can only be noticed at the admin block and the outpatient unit but not in the patient's ward where it is mostly desired.



Plate 4.18 – Facade greening and landscaping

Source: Researcher's fieldwork (2012).

Table 4.1A - Assessment of Application of Biophilic design feature One at Babbar Ruga fistulae centre Katsina

		BIOPHILIC DESIGN ELEMENT 1: NATURAL LIGHTING AND VENTILATION **Scale Factor: Good = 4, Strong = 3, Weak = 2, and Very Weak = 1.**			
Variables	**Features**	**Description**	**Method of utilisation**	**Weight Factor**	**Remarks**
Orientation of building in relation to climate	Positioning of building in relation to weather, with due Considerations to diurnal changes/ variations	Constant changing in direction and intensity of solar radiation and other climatic features.	Placement of building on north/south orientation and shading devices.	3	Positive
Placement of windows to capture dynamic natural light	Effective day lightning requirement	Changing pattern of brightness and shadow, and sparkle and reflection.	Exterior windows that admit light to the interior	3	Positive
Large operable windows on opposite walls	Positioning of opening for effective Cross ventilation and less use of mechanical means	The quality of air and the volume of air flow alter the perception of temperature.	Exterior windows on opposite side of walls	3	Positive
TOTAL				12	Average 3

Source: Researcher's field work (2013).

Table 4.1B - Assessment of Application of Biophilic design feature two at Babbar Ruga fistulae centre Katsina

BIOPHILIC DESIGN ELEMENT 2: LOCAL MATERIALS **Scale Factor: Good = 4, Strong = 3, Weak = 2, and Very Weak = 1.**					
Variables	**Features**	**Description**	**Method of utilisation**	**Weight Factor**	**Remarks**
Local materials	Locally sourced materials for the building native to site and surrounding.	Low impact building materials that is organic in nature.	Nil	2	Negative
Sense of place	Connection to the culture and ecology of a place.	Building and landscape that affirm the spirit of place, create a sensory connections between the built and the immediate environment.	Nil	1	Negative
Modern materials	Non organic modern refined materials	Materials that require energy and technology in manufacture and usage.	Use of Concrete, sandcrete block, aluminium and glass.	3	Positive
TOTAL				6	Average 2

Source: Researcher's field work (2013).

Table 4.1C - Assessment of Application of Biophilic design feature three at Babbar Ruga fistulae centre Katsina

		BIOPHILIC DESIGN ELEMENT 3: VIEWS AND PROSPECT **Scale Factor: Good = 4, Strong = 3, Weak = 2, and Very Weak = 1.**				
Variables		**Features**	**Description**	**Method of utilisation**	**Weight Factor**	**Remarks**
Strategic viewing location		Visual connections between the interiors and the exterior spaces.	Strategic viewing condition from a position of safety and security.	Provision of verandas, covered walkways and gazebos	3	Positive
Windows positioned to frame views of nature		The play of natural light seen through clear and decorative glass.	Nearby views link us to the intricacies and immediate sensory pleasures of the site.	Plantations around the building that can be seen and admired from interiors	3	Positive
Views of nature		Natural pattern of scale and proportion, balance and harmony helps to explain the complexity of nature.	Diversity, variety and intricacies of the nature provides environment for all species to live	Open spaces with vast undeveloped land with bushy like setting	3	Positive
Visual distance		Visual and physical barrier between the indoor rooms and outside spaces dissolved into a mosaic of inside-outside spaces	Ability to see into distant scenery. Distant views link us to the greater natural order of the site.	Glazed aluminium windows providing clear visual corridor	3	Positive
TOTAL					12	Average 3

Source: Researcher's field work (2013).

Table 4.1D - Assessment of Application of Biophilic design feature four at Babbar Ruga fistulae centre Katsina

		BIOPHILIC DESIGN ELEMENT 4: NATURAL FEATURES **Scale Factor: Good = 4, Strong = 3, Weak = 2, and Very Weak = 1.**				
Variables		**Features**	**Description**	**Method of utilisation**	**Weight Factor**	**Remarks**
Respect for site		Designing with sense of care and appreciation of site features	Emotional response of intense pleasure at the physical beauty of nature	Nil	3	Positive
Land forms and vistas		Building that emanates from site	Building growing out of site following natural flows, flexible and adaptable	Nil	1	Negative
Water bodies/ features		Water body like ponds, lakes, fountains and pools	Located along green spaces, corridors	Nil	3	Positive
Varied vegetation and plantations		Vegetations and tree shadings within the site, green roof to reduce environmental impact, and rest areas for patients with seats for group interactions and relaxation	Variation in temperature, air movement and texture caused by natural vegetation, plantations, gazebos and relaxation areas.	Organised landscaping. Shade trees, bushes and plantations	3	Positive
TOTAL					10	Average 2.5

Source: Researcher's field work (2013).

Table 4.1E - Assessment of Application of Biophilic design feature five at Babbar Ruga fistulae centre Katsina

		BIOPHILIC DESIGN ELEMENT 5: NATURAL FORMS, SHAPES AND PROCESSES **Scale Factor: Good = 4, Strong = 3, Weak = 2, and Very Weak = 1.**				
Variables		**Features**	**Description**	**Method of utilisation**	**Weight Factor**	**Remarks**
Building form and layout		Building form and shape that illicit natural features, forms and processes.	Curvilinear forms mimic nature more than rectilinear	Nil	2	Negative
Design derived from nature		Ecological approach to aesthetics	Connecting history and culture into the built environment.	Nil	2	Negative
Use of natural pattern, form and texture		Natural features are often curvilinear, flowing and adaptive	Forms and texture that depict nature in shape and character.	Nil	2	Negative
TOTAL					6	Average 2

Source: Researcher's field work (2013).

4.3.2 CASE STUDY TWO: – SPECIAL V.V.F. CENTRE BIRNIN KEBBI

4.3.21. **Facility Name**: - Special Vesico-vagina fistulae (VVF) centre, Birnin Kebbi. Kebbi state

4.3.22. **Location:** -- Gesse 1 housing estate, Birnin Kebbi.

4.3.23. **Year Of Construction**: -- 2005

4.3.24. **Architects**:-- Kebbi state Ministry of works, Birnin Kebbi.

4.3.25. **Client/ Sponsor**: --- Kebbi State Government.





Plate 4.21A- Entrance porch **Plate 4.21B** – Commissioning plaque

Source: Researcher's fieldwork (2012).

4.3.26. **Architectural Design**: --- The facility is a single storey building paced in isolated block units interconnected by covered walkways creating a loose court yard in the centre. The architecture of the facility is modern architectural elements. The general planning and layout of buildings are individual blocks units connected by covered walkways and organised parking spaces at the approach of the facility.

4.3.27. **Facilities Available**: -- Special VVF centre Gesse 1 Birnin Kebbi provides two kinds of services that are each headed by a unit head, which includes;

- The vesico-vaginal fistulae centre: - The centre comprises of the administrative block, pre-operative ward, post operative ward, the theatre and the central kitchen.
- An outpatient clinic that renders outpatient services for both male and female patients.

4.3.28. **Use Of Biophilic Design features: -** Some of the biophilic design features were considered as case study checklist and are analysed below, to measure the level of its utilisation in the facility.

i. **Natural Lighting and Ventilation: -** Windows are provided on opposite walls to admits in natural light and provide ventilation to interiors especially in the patient's wards.





Plate 4.22 A & B – Natural lighting and Ventilation from windows

Source: Researcher's fieldwork (2012).

II. **Natural Materials:-** All the materials used from the building fabric to finishes are modern materials that are in no way vernacular or organic



Plate 4.23 – Materials used are non organic

Source: Researcher's fieldwork (2012).

III. **Building Form and Layout: -** The general building forms consist of linear pattern of interconnected blocks of buildings. The layout of the buildings within the site is a layout pattern that places the buildings in compact pattern creating a loose court yard at the centre with all activities around the operation theatre. The buildings are placed in an advantaged position in relation to orientation.

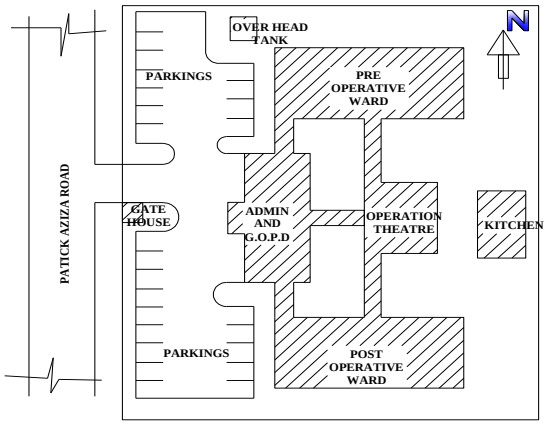


Figure 4.1 – Site Plan showing rectilinear shapes of buildings and layout

Source: Researcher's fieldwork (2012).




Plate 4.24 – Rectilinear shapes of buildings and layout

Source: Researcher's fieldwork (2012).

IV. **Environmental Features: -** The centre is dry of vegetation and water bodies. Very few and isolated trees can be seen in and around the site.




Plate 4.25 – Scarce environmental features like trees

Source: Researcher's fieldwork (2012).

V. **Natural Forms and Shape:-** The only natural shape that can be noticed is the entrance porch to the buildings, curvilinear forms like arches were used, all other places are straight lines and pointed edges/corners.





Plate 4.26A- Curvilinear form at approach porch **Plate 4.26B-** Rectilinear forms

Source: Researcher's fieldwork (2012).

VI. Views and Prospects: - Even though there is good cross ventilation and lighting in all the wards. The openings do not provide a good view window of the exteriors. Some verandas were used to create a sitting place for patient especially during hot dry months.





Plate 4.27A- Views provided by windows **Plate 4.27B-** Views provided by verandas

Source: Researcher's fieldwork (2012).

VII. Landscaping and Facade greening:- Planned landscaping and facade greening can only be noticed at the outpatient clinic which happens to be the main approach of the facility but not in the patient's ward where it is mostly desired.





Plate 4.28 - Plantations and landscaping

Source: Researcher's fieldwork (2012).

Table 4.2A - Assessment of Application of Biophilic design feature two at Special VVF centre Gesse 1 Birnin Kebbi, Kebbi state.

BIOPHILIC DESIGN ELEMENT 1: NATURAL LIGHTING AND VENTILATION **Scale Factor: Good = 4, Strong = 3, Weak = 2, and Very Weak = 1.**					
Variables	**Features**	**Description**	**Method of utilisation**	**Weight factor**	**Remarks**
Orientation of buildings in relation to weather	Positioning of building in relation to weather, with due Considerations to diurnal changes/variation	Constant changing in direction and intensity of solar radiation and other climatic features,	Placement of building on north-south orientation and shading devices	3	Positive
Placement of windows to capture dynamic natural light	Effective day lighting requirements	Changing pattern of brightness and shadow, and sparkle and reflection.	Windows that admits light into the interiors.	3	Positive
Large operable windows on opposite walls to provide cross ventilation	Positioning of openings for effective cross ventilation and less use of mechanical means	The quality of air and the volume of air flow alter the perception of temperature.	Windows placed on opposite walls	3	Positive
TOTAL				9	Average 3

Source: Researcher's field work (2013).

Table 4.2B - Assessment of Application of Biophilic design feature two at Special VVF centre Gesse 1 Birnin Kebbi, Kebbi state.

		BIOPHILIC DESIGN ELEMENT 2: LOCAL MATERIALS **Scale Factor: Good = 4, Strong = 3, Weak = 2, and Very Weak = 1.**			
Variables	**Features**	**Description**	**Method of utilisation**	**Weight factor**	**Remarks**
Local materials	Low impact building materials that are organic in nature	Locally sourced materials for the building, native to the site and surrounding	Nil	1	Negative
Sense of place	Connection to the culture and ecology of a place.	building and landscape that affirm the spirit of place , create a sensory connections between the built and the immediate environment	Nil	1	Negative
Modern materials	Non organic modern refined materials	Materials that require energy and technology in manufacture and usage	Use of concrete sandcrete block, aluminium and glass	3	Positive
TOTAL				5	Average 1.67

Source: Researcher's field work (2013).

Table 4.2C - Assessment of Application of Biophilic design feature two at Special VVF centre Gesse 1 Birnin Kebbi, Kebbi state.

BIOPHILIC DESIGN ELEMENT 3: VIEWS AND PROSPECT **Scale Factor: Good = 4, Strong = 3, Weak = 2, and Very Weak = 1.**					
Variables	**Features**	**Description**	**Method of utilisation**	**Weight factor**	**Remarks**
Strategic viewing location	Visual connection between the interiors and exterior spaces	Strategic viewing condition from a position of safety and security	Provision of verandas and covered walkways	3	Positive
Windows positioned to frame views of nature	The play of natural light seen through clear and decorative glass	Nearby views link us to the intricacies and immediate sensory pleasures of the site	Scarce plantations around the building	2	Negative
Views of nature	Natural pattern of scale and proportion, and balance and harmony helps explain the complexities of nature	Diversity , variety and intricacies of nature provides environment for all species to live	Nil	1	Negative
Visual distance	Visual and physical barrier between the indoor and outside spaces dissolved into a mosaic of inside – outside spaces	Distant views link us to the greater natural order of the site	Nil	1	Negative
TOTAL				7	Average 1.75

Source: Researcher's field work (2013).

Table 4.2D - Assessment of Application of Biophilic design feature two at Special VVF centre Gesse 1 Birnin Kebbi, Kebbi state.

		BIOPHILIC DESIGN ELEMENT 4: NATURAL FEATURES **Scale Factor: Good = 4, Strong = 3, Weak = 2, and Very Weak = 1.**				
Variables		**Features**	**Description**	**Method of utilisation**	**Weight factor**	**Remarks**
Respect for site		Designing with sense of care and appreciation of site features	Emotional response of intense pleasure at the physical beauty of nature	Nil	1	Negative
Land forms and vistas		Building that emanates from site	Building growing out of site following natural flows, flexible and adaptable	Nil	1	Negative
Water bodies/ features		Water body like ponds, lakes, fountains and pools	Located along green spaces, corridors	Nil	1	Negative
Varied vegetation and plantations		Vegetations and tree shadings within the site, green roof to reduce environmental impact, and rest areas for patients with seats for group interactions and relaxation	Variation in temperature, air movement and texture caused by natural vegetation, plantations, gazebos and relaxation areas.	Organised landscape, Shade, trees, bushes and plantations	3	Negative
TOTAL					6	Average 1.5

Source: Researcher's field work (2013).

Table 4.2E - Assessment of Application of Biophilic design feature two at Special VVF centre Gesse 1 Birnin Kebbi, Kebbi state.

		BIOPHILIC DESIGN ELEMENT 5: NATURAL FORMS, SHAPES AND PROCESSES **Scale Factor: Good = 4, Strong = 3, Weak = 2, and Very Weak = 1.**			
Variables	**Features**	**Description**	**Method of utilisation**	**Weight factor**	**Remarks**
Building form and layout	Building form, shape and layout that illicit natural features, forms and processes	Curvilinear forms mimic nature more than rectilinear forms and shapes.	Use of curvilinear form in the entrance porch	2	Negative
Design derived from nature	Ecological approach to aesthetics	Connecting history and culture into the built environment	Nil	1	Negative
Use of natural pattern, form and texture	Natural features are often curvilinear, flowing and adaptive	Forms and texture that depict nature in shape or character	Nil	1	Negative
TOTAL				4	Average 1.5

Source: Researcher's field work (2013).

4.3.3 CASE STUDY THREE: – MARYAM ABACHA V.V.F. CENTRE SOKOTO

4.3.31. **Facility Name**: - Maryam Abacha VVF centre, Sokoto. Sokoto state

4.3.32. **Location:** -- Tsohuwar kasuwa area Aliyu Jedo Road Sokoto.

4.3.33. **Year of Construction**: -- 1997

4.3.34. **Architects**: -- Sokoto state Ministry of works, Sokoto.

4.3.35. **Client/ Sponsor**: --- Sokoto State Government.





Plate 4.31A- Entrance porch **Plate 4.31B**- Commissioning plaque

Source: Researcher's fieldwork (2012).

4.3.36. **Architectural Design**: --- The facility is a single storey building paced in isolated block units interconnected by covered walkways creating a loose court yard in the centre. The architecture of the facility is modern architectural elements. The general planning and layout of buildings are individual blocks units connected by covered walkways and organised parking spaces at the approach of the facility.

4.3.37. **Facilities Available**: -- Maryam Abacha VVF centre Sokoto incorporates two kinds of facilities that are headed by chief medical director, which includes;

- The vesico-vaginal fistulae centre: - The centre comprises of the administrative block, pre-operative ward, post operative ward, the theatre and the central kitchen.
- Women and children hospital:- providing general health care service to women and children on free service.

4.3.38. **Use of Biophilic Design features: -** Some of the biophilic design features were considered as case study checklist and are analysed below, to measure the level of its utilisation in the facility.

i. **Natural Lighting and Ventilation: -** Windows are provided on opposite walls to admit in natural light and provide ventilation to interiors especially in the patient's wards.



Plate 4.32 – Natural lighting and Ventilations from windows on opposite walls

Source: Researcher's fieldwork (2012).

ii. **Natural Materials:-** All the materials used from the building fabric to finishes are modern materials that are in no way vernacular or organic





Plate 4.33 – Use of non organic building materials

Source: Researcher's fieldwork (2012).

iii. **Building Form and Layout:** - The general building forms consist of linear pattern of interconnected blocks of buildings. The layout of the buildings within the site is a layout pattern that places the buildings in an advantaged position in relation to orientation.





Plate 4.34 - Rectilinear forms and layout

Source: Researcher's fieldwork (2012).

iv. **Environmental Features: -** Court yards are provided with vegetation to create a micro climate in the centre. Very few and isolated trees can be seen in and around the site providing car shades and resting spots for patients during hot dry months.




Plate 4.35 – Use of environmental features like trees and landscaping

Source: Researcher's fieldwork (2012).

v. **Natural Forms and Shape: -** The entire building is in straight line/ linear form with post and beam (vertical and horizontal forms) no natural or vernacular form can be noticed.




Plate 4.36 – Rectilinear shapes used for all buildings

Source: Researcher's fieldwork (2012).

vi. **Views and Prospects: -** Even though there is good cross ventilation and lighting in all the wards, the openings do not provide a good view window of the exteriors. An attempt is made in providing verandas and covered walkways that to some extent link spaces.





Plate 4.37 - Views provided by windows and verandas

Source: researcher's fieldwork (2012).

vii. Landscaping and Facade greening: - There is no planned landscaping and facade greening in the centre except some isolated trees seen scattered.





Plate 4.38 – Scarce trees and unorganised landscaping

Source: Researcher's fieldwork (2012).

Table 4.3A - Assessment of Application of Biophilic design feature three at Maryam Abacha VVF centre Sokoto, Sokoto state.

		BIOPHILIC DESIGN ELEMENT 1: NATURAL LIGHTING AND VENTILATION **Scale Factor: Good = 4, Strong = 3, Weak = 2, and Very Weak = 1.**			
Variables	**Features**	**Description**	**Method of utilisation**	**Weight factor**	**Remarks**
Orientation of building in relation to weather	Positioning of building in relation to weather, with due considerations to diurnal changes/variations.	Constant changing in direction and intensity of solar radiation and other climatic features.	Placement of building on north south orientation.	3	Positive
Placement of windows to capture dynamic natural light.	Effective day lighting requirements.	Changing pattern of brightness and shadow, and sparkle and reflection.	Exterior Windows that admits light into the interiors	3	Positive
Large operable windows on opposite wall to provide cross ventilation.	Positioning of opening for effective cross ventilation and less use of mechanical means	The quality of air and volume of air flow alter the perception of temperature.	Exterior windows on opposite walls.	3	Positive
TOTAL				9	Average 3

Source: Researcher's field work (2013).

Table 4.3B - Assessment of Application of Biophilic design feature three at Maryam Abacha VVF centre Sokoto, Sokoto state.

BIOPHILIC DESIGN ELEMENT 2: LOCAL MATERIALS **Scale Factor: Good = 4, Strong = 3, Weak = 2, and Very Weak = 1.**					
Variables	**Features**	**Description**	**Method of utilisation**	**Weight factor**	**Remarks**
Local materials	Low impact building materials that are organic in nature	Locally sourced materials for building, native to the site and surrounding.	Nil	1	Negative
Sense of place	Connection to the culture and ecology of a place	Building and landscape that affirm the spirit of place create a sensory connection between the built and the immediate environment	Nil	2	Negative
Modern materials	Non organic modern	Materials that require energy and technology in manufacture and usage	Use of Concrete, sandcrete block, aluminium and glass.	3	Positive
TOTAL				6	Average 2

Source: Researcher's field work (2013).

Table 4.3C - Assessment of Application of Biophilic design feature three at Maryam Abacha VVF centre Sokoto, Sokoto state.

		BIOPHILIC DESIGN ELEMENT 3: VIEWS AND PROSPECT **Scale Factor: Good = 4, Strong = 3, Weak = 2, and Very Weak = 1.**			
Variables	**Features**	**Description**	**Method of utilisation**	**Weight factor**	**Remarks**
Strategic viewing location	Visual connections between the interior and exterior spaces	Strategic viewing condition from a position of safety and security	Provision of verandas and covered walkways.	3	Positive
Windows positioned to frame views of nature.	The play of natural light seen through clear and decorative glass	Nearby views link us to the intricacies and immediate sensory pleasures of the site.	Scarce plantations around the building.	2	Negative
Views of nature	Natural pattern of scale and proportion, and balance and harmony helps to explain the complexity of nature.	Diversity, variety and intricacies of nature provides environment for all species to live	Nil	1	Negative
Visual distance	Visual and physical barrier between the indoor and outside spaces dissolve into a mosaic of inside-outside spaces	Distant views link us to the greater natural order of the site	Nil	1	Negative
TOTAL				7	Average 1.75

Source: Researcher's field work (2013).

Table 4.3D - Assessment of Application of Biophilic design feature three at Maryam Abacha VVF centre Sokoto, Sokoto state.

		BIOPHILIC DESIGN ELEMENT 4: NATURAL FEATURES **Scale Factor: Good = 4, Strong = 3, Weak = 2, and Very Weak = 1.**				
Variables		**Features**	**Description**	**Method of utilisation**	**Weight factor**	**Remarks**
Respect for site		Designing with sense of care and appreciation of site features	Emotional response of intense pleasure at the physical beauty of nature	Nil	1	Negative
Land forms and vistas		Building that emanates from site	Building growing out of site following natural flows, flexible and adaptable	Nil	1	Negative
Water bodies/ features		Water body like ponds, lakes, fountains and pools	Located along green spaces, corridors	Nil	1	Negative
Varied vegetation and plantations		Vegetations and tree shadings within the site, green roof to reduce environmental impact, and rest areas for patients with seats for group interactions and relaxation	Variation in temperature, air movement and texture caused by natural vegetation, plantations, gazebos and relaxation areas.	Un organised plantations.	3	Positive
TOTAL					6	Average 1.5

Source: Researcher's field work (2013).

Table 4.3E - Assessment of Application of Biophilic design feature three at Maryam Abacha VVF centre Sokoto, Sokoto state.

		BIOPHILIC DESIGN ELEMENT 5: NATURAL FORMS, SHAPES AND PROCESSES **Scale Factor: Good = 4, Strong = 3, Weak = 2, and Very Weak = 1.**			
Variables	**Features**	**Description**	**Method of utilisation**	**Weight factor**	**Remarks**
Building form and layout	Building form, shape or layout that illicit natural features, forms or processes.	Curvilinear forms mimic nature more than rectilinear forms and shapes	Nil	1	Negative
Design derived from nature	Ecological approach to aesthetics	Connecting history and culture into the built environment	Nil	1	Negative
Use of natural pattern, form and texture	Natural features are often curvilinear, flowing and adaptive.	Forms and texture that depict nature in shape or character.	Nil	1	Negative
TOTAL				3	Average 1

Source: Researcher's field work (2013).

4.4.0 CASE STUDIES FINDINGS

The selected case studies were conducted and the results obtained presented in tables 4.1A-E, 4.2A-E and 4.3A-E. This section deals with the analysis and discussion on the findings in the case studies and other instruments of data collection used in the research.

4.4.1 CASE STUDY ONE: - BABBAR RUGA FISTULA CENTRE KATSINA:-

Table 4.4 - Summary of case study one

SN	BIOPHILIC DESIGN FEATURE	WEGHT FACTOR	REMARK
1	Natural lighting and ventilation	3	Positive
2	Local materials	2	Negative
3	Views and prospects	3	positive
4	Natural features	2.5	Negative
5	Natural forms, shapes and processes	2	negative

Source: Researcher's field work (2013).

From the data presented above it can be seen that Babbar Ruga fistulae centre utilises the use of natural lighting and ventilation by providing windows on opposite walls enough to admit natural light and cross ventilation even though this does not eliminate the use of artificial means especially in the nights and hot dry months. The windows provided also serves to give a visual window to the exteriors. However the utilisation of natural features was minimal. The buildings do not incorporate natural shapes and processes except for the entrance gate and interior of some wards where curvilinear forms are used. Natural features like water (in form of fountain even though not

functional), land forms and natural vegetations are used but not to greater extent as to have tremendous impact on the environment.

4.4.2 CASE STUDY TWO: - SPECIAL VVF CENTRE GESSE 1 BIRNIN KEBBI

Table 4.5 - Summary of case study two.

SN	BIOPHILIC DESIGN FEATURE	WEGHT FACTOR	REMARK
1	Natural lighting and ventilation	3	Positive
2	Local materials	1.67	Negative
3	Views and prospects	1.75	Negative
4	Natural features	1.5	Negative
5	Natural forms, shapes and processes	1.5	negative

Source: Researcher's field work (2013).

From the data presented above it can be seen that special VVF centre Birnin Kebbi utilises only the use of natural lighting and ventilation features of biophilic design by providing windows on opposite walls enough to admit in natural light and cross ventilation even then, this does not eliminates the use of artificial means especially in the night and hot dry months. The windows do not provide any visual corridor to the exteriors due to the compactness of the site. Use of natural features like, natural vegetations, land forms and water features are not integrated in the design.

4.4.3 CASE STUDY THREE: - MARYAM ABACHA VVF CENTRE SOKOTO

Table 4.6 - Summary of case study three.

SN	BIOPHILIC DESIGN FEATURE	WEGHT FACTOR	REMARK
1	Natural lighting and ventilation	3	Positive
2	Local materials	2	Negative
3	Views and prospects	1.75	Negative
4	Natural features	1.5	Negative
5	Natural forms, shapes and processes	1	negative

Source: Researcher's field work (2013).

From the data presented above it can be seen that Maryam Abacha VVF centre Sokoto utilises only the use of natural lighting and ventilation feature of biophilic design by providing wide windows on opposite walls enough to admit in natural light and cross ventilation even though this does not eliminates the use of artificial especially in the night and hot dry months. The windows do not provide any visual corridor to the exteriors as there are scarce environmental features in the site due to the fact that, the site was formally an old market of Sokoto that was relocated and the old structures demolished making the ground level, clearing all the natural features of the site. Use of natural features forms, shapes and processes like water bodies, natural vegetations and Land forms are not utilised in the facility.

4.5.0 SUMMARY OF CASE STUDY FINDINGS

In general the findings made from case studies can be summarises as follows

i. All the case studies utilises the use of natural lighting and ventilation more than artificial means by providing cross ventilation and enough operable windows, also use of loose court yard, verandas and covered walkways helps to direct solar radiation into interiors.
ii. The architectural styles of all the cases studies were modern style as against the vernacular and organic architecture which are the main components of biophilia
iii. The materials used in all the buildings studied from the building fabric to finishes were modern refined materials (mostly concrete, sandcrete block, aluminium and glass) that require a lot of energy and technology in manufacture and usage instead of using locally sourced materials (low impact materials that are organic in nature).
iv. The building forms, shapes and lay out of all the study areas were generally rectilinear shape with perfect straight lines and sharp edges, which suggest human action, while nature is not perfect in its geometry.
v. Except for Babbar Ruga fistulae centre in Katsina that has a vast undeveloped bushy (natural) like environment within the site all others do not have a nature like setting in the environment, they have a compact site that do not have enough spaces for such features.
vi. There is the general prevalence of curvilinear forms and shapes in the entrance porches and gates in all the facilities studied.
vii. There is the general prevalence of rectilinear forms and shapes in the entrance porches and gates in all the facilities studied.
viii. All the facilities studied provide other clinical services apart from VVF treatment and rehabilitation services, such services ranges from Outpatients clinic, women and children clinic and maternity services.

ix. Non-clinical facilities such as play area, lounges, cinemas, recreation, relaxation area etc are not integrated in the centres studied.

x. Except for Maryam Abacha VVF centre Sokoto preventive services for VVF prevalence like maternity services (mainly ante natal and post natal care) are not provided in the centres.

xi. Apart from Babbar Ruga fistulae centre in Katsina that has enough undeveloped area for future expansion all others do not have any room for future expansion potentials.

CHAPTER FIVE

5.0. THE DESIGN PROPOSAL

5.1.0. THE SITE

5.1.1. Historical background of Zamfara

Zamfara state was created in 1996 by the Late General Sani Abacha led federal military government of Nigeria; it was carved out of old Sokoto state, with its state capital in Gusau. Zamfara state lies on latitudes 10 degrees 50'' and 13 degrees 10'' to the north, and longitudes 4 degrees 40'' and 7 degrees 10'' east, it shares borders with Sokoto and Kebbi states to the west, Niger state to the southwest, Kaduna to the south, Katsina state to the east and Niger republic to the north. Zamfara state covers a land mass of approximately 39,792.00 square kilometres, representing 4% of Nigeria. It has fourteen (14) local government areas.

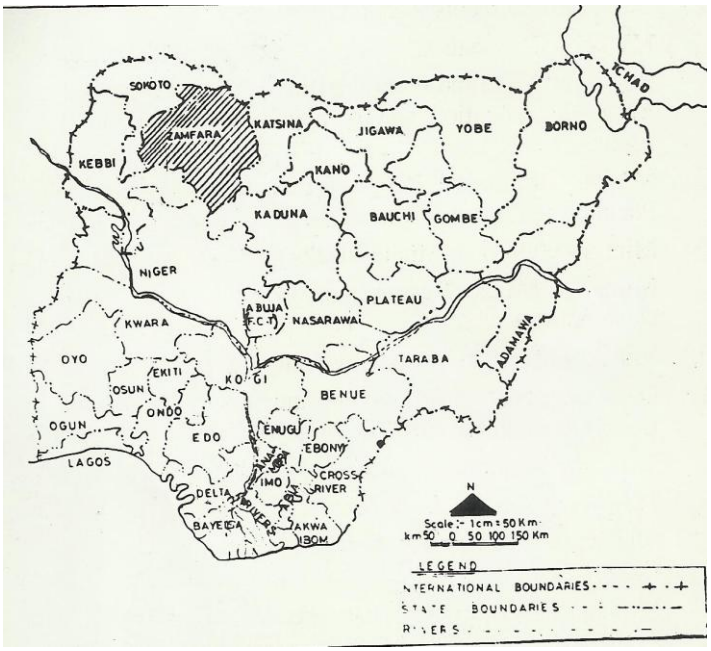


Figure 5.1- Map of Nigeria showing Zamfara State

Source: Zamfara state Year book (1997).

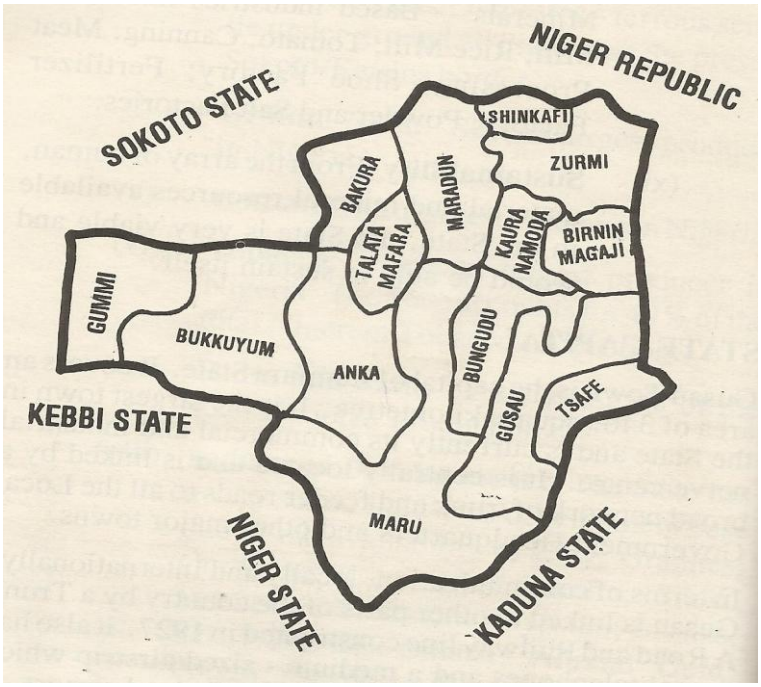


Figure 5.2 - Map of Zamfara State showing Gusau Local government

Source: Zamfara state Year book (1997).



Figure 5.3 - Map of Gusau Local government showing Gusau town.

Source: Zamfara State Year book (1997).

5.1.2. Physiography of Zamfara State

The general landscape of Zamfara state is characterized by a blend of relatively flat terrain (low plains) in the north and west to gentle and undulating plains (land forms) in the central zone. Gusau the state capital is surrounded by residual hills associated with peripherastic massive granite and granite gneiss referred to as inselberg. The prominent feature of the area is the famous kotorkoshi inselberg located some 7km due east of the state capital, Maru Hills and Maradun Highlands. There are five major rivers in the state namely; river Zamfara, river Sokoto passing through Gusau, river Bunsuru, river Gagare and river ka, with two major lakes; the kalale hippopotamus lake in Maru local government (a tourist attraction) and the Natu lake in Bakura local government (fishing lake). Tourist attractions in the state include kuyambana game reserve, Dajin rugu (forest reserve), Bakalori Dam, kalale Hippopotamus Lake, sarakara crocodile pond and Namoda tomb in kaura namoda. About 75% of all the soil in Gusau is classified as loamy sands.

5.1.3. Site location

The proposed site for Vesico-vaginal fistulae centre is located along the new bye pass road linking Sokoto and Kaura Namoda roads in Daza village a periphery of Gusau town the state capital of Zamfara state.

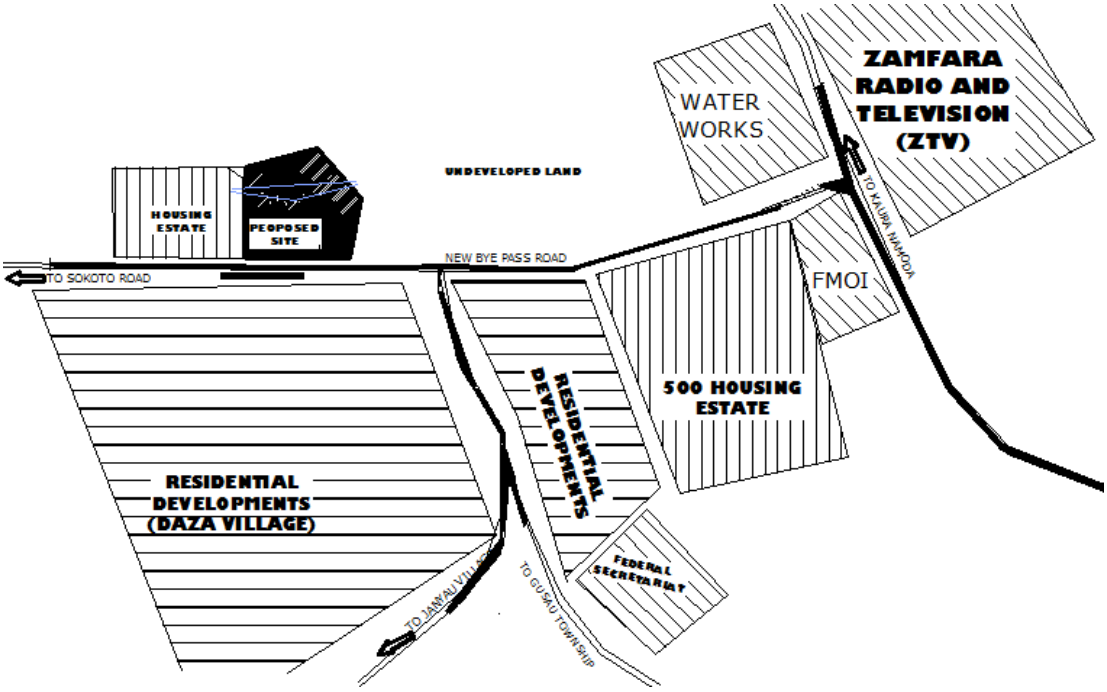


Figure 5.4 – Site location plan.

Source: Researchers field work (2013).

5.1.4. Site selection

The site was selected after careful analysis of a set down criteria based on literature review and the relevant guidelines for the establishment of health care and rehabilitation institutions in Zamfara state. The following parameters were set down as site selection criteria;

- Location and accessibility to the users. The ease of ingress and egress to and out of the site for both vehicle and people,
- Size of site and possibility for future expansion potentials; enough land to accommodate the various functions as well as give room for future development and expansion,
- Land use compliance; the site has to be within the land use for institutional development,

- Environmental features like land forms, rock out crops, hills, valleys, stream, natural vegetation, and any other special character that makes the site unique and can be utilized for the intended project.

5.1.5. Site analysis

General study of the micro site and it's features considering it's potentials and treats in an attempt to utilise the advantages and tame the disadvantages. In trying to understand the site, the following parameters were considered and analysed;

5.1.51 Site characteristics: - This is the study of the physical character of the particular site. The site characteristics comprises of the topography and land forms, vegetation, soil type, neighbourhood.

- **Topography: -** The site has an undulating surface with a relatively flat pattern towards the approach road and a steep slope with undulating character towards the north draining it's surface run-off into a small stream that passes through the site. Therefore the site drainage will take advantage of the slope direction so as to make use of natural gravity. The planning of the proposed project will take into consideration the topography of the site as design tool.
- **Vegetation: -** Gusau falls in the Sudan savannah vegetation zone, which is characterised by short grasses forming a matrix of thorny structures and shrubs. Perennial forest vegetation can be found along the valleys of major rivers and streams that truncate the state together with the several cereal crops grown during the wet season. The vegetation cover moderates the harsh physical landscape.

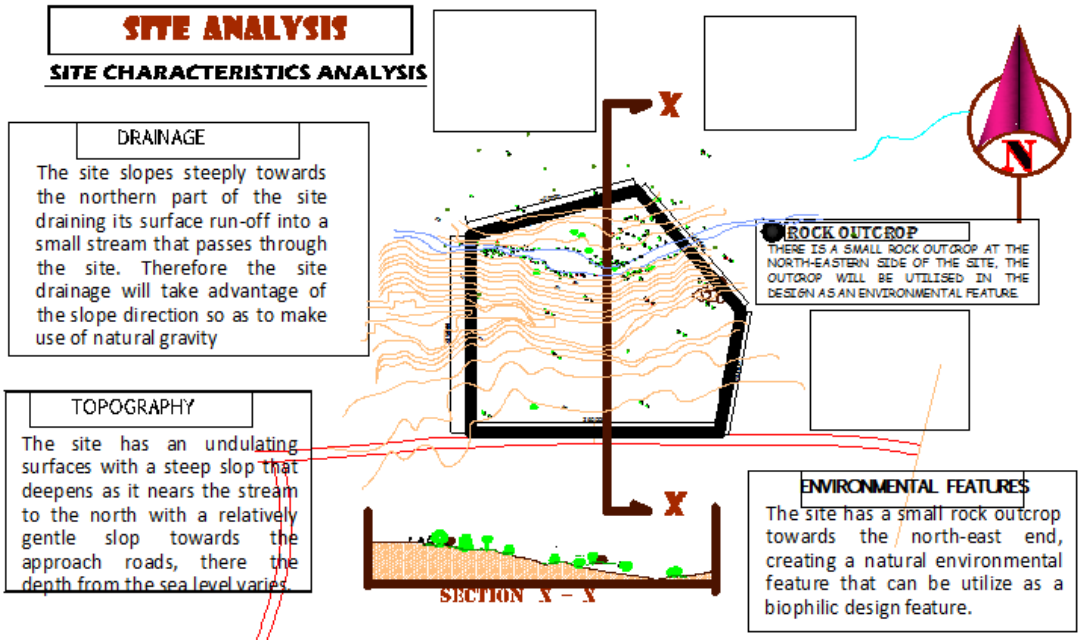


Figure 5.5 - Site characteristics analysis.

Source: Researcher's field work (2013).

5.1.52 Climatic data analysis: - The study and analysis of the micro climate of the site and relate it to the macro climate of the area with due considerations to the site features.

- **Precipitation: -** Records indicates that precipitation in form of rain fall is only experienced between the months of April to October, with a fluctuation in level from the lowest in April to June to the highest in the months of July to September. Provision will be made for rain water harvesting to be stored in an underground storage facility for use in the site.

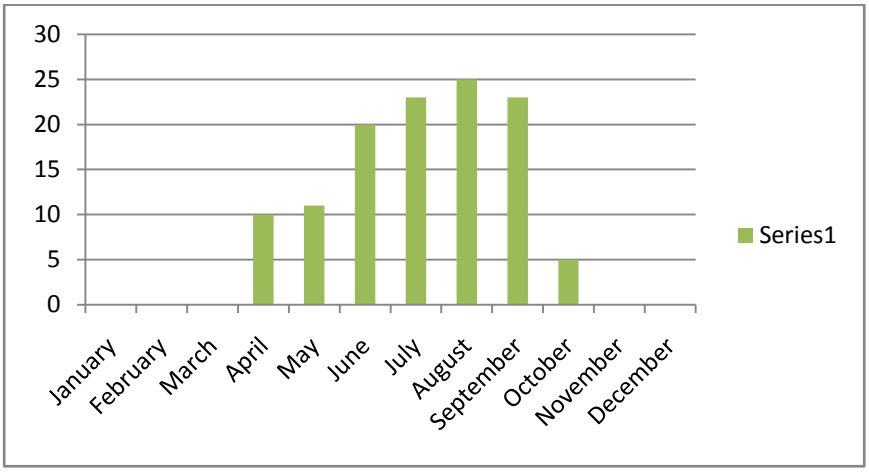


Figure 5.6 - Mean Annual Rainfall 2012.

Source: ZADP Gusau (2013).

- **Temperature: -** Zamfara state having fall within the hot dry region of Nigeria records temperatures of up to 40°C in hottest months, with temperature ranging from 32°C to 42°C. January is the coolest month of about 21.66°C. The temperature difference between the two extremes will be tamed by the use of appropriate building material, orientation and shading devices.

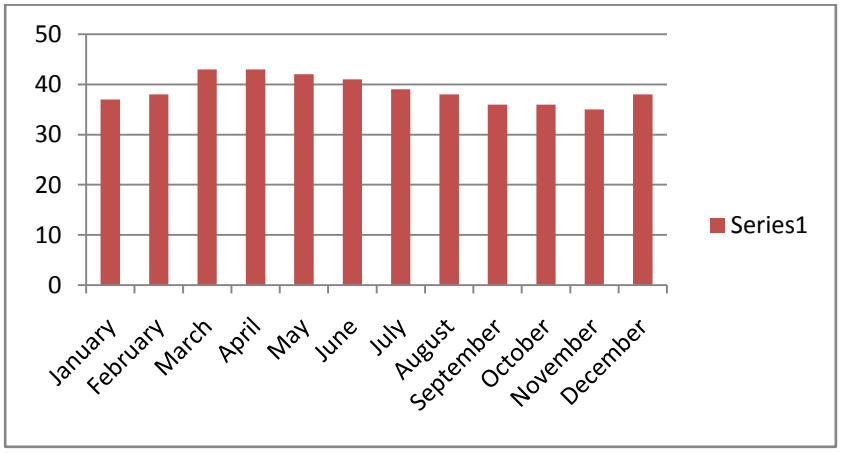


Figure 5.7 - Mean annual Maximum temperature 2012.

Source: ZADP Gusau (2013).

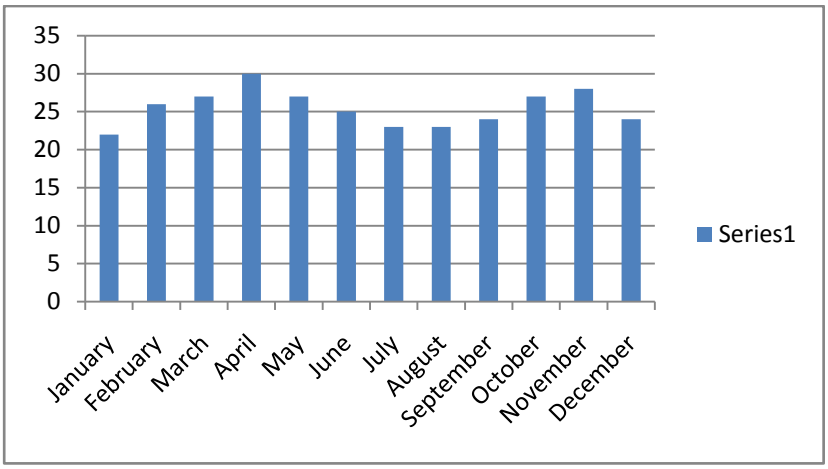


Figure 5.8 - Mean annual Minimum temperature 2012.

Source: ZADP Gusau (2013).

- **Relative humidity: -** Relative humidity is increasingly high during wet seasons and sharply drops in dry season. This type of variation in air humidity affects the building components and interior spaces, this can be tackle by proper choice of building materials and adopting a design that integrate and utilises diurnal and seasonal changes.

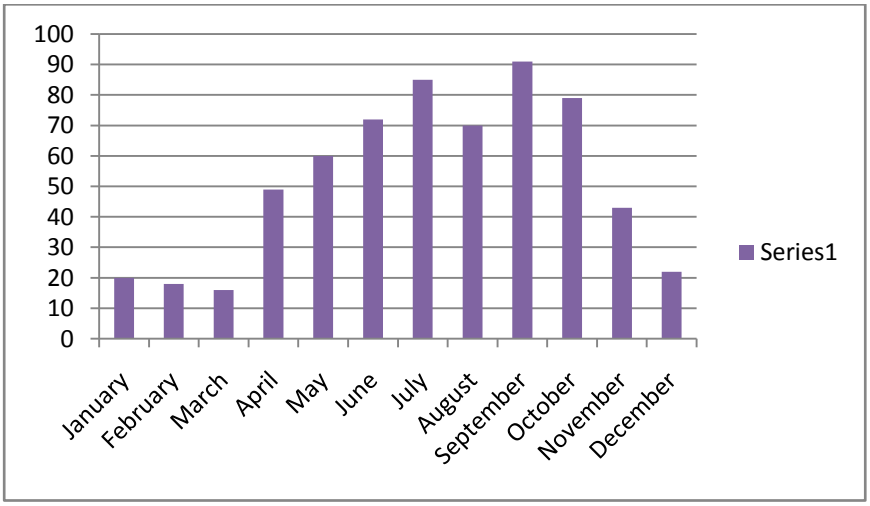


Figure 5.9 - Relative Humidity 2012.

Source: ZADP Gusau (2013).

- **Wind: -** There are two dominant prevailing trade winds in the region; Wet season south-west monsoon wind with cool breeze from sea influences rainfall between April to October, fenestration should best be in this direction for better performance, and dry season north-east tropical wind characterized by dry wind and harsh hammattan wind from desert, fenestration should be avoided in this direction for better performance except with some shading devices.
- **Sun radiation: -** The hours of sunshine varies with the time of the year, the average ranges from 6.5 hours per day in August to 10 hours per day in December. The approximate elevation angle is 73 at noon. The incidence of Sunshine during the dry season is 8.6hours per day and 6.0hours per day during at cold times. There is relatively high daily radiation which ranges from 19MJ/m in early August when temperatures are a little lower during the wet season and 25MJ/m in April when temperatures are a little higher during the dry (Hot) season.

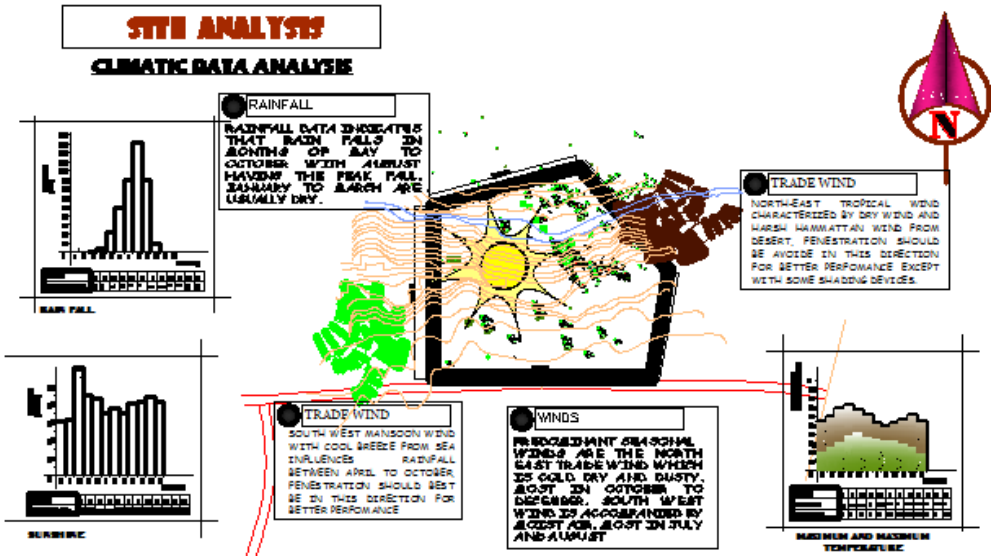


Figure 6.0 - Climatic data analysis.

Source: Researcher's field work (2013).

Visual analysis

- **Neighbouring Developments**

To west side of the site is housing estate under construction for middle cadre staff of Zamfara State is located adjacent to the site. The estate is a medium density settlement and hence it generate little crowd but no traffic jam and therefore unlikely to create any impediment to the proposed development.

- **Vista and attractions**

The site has a distant eye-catching vista east wards due to the naturally occurred famous Kotorkoshi Mountain (Inselberg) which is one of the tourist attractions in Zamfara state. However, there is no any major attraction nearby the site except for an undeveloped land that provide an uninterrupted view of the horizon, and green vegetation.

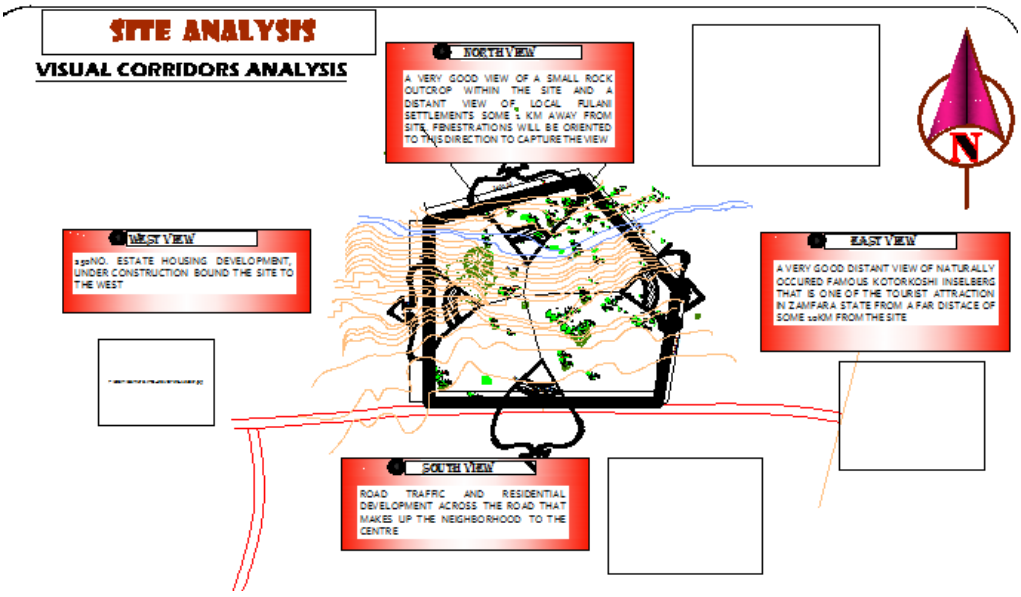


Figure 6.1 - Visual site analysis.

Source: Researcher's field work (2013).

5.1.34 Environmental site analysis

- **Future Land Use Plan for The Surrounding Environment**

The area is one of the future administrative zones of Zamfara state. The new Federal government secretariat under construction located within the axis, the new Government house proposed site, coupled with the housing estate for civil servants just adjacent to the site, are clear indications of the land use intentions of the State government for the location.

- **Source of Noise**

The site is lies in the outskirt of Gusau the state capital; therefore there is little nuisance beside that created from the new bye-pass road by moving vehicles. The neighbouring structures and housing estate cause a negligible noise that has very little impact on the site zoning.

- **Sites Cultural Significance**

The compatibility between the site's proposed land use and intended surrounding land use and plan is enough to clear any doubt that the development will not impact negatively on the socio-physical setting of the entire environment. The development is not in conflict with the original norms, values and religion of the people of Zamfara State, thus suits the intended future land use of its surrounding.

- **Sites Biophilic Significance**

The undulating terrain of the site coupled with other site features like the small stream, the vegetation and accessibility are the main components that make the site unique and suitable for the intended project as these qualities combined with the design strategies will give a biophilic experience.

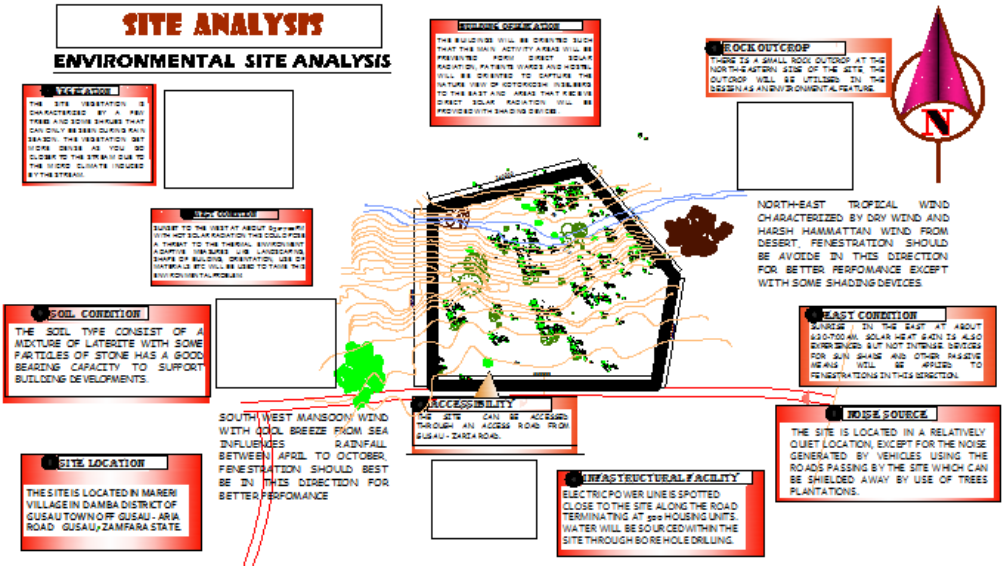


Figure 6.2 - Environmental site analysis.

Source: Researcher's field work (2013).

5.2.0. THE DESIGN BRIEF

5.2.1. Development of Design Brief

The design brief was developed based on the findings from case studies conducted and the basic guidelines for establishing health and rehabilitation institutions in Zamfara state. Four sections were identified and their brief developed below:

5.2.11. Administrative Section: - The administrative organ of the centre where day to day affairs and the policies implementation of the centre takes place. It comprises of the following spaces

i. Reception:- The main and first point of call by people going into the facility,

ii. Medical Director: - The head of all medical services and the management team of the centre,

iii. The Secretary: - The head of personnel affairs and the secretary to the management board,

iv. Public Relation Officer: - Relate to the outside bodies and individuals on behalf of the centre, also the information data bank of the centre,

v. Accountant: - Keeps records of all finances in and out of the centre,

vi. Cashier: - Pays out and receive monies on behalf of the centre,

vii. Medical record: - Keep all records of patients,

viii. Staff Lounge: - Relaxation place for the staff, to refresh and relate with one another,

ix. Maintenance unit: - Otherwise known as the technical or physical planning unit, responsible for the general repairs and maintenance of buildings and equipments,

x. Medical briefing room: - a hall for briefing to staffs on a new health issue, or weekly review of the activities of the centre,

xi. Computer room,

xii. Board room/ meeting room,

xiii. Toilets.

5.2.12. The Clinical Section: - This is the main focal point in the centre as the clinical services providers of the centre. The clinic renders services not only in VVF cases but also provides outpatient services to women and children cases. The following spaces were identified for the clinical services:

i. Waiting area,

ii. Chief nursing officer,

iii. Medical Consultants offices,

iv. Card room,

v. Pharmacy,

vi. Injection room.,

vii. Treatment / dressing room,

viii. Laboratory,

ix. Operation Theatre,

x. X- Ray room,

xi. Ultra sound and scanning room,

xii. Nurses stations,

xiii. Pre-operative wards,

xiv. Post- operative wards,

xv. Labour and delivery rooms,

xvi. Labour and delivery wards,

xvii. Antenatal care unit,

xviii. Post natal care unit,

xix. Toilets.

5.2.13. Rehabilitation Centre: - Here is the second focal point in the centre as it prepares the repaired patients for re-integration back into the society as productive and responsible members. It comprises the flowing spaces:

i. Principal,

ii. Councillors,

iii. Welfare secretary,

iv. Staff room,

v. Staffs lounge,

vi. Library,

vii. Computer laboratory,

viii. Classrooms,

ix. Workshops,

x. Multi-purpose hall,

xi. Accommodations,

xii. Toilets,

xiii. Common rooms,

xiv. Matron rooms.

5.2.14. Auxiliary services: - these are services that are not part of the clinical services neither the rehabilitation services but are needed in the centre for the betterment and good living conditions in the centre they include the following:

i. Kitchen and dining hall,

ii. Restaurant,

iii. Mosque,

iv. Laundry,

v. Mortuary,

vi. Arena (amphitheatres),

vii. Recreation: - sports and outdoor physical activities,

viii. Relaxation: - gardens, open spaces with sitters and sun bath areas,

ix. Parking: - for both staff, patients and visitors,

x. Landscaping: soft and hard landscape elements like walkways, water bodies, plants, and undisturbed vegetation.

5.2.2. Space requirements and analysis

5.2.21. Administrative Section.

Table 5.1- Space requirements for Administrative Department.

S/N	SPACE	NUMBER OF UNITS	SIZES (M2)	TOTAL AREA (M2)
1	Reception	1	8 x8	64 m2
2	Medical director's office	1	6 x 8	48 m2
3	Secretary's office	1	4 x 6	24 m2
4	Public relation officer	1	4 x 6	24 m2
5	Accountant	1	4 x 6	24 m2
6	Cashier	1	4 x 4	16 m2
7	Medical records	1	4 x 8	32 m2
8	Staff lounge	1	6 x 8	48 m2
9	Maintenance office	3	4 x 6	72 m2
10	Medical briefing room	1	8 x 12	96 m2
11	Computer room	1	4 x 6	24 m2
12	Board room/ meeting room	1	6 x 12	72 m2
13	toilets		2 x 3	6 m2

Source: Researcher's field work (2013).

5.2.22. Clinical Section.

Table 5.2 - Space requirements for Clinical Department.

S/N	SPACE	No. OF UNITS	SIZES (M2)	TOTAL AREA (M2)
1	Waiting area	1	12 x 30	360 m²
2	Chief nursing officer	1	6 x 8	48 m²
3	Consultants' offices	3	4 x 6	72 m²
4	Card room	3	4 x 4	36 m²
5	Pharmacy	3	4 x 8	96 m²
6	Injection room	1	4 x 4	16 m²
7	Treatment. Dressing room	1	4 x 4	16 m²
8	Laboratories	1	8 x 12	96 m²
9	Operation theatre	1	6 x 8	48 m²
10	X-ray	1	6 x 8	48 m²
11	Ultra sound and scanning	1	6 x 8	48 m²
12	Nurses station	Each ward	3 x 4	12 m²
13	Pre-operative wards	4	11 x 20	220 m²
14	Post-operative wards	4	11 x 20	220 m²
15	Labour and delivery rooms	1	8 x 16	128 m²
16	Labour wards	1	11 x 16	198 m²
17	Ante natal care unit	1	12 x 24	288 m²
18	Post natal care unit	1	12 x 20	240 m²

Source: Researcher's field work (2013).

5.2.23. Rehabilitation Section;

Table 5.3 - Space requirements for Rehabilitation Department.

S/N	SPACE	No. OF UNITS	SIZES (M2)	TOTAL AREA (M2)
1	Principal	1	6 x 8	48m²
2	Councillors	1	4 x 6	24m²
3	Welfare secretary	1	4 x 6	24m²
4	Staff rooms	2	6 x 8	48m²
5	Staff lounge	1	6 x 8	48m²
6	Library	1	7 x 12	84m²
7	Computer laboratory	1	7 x 12	84m²
8	Class rooms	2	7 x 12	84m²
9	Workshops	6	7 x 12	84m²
10	Open theatre	2	6 x 10	60m²
11	Boarding room	20	7 x 12	84m²
12	Kitchen	1	5 x 8	40m²
13	Dining hall	1	12 x 8	96m²
14	Laundry	1	4 X 6	24m²
15	Common rooms	2	12 X 12	144m²
16	Matrons rooms	2	4 x 4	16m²

Source: Researcher's field work (2013).

5.2.24. Auxiliary Section;

Table 5.4 - Space requirements for Auxiliary Unit.

S/N	SPACE	No. OF UNITS	SIZES (M2)	TOTAL AREA (M2)
1	Restaurant	1	6 x 12	72 m2
2	Mosque	1	6 x 9	54 m2
3	Laundry	1	8 x 12	96 m2
3	Mortuary	1	6 x 12	72 m2

Source: Researcher's field work (2013).

5.3.0. THE DESIGN DEVELOPMENT

5.3.1. Concept Development

Nature is the fundamental and recurring inspiration of biophilic design both in its outward forms and inner structures (Dillon, 2008), it offer endless ideas and concepts for design, therefore the design concept for this thesis evolved as a fragmental ideas that are rooted in nature and its processes. The main conceptual ideas stem from the following inspirations:

5.3.11 NATURE INTERACTION:

- Inside out- side relations;
- Landscaping and greening;
- Water features (Fountains);
- Respect for site.

5.3.12 REDUCED ENERGY CONSUMPTION:

- Natural lighting;
- Natural ventilation;
- Roof garden;
- Shading devices.

5.3.13 FORM AND STRUCTURE:

- Simple form;
- Spirit of place ;
- Flexibility and adaptability;
- Court yards.

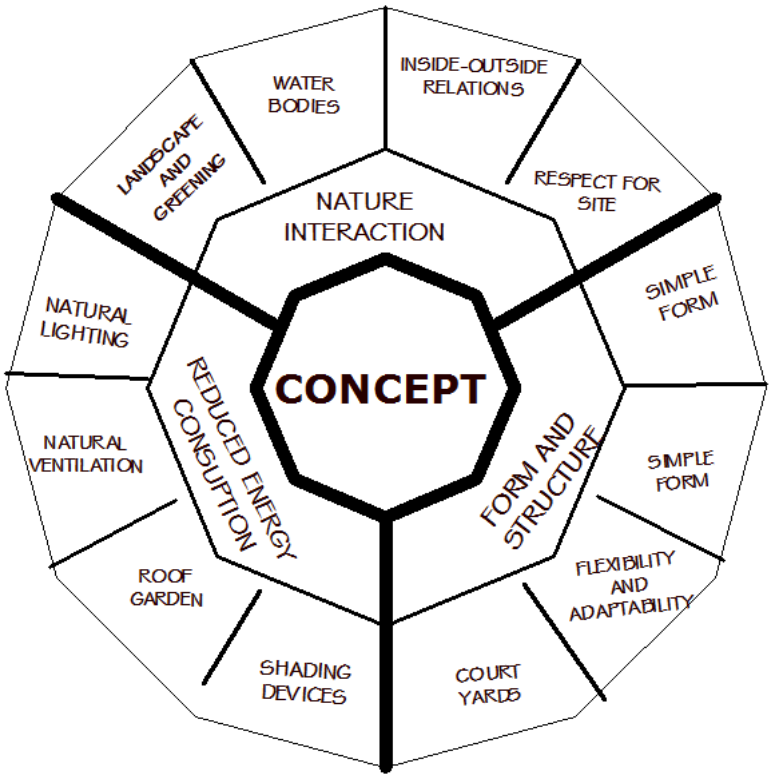


Figure 6.3 – Concept Evolution Circle.

Source: Researchers work (2013).

5.3.2. Site Concept

The site planning concept takes note of the site features and land zoning of functions. The inspirational ideas are:

- Exploitation of site features;
- Topography and drainage by gravity;
- Access and circulation.

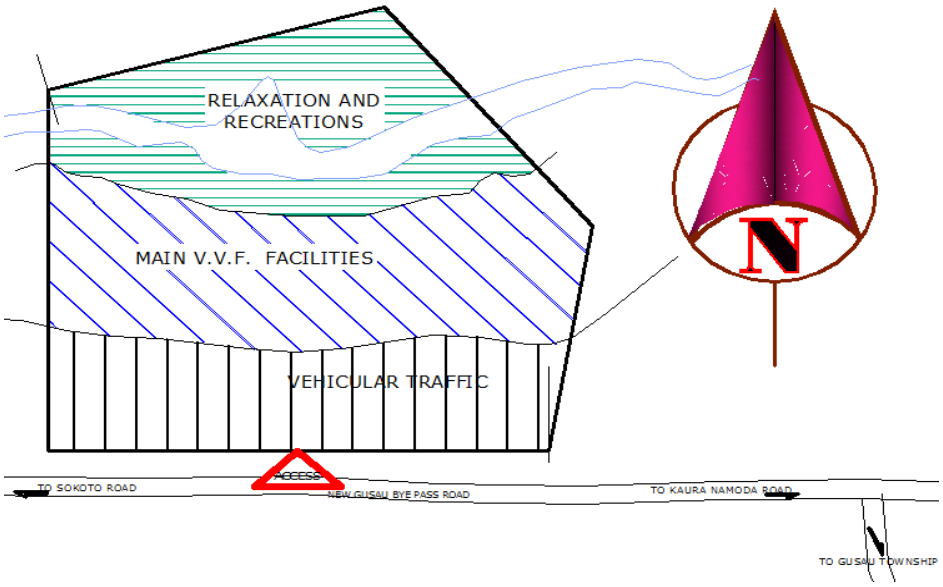


Figure 6.4 – Site Concept Development.

Source: Researchers work (2013).

5.3.3. Elevation Concept

The elevation concept is an interplay of natural features, indigenous architecture and aesthetics by the articulation of architectural forms to achieve harmonious relationship between the building and the environment and at the same time maintaining balance. The massing of the building shows the integration of architectural forms into nature in enhancing good visual perception.

5.4.0. DESIGN CONSIDERATIONS

5.4.1. Environment/ site features: - Natural feature of the site like land forms, water features, trees and vegetations, rock out crop and topography were taken into considerations in the planning of the site concept. Natural elements of the site like lightening, ventilation, site contours and views and prospects were the major elements that were utilised in the design by the provision of operable windows on opposite walls to admit in natural lightening, natural ventilation as well as provides a good view window of nature from a position of security.

5.4.2. Respect for site: - designing the facility following the natural pattern and flow of the site trying as much as possible not to disturb the natural topography, natural features and natural elements of the site. Respect for site means to design the environment in a more humane and organic order.

5.4.3. Circulation: - circulation within the site was classified into three categories; vehicular, pedestrian and aided movements (wheel chairs and trolleys). The vehicular circulations are restricted to the approach of the facilities and are designed not to interrupt other types of circulation for ease and security of movements. The circulation within the complex is through verandas, walkways and covered linked corridors between one function to the other, these are use by both pedestrians and aided movements.

5.4.4. Zoning of facilities and functions: - Activities in the centre are zoned based on the aspects of health care delivery service which are; prevention, cure and rehabilitation. The preventive section that receive more people was place in the approach in form of the outpatients departments, counselling and advice, labour and delivery, ante natal care unit and post natal care unit, investigations and diagnosis (laboratories, x-ray, scanning and ultra sound). The curative section that receives fewer patients was place at the core of the facility and

comprises of the inpatients department in form of operation theatre and patients in-laying wards. The rehabilitation section receives lesser number of patients therefore was place at the extreme of the centre this comprises of the physiotherapy unit, skill acquisition, literacy classes and the social mobilisation.

5.4.5. Spirit of place: - the strength of architecture is that it blends building into various setting so that there is a natural harmony between climate, architecture and people. Buildings and features that have sensory connection to the culture and ecology of the site helps in adaptation of its users, as such cultural affiliations and traditional architectural styles were employed to give the building a character as well as sense of place and belonging. Hausa traditional motifs were used as well as court yards as a character of Northern Nigerian architecture of which the site fall within.

5.4.6. Architectural expression: - The architectural style is designed to reflect a fusion of Hausa architectural forms into modern design in a harmonious relationship taking cognisance of environmental potentials that can be utilised in the design.

5.5.0. BUILDING MATERIALS AND CONSTRUCTION METHODS

Simple technology and materials are used through the application of locally sourced organic materials that are native to the site and surroundings, that have low impact, in conjunction with reinforced concrete throughout the building for both the building fabric and finishing. The construction technique is a frame structure of reinforced concrete columns, lintels, beams, slabs. Compressed earth block was used as an infill for all masonry work for both the building envelop and the partitioning systems.

5.6.0. SITE PLANNING AND BUILDING.

The physical environment is understood to mean the building itself, the layout, the use of materials and the direct vicinity of the building. Buildings are placed within the site to give a traditional community setting enclosing a court yard, symbolizing a village communal setting with trees planted and water fountain to serve the dual purpose of retardant to solar intensity and an admiration sport for both the staffs and the patients. The site planning takes into consideration the natural features afforded by the site and incorporate them into the design to achieve harmony between the site and the building. The major features of the site that were optimally utilised are the site contours (topography) and the small stream passing through the site. Buildings are arranged to follow the natural topography of the site by way of creating split levels connected by ramps and stairs ways.

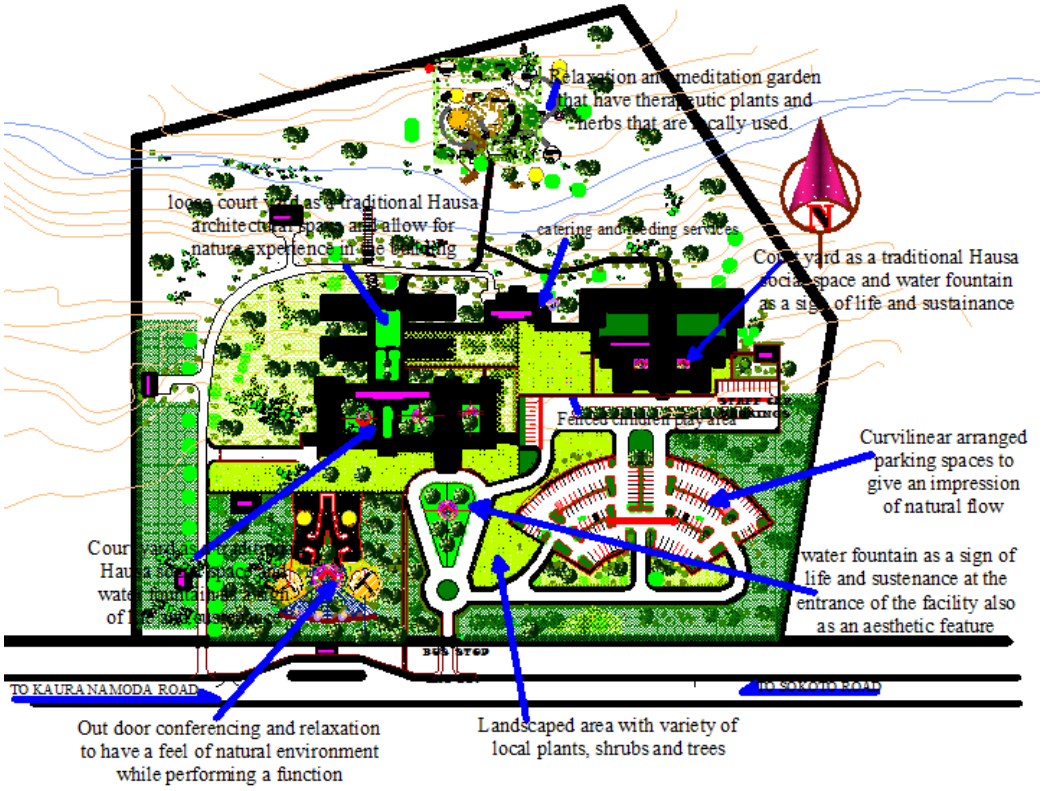


Figure 6.5 – Site Plan of the Proposed Facility.

Source: Researchers proposal (2013).

5.5.1 FLOOR PLANS

The facility has two floors and split levels that follows the topography of the site; ground floor and first floor is the general outpatients department, while split levels are the in patients in-laying units. The plan shape was deliberately chosen to allow for ease of circulation for both aided and non aided movement and to give multiple enclosed court yards as an architectural character of the area and allow for providing cross ventilation to each enclosed space. The upper floors are accessed by the use of staircases and ramps provided at strategic locations for ease of movements and circulation of patients and staffs.

5.5.2 ELEVATIONS

The elevation follow the natural features of the environment coupled with the traditional architectural styles of Hausa land and of Zamfara state in particular, by the application of motifs, pinnacles and curvilinear forms in the facade to portray an organic and regional identity of the facility. This is in considerations of the users that are mainly from poor rural areas to have a feeling of belonging and familiarity with the architecture of the facility, so as not to scare them away from patronising the centre, which is one of the major problems the government has in trying to identify and manage the vesico-vagina fistulae cases in Northern Nigeria.

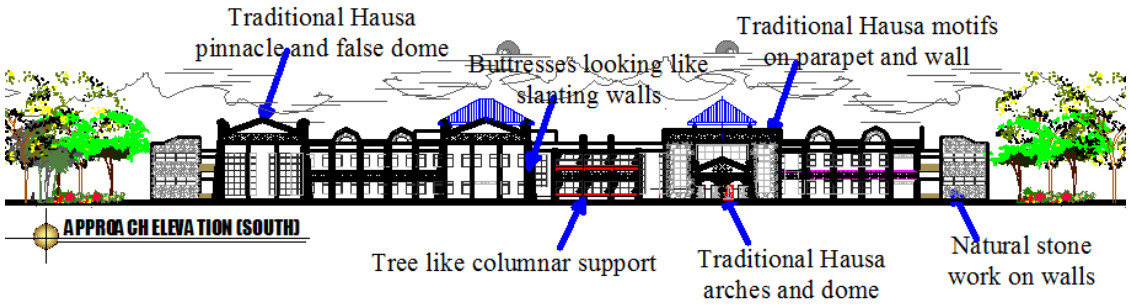


Figure 6.6 – Approach elevation of the Proposed Facility (South Elevation).

Source: Researchers Proposal (2013).

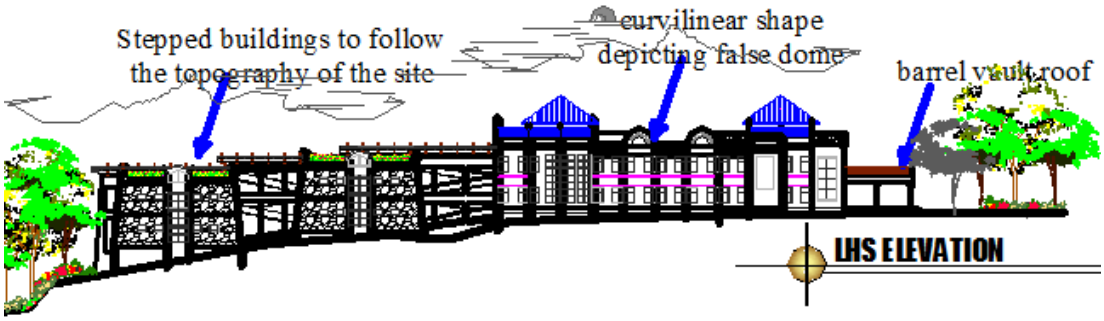


Figure 6.7 – Side elevation of the Proposed Facility (East Elevation).

Source: Researchers Proposal (2013).

5.5.3 WALLS

Exterior walls are of compressed earth brick as an available local material that do not require sophisticated technology and give a sense of place laid double in stretcher bond that make up the building envelop, they are however faced with different materials depending on the desired effect. Some exteriors are rendered in stone facing to give it organic features. Some are decorated with Hausa motifs to make it look original. Internal partition walls are made of compressed earth brick laid in single stretcher bond as the infill for internal wall rendered in cement / sand plaster.

5.5.4 ROOFS

Roof used is of three categories; the traditional Hausa roof with normal pitched roof covered by traditional parapet and pinnacles, which dominates the roof structure, was chosen to depict the identity and give a sense of belonging to the users. Roof gardens were also used to serve a dual purpose of reducing the impact of solar radiation into the building interior and aesthetic as well as recreational spaces for relaxation and social interaction. The majority of the "green roofs" are covered with native vegetation and soil and planted over a waterproofing membrane. The decision to utilize green roofs stems from a variety of benefits which include reducing heat loads, increasing the roofs life span and insulation and for filtering rainwater into the pond. A cistern will be located

beneath the ground for excess water to be stored for use. Another major reason was to incorporate the green roofs as rooftop gardens for both patients and staffs to enjoy. There are three roof top gardens located at different floor levels of the building. The first floor gardens provide seating and relaxation area. The roof garden in the second floor is designed to allow the users to see and appreciate the good view of the surrounding below. The other type of roofing used is the traditional thatched pitched roof to give the building an organic character.

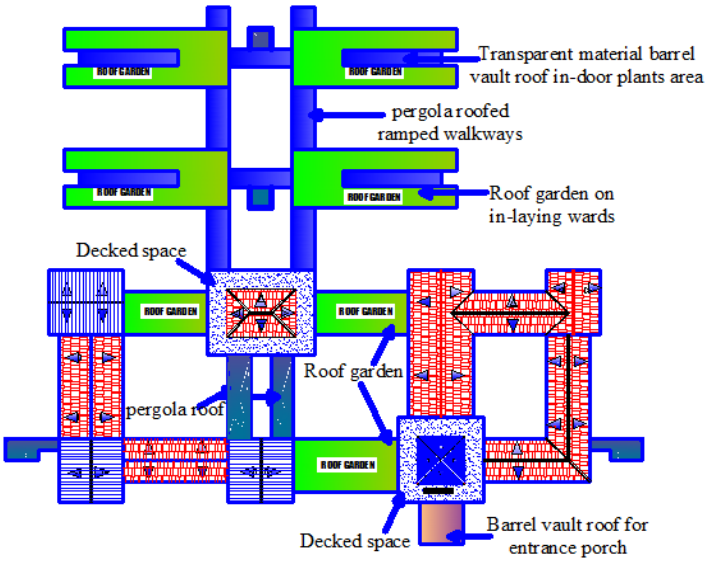


Figure 6.8 – Roof Plan of the Proposed Facility.

Source: Researchers Proposal (2013).

5.5.5 WASTE DISPOSAL

Solid and grey waste generated within the site will be disposed through septic tanks and soak away pits that will be constructed at specific locations within the site.

5.5.6 COURTYARDS

In order to create a micro climate within the built area and a buffer zone for ventilation, courtyards are created in the building to give the facility a character of buildings type in hot dry climate and a traditional Hausa social and psychological space. The courtyards contain fountains and trees to promote evaporative cooling and provide shade. Courtyards moderate the climatic extremes in many ways:

- The cool air of the summer night is kept undisturbed for many hours from hot and dusty wind provided that the surrounding walls are tall and the yard is wide,
- The rooms draw daylight and cool air from the courtyard.
- It enhances ventilation and filter dust.
- Provides privacy to individual blocks and keeps their activities and noise away from others.
- The courtyard with its gentle microclimate provides a comfortable outdoor space to enjoy.

5.5.7 WATER FEATURES AND FOUNTAINS

Water as a source of life as the popular saying ‘’water is life’’ was incorporated in the complex to give life to the centre, by using the healing power of water to aid in the recovery and healing processes for patients. The functional spaces in the complex are separated by an open air courtyard that houses various native grasses and plants as well as a designed water fountain that mimics a natural waterfall. The most efficient natural cooling systems found in traditional architecture make use of water. These systems exploit the cooling effect caused by the evaporation of water. Warm air when blown over a water surface, or a damp wall, transfers part of its heat to the water, causing a partial evaporation thereby cooling the environment.

5.5.8 LANDSCAPE

Humans seem to show a universal appreciation for environments with water-features, flowers and plants. The preference for these contents can be explained by the fact that it was adaptive to like those features that contributed to survival and by the fact that these preferences became part of the human genetic make-up. These natural elements probably had an important survival value for ancestral humans. Trees offered protection against the rain, and gave early humans views of the surrounding environment; also increase the aesthetic attractiveness of the setting. Besides creating shade, vegetation transpires water and thus provokes natural cooling through evaporation. Hard and soft landscape elements were used to entice the users. Extensive organised green areas and plantations are used to provide solar radiation retardant in addition to relaxation and admiration. The general landscape pattern of the site was categorises into two; the low level grasses, shrubs and hedges in the facade to a taller tree at the fore ground creating a near natural forest.

5.5.9 RECREATIONS, RELAXATION AND OUTDOOR SERVICES

Outdoor Services such as relaxation, conferencing and recreation spaces are provided for the benefits of the users of the facility in form of therapeutic garden, children play area, amphitheatres, meditation path and landscaped area. Relaxation spaces were provided with shade trees, gazebos and water fountains for the use and admiration of the users.

5.5.10 FUTURE EXPANSION AND SERVICES

Undeveloped land was reserved in the site for future expansion of the facilities. Services such as power supply, water, telephone & communications, etc, can be sourced on site and augmented by the public mains accessible close to the site. Other services such as power cables, Central Cable Television (CCTV) cables and water line are concealed in the vertical and horizontal service ducts provided with outlets where necessary.

CHAPTER SIX

6.0. SUMMARY, CONCLUSION AND RECOMMENDATION

6.1.0. SUMMARY

This research work is an attempt to explore biophilia theory and its design features in the creation of a built environment that speaks to its users in their native language, an environment that promote, invigorates, sooth and offer optimal healing and recovery potentials. The research explores Biophilia and biophilic design features that can be applied to the design of such facilities, through a critical study of the suitability and adaptability of those features in the design of vesico-vagina fistulae centre with more emphasis in hot dry climate. This thesis sought to find out how to apply the various features of biophilic design into the design of vesico-vagina fistulae centre.

The research starts with an introduction that discuss on the topic and states the problem that justify the research, identify the aim and objectives as well as the research justification. Relevant related literature works was reviewed, on both biophilia and vesico-vagina fistulae, with, more emphasis on the biophilic design features, that can be used in architectural practice. Those features of biophilic design identified as applicable to health centre design especially in hot dry climate are; natural lighting, natural ventilation, local materials, natural forms and shapes and natural views and prospects.

The research methodology and methods applied to carry out the research and based them to known and established mode of scientific research was case study methodology and purposive sampling method was used to select three case study sites in Katsina, Kebbi and Sokoto states, based on two criteria; socio-cultural similarities and geo-climatic similarities. The three selected case study sites were analysed based on predetermined variables to ascertain the degree of utilization of biophilic design features. Those variables were derived from literature review of biophilia and vesico-vagina

fistulae and they include; natural lightening, natural ventilation, prospect and refuge, natural materials, and fundamental natural forms. Analysis of the study area and design development was discussed in chapter five, it critically study the area in terms of geography, climate, and environmental features. The chapter also outline the concept development and the design development. The conceptual idea was a fragmented one derived from the findings of the research by identifying those aspects of biophilia that can be applied to the design of Vesico Vagina Fistulae centre with special emphasis in hot dry climate; nature interaction, reduced energy consumption and form and structure of the building were considered as the inspirational ideas. These core ideas of the concept were used in the development of the design proposal for a humane and befitting vesico-vagina fistulae centre.

The research project proposes construction and environmental systems based on the natural potentials of the site and environment. The design aims to poster positive experience of nature by incorporating the use of natural light, natural ventilation, natural / local materials, local technology, natural features, natural forms and processes and of spirit of place.

6.2.0. CONCLUSION

The concept of biophilia and biophilic design features is a new design theory that is not widely known and practice in developing countries probably due to in adequacy of knowledge and research works on the subject matter. Nonetheless this research was able to conclude that biophilic design is the best design approach to healthcare institutions due to the healing effect of Mother Nature.

The design proposal for this thesis was conceived through an understanding and analysis of the requirements of biophilic design leading to the creation of a building complex that would facilitate and or set the grounds for a positive experience in health and rehabilitation institutions designs. The

design concept aims at respecting the existing natural setting by introducing buildings that complement the surrounding landscape and connects its users to the natural environment. The facilities are designed as a system that works in attaining a built environment which interacts positively with all the components of the natural site; a built environment that becomes part of the natural surroundings, with minimal negative environmental impact and environment that speaks to its users in the their native language. The design provides spaces for a hub of activities and promotes interaction between the users and the site's natural features., using locally available materials and utilizing biophilic design features, the design capitalizes on nature's grandeur and produces a functional and comfortable environment, with sense of place, but at the same time promoting physical and psychological well-being by fostering a connection between the users and natural environment.

6.3.0. RECOMMENDATION

The research was able to identify the following recommendations after careful study and analysis of the vesico-vagina fistulae situation and vesico-vagina fistulae centres in the country;

1. Biophilia should be adopted as a design principle for the design of health and rehabilitation institutions as Government policy for better result in the recovery and rehabilitation process.
2. Health institutions need to be designed to incorporate those features of biophilia that make the environment more lively and interactive to aid healing and recovery processes.
3. Local and indigenous architecture and materials should be use in the development of healthcare institutions for rural populace due to it's economic and social efficiency.
4. More awareness programmes need to be made to educate the rural populace especially young uneducated couples on the dangers of vesico-vagina fistulae.

5. More health facilities and personnel are required especially in the rural areas to attend to maternal issues for safe motherhood.
6. Many of our health care institutional buildings are so sophisticated that rural populace are scared away from patronising them. Therefore health care institutions should be built using vernacular and organic features and materials for the users to have a feeling of belonging and familiarity.

6.4.0. CONTRIBUTION OF THE RESEARCH TO THE BODY OF KNOWLEDGE

This thesis has made an attempt to contribute to architectural knowledge in the field of biophilic architecture as well as the design of vesico-vagina fistulae centres. This exercise has helped the researcher to produce a design proposal that has achieved the following results:

1. The research was able to create a template for the design of vesico-vagina fistulae complex using biophilic design features that would facilitate positive experience in healthcare and rehabilitation institutions designs. .
2. The research was able to identify those aspects of biophilic design features that can be applied to healthcare institutions design especially in hot dry climate.
3. The research also set the phase upon which other researchers can build upon in an attempt to improve, as knowledge and developments are continuous processes.

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