FARMSTEAD PLANNING USING GEOGRAPHICAL INFORMATION SYSTEM (G.I.S): A CASE STUDY OF GWAZUNU AREA OF SULEJA LOCAL GOVERNMENT AREA OF NIGER STATE

BY

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PGD/AGRIC ENG/2003/176

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APRIL, 2005

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CERTIFICATION

This is to certify that this project work was carried out by AHMAD MUHAMMAD DAN No. PGD/AG.EN/2003/176 in the Agricultural Engineering Department of the School of Engineering and Engineering Technology Federal University of Technology, Minna.

.... 28/04/2005

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Signature and Date

DEDICATION

This project work is dedicated to all the poor and the down trodden populace who are living below poverty level line in this great most populous single black nation of the world, Nigeria.

Only JAH loves them.

ACKNOWLEDGEMENT

All praises are due to Allah, the most high, most merciful most compassionate, the lord of the worlds and the saviour of all.

Special thanks goes to my project supervisor Engr. Dr B Alabadan and my H.O.D Engr. Dr D Adgidzi and my dear Engr. M Bashir whose words of encouragement led me through the programme. Sincere appreciation to Alhaji Dauda Daudu of civil Engr. Lab who contributed immensely to the success of this work. I would never forget our "Mama" the PG co-ordinator Engr Dr (Mrs.) Z.D Osunde whose relentless efforts and continuous assistance and encouragement made the programme successfully possible.

In the same manner, my special thanks go to the Engr. Professor Ajisegiri, Engr. P. Idah, Engr. O. Chukwu and Engr. C. Onuachu it is my strong believe that we are one big happy family, now and forever. I sincerely appreciate the contributions of all the members of staff of the department, both the academic and non academic, wishing all of them God's protection, guidance and abundant rewards here on earth and in the hereafter. Special regards to Mallam Isyaku A. Muhammed, and all my colleagues, both here in the school and in my Ministry that gave me the courage throughout the duration of the programme. The support and assistance received from

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AHMAD M.D

ABSTRACT

For an optimum utilization of space, material, human and financial resources, effective efficient and prudent management, careful and accurate planning is necessary to achieve short and long term desired goals. To realize these objectives in planning a farmstead, the Geographical Information Systems is recommended for use in this modern digital world. It simplifies and enhances easier and faster work with better precision in terms of planning and monitoring. The information gathered from the G.I.S gave us a clear picture of the study area which enabled us to select suitable positions for various farm activities. For crop production, soil P^H ranges between 4.5 in the upper region to 6.12 in the lowest part of the farm. While the soil nutrients values of N, P and k vary from point to point. For farm structure , the geo-technical soil classification results showed that the natural moisture contents of the soils ranges between 22.05 in the upper part of the farm to 17.42 in the lower part of the farm. The plastic and liquid limits of the soils also differ, while the values of the upper part ranges from 55.0% and 30.87% respectively the lower part has just 25..0% liquid limit and nil plastic limit. Since the upper part of the study site has stronger texture and can retain buildings at a cheaper cost of construction, it is recommended for

the structures to be erected there in, while the lower part hosts the agronomic crop production which is far away from the living or dwelling house.

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CHAPTER ONE

1.0 INTRODUCTION

The farmstead forms the nucleus of the farm operations where a wide range of farming activities takes place. It normally includes dwelling, animal shelters storage structures, equipment shades, workshops and other structures like ware houses and, silos etc. or simply the farm house (farmer's house) and other farm buildings.

A carefully organised farmstead plan should provide an arrangement of building facilities that allows adequate space for convenient and efficient operations of all activities , while at the same time protecting the environment form such undesirable effects such as odours, noise flies and heavy traffic,

1.1 Location of Farmstead.

The majority of Africans farmers are small holders who have limited resources and income and thus a low standard of living. The primary goal of most of these farmers is to produce food for the family and sell surplus to provide income for such things as children education and goods for personnel consumption. However, as urban population increases the demand for commercial crop production is turning many farmers to the goal of financial profit in operating their farm businesses. In any case, the farmer will like to make optimum use of his resources such as land, labour, capital and fixed assets, in order to achieve the desired result.

A plan for an individual farm is influenced by a number of factors over which the farmer has no direct control e.g., climate, soil fertility , government policies, state of knowledge about agric. Techniques, value of inputs and output, utilities and services (such as roads electricity etc) land (topography, drainage soil types etc)

1.2 Aim and Objectives

The aim of the project is to plan a simple case study farm in Suleja using geographical informations system (G.I.S) to ensure proper management of resources, such as land, water, human, material and financial.

1.3 Justification

The ever increasing world population which dictates the necessity of conserving natural resources, food, fossil fuels, soils, minerals, timbers and many other materials are being exhausted at an alarming rapid rate now and in future years. The decreasing population of wildlife and the disappearance of many species are evidence that much of the problems are related to pollution. (F.A.O 1979) In agriculture, soil erosion from farm land is not only one of the major causes of water pollution, but the loss of the land itself reduces the production of food and fibre. Natural resources should be passed on to future generations in good or better conditions than previous generation left them. (Joseph 1990). Hence the need for proper and adequate modern farmstead planning. The use of computers and computerised information systems has suddenly encompassed all disciplines and is becoming increasingly unavoidable. One of such systems has been variously described as geographical information science spatial information system or geo-informatics. (Ayeni 2001).

G.I.S is versatile and has the capability to store and asses any logical combination of data layers of analysis and display. Representative layers, illustrating stored, position over a common geographical area and used

A geographical information system,(G.I.S) can be defined as a set of tools or system used for capturing , storing updating, analysing, manipulating and displaying spatial data reference to the earth (Burroughs 1980). This information is in both graphic and non graphic data base form. A

together in analysis is as shown in fig 1.1

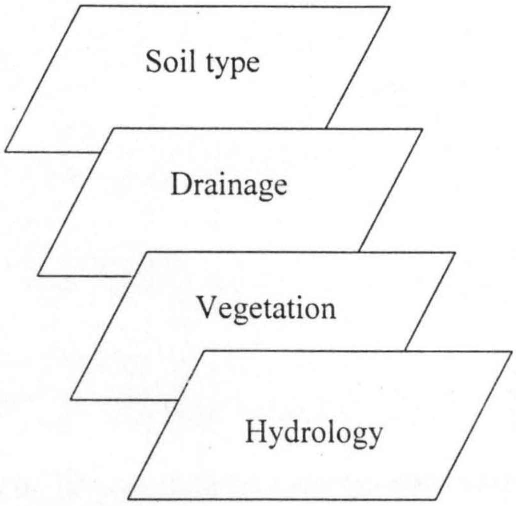


Fig 1.1 G.I.S DATA LAYERS (Modification of Ayeni 1996)

According to Perker (1988), a G.I.S is not computer map but an information technology tool. G.I.S consists of data hardware, soft ware and personnel for solving special problems. Data in G.I.S can be spatial and aspatial. Spatial data refer to objects in terms of their geographical positions with respect to given coordinates systems, while aspatial data refers to ungeoreferenced data or data not bound to a specific position or location in a map coordinate system.

G.I.S might allow emergency planners to easily calculate emergency response times in the event of a natural disaster or it might be used to find out wet lands that need protection from pollution.

1.4 How Geographic Information System Work.

Relating informations from different source. The power of a G I.S comes from the ability to relate different informations in a spatial context and to reach a conclusion about these relationships. Most of the informations we have about our world contains a location reference, placing that information at source points on the globe. When rainfall information is collected, it is important to know where the rainfall is located. This is done by using a location reference system such as longitudes and latitudes and perhaps elections. Comparing the rainfall information with other information such as the location of marshes across the landscape may show that certain marshes receive little rainfall.

CHAPTER TWO

LITERATURE REVIEW

2.0 Use of GIS in Planning

Basically, the sources of spatial data include analogue and digital maps, census and survey data, aerial photograph, remotely sensed images, and data from global positioning systems (GPS) (Burrough and Mc Dowell, 1998).

GIS can be viewed as tools of investigation; therefore it can be used by variety of scholars from wide range of fields or disciplines. It may be used for variety of purposes, interdisciplinary and multidisciplinary researchers, investigations and planning. Academic disciplines such as geography, geology, petroleum, civil, and agricultural engineering are making use of this technology. The potential users of GIS are nearly limitless. The types and users of GIS are growing at an amazing pace.

Agriculture Engineers may employ GIS as a spatial decision support system for surface and groundwater modelling: precision farming, irrigation and drainage, water resource planning and development, image processing of food and agricultural wastes, crop weather forecasting and environmental impact assessment of projects e.g irrigation, dams, and rural road development.

In this project, GIS is used to produce a detailed map of Gwazum area of Suleja Local government Area of Niger state for the planning of a farm stead with a view of making a model.

2.0.1 Farmstead Planning

Planning is the first and most important step in designing a farmstead (Alabadan B (2003). While it cost very little to change a plan on paper, the expenses of an alternation to a finished building can be prohibitive and a poorly conceived arrangement of buildings can diminish profit far into the future. Since the construction of new farmstead is a long term project, good planning can hardly be over emphasizing.

Only a few years ago, most planning involved some expansion or replacement of some parts of an existing farmstead. Today, however, the trend to larger farms requiring space for larger buildings has greatly increased the frequency of costively a new farmstead on a new site (Alabadan B (2003).

Every farmstead is unique. The various factors must be evaluated and reasonable compromises made careful planning with the very best information available will help to attain desirable compromise. By long range planning with gradual change, the efficiency of an existing farmstead may be materially improved.

Once begin, is continuing part of farm management, adjustment and additions to your plan will reflect changes in your life and your farming operations. Planning involves setting goals, evaluating farm and family needs, mapping existing facilities, and making decisions. Typical objectives of the planning process are expanding facilities, improving performance creating greater capacity, or making better use of labour.

Akintoki (1986) said that Farmstead planning includes mapping where things are and also evaluating how useful they are. Careful planning includes reviewing the present, accessing the future and providing flexibility for expansion.

2.1 Why Plan?

A good farmstead plan helps determine the location and arrangement of new facilities to provide more pleasing appearance, allow for expansion space, minimize wasted workers time and avoid hazardous situations. Many factors determine a good plan and while some are based on common sense. overlooking critical factors result in a farmstead that is unsafe or functions poorly. A building in the wrong place is a mistake that can have a 20 year effect on farmstead use and expansion. While there is seldom a single best plan, some plans work better than others Akintoki. (2001).

Good planning can help you avoid costly errors and prevent you from having to live with poorly designed facilities or inefficiently arranged work areas. It can prevent you from trying to build on a site with poor drainage. It can also help you avoid selecting a site that will make expansion difficult or avoid dangerous access to a busy road. Since farmstead evolve over time, careful planning is needed for a farmstead to adapt and grow over a period of many years.

In short, planning helps develop an environmentally friendly and efficient farmstead that can provide for a variety of needs, enterprises, and sizes of agric operations.

2.2 An Overview of Farmstead Planning.

Farmstead planning usually starts with a question: - is this site or place suitable for a new livestock operation? Should the machine be remodelled? How can the grains handing facilities be upgraded? Where can we build a new dairy ban? How can we modernise our manure handling facilities? etc.

At the start of the planning process, assess your short and long term needs. The analysis should include a mix of factors, including family needs as well as production and enterprise goals. A typical list might look like the following:-

1) Increased labour efficiency

2) Better cash flow

3) More time off for family members

4) Higher family income

5) Gradual expansion to limit risk

6) Reliance on sound business principles when making decision.

7) Need to separate farm activities from living area.

Note that at some point you may need to obtain a competent and professional advice from experts to help with the planning process. Persons with farmstead planning experience can help evaluate options and provide big picture advice to show how all the components fit together as a system. Plan on paper, where mistake can be easily corrected and seek financial advice to make a cost / returns analysis and evaluate a plan feasibility of the changed involves a significant investment.

Farmstead activities areas

Begin by assessing the farmstead activity areas. Most farmsteads include a family living area, a shade with machinery area and an adjoining service. May also have areas for crop storage/ processing chemical/ fertilizer storage stores handling, fuel storage and livestock changing and developing one area often affect another farmstead area e.g. purchasing larger field machinery requires more space for movement and parking. A new or remodel may require more living area: an added enterprise requires more space.

2.3 Zone Planning

One way to organise farmstead activities and the family living area is to use zone planning to allocate space on the farmstead for specific activities. Using zone planning can improve overall farm efficiency, increase farm safety, pressure opportunities for expansion and increase control over nuisance situations.

The activity zones in fig 1. Are concentric circles spaced 100-200 apart around the farmstead centre. The larger the enterprise on the farmstead the larger the diameter the zones should be.

2.3.1 Zone 1

Is for family living lawn, recreation, gardens and visitors parking. Protect zone 1 from odours, dust, insect's field machinery traffic and other unwanted visitors by locating farm production enterprises outside zone 1.

Locating the family living area to one side of the farmstead close to the public road showing the farmstead, permits control of traffic access to the farmstead. This type of location also presents the most aesthetically pleasing view to the public. Choose a location that allows an unobstructed view of entering vehicles, machinery, livestock and people. Such a location deters theft and vandalising and improves bio security. Consider locating the family living area at a separate site on very large farms with lots of outside labour and vehicle s traffic, to improve privacy and safety in larger operations and office may replace the residence and serve the functions of enhancing security.

2.3.2 Zone II

Is for machinery storage, a repair workshop and related activities that are relatively quiet. Dry and odour free such as much of the drive way, service yard, and temporary parking space. Locate fuel storage, chemical handling and other more hazardous activities in the outer part of the zone II, away from the family living area.

2.3.3 Zone III

Contains grains feed storage structures and smaller livestock units, activities that have more frequent noise, dust, traffic and odour, but which require careful supervision. Locate the electric power distribution centre propane storage, and temporary anhydrous ammonia, wagon parking either in the outer portion of zone II makes sure that no tall metal equipment will be used in the vicinity of overhead power lines.

2.3.4 Zone IV

Is for major livestock enterprises needing more expansion space and facilities for feeds and manure management. Large sources of noise, dust, odours, and traffic are placed in this zone IV. They should be the farthest from the hove and from public road and neighbours. The location of farmstead with respect to public roads affect the living area (zone 1) and overall farmstead layoiut. In the upper mid-west, the preference is to have the driveway enter the farmstead from the south or east. This arrangement allows for an undisturbed free windbreak along the west and north to protect the farmstead from snow and prevailing winter winds yet allow prevailing south westerly winds to freely enter the farmstead in summer. Fig. 1.2 shows several recommended farmstead arrangements in relation to the driveway public road access.

NOTE:- there are no farm buildings or other operations closer to the public roads than the farm home in any of the arrangements.

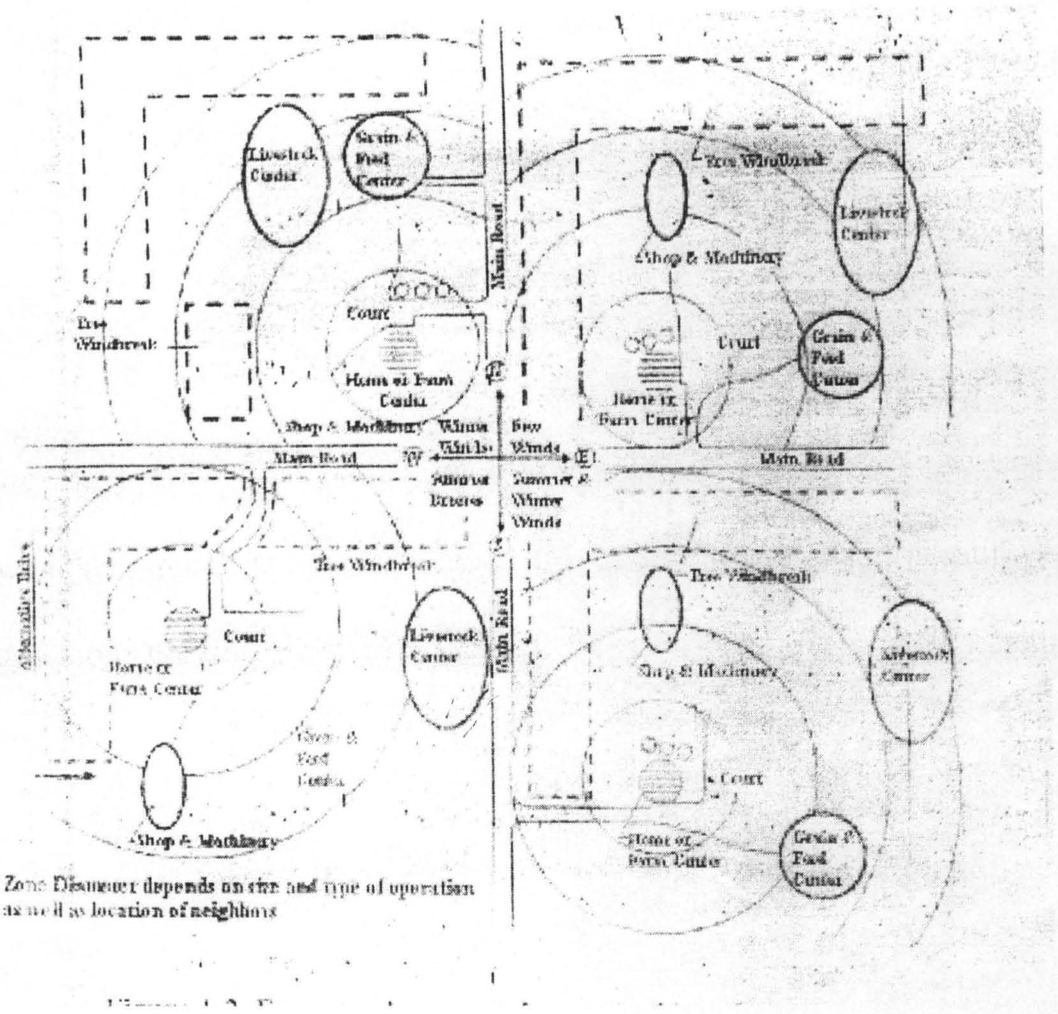


Fig 1.2 farmstead zones and areas to the main road

2.4 Separation Distance.

Closely spaced building interfere with too much space, however, wastes labour and increases utility and road cost and yard maintenance effort, so deciding on separation distances often involves compromise. Separation distances between farmstead buildings and between the farmstead and off farm features depend on a wide variety of factors. Following are several guidelines:-

2.4.1 Operation Size:- larger operations create more noise, odours, dust, and traffic, thus require greater separation distance from the farm home and from the off-farm feature e.g. a feed centre for processing a few bushels a day will have less impact on the living area than one handling large grain volumes and large vehicles. The smaller feed centre can be closer to the farm home and to other buildings than the large operation.

2.4.2 Management Needs: - locate high labour facilities closer to the farm centre than those that require less labour.

2.4.3 Potential Pollution Hazard. - livestock operation results in odour, dust and noise from large livestock operation can often be detected half mile or more down wind consider combined influence of other neighbours and the types of operations on a neighbouring farm. The operation may affect a particular neighbour only. 2% of time, but you and other neighbours combined may affect particular neighbour. 5% of time this may be unacceptable. (see chapter 2, site selection for details on selecting a site based on separation distances from neighbours) chemicals, fertilizers, pesticides and fuels can cause air and water pollution problems if improperly handled, so facilities for the handling of there materials must have adequate separation from other elements on the farmstead.

2.4.4 **Appearance:** - a neat and attractive farmstead is very important. Facilities that are near the living area, and visible from the public roads should be well landscaped and have a pleasant appearance. Locate less attractive materials farther away.

2.4.5 **Ventilation Needs:** - large, naturally ventilated livestock buildings (more than 30m wide or more than 60m) require at least soft clearance; both upwind and downwind to prevent blocking air current. 75ft is mostly preferred) bio security concerns may dictate even greater distances to minimize disease spread.

2.4.6 **Water Supply:** - to protect the well, spring, or surface water supplies from potential sources of contamination, they must be separated from sources and activities that could cause contamination. In most cases at least a soft separation is needed to protect the water source from contamination, but some states or local jurisdiction may require (100-300ft) or more.

2.4.7 **Access Need:-** separate all buildings by at least 35ft (50-75ft) is being for bid to allow for access, for removing and storing snow and for fire protection

2.4.8 Future Expansion

assume that your operation will double in size over the next 10-20 years provide adequate space for new buildings, enough space for adequate clearance between buildings and space for other expansion . Consider space needed for vehicle access and parking. To ensure adequate space for future expansion developed a drawing of the existing farm stead that includes that expansion (perhaps dotted in). Having a vision of the long term farmstead will look like to make short term decisions easier.

Farmstead planning is complicated by the fact that no two FST are alike and differences in management philosophy. Farm size plays a major role in farmstead planning.

Table 1:1 below shows how farms and farm sizes vary from state to state in the mid-west Table 1:1-farm size distribution for the states of the north central region

In addition to the amount of space involved, the size of a livestock operation affects farmstead planning e.g. doubling the number of livestock affect the needs for water, drainage, space for feeds and equipments storage and access routes. It also increases nuisances such as dust, odour and noise of farm factors to be accounted for in planning the expansion of an operation include zoning, environmental regulations, set backs and neighbour/ and consumer attitudes.

Farmstead planning also depends on enterprise type e.g. a green farm requires less farmstead space then a green and livestock farm. Also, noise and dust from harvesting, transporting and processing cash green occurs on relatively few days each year and has less impact on a farmstead than those closes daily livestock processing and handling.

Table 1.1 shows the approximate space usually allocated for a typical farm building and adjoining areas. Use the table as a rough guide for estimating space requirement for each activity area. Consider the type of farm being developed and use that goal as a way to determine how much space to provide for each activity.

Table 1:1 approximate space needs for farm buildings and adjoining areas.

Farmstead Component	Sq-Ft	Acres
House/attached garage and adjacent yard	20,000—40,000	0.5-1.0
Well (100 feet radius)	37,000	0.72
Household wastewater system and replacement area	5,000—20,000	0.11-0.46
Windbreak, shade trees	0-20,000	0-0.5
Drive way and service yard	0-20,000	0-0.5
Shop and adjoining parking space	1,000—5,000	0.02-0.1
Machinery storage, parking	1,000—50,000	0.02-1.2
Chemical storage/handling area	1,000—2.500	0.02-0.6
Crop storage	1,000—30,000	0.02-0.7
500 head cattle feedyard	10,000—150,000	0.3-3.4
1000 head cattle feedy system	25,000—350,000	0.6-7.9
100-sow farrow/finish system	5,000—10,000	0.1-0.2
200-sow farrow/finish system	200,000	5
600-sow farrow/finish system	350,000	8
50-cow dairy stallbarn, w/helfers no manure storage	20,000—40,000	0.50-1.0
100-cow dairy freestall w/heifers, parlor (a)	70,000—100,000	1.5-2.5
500-cow dairy freestall w/heifers, parlor (a)	250,000—300,000	6-7
1000-cow dairy freestall w/heifers, parlor (a)	490,000-615,000	11-14

Source: US Census of Agriculture USDA March 1999

.Use only farm approximate building space see other M.W.P.S hand books for specific information for enterprises arrangement. Example; estimate the space needed for a basic farmstead with only a house and shop (house) 40,000 + (wind break) 20,000 + drive way) 20,000 + (shop) 5, 000 = 85 000 sqft.

(A) 43, 560 sqrt/ac = approximately. 2ac/house size and soil type dependent.

CHAPTER THREE

3.0 METHODOLOGY

The problem of planning a farmstead in most places is how to get the proper information required in one place. Basically one has to take a cognisance survey of the area to see the topography of the site to see the soil types, the vegetation, see the positions of streams, valleys and hills, know the climatic conditions of the area, rainfall data etc. all these informations required are not easily available.

In order to simplify the problems, in this research we tried to bring most of the necessary informations needed and superimpose them into one map using different layers.

1.Topo sheet of the study area was obtained from the ministry of Lands and Survey Minna. The map has only little relevant information available. It does not include information on the soil types or soil classification but indicates the presence of streams, hike rocks and valleys.

With the aid of the map, a reconnaissance survey of the site was conducted to acquaint ourselves with the type of vegetation available in the area.

3.1.2 Soil Sampling: Due to lack of any existing soil classification map of the area, there arise the need to extract soil samples from the site at different locations in order to analyse them and come out with a satisfactory and good description of the soil types available in the area according to BS. 1377:1975, for soil classification text, Soil samples which is taken from a depth of not less than 1m from the top surface soil, and then carry out at least 3 or more different types of tests such as: moisture content determination test, the soil grains particles, the AASHTO soil classification test etc. soil samples for engineering purposes were taken from 12 different positions at random at a depth of 1.5m. From the top soil surface and were numbered 1-12. While the samples of soils for agricultural purposes were extracted at a depth of 300-500cm below the surface of the top soil. The samples were also numbered 1-12 in green and also taken from 12 different positions at random.

3.1 LABORATORY TESTS

The soil samples were brought to the University for analysis. The samples taken for agricultural purposes were taken to the soil science laboratory for the test. To determine the soil nutriends available . i.e., the P^H (the acidity level) the nitrogen, phosphorus, potassium contents of the soil (N.P.K). The soils samples taken for the geo technical (engineering) purpose were submitted to the civil engineering department laboratory for the soil classification test which includes the natural moisture content, sieve analysis, Atterberg test i.e. liquid and plastic limits index of the samples as recommended by AASHTO soil classification method.

AASHTO = American association of state highways and transportation officials while

BST = British Standards Institution

3.1.2 Agricultural Purpose Soil Tests

Findings, results and interpretation of the chemical analysis of the soils and the particle size analysis.

Generally, the soil samples collected and based on the geomorphology nature of the soil. The samples collected at the valley bottom are moderate terms of the PH level and invariably the availability of nutriends present. Soils collected at the upper or middle slope have a more PH value which could be as a result of the leaching process.

3.1.3 Engineering Soil Classification Tests

Determination of natural moisture contents. Atterberg limits i.e. liquid and plastic limits, plastic index sieve analysis of the % timer. Generally, samples 1, 2 and 3 were found to be similar to each other i.e. they are gravely soils which are good for foundation base and good for roads.

Samples 5, 6, and 7 are fairly gravely and also can be used as foundation base. Sample 8 and 9 are much stronger and contain also gravels and clay.

The down slope area where the samples 10, 11 and 12 were collected seems to have more of sandy and marshy nature which can not be recommended for structures or road works.

3.2 DIGITALIZATION

The topographic map obtained form the Ministry was used as the base map to superimpose the following information's in layers of colours and sizes

1.contour lines and heights

2.roads and paths

3.soils types and classifications (agro and geotech information)

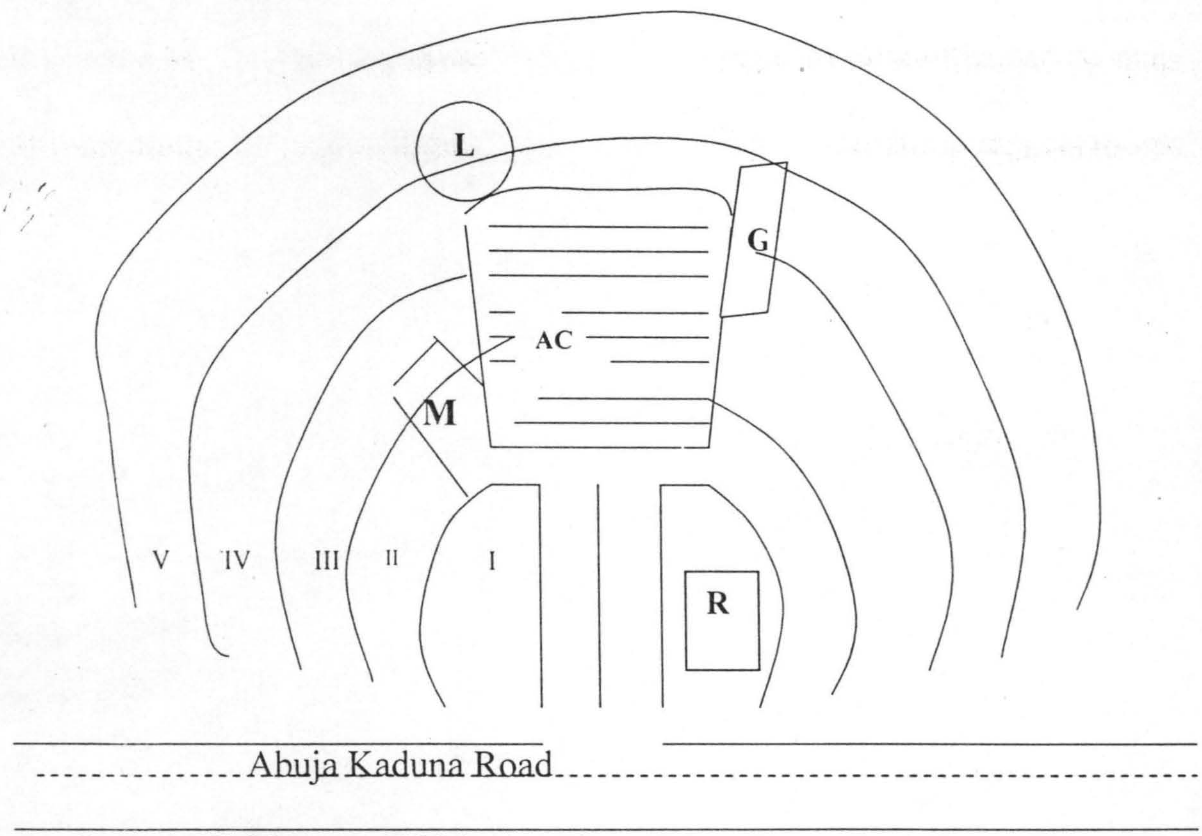
4.streams, rivers

5.settlements, developed areas/plots etc

6.Hills, rocks and mountains.

3.3 Farmstead Design

As a result of the outcome of the digitized map, it has become easier now to plan and design the farmstead and to allocate positions most suitable for crops and the plots mot suitable for structures, farm house warehouse, machine and equipment sheds, livestock positions and recreational areas which will fit the place



Source: Field survey 2004

R = Family Residential, living and dwelling area.

M = Machinery and implements storage

G = Grains and feed storage

L = Livestock buildings

AC = Access roads and courtyard.

The four zones indicated in the fig. above are:

Zone I = At the centre and high upland side of the farmstead is for the family residentially or living area which is properly ventilated, aerated and free from dust, odour, noises and flies or insects. It is a well drained are overlooking all the rest zones of the farmstead.

Zone II = Clean dry and quiet activities where implements sheds and small storage structures can be built.

Zone III = Larger grain stores, feed stores, silos and small animal units such as poultry, goats and sheep are placed.

Zone IV = Large scale animal production, heavy livestock with their grazing fields an Dairy production.

Zone V = Space allocated for agronomical crop production in large scale.

This provides space for present farm operating, future expansion and a good living environment.

CHAPTER FOUR

4.1 RESULTS AND DISCUSSION

A breakdown of the results of the soil classification tests carried out in the laboratories are as follows

A –soil tests for agronomy purposes:

Physio chemical analysis of soils

Particle size analysis.

TABLE 4.1: SOIL NUTRIENTS TEST RESULT.

S/NO	P^H	%N	PPM_P	Exchangeable Cmole, K kg	%SAND	%SILT	%CLAY	SOIL TYPE
1	4.8	0.150	5.14	0.79	78.2	14.3	7.5	SL
2	5.2	0.145	4.99	0.81	83.3	10.3	6.7	SL
3	5.0	0.200	4.28	0.77	86.1	0.23	11.6	SL
4	5.5	0.195	4.55	0.85	65.0	25.4	9.6	SCL
5	5.2	0.201	6.22	0.69	79.7	05.1	20.2	SCL
6	5.2	0.153	6.00	0.53	89.2	06.0	48	LS
7	4.5	0.130	4.52	0.65	74.7	7.2	18.1	SCL
8	5.7	0.155	4.52	0.59	68.3	10.44	21.26	SCL
9	4.8	0.135	5.44	0.72	79.2	18.6	2.2	LS
10	6.12	0.155	5.56	0.63	62.5	18.9	18.6	SCL
11	6.0	0.150	3.92	0.65	67.9	19.1	13.5	SCL
12	6.10	0.150	4.52	0.80	75.2	09.4	15.4	SL

SOURCE: Field survey, 2004

INTERPRETATION OF TEXTURE NAMES

SL = SANDY LOAM

SCL = SANDY CLAY LOAM

LS = LOAMY SAND

4.2 Discussion

The soil P^H is slightly acidic, therefore the soil would P^H condition necessary for agronomic purposes (see table 4.1)

The nitrogen values are moderate, therefore they may not need any application of nitrogen during the current cropping season, however, this should be further monitored for cropping by analysing the soil I subsequent years. the P values are low and may support agronomic conditions. Therefore fertilizers with p source should be added or applied to enhance higher agronomic yield of crops. Single or triple phosphate fertilization may be applied.

The level of potassium (K) is moderate thus, therefore can support agronomic conditions. Fertilizers with K source muriate of potassium may not be applied in the current farming season, but this must be monitored.

The general observation from the findings of the soils of the study area full under 3 major classes name:

1.sandy clay loam (SCL)

2.sandy loam (SL)

3.loamy sand (LS)

The practice of array cropping should be encouraged with better soil conservation measures to be adopted. From time to time the soils of the area can be analysed to monitor the soil fertility status in order to ensure better utilization of the farm.

TABLE 4.2: GEO-TECHNICAL, SOIL CLASSIFFICATION RESULTS OF THE STUDIED AREA

Sample Number	NMC	ATTERBERG LIMITS			SIEVE ANALYSIS			GROUP INDEX	AASH TO CLASSIFICATION	REMARKS
		L.L	P.L	P I	No.10	No.40	No.40			
	22.05	55.00	30.87	22.13	87.10	44.04	7.85	0	A 2-7	Gravely soil. Use as foundation good use as base cover fair
	16.09	54.50	32.02	22.48	68.18	19.58	8.28	0	A 2-7	Same as above
	22.19	50.50	28.65	21.35	88.90	41.07	5.77	0	A 2-7	Same as above
	23.58	31.00	15.20	15.80	81.00	39.55	7.85	0	A 2-6	Gravely soil, use as foundation good, use as base cover fair to good.
	21.90	48.00	26.30	21.70	87.20	43.14	5.51	0	A 2-7	Gravely soil. Use as foundation good – use as base fair
	22.04	40.00	23.01	16.99	94.48	45.99	7.78	0	A 2-6	Gravely soil –use as foundation good – use as base fair
	23.62	40.50	22.62	17.88	98.62	45.54	9.52	0	A 2-7	Gravely soil – foundation good – base cover fair good
8	23.58	42.00	21.98	20.02	94.30	46.14	8.38	0	A 2-7	Same as above
9	23.54	41.50	22.00	19.50	93.75	46.00	10.04	0	A 2-7	Same as above
10	17.70	26.00	NP	-	99.95	76.45	5.01	0	A3	Sandy soil not good for foundation
11	17.42	25.00	NP	-	99.85	75.06	4.86	0	A3	Not suitable for base
12	17.98	27.50	NP	-	99.57	75.42	4.87	0	A3	Same as above

Source: Field survey, 2004

Key

LL = Liquid limits

PL = Plastic limits

PI = Plastic index

Generally, the soil samples taken at the foot or base of the hills show a high degree of gravel contents (see table 4.2) which can firmly support foundations for erecting farm structures and can also be suitable for road constructions or pathways. Buildings of high standards can be constructed without much problem, but the samples taken down the slope, at the valleys, prove to be soft sandy and not suitable for erecting structures for basement cover. Therefore these samples collected could be recommended for Agronomical purposes or production. Cereal crops may be tried in such positions where the soils are marshy near the streams.

For geo technical purpose, the family farm house, the ware house and the grains and feed storage facilities are located at the upper part of the site. While the cropping area and livestock or cattle ranch are shifted down the slope in order to avoid the noises and odours of the animals and stop them from reaching the courtyard and the dwelling area of the farmstead.

The prevailing east-west winds will certainly take care of the above mentioned phenomenon and a careful planning of the area should take good care of the hazards and must be environmentally friendly to the internationally standards.

4.3 Digitization of Data on Topo Map.

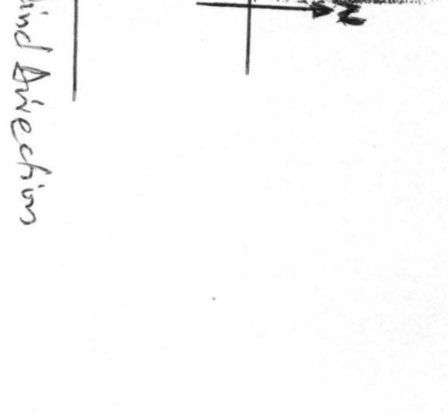
Using an existing Topo map of the study area obtained from the Ministry of Land and Survey Minna Niger State as the base map, digitalization of additional information was carried out using scanners and digitizing equipments at Sky Memorial Complex, zone 5 Abuja. This updated the map to a GIS standard providing multiple information on a single base. Fig 4.2 the digitized map.

4.4 Farm stead design of study area.

From the concept discussed in 3.3 above a farm design of the area was carried using the GIS map produced.

Allocation of space for various purposes were based on the concept of (Alabadan 2003) in addition to the results obtained from the soil analyses carried out. Fig 4.3 shows the final farmstead design of the study area.


302100 E
1016500 N
303600 E
1016600 N


Wind Direction
N

302100 E
1016600 N
303800 E
1016600 N
N
Wind direction
IRR
ORC
ED
TUBERS
TUB
GRZ
LIV. BUD
GS
FS
FMS
AC
FH
GS
CEREAL CROPS
FH-FARM HOUSE
FMS-FARM MACHINERY SHED
FS-FERTILIZER STORE
GS-GRAIN STORE
LIV.BUD-LIVESTOCK BUILDING
ORC-ORCHARD
ED-EARTH DAM
IRR-IRRIGATION
TUB TUBBER CROPS
GRZ-GRAZING RESERVE
CRL-CEREAL CROPS
LEGS-LEGUMINOUS CROPS
DARK SANDY SOIL
DARK BROWNISH LATERITE
DARK SANDY CLAYISH SOIL
BROWN LATERITE SOIL
DARK GREYISH LATERITE SOIL
DARK BROWNISH LATERITE SOIL
DARK CLAYISH LATERITE SOIL
DARK GREYISH LATERITE SOIL
DARK GRAVEL LATERITE SOIL
DARK CLAYISH SOIL
1014900 N
303800 E

FIG 4.3

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION.

5.1 Conclusion

The project was conducted to improve the methods of planning from the former analogue systems to the must modern digital system. The modern world now has been computerised. Every aspect of human endeavour has been further simplified by the use of modern technology i.e. the use of computers.

Together very many informations in one place and compute many different data, query and analyse them and get prompt solutions and take decisions all have been made possible by the use of modern computers.

Similarly, farmstead planning is possible and much easier and faster by using geographical information systems (GIS) which is just a form of modern computerised information technology (IT). The GIS. Simply gather the geographical data of the place, such as the topography, hills, rocks, valleys, lakes, streams, rivers soil types rainfall climate etc all on one map, to enable the user take fast decisions on land allocation. Using GIS, further simplifies the problem of looking for suitable positions to recommend for planting crops or trees, where to put up buildings, water treatment or storage tanks, structures, shop etc. digitized maps can enable us decide the proximity of a place to urban centres, markets, airports or seaports, electricity and communication networks . Adequate planning gives allowances for future expansion.

5.1 Recommendations

The use of Geographical Information System is highly recommended to be used for planning of our day to day activities. Regional and town planners, census or population experts, agricultural and educational researchers etc. Due to high cost of producing a GIS map the government at all level should take the responsibilities of providing geo-referenced maps of their various areas with detailed geographical and other data to ease research and planning's.

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KEBBI STATE
KADUNA STATE
KWARA STATE
KOGI STATE
F.C.T.
Rijau
Bangi
Ukata
Chifu
T. Maraji
Agwara
Kabe
Ibeto
Nasko
Kontagora
Alawa
Mariga
Kagara
Auna
Mashegu
Tegina
New-Bussa
Shaho-Rami
Patiko
Pellegi
Shiroro
Kuta
Duba
Wushishi
Gwada
Maikunkele
Fuka
Daja
Bosso
MINNA
Kafin koro
Kutiwengi
Mokwa
Lemu
Paiko
Gawu
Dikko
Kudu
Kutigi
Bida
Lapai
Suleja
Agaie
Doko
Duma
Baro
Gulu
Km20 0 20Km
SCALE
11°
11°00N
10°
10°00N
9°00N
9°
4°00E
5°00E
6°00
7°00E
N

LEGEND