INTEGRATED AGRICULTURAL CENTRE
M.TECH (ARCHITECTURE) THESIS

BY

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DECLARATION

I hereby declare that this project write-up for the M.Tech Degree has no bearing to any work done by any person or group of individuals which had been presented and accepted for a degree. It has been composed by me and is a record of my research work. All quotations are distinguished by references which mark the sources specifically acknowledged.

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AUGUST, 1992

CERTIFICATION

This project write-up (for M.Tech Degree) entitled "Integrated Agricultural Complex" for the rural farmer by Thanni Gbemisola (Miss) meets the regulation governing the award of the degree of Masters of Technology in Architecture and is approved for its contribution to knowledge and literacy presentation.

Supervisor/H.O.D
(Architecture)

Signature

Examiner

Signature

Dean
School of Environmental
Technology

Signature

DEDICATION

To my late father, Mr. F.A. Thanni

and

best mother in the world, Mrs. V.T. Thanni

ACKNOWLEDGEMENT

My great appreciation goes to God Almighty for his guidance, protection and love throughout my entire stay in this University. His Grace and Blessings to make this process a success I cannot re-count.

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Once more my biggest appreciation goes to God for everything.

ABSTRACT

Food, clothing and shelter are the three basic needs of mankind. Primitive man subsisted by gathering nuts, grains and fruits and catching animals for meat. He learnt the art of harvest and storage before he discovered how to plant. Shelter was the most important to him after food; not only for defence from his enemies and weather but also to store his gathered food.

In modern times, food is still given topmost priority followed by shelter. Infrastructural recources play a prominent role in agriculture, therefore it should not be left out when thinking of agricultural development. From the point of view of the importance of agriculture inthe nation's economy, the basic problem of improving our agricultural productivity to which we have not been able to find an effective and workable solution is the development of peasant farmers.

An effective farmers' training approach requires a thorough understanding of the present structure of peasant agriculture and its problems.

Looking at the reality of the situation, Nigeria has no choice but to modernise her agriculture and improve the living conditions in the rural areas. What is therefore needed is to put this knowledge into practical use and to provide and mobilise the pre-requisites in a

meaningful way so as to achieve our desired objective.

In this respect, an agricultural revolution that will bring into play educational procedures, to improve farming methods and techniques, increase production efficiency and income; better the level of rural life as well as lifting the social and economic standards of rural life is the major focal point of this project.

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CHAPTER ONE

General Introduction and Scope of Project:

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Research Methodology and Data Collection:

Brief Historical Background of the Project.

INTEGRATED AGRICULTURAL COMPLEX, MINNA

1.0 INTRODUCTION

Agriculture is no doubt the most important economic activity in the world. It is estimated that agriculture engages about two-thirds of the world's population (Onokerhoraye, 1985: 132-147). Furthermore, agriculture supplies the world with the primary products which are essential for life. It is a source of supply for foodstuffs, daily products, beverages and industrial raw materials.

The significance of agriculture as an economic activity in the rural areas is in fact more crucial in the developing countries where most of the rural people are agriculturists. Most African countries recognize these important roles of agriculture in the development plans have generally emphasized the need to increase agricultural productivity.

In Nigeria, the Federal Government in collaboration with State Governments in striving hard to provide the necessary inputs like mechanization and agricultural extension services (especially in rural areas) to ensure a success in agricultural development strategies. Despite these efforts by the government, the relative importance of agriculture seem to be declining as the country develops and population grows.

Evidence has shown that the government's effort is not yielding much success as people continue to move from our rural areas to urban centres in search of non-farm jobs. The mechanization provided by the government has not been very helpful to the rural farmers as not very many of them can afford the purchase or hire of these machineries even at the said government subsidized rate. Extension services whose primary objective is to improve agricultural productivity by educating farmers especially in rural areas have also failed to an extent. This failure stems from the methods and techniques employed by the extension workers. One extension worker is assigned to a village of about five hundred farmers to educate them. The extension work is concerned with how to raise the standard of living of the rural farmer

considering his peculiar problems and this is done using demonstration plots and model farms as teaching devices at village or group meetings, market days and the like practices that are viewed as good.

These unsuccessful field of the governments' efforts has led to a continuous rural-urban migration of especially the rural youth in search of non-farm jobs. For some lucky ones their dreams come true while for countless others, the city is a harsh and disillusioning place. An uncontrolled expansion of our urban areas overwhelms the efforts of th authorities to keep pace with the provision of roads and services. Efforts have to be made to promote the smaller towns and provincial centres as alternative centres of development. Rural life must also be improved so that it offers people a more attractive future than migration to the urban slums. It is high time to identify more appropriate objectives for agricultural development particularly in rural areas of which infrastructural provision must be an integral part and to establish the broad guideline of a strategy through which these goals can be achieved.

Bearing this in mind, every Nigerian is faced with a national assignment - a task that must be accomplished if we

are to survive. This task is the revival of agricultural development in Nigeria. In this crucial national assignment, the building industry has got an important role to play in the provision of infrastructure and this cannot be done effectively without any architectural touch or contribution. From an architectural point of view, infrastructural resources play a prominent role in agricultural modernization and rural development. This project therefore seeks to make our rural areas a better place for a brighter future through provision of adequate facilities for manpower training, research on agricultural activities, home economics and food nutrition for women among others in an agricultural community with a difference.

The integrated agricultural complex will take into cognisance provisions of facilities like:

Ancillary buildings - admin block, service yard, stores, quarters for junior staff, clinic and veterinary centre.

Fishery Unit - ponds, dams, cold store, smoking room.

Poultry Unit - layer and broiler houses, hatchery unit and processing unit.

Livestock Unit - guarantine unit, cattle ranch, sheep and goat shed, dairy unit, abattoir and grazing field.

Crop farm - maize, corn, millet and yam farms.

Horticultural zone - flower and vegetable gardens, green house.

In a nutshell, this project will focus on different ways architecture can be used to intensify agricultural growth in realization of the national objective.

1.2 AIMS AND OBJECTIVES OF PROJECT

This project aims at various ways in which architecture can revive agricultural development as explained below:

a. To provide a complex where prototype methods and techniques of agricultural production will be advertised to ease the financial problems of farmers trying to hire or buy heavy machines for farming. Besides advertisement, the complex will also make provisions for demonstration halls and training centres for farmers.

b. To wipe out the belief people hold about agriculture/ farming as being just cultivating a piece of land and

growing animals for food.

c. By providing educational facilities for training farmers not only to cultivate land and grow animals but also to develop better ways of planning a farm set up, improvement of effectiveness of their cooperatives, management of family income, child care food and nutrition.

d. Facilities will also be provided for training of women to give them additional better life in the rural environment, which is also a national objective.

e. Another aim of the project is to provide research facilities on crops and livestock and on human nutrition in order to discover new facts about agriculture and nutritional value of farm produce and to transfer the discovered facts to the farmers in a much more conducive environment.

f. Provision of facilities for recycling of residues and by-products to maximize internal input and minimize external input.

g. The project will also seek to keep farmers busy all through the year by proper planning of the facilities to avoid idle time for farmers. The complex will also

provide additional employment opportunities for rural youths to earn a brighter future in the rural set up than going into the cities.

h. Agricultural technology students and even food technology students will have an ideal place for proper industrial training with a proper feel of a real farm situation to practicalise what they are being taught in school.

3 RESEARCH METHODOLOGY AND DATA COLLECTION

Methods of research and data collection for this project are:

i. Literature review of agricultural books and journals.

ii. Questionnaires to find out present problems of agriculture and future proposals.

iii. Case studies of existing livestock, crop and fish farms within and outside the state.

1.4 HISTORY OF AGRICULTURE

1.4.1 Beginnings of Agriculture: Primitive man subsisted by gathering nuts, grains and fruits and catching animals and fish for meat. He learned to harvest before he discovered how to plant. The legends of the beginning of cultivation

covers a wide range of speculations, including divine teachings by gods, observation of sprouting seeds in burial grounds and of colonies of ants that were believed to nurture seeds and to harvest and store grain. The archaeological discoveries show man using stone weapons and arrow heads to kill animals for food. Soil working implements were probably made of wood and were not preserved. The more recent investigations led to the conclusion that agriculture began much earlier in the history of human development than was formerly supposed.

The primitive nomads or wondering families were the first to live by hunting and fishing, wonder from one rich pasture or forest to another. In pre-historic times, some colonies of the human family settled infertile valleys and began civilization as was defined. The dog was probably the animal first domesticated by the hunters. The horse was some what later. Goats, cattle and sheep were confined for meat and milk. For 10,000 years, men explored the earth seeking places for permanent homes before they settled and began to develop agriculture.

1.4.2 Early Development: The development of agriculture was an intensification by man of his food extractive

processes. More food could be obtained in a given area by encouraging plant and animal species found useful. This provided food for an increased population and gave better opportunity for settled life. Durable houses as well as tools such as pestles, mortars and grinding stones, all of which had long been known in scattered places came into more general use.

1.5 AGRICULTURAL DEVELOPMENT IN NIGERIA

1.5.1 Pre-colonial Period

The type of agriculture that was practised during this period was mainly rural agriculture. The technique of agricultural production during this period was very simple; hoe and cutlass were important implements which helped people to expand cultivation in the rain forest zone. As time went on increases inhuman population led people to look for new settlements where they cultivated crops and raised animals.

1.5.2 Colonial Period

When the British conquered the ethnic groups in Nigeria, they established the system of indirect rule. They ruled through warrant chiefs that were appointed by them. These chiefs took advantage of their positions to use slaves

on their farms. The exploitation of the slaves and the control of land was the beginning of mechanized agriculture in Nigeria.

Peasant farmers were forced to produce cash crops like cocoa and oil palm which were sold to the British merchants at very cheap prices. Later other Europeans joined the British to buy farm products from Nigeria. This led to the spread of rural plantation farms and individual commercial farms.

1.5.3 After Independence

Nigeria began to develop her own agricultural policies and programmes immediately after independence. The policies emphasized the production of cash crops and between 1953 and 1966, these policies were aimed at developing export crops in order to earn foreign exchange.

1.5.4 Agricultural Development Schemes

Since independence, various governments in Nigeria have adopted various plans to develop agriculture. Some of the measures adopted by state and federal governments to develop agriculture include:

i. Subsidies on agricultural inputs (fertilizer, seeds and insecticides).

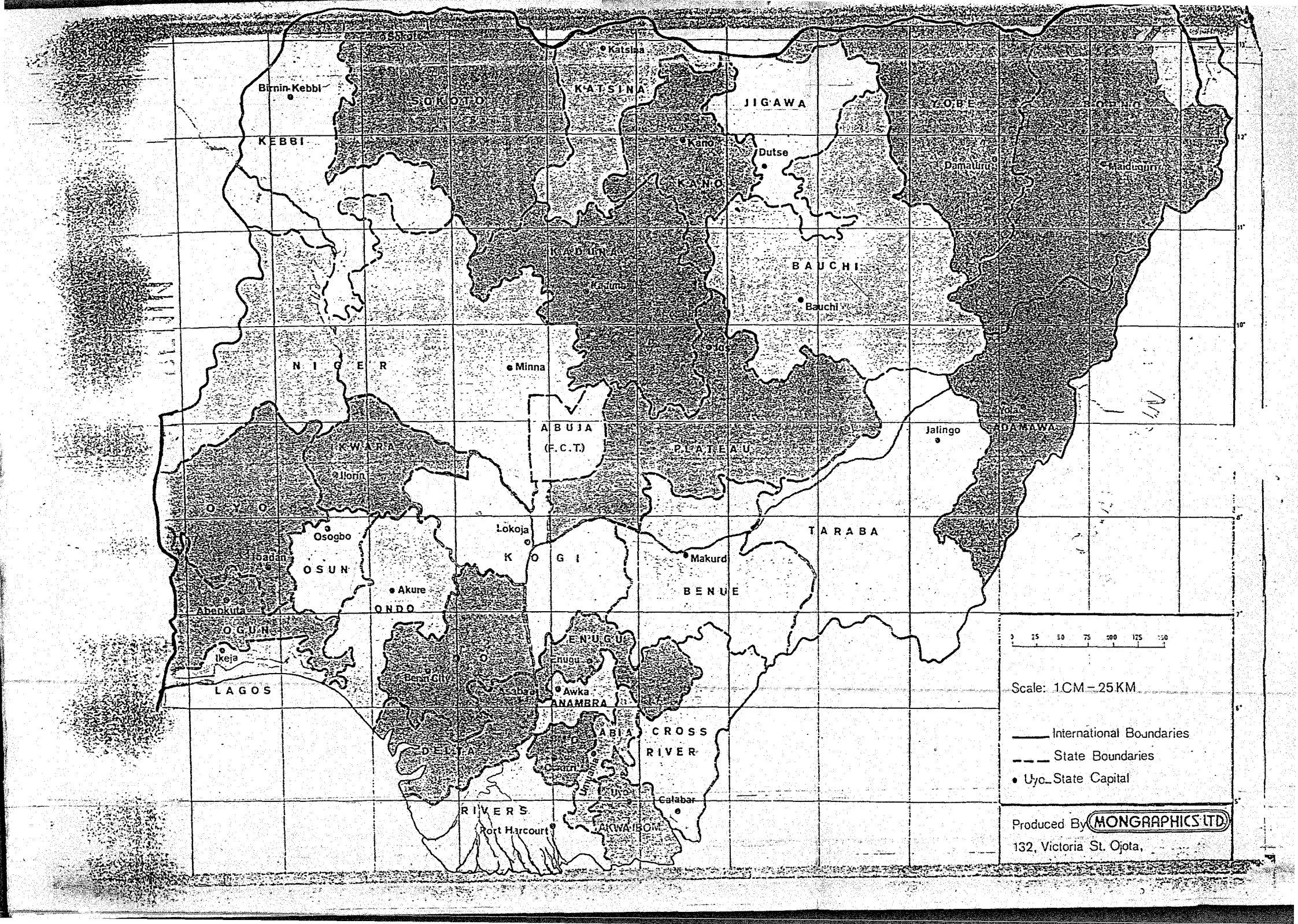
ii. Establishment of River Basin Development Authorities.

iii. Establishment of Marketing Boards.

iv. Establishment of Research Institutes.

Loan schemes for farmers.

Introduction of Operation feed the nation, Green evolution and Back-to-land programmes.


Katsina
Birnin-Kebbi
SOKOTO
KATSINA
JIGAWA
YOBE
BORNO
KEBBI
Kano
Dutse
Damaturu
Maiduguri
KANO
KADUNA
BAUCHI
Kaduna
Bauchi
NIGER
Minna
ABUJA
(F.C.T.)
Jalingo
ADAMAWA
PLATEAU
KWARA
Ilorin
OYO
Osogbo
Lokoja
TARABA
Ibadan
OSUN
KOGI
Makurdi
Akure
BENUE
ONDO
Abeokuta
OGUN
ENUGU
Ikeja
Enugu
Benin City
LAGOS
Asaba
Awka
ANAMBRA
ABIA
CROSS
RIVER
DELTA
Uyo
Calabar
RIVERS
Port Harcourt
AKWA IBOM
0 25 50 75 100 125 150
Scale: 1CM – 25KM
International Boundaries
State Boundaries
Uyo State Capital
Produced By MONGRAPHICS LTD
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CHAPTER TWO

NIGER STATE AT A GLANCE

PHYSICAL BACKGROUND:

Geographical Location

Climate and Vegetation

Geology

Soils

SOCIO-CULTURAL BACKGROUND:

Economy and Commerce

People

Agricultural Land-Use

Group farming amongst the Nupes

2.1 PHYSICAL BACKGROUND

2.1.1 Geographical Location

Niger State is one of the thirty States of the Federal Republic of Nigeria. It was created in 1976 when the number of states were increased from twelve to nineteen, by the division of the former North-Western State. Niger State is located in the middle belt region of Nigeria and is presently bounded by five states and the Federal Capital Territory with the division of the country into thirty states. To the north of the state are Kebbi, Sokoto and

Kaduna states. To the south are Kwara and Kogi states. The state derived its name from the famous river Niger. Based on the 1991 census figure, Niger State have a population of two million, four hundred and eighty two thousand, three hundred and sixty seven (2,482,367).

2.1.2 Climate and Vegetation

Niger State is characterized by a spatial variation in the total annual rainfall. The length of the dry season varies considerably but high variability in the monthly total rainfall is characteristic of the entire region. Niger State is a zone of transition between the forested south and the sudan savannah.

Minna has a mean annual rainfall of 1334mm (52 inches). taken from an exceptionally long period of 54 years. The highest mean monthly rainfall is in September with almost 300mm (11.7 inches). The rainy season starts in April and lasts between 190 - 200 days. The mean monthly temperature is highest in March at 30.5 ^{o}C (87 ^{o}F) and lowest in August at 21.1 ^{o}C (77 ^{o}F).

The vegetation of this region like the climate is transitional and consists of open savannah woodland. During

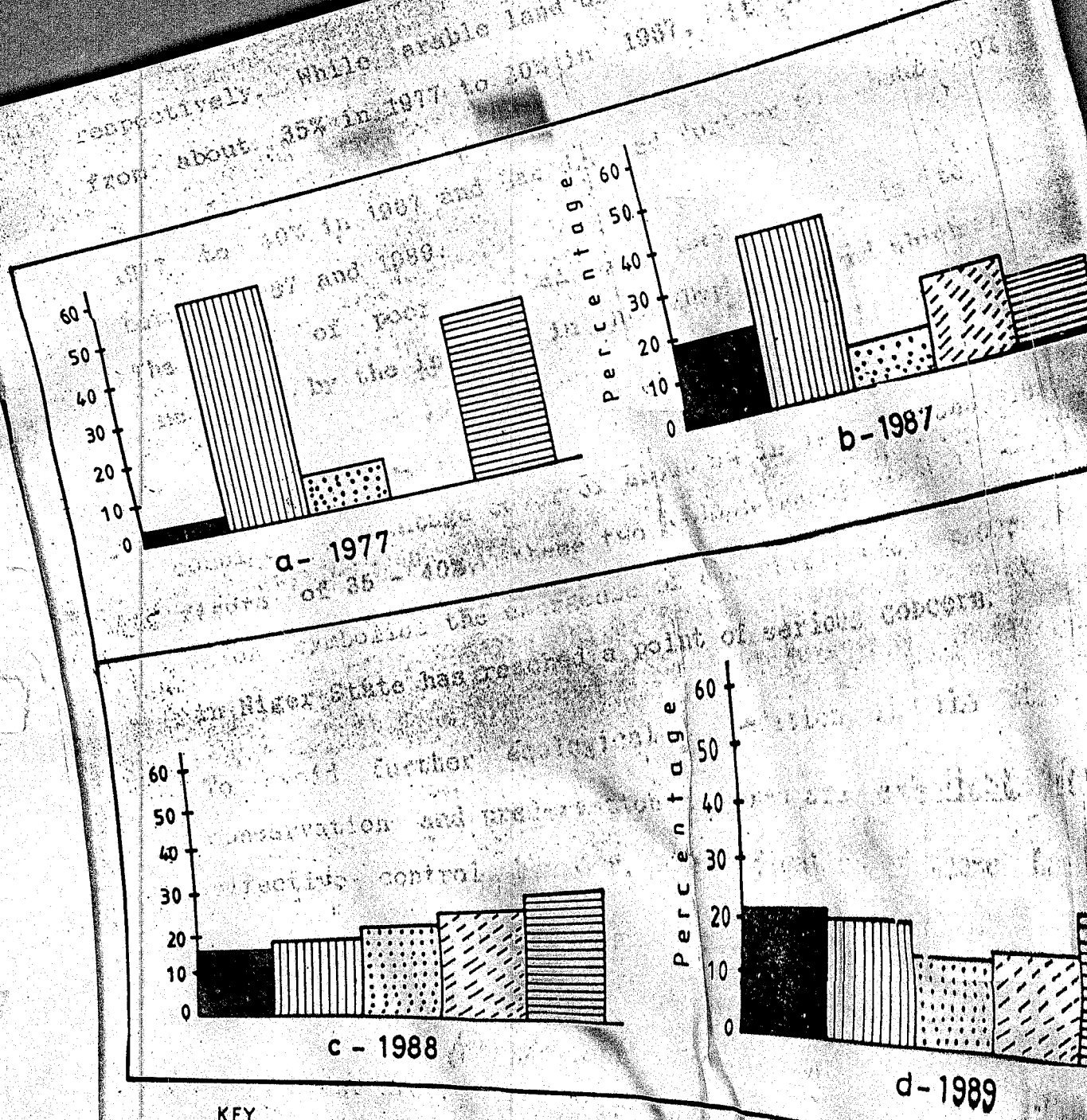


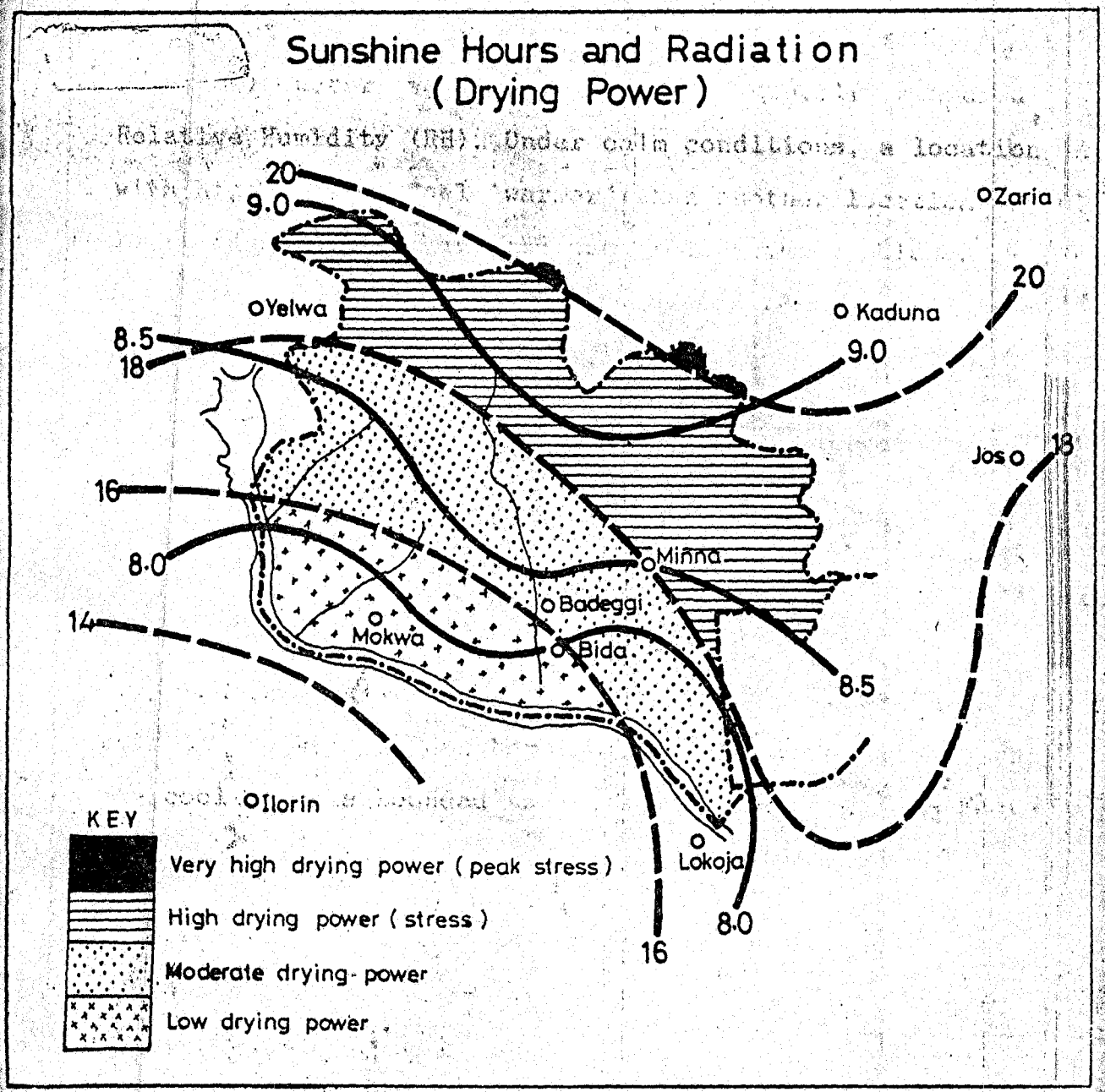
Fig. 6 Percentage of

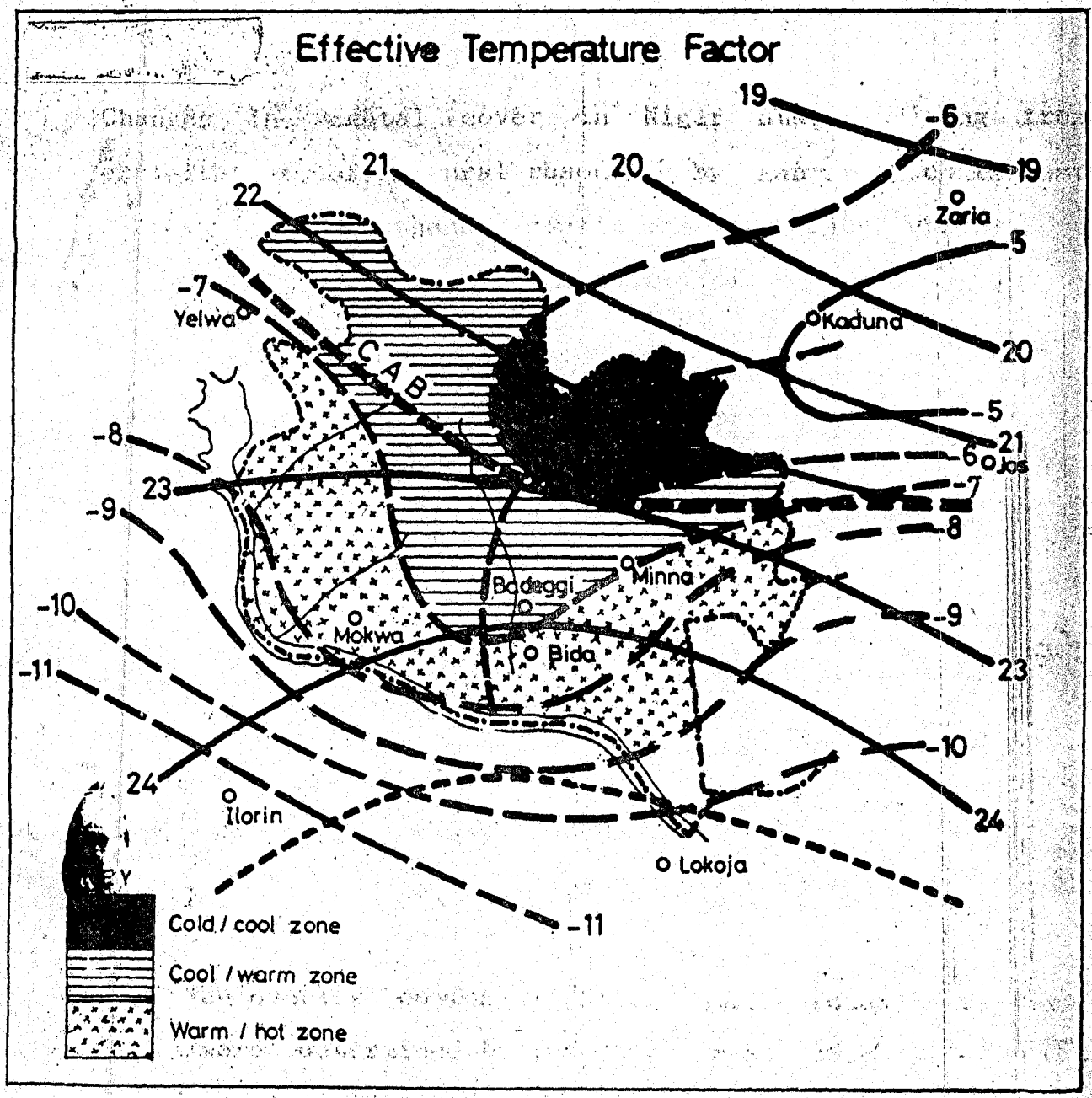
the early dry season when the vegetation is usually burnt, the ground becomes barren and blackened. Several trees are destroyed in the annual fires while others merely loose their leaves but survive with partly burnt trunks. No sooner is the bush fired than the grass begins to sprout, and in a few weeks the ground is covered with green grass. Some of the trees also come into new leaf before the rains begin. Rank grass and trees dominate the landscape contrast with the barreness of the dry season.

To put up with the climate of this region, most buildings are designed with courtyards open to the sky for maximum ventilation. This is to help solve the problem of high temperature all year round. Windows are normally protected by roof overhangs and wall projections to reduce the effect of sunlight. Intensive farming activities take place for only five months (April - September) during the rainy season. Because of the effects of this climate, most units in my proposed complex will be designed to have open courtyard. Secondly, the complex will be planned such that farmers or trainees would be busy all year round regardless of whether it is rainy season or not.

2.3) EFFECTIVE TEMPERATURE FACTOR (heating rate)

Agricultural planning should always take cognizance




Effective Temperature Factor
19
-6
19
21
20
Zaria
22
-7
Yelwa
Kaduna
5
C
A
B
20
-8
-5
21
6
Jos
23
-7
-9
-8
Minna
Badeggi
-10
Mokwa
Bida
-9
23
-11
-10
24
Ilorin
24
Lokoja
-11
KEY
Cold / cool zone
Cool / warm zone
Warm / hot zone

2.1.3 Geology of the State

The geology of Niger State has a fundamental effect on the characteristics of the various regions within the state. Three main geological formations underlie Niger State. The north-east half of the state lies on granite, gneisses and related rocks of the basement complex. Sandstones, siltstones and clays of the Nupe sandstones formation underlie most of the south-western half of the state. There are deposits of river alluvium of various ages in the river valleys which cross both the other major geological units.

2.1.4 Soils

Almost all of the soil types typical to the savannah regions of West Africa are represented in Niger State. Soils vary from the skeletal soils found around rock outcrops of the Basement Complex and mesas of the Nupe sandstones to deep (over 150 cm) soil of valley fadama. In general, deeper soils, unless too free draining, are better from the point of view of agriculture and are found on lower lying land away from hills or on extensive undissected plains.

2.2 SOCIAL-CULTURAL BACKGROUND

2.2.1 Economy and Commerce

Until recently, Niger State was known to be one of the least developed sates of the federation. In fact according to the 7th edition of the industrial directory, the state was said to have inherited only four industries out of fifteen from the former North-Western state after the creation of the new state, but this was excluding small scale industries.

The situation has however changed following the introduction of small scale industries (like Chanchaga clay products, Minna Bottling Company, Bosso Flour Mill, Mona Juice Factory) and the recent re-division of Nigeria into thirty states which has earned the state more local government areas with an advantage of more revenue generating areas lke Kainji dam and others.

With the present face lift Minna is receiving, it is most likely that more industries will be established. This present rate of development has brought in many construction companies like Julius Berger, Turnkey, Bouygues, Foundation Mira and a host of others.

Zone `B´ - Chanchaga, Shiroro, Paikoro, Bosso, Gurara and Suleja.

Zone `C´ - Rijau, Agwara, Borgu, Mariga, Magama, Wushishi and Rafi.

The people of Niger State fall into four major groups namely, the Nupes, Gwaris, Hausas and Kamberis. Minna, the state capital is basically a Gwari town and got its name from a ritual performed yearly by the gwari founders of the town to observe the beginning of a new year. The early settlers and founder of the town lived on top of the range of hills which line the eastern and northern sides of the present Minna. Evidence of early settlement on the hill top remains in the form of dilapidated foundations, broken pots and many baobab trees that characterized ancient towns in the north. However, before the town became a modern city that it is now, it went through four metamorphoses. The first was in 1905 when the construction work of the rail line got to the area. The second face lift in 1908 when an Alkali (Judge) was provided for the camps. The third metamorphosis was in 1910 when the Gwari inhabitants decided to move from the hill top to settle down on the areas of the present Paida. The fourth change of status of the town came

in February, 1976 when it was made State Capital of the newly created Niger State. Since then the government has been battling hard to give Minna a face lift and a look befitting a state capital.

The Nupes live in large villages, most of which have daughter settlements which consist of small farm harmlets usually located within a radius of six to seven miles of the parent village. The harmlets of a village are often founded by villagers in search of better or more farmland and may be abandoned if harvests are poor or if the sites prove unhealthy. The hamlet is essentially a rural farm outpost that has no social life of its own. It possesses no market, no independent political organization and celebrates its feasts and ceremonies with the mother village.

Many Yorubas, Hausas and Fulani settled permanently in Nupe territory. The Kamberis who are essentially upland dwellers are the most widespread group and are found in Kotonkoro district, Kontagora emirate, Agwara and Borgu areas. They live in small scattered hamlets often located in remote, inaccessible country side. According to Gun, the Kamberis formerly lived in Yauri territory which include much of the present day Kontagora emirate; but were forced

to retire in small numbers into the bush following the destruction of lives and settlements during Fulani military operations in the area during the 1850s.

2.2.3 Agricultural Land-Use

The first important fact about farming in this region is that farmland is abundant, so every member of any village community can farm as much land as he requires to maintain his family. Farm sizes are large by Nigerian standards, the limiting factor being the number of working adults per family or the amount of labour the farmer can employ. Amongst the Kamberis who are reputed to be the most energetic farmers in this region, each adult male cultivates between four to six acres every year. The lowest acreage per man is recorded in the Nupe area, where adult males rarely cultivate more than three acres per year.

Another fact about farm sizes is that fadama (swampy) farms and field along streams are much smaller than fields on the uplands which are generally less fertile. Guinea corn is the most important crop in this region and covers up to 95% of the land cultivated by Kamberi farmers. It is the main staple food in Kontagora and Borgu as well as raw material for beer, which the Kamberis consume in large

paid labour.

Nupe farming groups are organized on lineage basis ... usually consist ...

quantities. It is usually inter-cropped with millet and cowpeas. Yam is important amongst the Nupes and Gwaris. Rice cultivation has expanded rapidly during the last fifteen years as shown in the case of Bida. Unlike other crops, rice is grown continuously on the same field every year. Although in some areas the land may be left fallow for one year after five years of continuous cropping.

2.2.4 Group Farming Amongst the Nupes

Group farming is an aspect of traditional food farming which was once common all over Nigeria and is still practiced, albeit with considerable modifications in various parts of the country. It is a system of farm labour supply which makes it possible for a farmer to cultivate a larger acreage than he would normally be able to do if he depended strictly on family labour. Members of the same age group from a particular village would decide to form a farming group, which worked in turns for each member. There is another arrangement, the Nupe type, in which a number of households combine to pool independence of young men. The commercialization of agriculture as well as the growing need to work for cash, other than for a day's food and wine has led to the replacement, in some areas of group farming by

CHAPTER THREE

CASE STUDIES

Barc Farms, Jos

Tagwai Integrated Agric. Complex, Minna

Keita Integrated Development Project, Niger Republic

Hackney City Farm, London

Vauxhall City Farm, London

Minna Ultra Modern Abattoir

Niger Livestock and Dairy Company

Dan Farms, Garatu, Minna

For this project, case studies were taken within and outside Niger State. Only case studies of existing related fields were taken since there has not been any complex of this type existing in the country. Places visited are as follows:

Barc Farms, Jos

Tagwai Integrated Agric. Complex, Minna

Keita Integrated Development Project, Niger Republic

Hackney City Farm, London

Vauxhall City Farm, London

Minna Ultra Modern Abattoir

Niger Livestock and Dairy Company

Dan Farms, Garatu, Minna

Agric. School, Mokwa.

3.1 BARC FARMS, JOS

Barc farms is located 30 km north of Jos along Jos - Zaria road with a total area of 4,000 hectares. The farm is owned by Jos International Breweries. The project was embarked upon in an attempt to promote agricultural activities in Plateau State on a large scale. Activities carried out on the farm include:

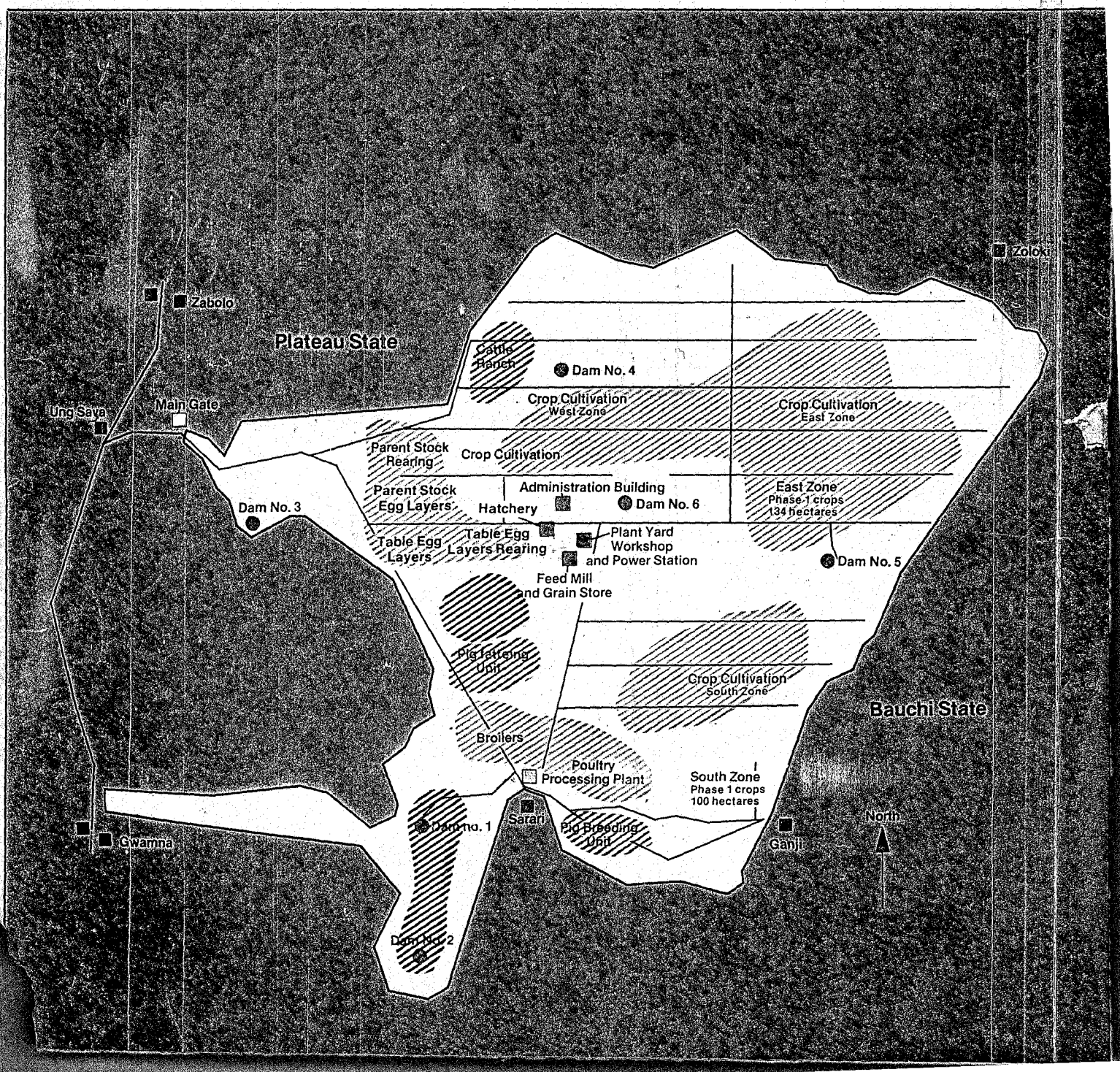
- Cultivation of rainfed and irrigated grains, vegetables and tree crops.
- Feed lot for cattle to utilize brewery by products.
- Poultry farm with parent and hatchery units
- Piggery
- Abattoirs for poultry, pigs and cattle

The Company is divided into profit centres and cost centres. The profit centres include crop farm division, poultry division including poultry processing plant and livestock division. The cost centres are - administration section, marketing section, engineering section and research section including veterinary department.

MAP

B.A.R.C.
FARM
SITE

- CROP FARM DIVISION
- POULTRY DIVISION
- HORTICULTURAL DIVISION
- SERVICE CENTRES



Crop farm division - maize, sorghum and soyabeans are the principal crops grown. Minor crops include sunflower, cassava and cowpeas. The sorghum and maize produced are used as brewery adjunct.

Horticultural division - about 30 hectares of land are used to plant potatoes, onions, carrots and tomatoes under irrigation and rainfed situations.

Poultry division - Barc farms has three parent stock rearing units, six parent stock laying units, a hatchery and twenty five broiler houses. The feedmill is responsible for producing poultry feeds.

Livestock division - the cattle section comprise of a quarantine lot and a feed lot. The piggery section has two breeding units and one fattening unit.

Admin section - this section is responsible for financial and management accounts, salaries, purchasing and store control, personnel administration, security, secretarial services and information.

Engineering section - is responsible for the maintenance of plant, vehicles and machinery, agro-industrial equipment, power and water supplies, buildings and maintenance, bore holes and irrigation equipment.

Research section is limited mainly to adaptive agricultural and veterinary research as well as quality, pest and disease control.

All the units are well spaced out with the distance between one unit and another not less than 100m. According to the personnel in-charge, the buildings need to be spaced out for proper control of spread of diseases amongst animals. Beside the main administrative building, each unit has a small admin office for proper control of activities of the unit. Other facilities present are staff canteen, changing rooms, common rooms an a small shop where farm produce are sold on a small scale. The farm as a whole is well land-scrapped and there is a well defined road network connecting all the units.

Merits

- Well spaced out units
- Crop cultivation all year round with help of irrigation
- Individual units properly landscaped
- Well defined drainage channels
- Relatively large site

Demerits

- No provision for staff housing
- No facility for exhibition and sale of farm produce
- Highly mechanized farming system therefore no chance for the rural farmer here
- Too many road network

3.2 TAGWAI INTEGRATED AGRICULTURAL COMPLEX

Tagwai Integrated Agricultural Complex is located along Minna-Paiko road, Chanchaga, Minna. The complex was started in April, 1991 by the State Government in an attempt to promote agricultural development in the State but was abandoned not long after it started due to financial constraints. The complex was to be the first of its kind in Nigeria according to the officer in-charge, with an objective of producing a self reliant and self sustaining agricultural complex. The farm is located close to river Chanchaga on which it partially depend for water supply.

The complex is made up of a block of offices, a poultry farm, livestock unit, tree bearing and non-tree bearing orchard, fish ponds, vegetable farm, maize and rice farm, a reservoir and a drainage tank. The complex lacks ancillary facility necessary for proper development and sustainability.

The office provision is inadequate and only one large building is intended to house the chickens, rabbits, ducks and other birds. There is no provision for grazing area for the animals.

Merits

- Nearness to river Chanchaga
- Close to the town
- Good road network

Demerits

- Space handicap
- No enough provision for staff offices and not even any for staff housing
- Lack other ancillary facilities
- Nearness to tow could have a pollution effect on complex in general

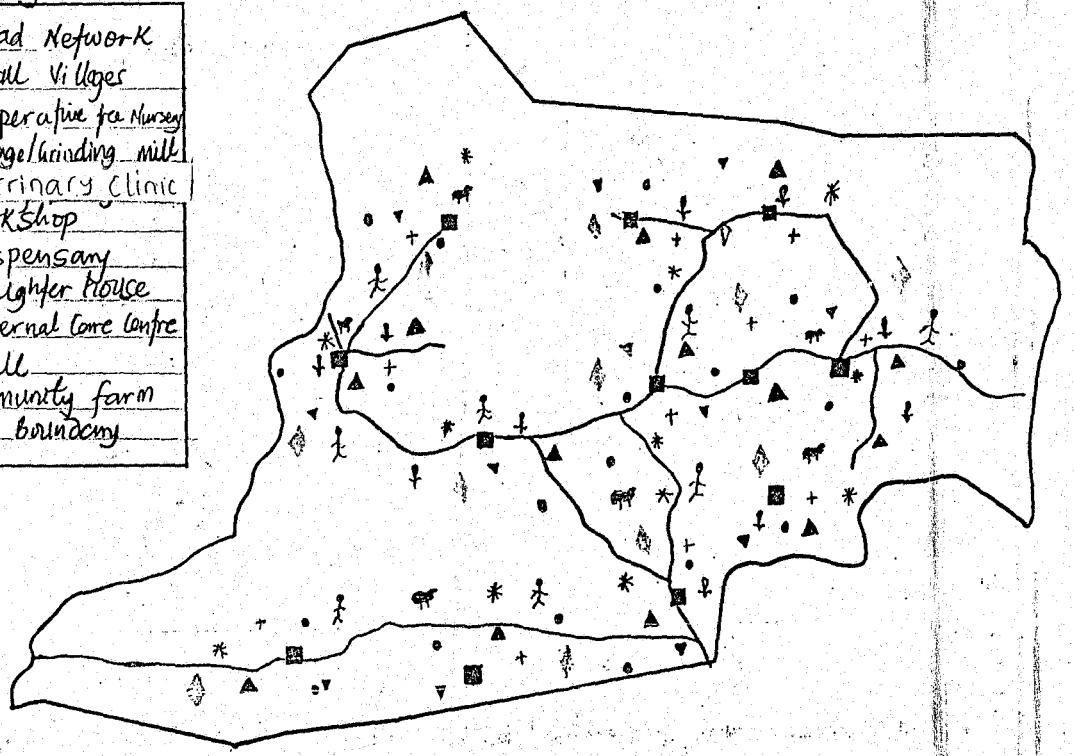
3.3 KEITA INTEGRATED DEVELOPMENT PROJECT, NIGER REPUBLIC

Keita district is one of the seven that form the department of Tahoua in Central Niger with an area of 4,860km^2 of plateaux rocky slopes, sandy and sloping plains and valleys. Keita Integrated Development Project testifies to the dramatic achievements that can result when human energy and innovations are applied to tackle the challenges of

KEITA INTEGRATED DEVELOPMENT PROJECT. NIGER REPUBL

Key.

—	Road Network
■	Small Villages
⚓	Cooperative for Nursery
▲	Storage/Grinding Mill
	Vetrinary Clinic
*	WorkShop
+	Dispensary
▼	Slaughter House
	Maternal Care Centre
•	Well
	Community farm
—	Map boundary



The Keita integrated development project testifies to the dramatic achievements that can result when human energy and innovation are applied to tackle the challenges of rural development. In just five years, the people of Keita have transformed their district from a barren landscape unable to meet basic food requirements to a flourishing environment for crops and livestock. The Keita project has put into practice FAO's objectives for integrated, sustainable development. From the start, people's participation has been the main vehicle for action. The local community has participated in decision-making, planning and executing all the project activities from watershed management, soil conservation and afforestation to improving crop production, infrastructure and social services. The role of women in the project has been crucial, indeed they made up ninety-five percent of the workforce at first. Each small step, from planting a tree to drilling a well, has directly benefited women and their families. Children have been engaged not only in the classroom but in tree-planting and other exercises that prepare them to become tomorrow's farmers and conservationists. In the District, one often finds children at play building miniature dams and terraces, further proof of the project's profound impact on local life. Integrated development entails looking at the community as a whole to ensure that changes in one area do not threaten progress in another. This publication is dedicated to the men, women and children of Keita District who have demonstrated enthusiasm and willingness to get involved under circumstances that might have led others to indifference or despair. They have mobilized body and soul to build a promising future.

FOOD DISTRIBUTION SESSION IN KEITA

BLACKSMITHS IN TRAINING SESSION

rural agricultural development. Keita district was targetted for a sustainable development programme as part of the Niger government's strategy to restore the country's agricultural base and infrastructure. The short term goals of the project are to increase agricultural production and attain economic independence and food self-sufficiency. The long term goal is to minimize the need for technical and financial assistance by helping the population become self-sufficient.

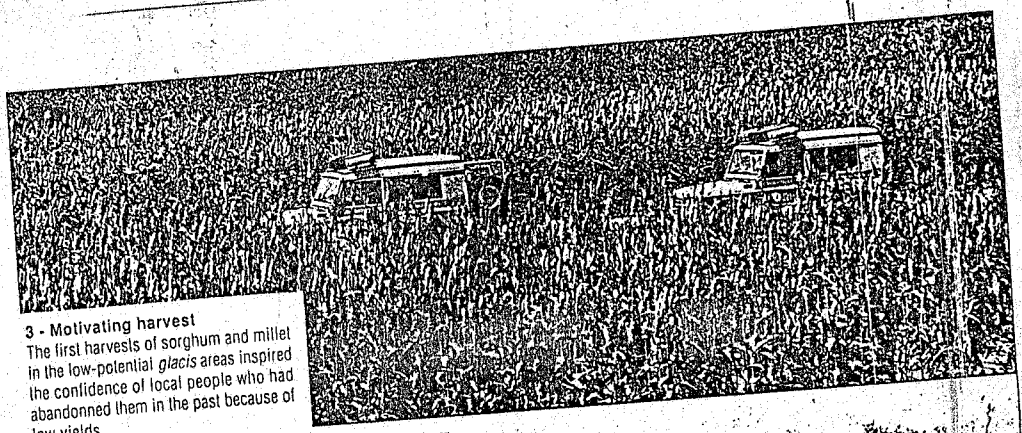
The men of Keita district are farmers, herdsmen, emigrant labourers and craftsmen. They prepare the ground and plant seeds during planting season, as do women and children. When in october, the heavy work of harvesting is done, many leave the district in search of seasonal employment. This integrated development project has, however, trained thousands of people in better farming and forestry techniques. Veterinary and plant health inspectors have been given the know-how needed to protect crops and livestock. First aid workers and midwives have received instruction in preventive health care. Nutritionists and extension workers have been trained to train others. The project provided a place where women can learn more about nutrition and child health. Market gardening and processing

food are making women more economically self-reliant. Through workshops they are learning how to dry and package food for sale.

Some of the infrastructure provided are:- a community centre to enhance quality of life; mills for grinding flour to help women reduce time spent on preparing the family's daily food; shops to provide an outlet for locally provided goods such as processed food and artisanal handicrafts; large deep wells have been drilled to meet water needs such as irrigation of gardens, out-of-season crops, tree nurseries and fruit orchards. Other facilities provided in this district include farm lands, workshops for mechanical training as well as repairs, classrooms, maternal care centre, school for their children, dam, blacksmith workshops, dispensary, veterinary clinic, storage and slaughter house.

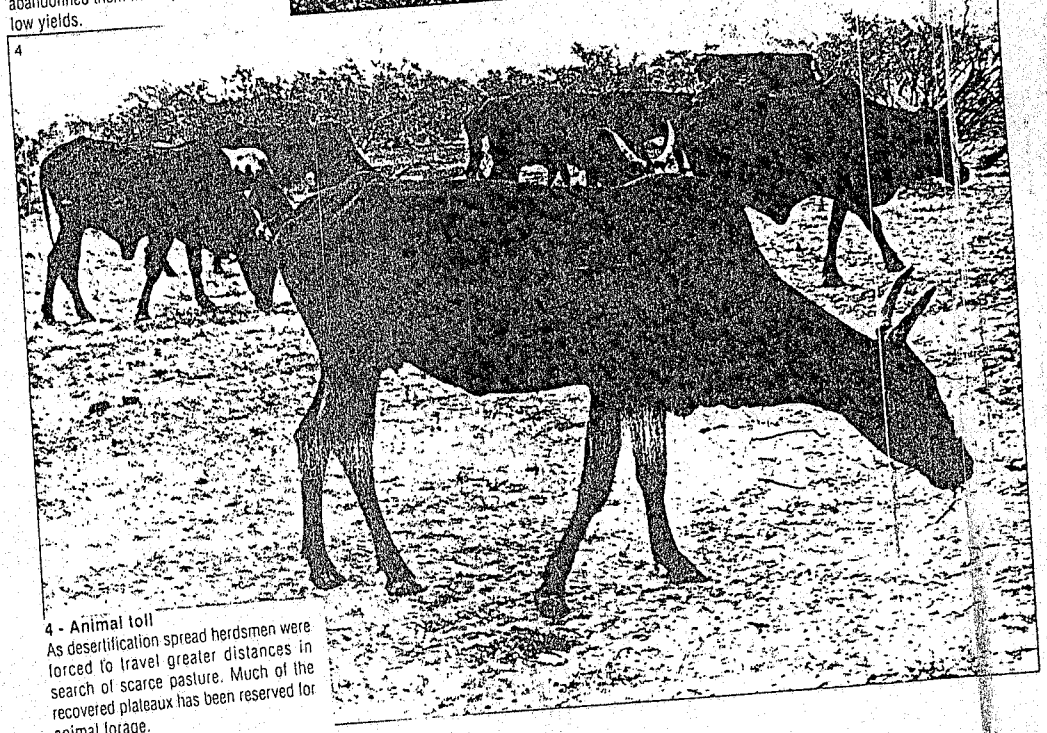
Merits

- Well planned integrated development programme
- Training provisions for rural farmers, women and children
- District is busy all year round.



3 - Motivating harvest
The first harvests of sorghum and millet in the low-potential *glacis* areas inspired the confidence of local people who had abandonned them in the past because of low yields.

4



4 - Animal toll
As desertification spread herdsmen were forced to travel greater distances in search of scarce pasture. Much of the recovered plateaux has been reserved for animal forage.

VIEWS FROM KEITA.

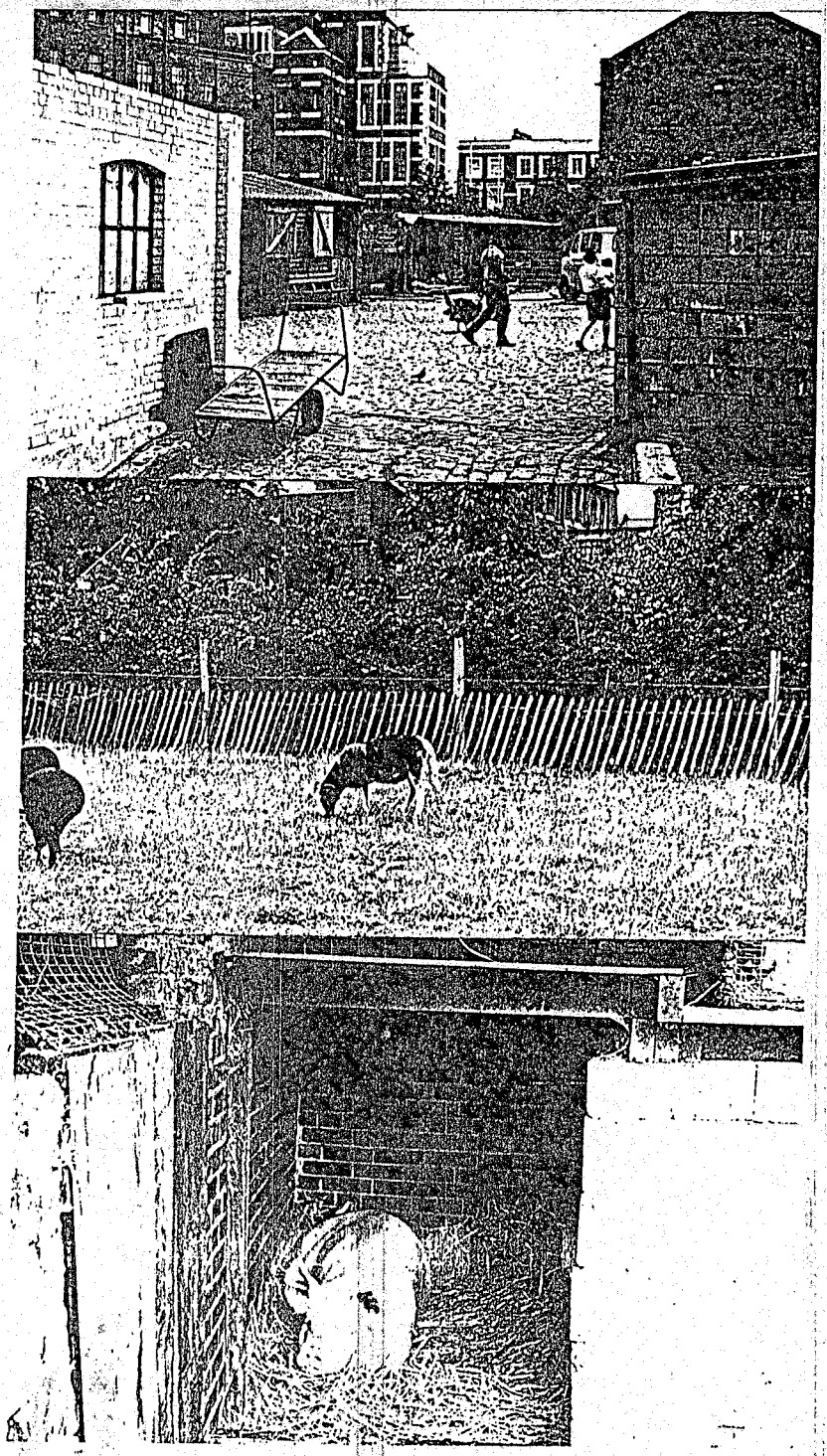
Demerits

- Inadequate training facilities i.e. no classrooms and furniture
- Goods/farm produce are distributed and sold on open fields
- Wells are unprotected from children
- No defined planning layout of facilities.

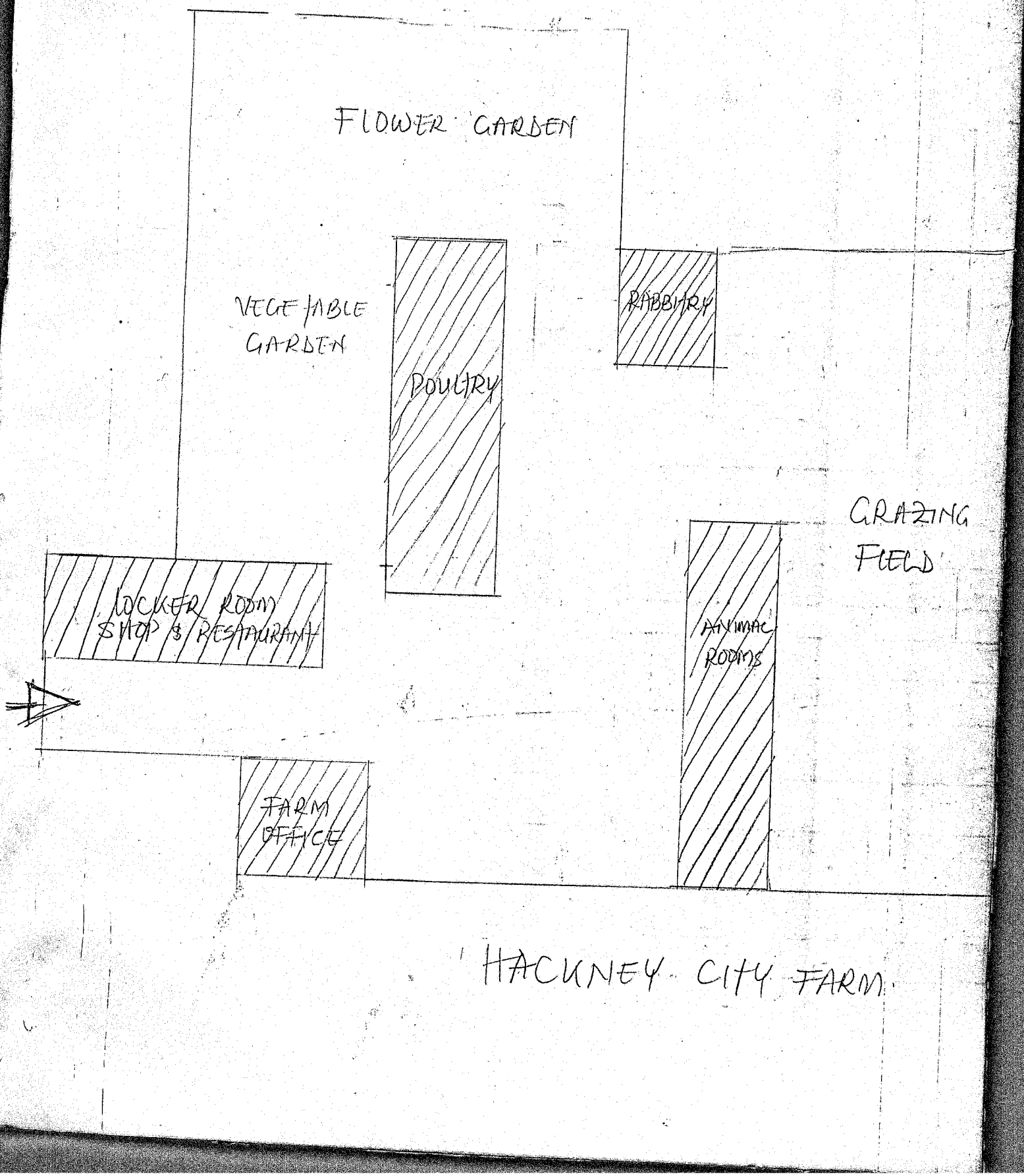
3.4 HACKNEY CITY FARM, LONDON

This case study was taken because of my intention to make the proposed complex as lively as possible by taking into consideration facilities that will attract visitors. hackney City farm is located at No. 1A Goldsmith road, London. The farm is such that the ultimate objective is not only to produce food but also to attract visitors. Infact attention is focused more on things that will interest visitors (like the ducks pond, aviary etc.) than food producing activities. It is called city farm because it is more of a tourist farm located in an urban area for visitors to be attracted and have a nice time on the farm.

The farm consists of a livestock unit, a poultry, a small vegetable and flower garden, birds house, administrative office, a restaurant, a shop, staff utility



VIEWS FROM HACKNEY CITY FARM


FLOWER GARDEN
VEGETABLE GARDEN
POULTRY
RABBITRY
GRAZING FIELD
LOCKER ROOM SHOP & RESTAURANT
ANIMAL ROOMS
FARM OFFICE
HACKNEY CITY FARM

and locker rooms and a grazing field. All the animal rooms are opened to a courtyard finished with rubble floor. The grazing field is large enough when compared to the number of animals using it.

The poultry unit consists of small rooms of 4.5 x 6m housing up to 30 birds. The floor of the room is bedded with straw. Pigs rooms are 2 x 2m in size also bedded with staw. One pig room is provided for two pigs. The farm generally is very clean and well landscaped to encourage visitors' further patronage.

Merits

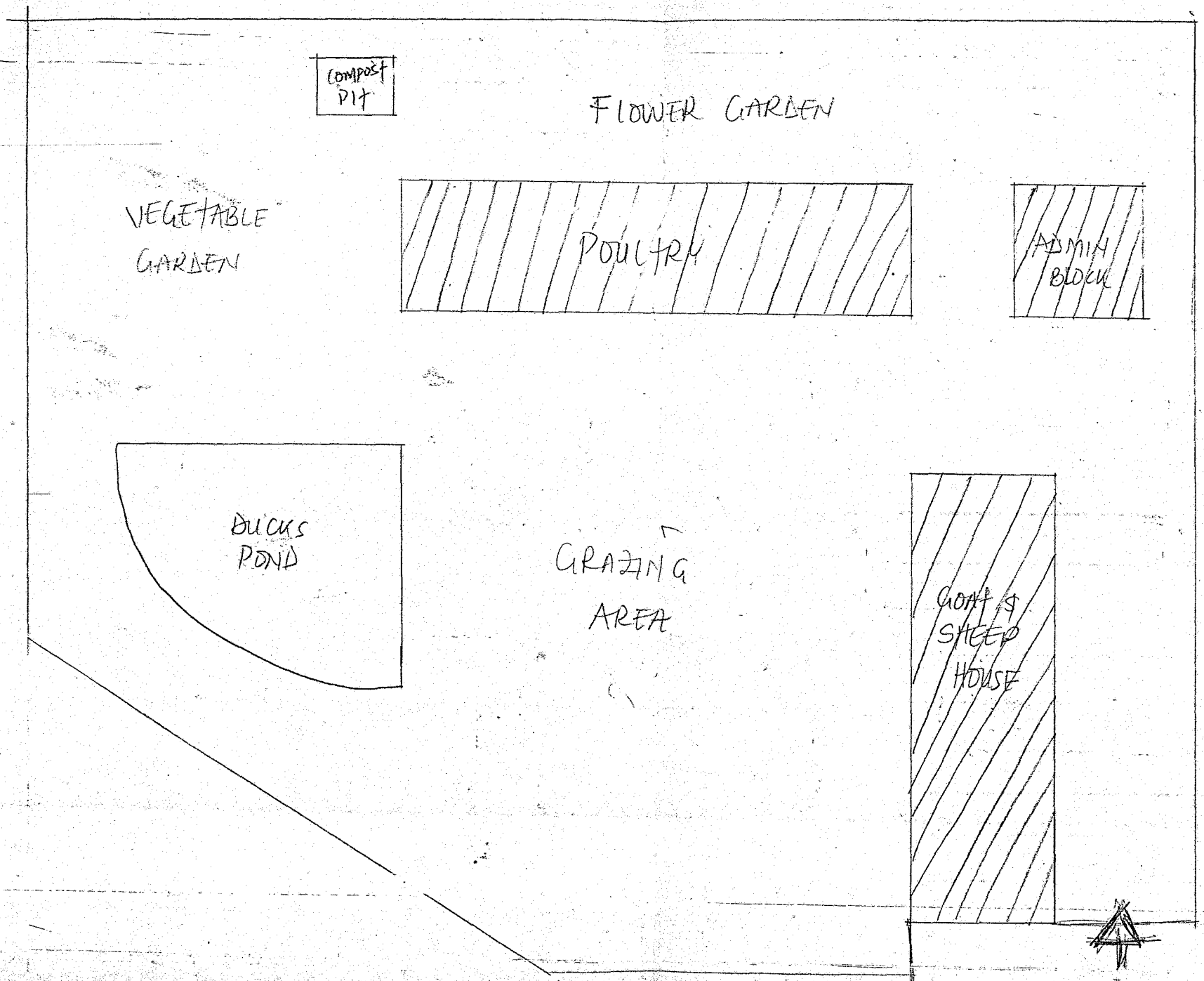
- Well space to units
- Proper landscape of farm environment
- Despite land scarcity, a grazing field is still provided.

Demerits

- Too crowded poultry unit
- Improper location at City Centre
- Space handicap

3.5 VAUXHALL CITY FARM, LONDON

The nature of this farm is the same as Hackney City Farm explained above. It is located at No. 24 St. Oswalds



VAUXHALL CITY

Place, S.E. 11, London. The farm consists of animal rooms, broiler room, layers room, vegetable and flower garden, ducks ponds, an office; locker rooms, kitchen and dining, grazing field, store and a compost pit.

The pigs rooms measure 2.5 x 2m/pig with a concrete floor bedded with straw. Goats and sheep rooms are 2.9 x 6.5m each for 15 animals. The floor is timber slatted floor. Rabbits live in cage raised with floors slatted with timber slats. Poultry is 2.8 x 3m in size for 25 birds and floor bedded with straw.

Merits

- Well managed
- Clean environment
- Staff facilities provided

Demerits

- Animal rooms too small
- Lack store for animal handling equipment
- Ducks pond not protected from animals

3.6 MINNA ULTRA MODERN ABATTOIR

Minna Ultra-modern abattoir is located along abattoir crescent off Wushishi road, Minna. This abattoir is considered a relevant case study because of the inclusion of

an abattoir in my proposed complex. The abattoir consists of animals holding ground, slaughter areas for cows, goats and sheep, cleaning area, collecting area offices, locker/ changing room and showers, bones disposal area and a water reservoir. The holding ground and bones disposal area are not part of the main building. The main slaughter areas cover two-thirds of the main building.

This abattoir is more or less a failure because of the crucial problems faced by the users. The failure stems from lack of good drainage channel and water problems. The gutters provided are not sloped for proper draining of used water and blood from slaughtered animals. These gutters are quite deep (about 1200mm) but instead of draining used water, it collects the water and blood until it is filled to the brim when the butchers use buckets to empty them. Even as the butchers empty the gutters inside the slaughter room, there is no defined drainage outside the building to drain the after away.

This stagnant water/blood has led to a permanent unpleasant smell of the abattoir and its surroundings. The soakaway pit provided is blocked therefore the waste is presently being drained into adjacent plots.

Another problem faced by the abattoir is that of water. The butchers have to fetch water from the reservoir outside the building as water does not come from the taps. This is due to lack of pumping machine to pump water into the overhead tank which in turn supplies water to the taps. For this reason, the slaughter area are not kept clean at all. The butchers only manage to fetch enough water to wash off blood from slaughtered animals.

Because of the unpleasant smell of the abattoir, the offices have not been used, some of them are turned into stores. The only good thing about the abattoir is the large parking area for vehicles collecting meat to the market. The holding ground is also large enough for the animals awaiting slaughter.

Merits

- Good location
- large parking area for collecting vehicles
- Enough provision for staff facilities

Demerits

- Bad drainage channel
- Lack of water
- Exposed waste disposal site

WOMEN: WORK, NUTRITION, CHILD CARE

3.7 NIGER LIVESTOCK COMPANY, MINNA

Niger Livestock Company (Dairy Farm Unit) is located along Minna-Paiko road, just before the Trade Fair Complex. The dairy farm is a very big farm and used to produce fresh milk on a large scale but now production of fresh milk is on a very small scale.

The farm consists of an Admin block, a feed store, catle holding ground which includes a lirage, a weighing track and milking parlour. Other facilities are - cattle lot, a residential block for people taking care of the cattle, grazing field, power house and dairy processing block.

The dairy unit consists of a laboratory, processing area, 2 offices, a cold room, a compressor room, a toilet and a store. Due to the dilapidated state of the building and the components, this unit is as good as none. The laboratory is not equipped, therefore it is out of use, the offices too are not functioning. No furniture, the compressor room is in a bad state too, even the compressor is spoilt. The only manageable place is the processing area the store and the cold room.

The cattle holding ground has been abandoned and every thing there is out of use. The cows are kept in the cattle lot and milling is done in the residential area. Sterilization of fresh milk from the cow is done with firewood, outside the dairy house because the sterilizing bowl is out of order. The number of cattle in the cattle lot as at the time of visit is not up to thirty. This, coupled with other problems analysed above make it quite obvious that this farm is fast deteriorating and will sooner or later go out of function. Despite all the problems though, there is a constant supply of water to the farm which is a great necessity in such a farm.

Merits

- Large grazing field
- Water availability
- Adequate animal facilities

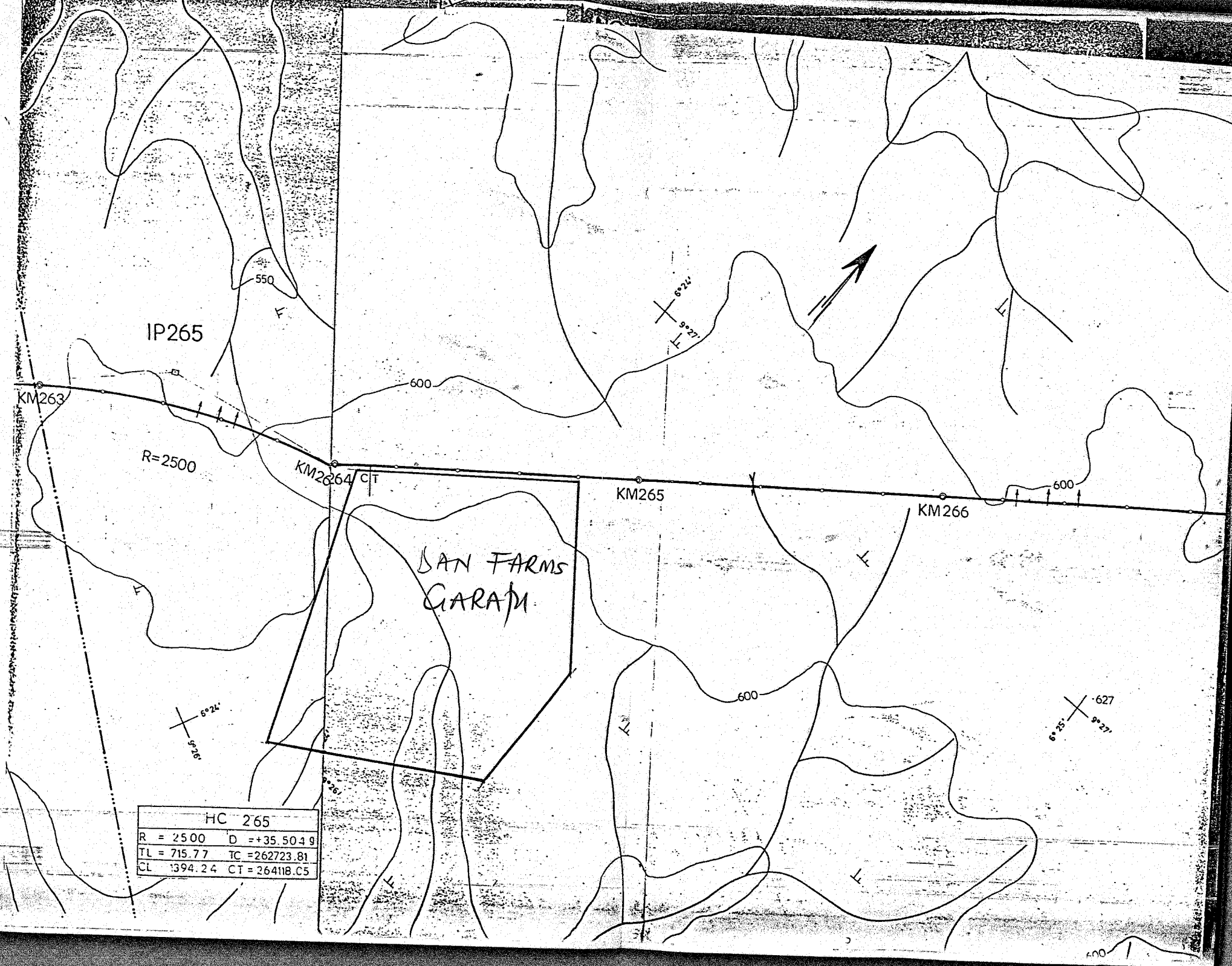
Demerits

- Poor management
- Unhygienic milking area
- Inadequate staff facilities

3.8 DAN FARMS, GARATU, MINNA

Dan farms is a typical rural farm set-up located along Minna-Bida road. This farm was considered a relevant case study for the project at hand because one important aim of the project is to make life in the rural areas (where peasant farming is the major occupation of dwellers) more interesting and self sustaining, devoid of outside influences. After studying and knowing the nature of rural farmers, it becomes important to take a typical rural farm setting as a case study. This will enable more light to be thrown on the way of life, farming methods and techniques, strange methods and facilities, livestock husbandry techniques and sale of surplus produce of a rural farmer. This will help alot in provision of a functional complex that will be highly appreciated by the farmers.

A study of the chosen farm shows that shifting cultivation and crop rotation is still being practiced by rural farmers. After cultivating a piece of land for about 4 or 5 years, the land is abandoned for another place. The piece of land left for fallow in some cases are used as grazing land for their livestock so that lost nutrients are replaced with the animal waste.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diseases and also to enrich places left for fallow. Cages and nests are built for the rabbits and birds and they are left in the day time to wonder around in search for food.

Role of Women: Beside household chores, rural women are mostly helpful during harvest and also when it is time to sell surplus farm produce. Women also help in processing of crops like rice and maize for storage and sometimes they help plant crops.

In conclusion, it was discovered that changing the ways and helping a rural farmer requires alot, it requires much more than sending extension workers to deliver new methods and planting techniques.

CHAPTER FOUR

THE DESIGN

Project at a glance

Choice of Site

Site Analysis

Design Philosophy and Concept

Functional Analysis

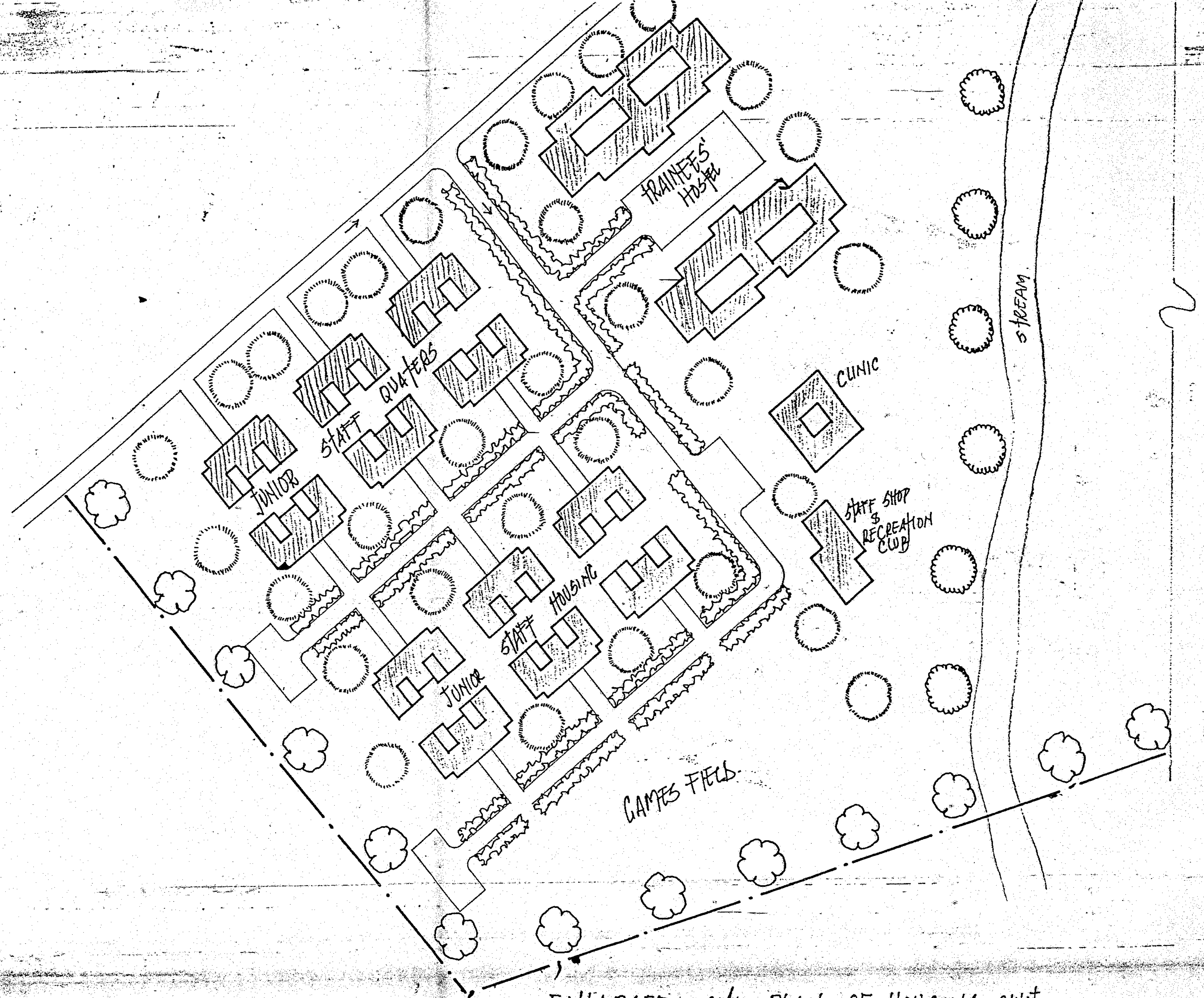
Site Planning

Space Requirement

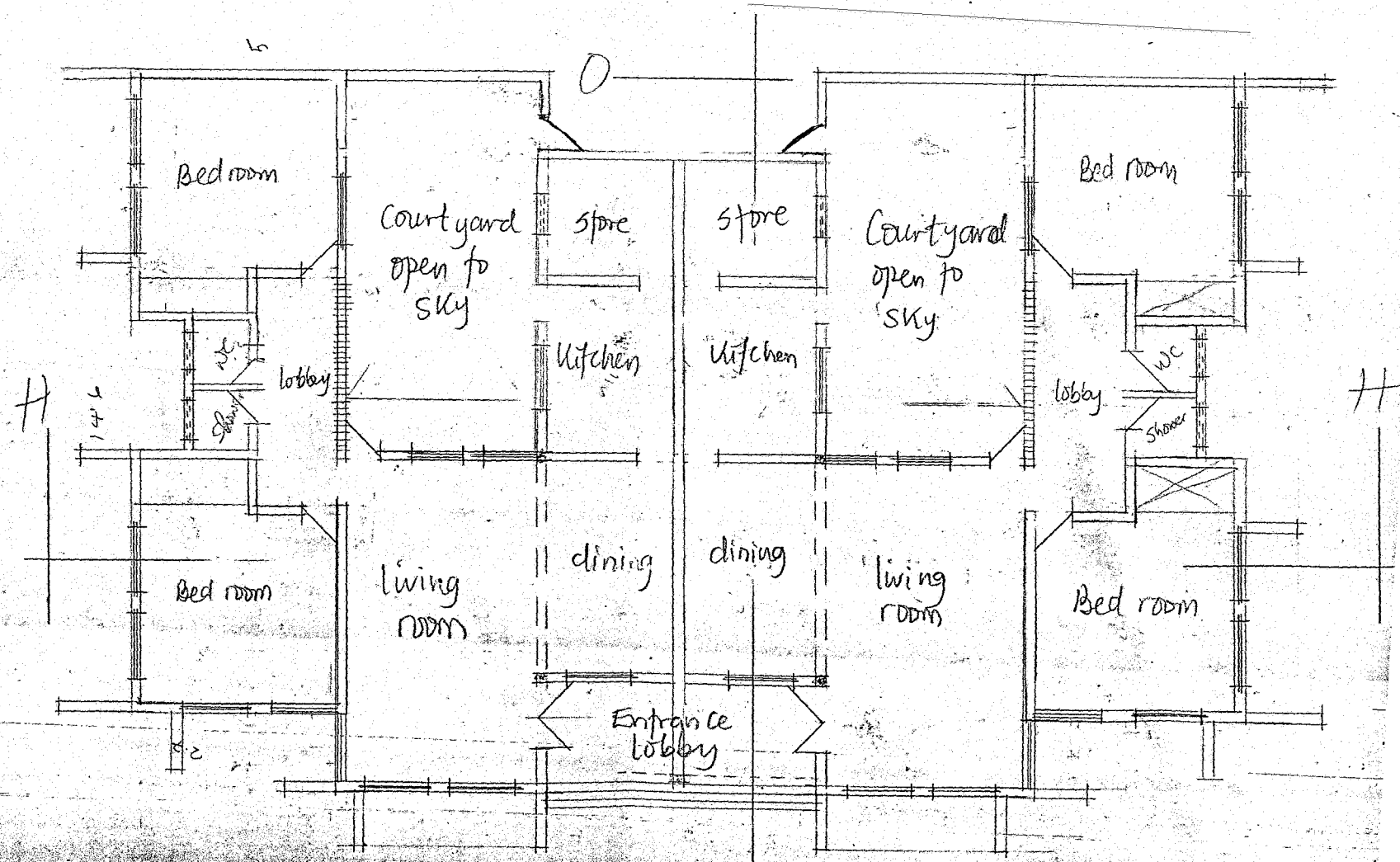
4.1 THE PROJECT AT A GLANCE

In designing an agricultural facility of this nature, the nature of the services offered and their relationship to one another must be given proper considerations. These considerations dictate the basic layout of the facility. For this complex to function properly, all facilities provided will be given equal consideration so that no area is neglected.

First and foremost, a suitable site is necessary to avoid problems of space handicap which can hamper development of the complex. For this purpose, a relatively



ENLARGED SITE PLAN OF HOUSING UNIT

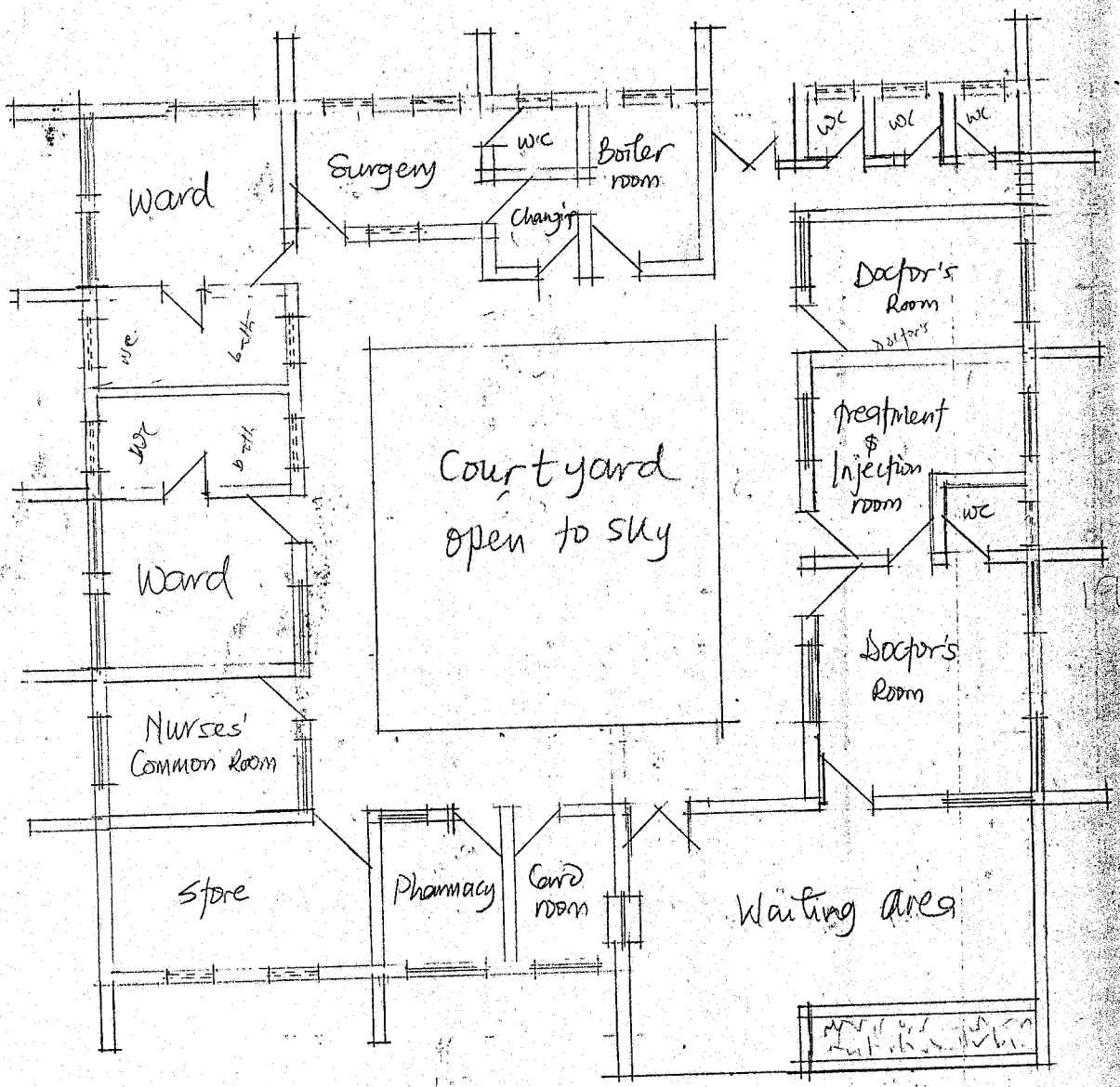


JUNIOR STAFF QUARTERS

large site away from an urban centre is needed. This will enable proper spacing of the facilities with areas for future expansion and for purposes of controlling disease outbreak in areas like the poultry and livestock units. Facilities provided can be classified under three broad headings namely, Educational, Agricultural and Ancillary facilities. The educational facilities comprise of farmers training classrooms, Food and Nutrition Centre and Research laboratories. This group of facilities is the main basis for this project. It is the purpose for which the complex was proposed; i.e. to train and educate rural farmers and women alongside researching into new farming methods and techniques to make life in our rural areas worth living.

The Agricultural facilities i.e. livestock, poultry and crop farms are also necessary for practical purposes. Moreover, peasant farmers have been reluctant to adopt new methods on their individual farms as doing so exposes them to great risks of failure resulting into starvation. This reason therefore dictates the need for such facilities.

Ancillary facilities as well known are supporting facilities. If the concept that led to its existence, (isolated state concept) then ancillary facilities cannot be



STAFF CLINIC

left out. These will ensure a self-sustainable complex devoid of outside influences to disturb the internal workings of the economy.

However, for highly mechanized agricultural institutions, the services of an Agric. Engineer will be highly required in designing facilities like the abattoir, hatchery, animal handling equipment etc. But in this case, due to the nature of the people to use these facilities, the design will consider the background of rural farmers therefore more attention will be paid to our traditional ways of agricultural practices. Emphasis will also be laid on the layout of facilities on site in order to achieve maximum functionality of the complex.

4.2 CHOICE OF SITE

Three different sites at different locations were available for this project. They are:

i. Site for Tagwai Integrated Agricultural Complex in Chanchaga just before the bridge.

ii. A piece of land off Zungeru road after the airport junction.

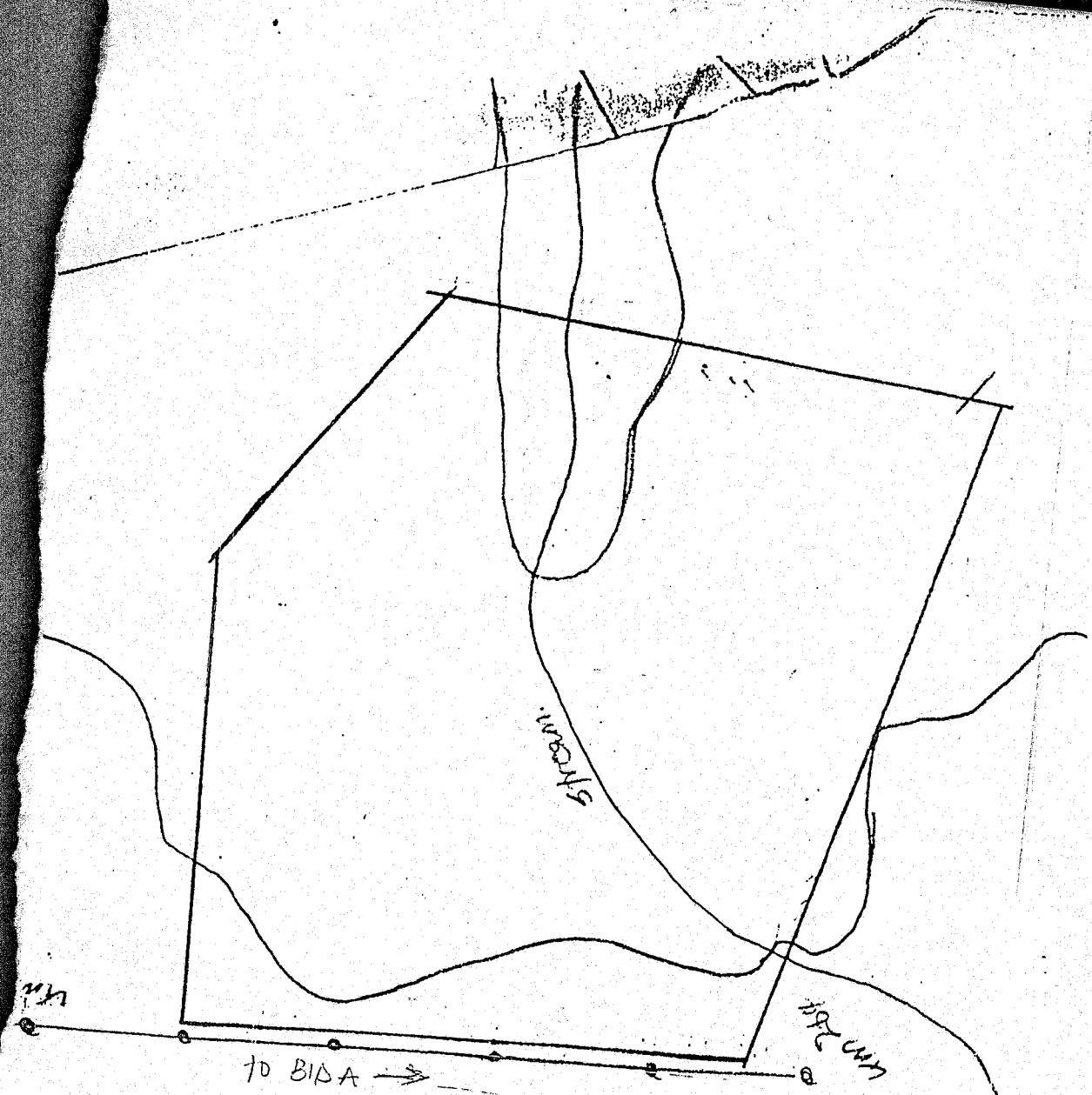
iii. Site for Dan farms along Bida road after the University permanent site.

ANALYSIS

analysis is the process of understanding site It considers factors that determine a site's the purpose each factor serves, the location of and the category into which each factor will fit sign process. Factors which determine a site's include natural and man-made factors. The natural e: water, topography, orientation, vegetation, limate while man-made factors include: location, ttraction, utilities, services, buildings and

e factors serve three purposes, functional ents of man, pleasurable requirements and natural requirements. The functional requirements for this t are - learning, working, shopping and living. The surable requirements are recreation and nature while the tural process requirements are the interaction of land, plants and animals in a self-supporting process.

Site analysis also requires an understanding of on-site and off-site conditions. On-site refers to the piece itself i.e. the piece of land while off-site refers to outside services like road and utilities.



PROJECT SITE.

Location

The Project site is located 21km from Minna along Bida road. This site was chosen because of the reasons explained under "Choice of Site" above and because from the master plan of Mina it is stated that "any new farm should be on the new Bida road beyond the Chanchaga or beyond new airport along the Minna-Zungeru road.

Terrain

The site is not very flat and it slopes in the NE and SW direction.

Vegetation

The site is optimally vegetated with shrubs and trees.

Drainage

The site has no defined drainage channel except that water flows along the slope direction into the stream.

Soil

The site has two soil types - clayey soil and well drained loamy soil as shown on the drawing.

4.4 DESIGN PHILOSOPHY AND CONCEPT

Architectural concepts are responses to important symbolic design themes and the formulation of these concepts and its development is a logical sequence in response to

those symbolic themes. A conceptual analysis aims at arriving at a medium by which all aspects of the design goals are expressive of the function for which they are designed and at the same time relative to the environment. The design concept therefore aims at satisfying the project aims and objectives and also symbolizes the function of the buildings which are mainly centred on the development of agriculture in Niger State.

The concept of this project is the isolated state theory of Von Thiinen which aims at producing a self-contained country, devoid of outside influences that would disturb the internal workings of the economy. The concept was adopted for reasons similar to Von Thiinen's. In an attempt to analyse and improve the problem of food shortage caused by population growth in Europe during his time; Von Thiinen proposed the isolated state theory. Similarly, in an attempt to help Nigeria's agricultural situation, I have decided to adopt this concept. The proposed complex as a whole will therefore function in isolation from our urban centres to avoid negative influences which could disturb the internal workings.

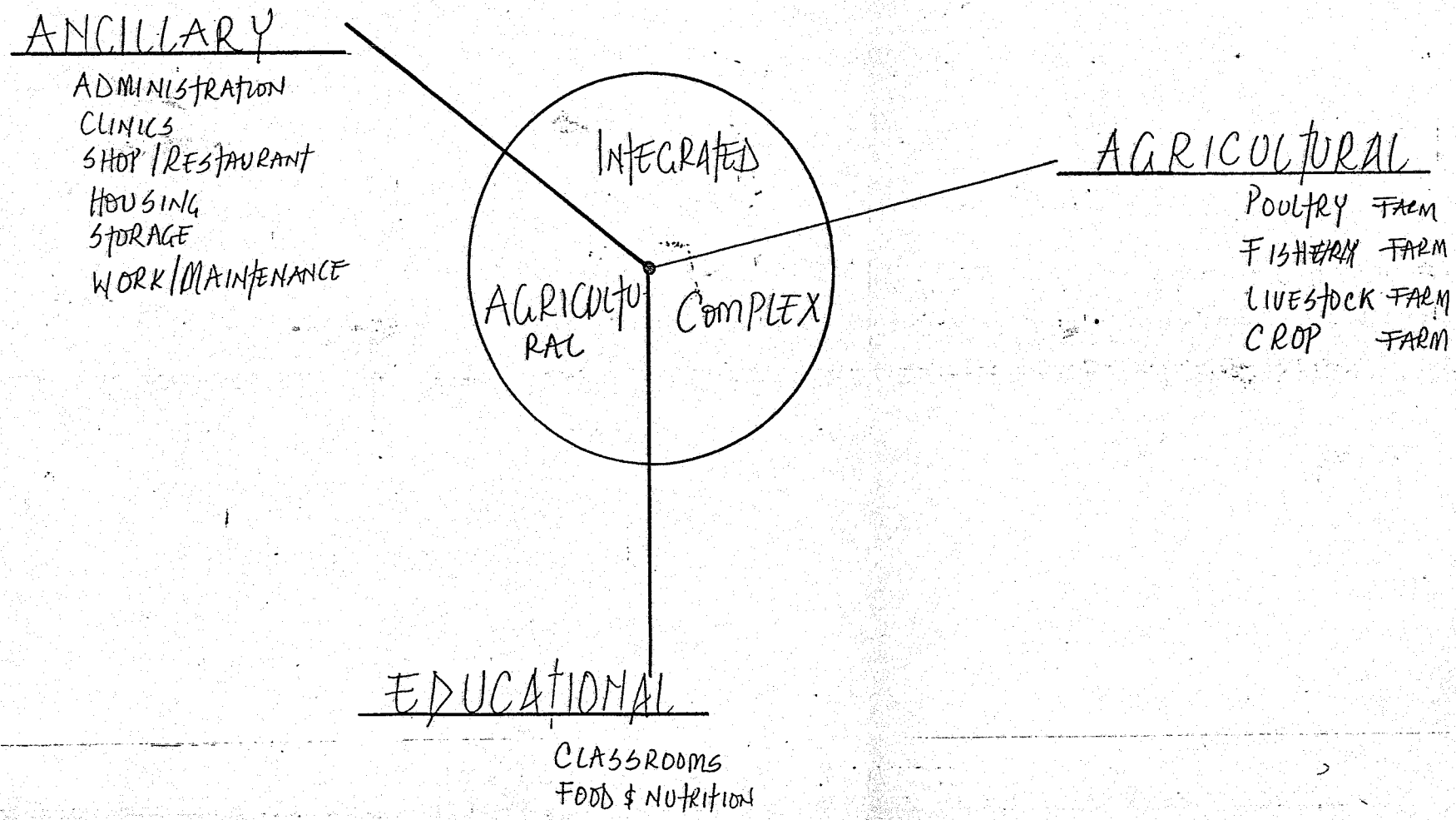
Unlike Von Thiinen's isolated state which was divided into five zones, my proposed complex would be divided into three zones. The first and innermost zone will be a zone of intensive animal and crop farming activities. The second zone, a semi public zone, will be a zone of poultry, fish and research farms. This zone allows the public to have a view of the complex to an extent. The third and outer most zone is the zone of Educational and ancillary facilities completely free to public access.

4.5 FUNCTIONAL ANALYSIS

For the proposed complex to function smoothly, there is a need to analyse the location of various facilities, their relationship with one another and with the complex as a whole. These functions however cannot be properly analysed without considering the flow of activities between one facility and another. Hence the need for a flow chart.

The facilities as earlier discussed are grouped into three, all of which are related to one another. The first group, the educational facilities group cannot function properly without the agricultural facilities group. This is to ensure proper understanding and utilization of the knowledge acquire in the training. The educational

FUNCTIONAL ANALYSIS.



facilities group is therefore related to the agric. facilities group for practical purposes. The third group which is the ancillary facilities group is related to the other two for purposes of sustaining the entire complex. It acts as a fuel to ensure smooth running of the complex towards achieving the aims and objectives of the project.

Flow Analysis

Your first encounter as you enter the site through the main entrance is the Administrative block in company of the Shop, Restaurant and Exhibition hall. The off season farm (green houses) is also on the same line with the admin block. Immediately behind the admin block are the classrooms Food and Nutrition Centre and Research laboratories. There is therefore a direct link between the Administrative block and this set of facilities. Adjacent to the classrooms block is the trainees' hostel for easy access of trainees' from class to hostel.

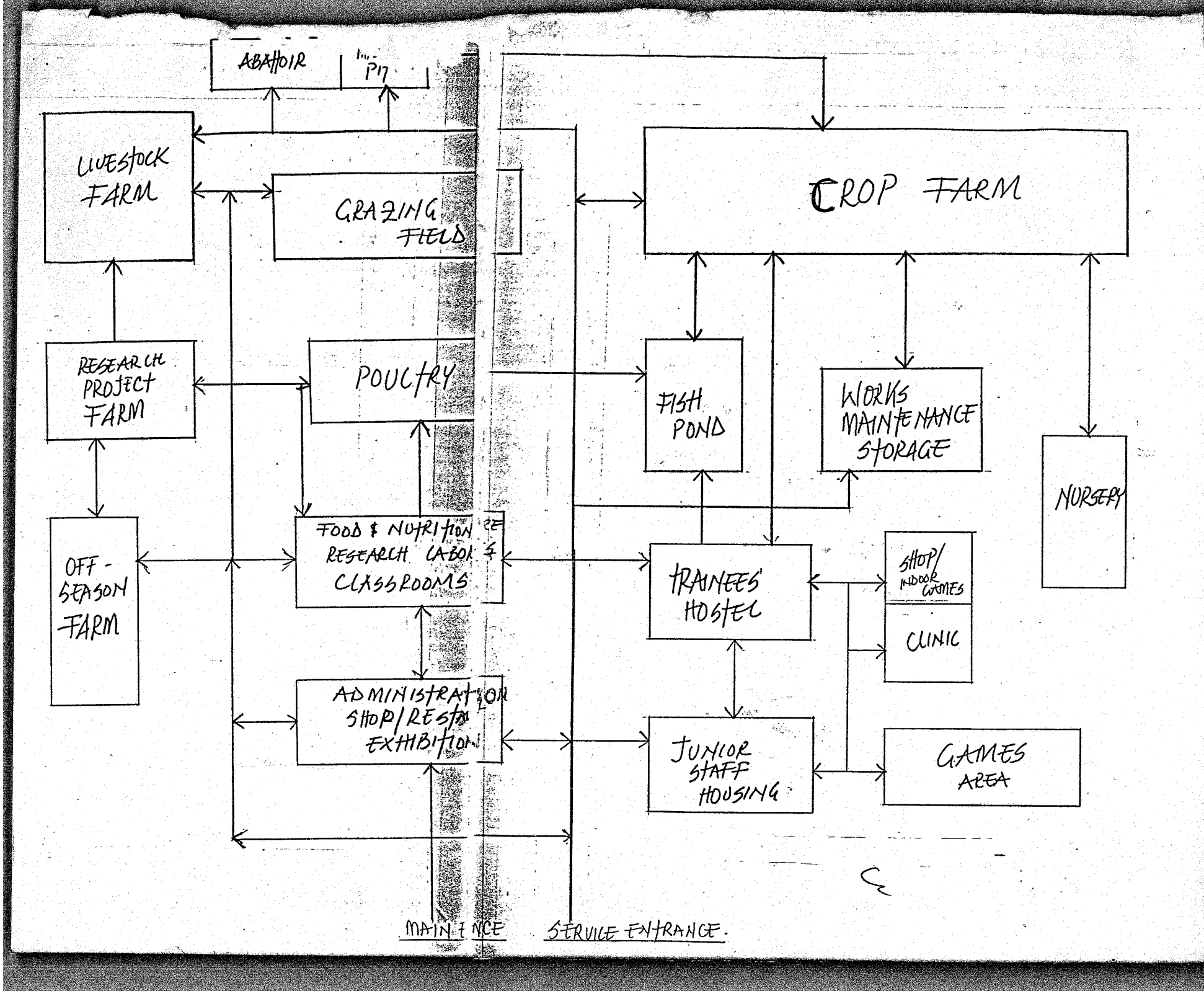
Research project farm, the poultry and the fish pond is next to the classrooms for easy access for practical work. This zone acts as a transition zone between the public zone (Educational and Ancillary facilities) and the zone of intensive crop and livestock farming zone. Livestock farm,

grazing field and crop farm is the last set of facilities in the innermost part of the site.

The service entrance takes you to the junior staff housing unit, trainees' hostel, staff clinic, shop and games area. These facilities are your first encounter as you enter the site through the service entrance. Works/Maintenance and storage department is located close to the crop farm where its services are needed most. There is also a direct link between the plant nursery and the crop farm.

Movement on Site

It is considered necessary to define movement on the project site in order to identify areas of restricted and non-restricted movement. From the main entrance, movement around the administrative block, classrooms block and off-season farm is non-restricted to the public. From the service entrance, movement around staff housing, trainees' hostel, staff clinic, shop and games area is also non-restricted to the public. Movement around the research project farm, poultry farm, fish farm and work and maintenance department is semi-restricted to the public. Highly restricted areas revolve around the livestock farm, grazing field, plant nursery, crop yard and storage


ABATTOIR
PIT
LIVESTOCK FARM
GRAZING FIELDS
CROP FARM
RESEARCH PROJECT FARM
POULTRY
FISH POND
WORKS MAINTENANCE STORAGE
NURSERY
OFF-SEASON FARM
FOOD & NUTRITION RESEARCH LABOR & CLASSROOMS
TRAINEES' HOSTEL
SHOP/ INDOOR GAMES
CLINIC
ADMINISTRATION SHOP/REST EXHIBITION
JUNIOR STAFF HOUSING
GAMES AREA
MAINTENANCE
SERVICE ENTRANCE

department.

4.6 SITE PLANNING

Planning of the project site was based on two criteria:

i. Zoning

ii. Facilities location analysis

Zoning

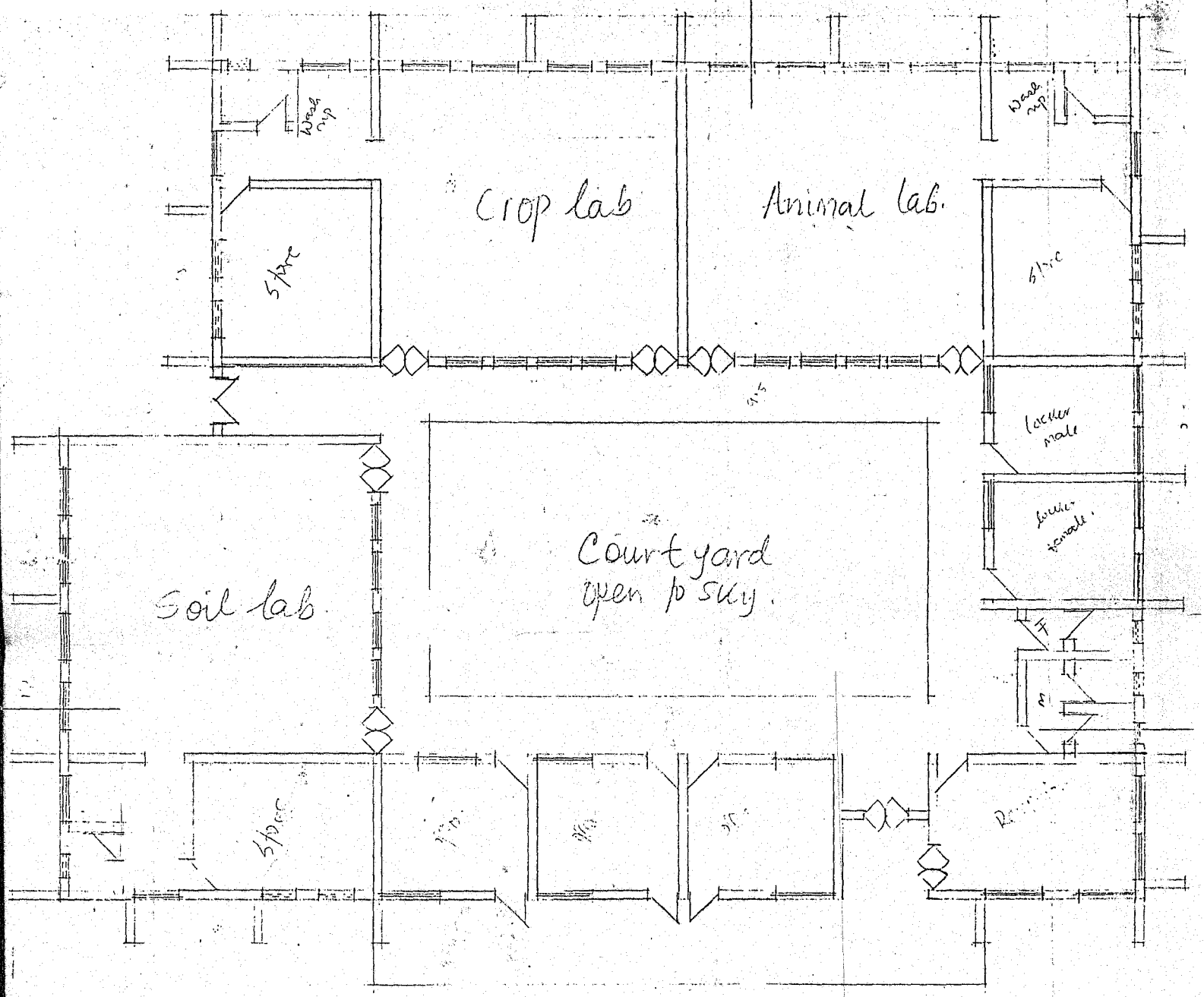
The site is divided into three zones which are public, semi-public and private zone. The public zone comprises the administrative block, Restaurant, Shop, Off-season farm, Food and Nutrition Centre, Classrooms, Research farm, Trainees' hostel, Staff Clinic and Shop, staff housing, recreation club and games area.

The semi-public zone consists of the research project farm, poultry farm, fish ponds, plants nursery and works/ maintenance department.

The private zone consists of the cattle ranch, abattoir, grazing field, veterinary clinic, crop farm and storage department.

Facilities Location Analysis

The slope of the site determined location of facilities like the livestock unit. This is sited on the uppermost or highest part of the site so that water can flow freely along



RESEARCH LABORATORIES

maintenance over a long period of time. Bricks are cheap because there is an abundance of the natural material from which they re made, that is clay. Bricks may be classified in accordance with their uses as commons, facings, and engineering bricks.

5.1.4 Facing Bricks

Facing bricks are by far the widest range of bricks as it includes any brick which is sufficiently hard burned to carry normal loads, is capable of withstanding the effects of rain, wind, soot and frost without breaking up and which is taught to have a pleasant appearance.

5.1.5 Hollow and Perforated Bricks

The class of bricks are lighter in weight than solid bricks and the cells and perforations facilitate drying and burning. The saving in clay and consequent reduction in weight is an advantage in non load bearing walls but does not significantly improve thermal insulation in external walls. Perforated bricks are also used in screen walls.

5.1.6 Clay/Ceramic Wall Tiles

Hard materials of various kinds including ceramic tile, brick, stone and glass are used in tile or slab form for wall surfaces and with the exception of glass, for floor

surfaces also. Ceramic tile or various shapes, sizes, thickness, colours and surface finishes are manufactured for use as a surfacing material for interior and exterior wall where a quality surface is desired.

5.1.7 Concrete Blocks

These are extensively used for load bearing and non-loadbearing walls, externally and internally. Light weight aggregate concrete blocks have good insulating properties against transfer of heat and are much used for the inner skin of cavity walls either with a brick outer skin or a concrete block outer skin. The disadvantage of concrete blocks as a wall unit is that they suffer moisture movement which may cause cracking of applied finished such as plaster.

5.2 FLOOR MATERIALS

5.2.1 Concrete

Solid ground floors - Most ground floors, today are constructed as solid ground floors with hardcore, oversite concrete and a damp-proof membrane on which a floor finish is laid or fixed.

For sheds, workshops, stores and garages, the finished top surface of the oversite concrete is sometimes used as

e to save the cost of an applied floor
. Concrete is not satisfactory as a floor
ven though it can be given a smooth finish
at, many of the fine particles of sand and
ht to the surface. These particles have a
to wear and in a short time the surface of
'dusts' and requires frequent vigorous
g a coarse grained material, concrete cannot
d if it becomes stained the stains are

/Cement Screed

pose of a screed is to provide a smooth level
hich a floor finish can be applied. The usual
or a floor screed are cement, sand and water
thoroughly mixed, spread over the surface of the
se, compacted, levelled and trowelled to a smooth

e are on the market several screeds designed
ally for use in public places and factories where
nce to wear, freedom from dust, resistance to oils
d ease of cleaning are considerations.

5.2.3 Terrazzo

Terrazzo wearing surfaces are constructed in a manner similar to concrete wearing surfaces, but a special aggregate of marble chips or other decorative material is always used, and this aggregate is exposed by grinding the surface. Terrazzo floor is more expensive than concrete and less expensive than tile or marble. Attractive and durable, terrazzo is in elastic and cold. The greatest objection to terrazzo floors is their tendency to crack. Dividing strips greatly reduce this objection.

5.2.4 Clay Floor Tiles

There are three types of these tiles - plain colours, virteous and encaustic. Plain tiles are manufactured from natural clays selected from their purity. Because finely ground clay is used the finished tiles are very uniform in quality and because little water is used in the moulding, very little shrinkage occurs during burning. The finished tiles are uniform in shape and size and have smooth faces.

Virteous floor tiles are made from felspar which melts when the tile is burned and causes it to have a smooth, glass-like surface which is impervious to water. The tiles are uniform in shape and size and have a very smooth semi-

glass surface which does not absorb water or other liquids. Virteous tiles are more expensive than plain colour floor tiles.

Encuastic tiles - the word `encuastic´ is used to describe a tile which has a pattern or design, inlaid in its surface in differently coloured clays.

5.2.5 Timber Flooring

Timber flooring is available in the following forms:

1. Strip flooring, consisting of long narrow pieces or strips with tongued-and-grooved joints along the sides and often along the ends also for hard woods.
2. Plank flooring, consisting of wider boards than strip flooring with tongued-and-grooved joints along the sides and ends.
3. Parquet flooring consists of short narrow boards cut to form patterns or mosaics.
4. Industrial wood block flooring, consists of heavy pieces cut in lengths of from 50mm to 100mm forming blocks which are set with the ends of the grain exposed to wear.
5. Fabricated wood block flooring, consisting of small square or rectangular blocks formed by fastening short

pieces of strip flooring together, tongued-and-groove joints being provided on all sides.

The simplest types are strip and plank flooring. They are quiet under foot and have good heat insulating qualities. On the other hand they require a good deal of labour to install and need regular painting in service.

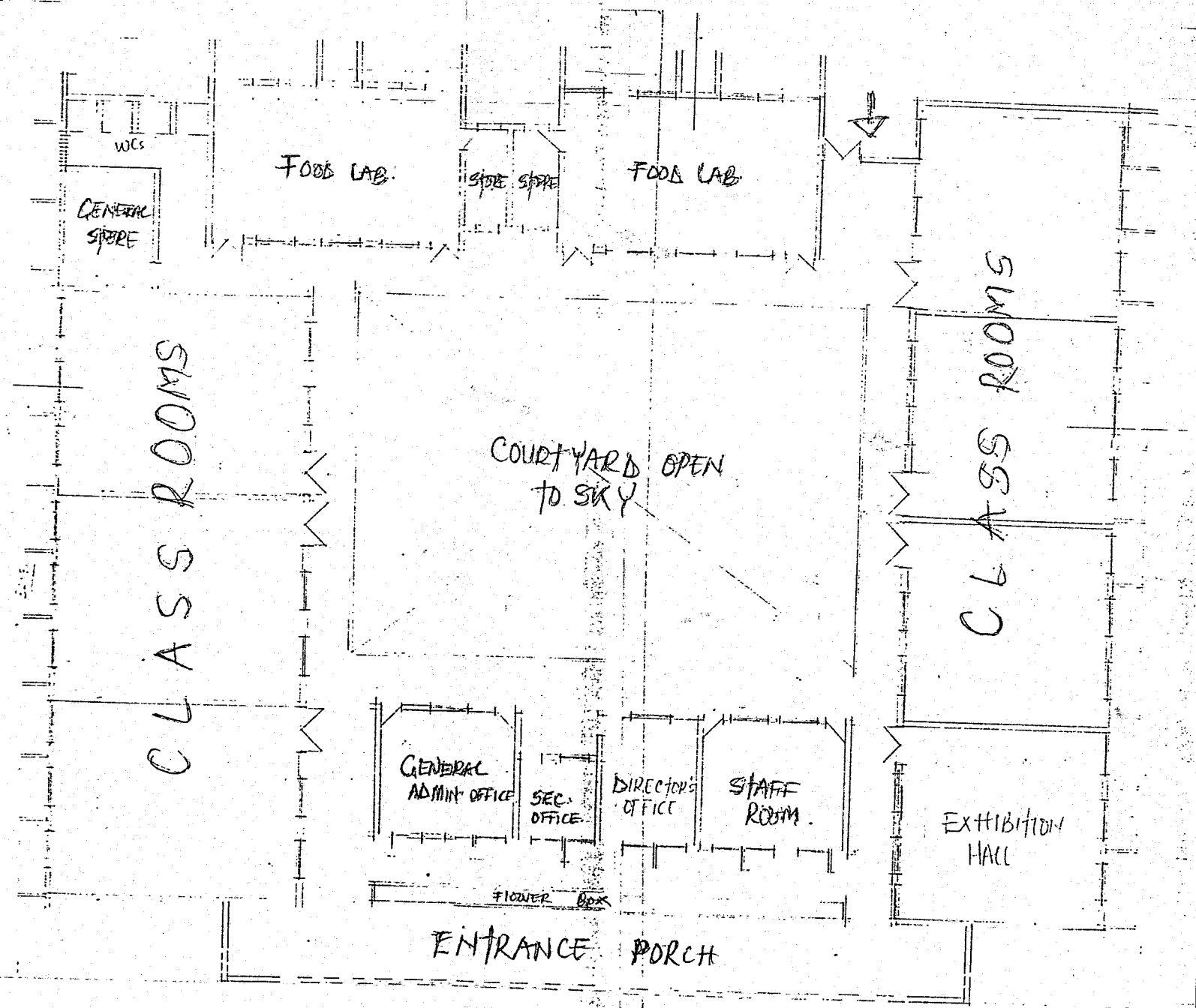
5.3 ROOF FRAMING MATERIAL

5.3.1 Timber

Trussed Raffer Rood: Trussed raffers are fabricated from stress graded timbers, accurately cut to shape and assembled and joined with steel connector plates. Much of the preparation and fabrication of these trussed raffers is mechanised, resulting in accurately cut and finished trusses that are delivered to site ready to be lifted and fixed as a roof frame.

Purline or Double Roof: A purlin is a continuous timber fixed horizontally under the roof raffers to give them support between the ridge and the tie beam. The purlin in turn is supported by means of timber struts which bear on to a load-bearing partition.

RESEARCH CENTRE		
Laboratories	3	
Offices	3	16.6
Locker room	2	12
Store	3	18
Toilet	3	1.5
Staff Quarters		
Living Room	1	37.5
Bedroom	2	24.75
Kitchen	1	9
Store	1	4
Bath/WC	2	1.8
Trainees' Hostel		
Sleeping Room	8	52
Laundry	2	19.2
Store	2	30
Common Room	1	55
WC	6	2.16
Shower	8	2.16
Office	2	10.5
Kitchen	2	40
Staff Clinic		
Reception/Card Office	1	6
Doctor's Room	2	18
Treatment & Inj. Room	1	16
Pharmacy	1	6
Ward	2	22
Surgery	1	28
Nurse's Room	1	10
Store	1	15
Toilet	3	3.6



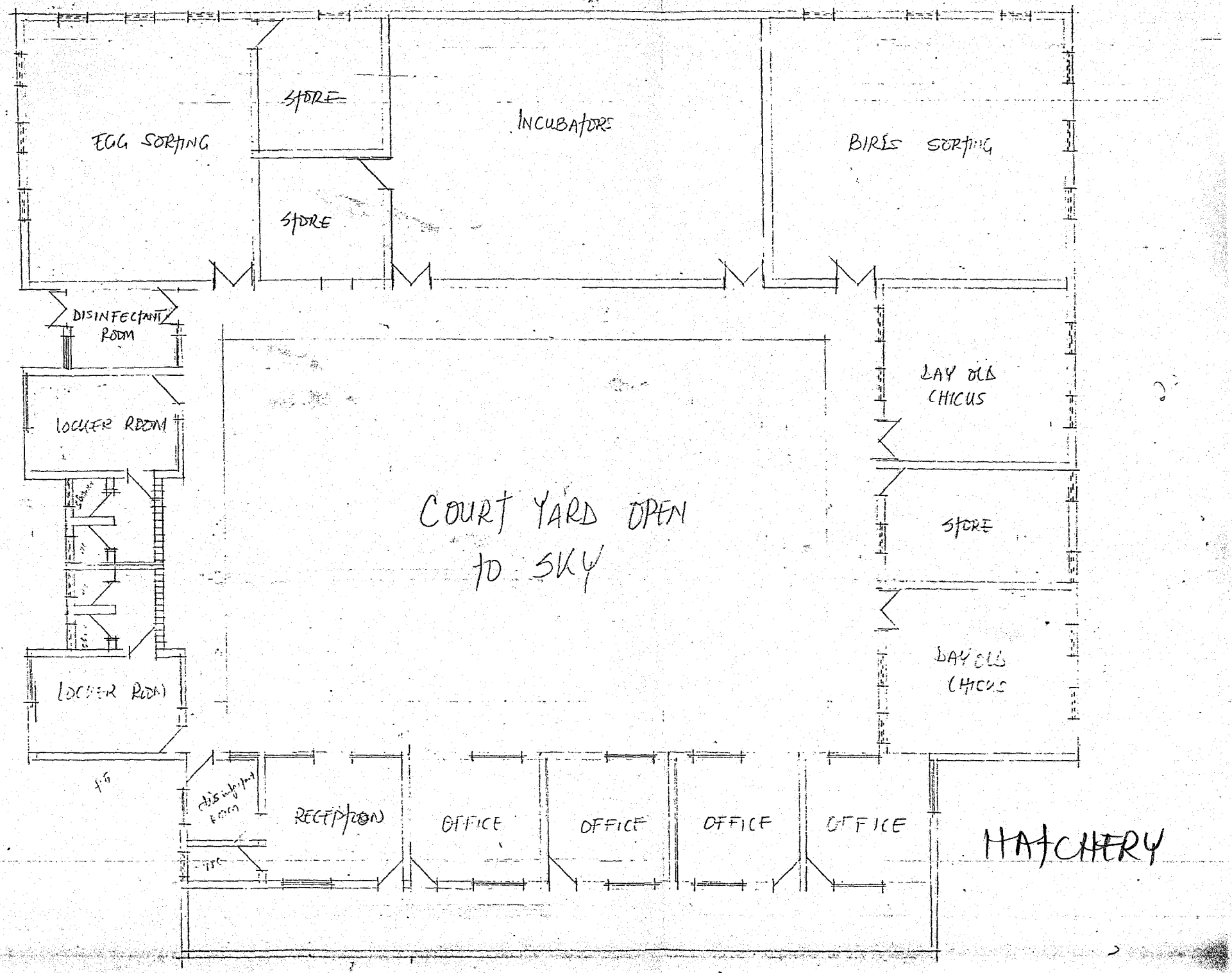
FOOD & NUTRITION CENTRE

the slop direction. This will prevent stagnant water around the cattle housing and the grazing field. The grazing field on the other hand is located such that it covers part of the stream so the animals can use it for drinking water while grazing.

Location of the fish pond was also influenced by the stream, for easy filling and draining and by the soil type along the stream bank for its water holding capacity. The scanty vegetation found on the left side of the site is responsible for siting the green houses there to ensure maximum sunlight reaching the green houses. The poultry is also located in an area of sparse vegetation so that the birds houses can be kept warm always by direct sunlight penetration. The crop farm location is also influenced by the stream for water availability.

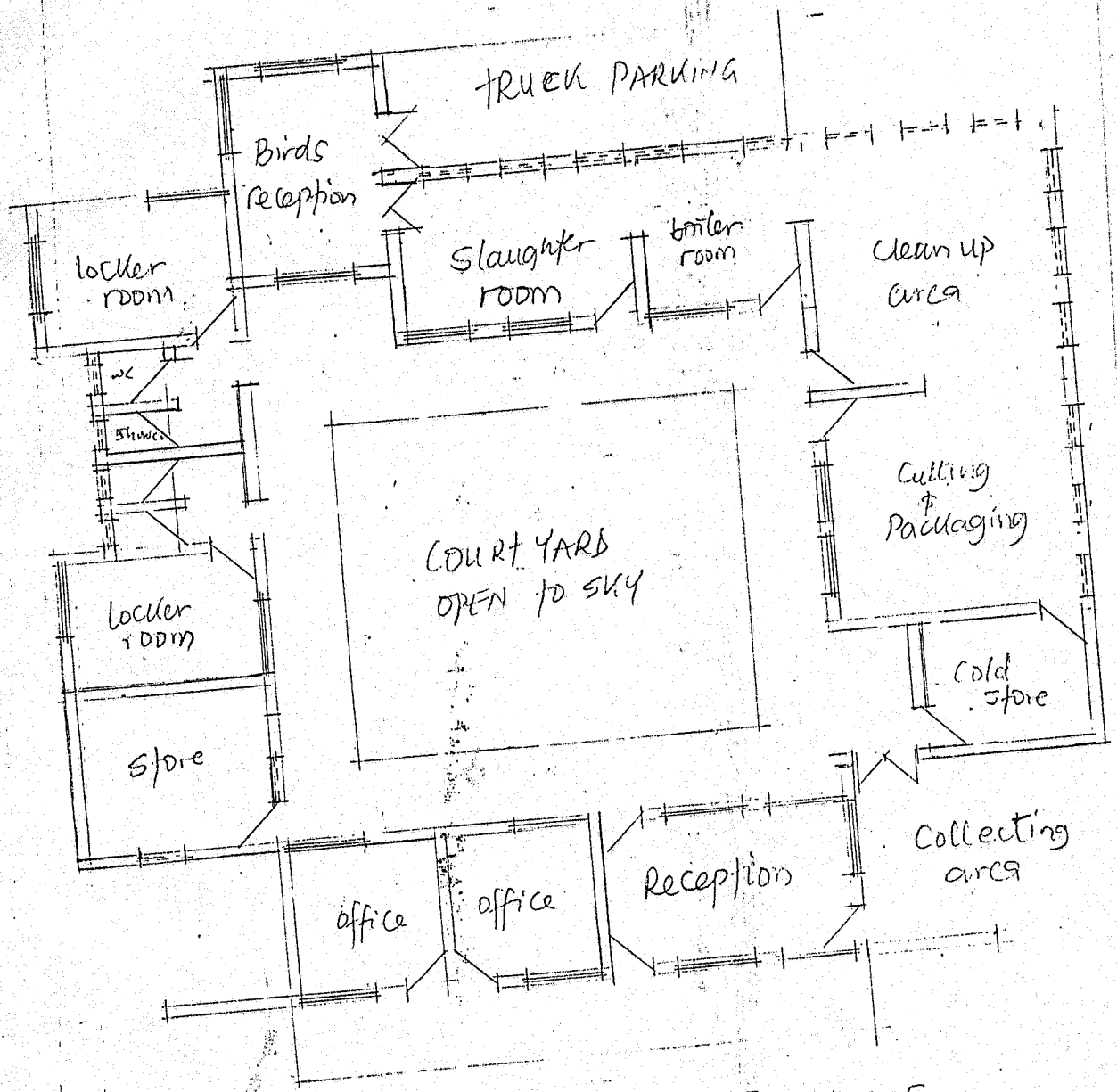
4.7 SPACE REQUIREMENT

The spaces given below are directly concerned with this project and are computable. Spaces that cannot be computed such as courtyards, approaches, entrance lobbies are not entered in the table. Such spaces will spring from the design.


EGG SORTING
STORE
STORE
INCUBATORS
BIRDS SORTING
DISINFECTANT ROOM
LOCKER ROOM
LOCKER ROOM
COURT YARD OPEN TO SKY
DAY OLD CHICKS
STORE
DAY OLD CHICKS
RECEPTION
OFFICE
OFFICE
OFFICE
OFFICE
HATCHERY

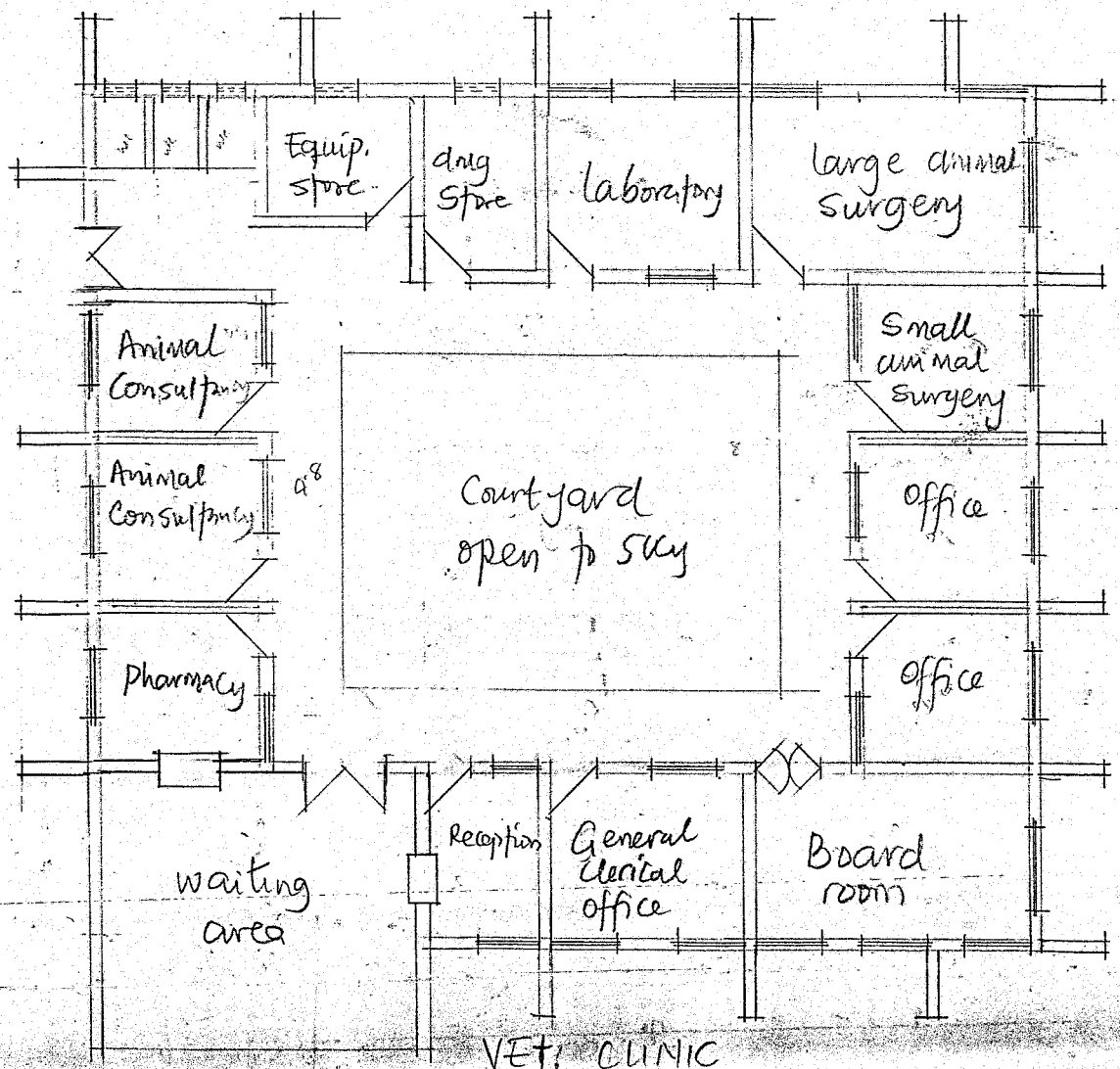
Service Yard		
Workshop	1	84
Tractor Packing	7	30
Grains Mill	2	24.5
Staff Changing	1	16
Equipment Store	2	20.25
General Store	2	50
Pit	1	24
Offices	3	7.5
Shower	2	3.6
WC	2	3.6
Grains Yard		
Nest of bins	8	9.6
Granary	8	25
Feed Store	3	30
Office	3	7.5
WC	2	1.5
Poultry		
Broiler house	9	150
Layer house	6	150
Feed Store	1	16
Office	1	9
Changing Room	1	1.8
Hatchery		
Reception	1	18
Office	4	16
Incubator Room	1	84
Birds Sorting Room	1	72
Egg Sorting Room	1	56
Disinfectant Room	2	7.5
Chick Room	2	30
Locker	2	13.5
Store	3	16
WC/Shower	5	1.8

Poultry Slaughter house		
Birds reception	1	12
Slaughter area	1	13.5
Cold Store	1	8.75
Boiler Room	1	9
Store	1	12.25
Locker Room	2	20
Office	2	9
Reception/Waiting Room	1	15
Cutting/Parking area	1	25
Cleaning area	1	25
Diary Centre		
Milking Parlour	10	2
Processing area	1	35.7
Cold Room	1	12
Laboratory	1	12
Compressor Room	1	9
Office	2	9
Locker Room	2	12
Equipment Store	2	4
Abattoir		
Slaughter Area	1	127.5
Holding ground	1	94.5
Cold Store	2	14
General Store	1	16
Office	3	12
Locker Room	1	22.5



POULTRY SLAUGHTER HOUSE

Veterinary Clinic		
Reception	1	6
Office	2	9
General Clerical Office	1	10.5
Large Animal		
Consultation Room	1	10.5
Small Animal Consul. Room	1	7.5
Surgery	2	15
Pharmacy	1	7.5
Drug Store	1	6
Equipment Store	1	6.25
Laboratory	1	10.5
WC	3	1.2


Equip. store
drug Store
laboratory
large animal surgery
Animal Consultancy
Small animal surgery
Animal Consultancy
Courtyard open to sky
office
Pharmacy
office
waiting area
Reception
General clerical office
Board room

VET. CLINIC

Units	No. of Units	Area/Unit (m^2)
ADMIN BLOCK	1	6 sq m
Reception	3	20
Executive Offices	11	16
Other offices	1	32
Board Room	1	
Store	1	2.7
W.C		
Exhibition Hall	1	80 sq m
Store	1	
RESTAURANT	1	80 sq m
Dining	1	36
Kitchen	2	7.5
Store	2	17.5
Locker Room	1	18
Servery		80 sq m
Shop		
Food & Nutrition Centre		
Classroom	6	72
Office	4	10.5
Laboratories	2	65
Exhibition hall	1	60
Store	2	12
W.C	4	1.5

Roof - Steel lattice truss, timber trusses, concrete aluminium sheet, corrugated zinc sheet.

5.1.1 Walls Materials

5.1.2 Block or Brick Walls

Walls are of two types, solid or framed. A solid wall is constructed either of blocks of bricks, burnt clay, stone or concrete laid in mortar with the blocks laid to overlap in some form of what is called bonding or as a monolith. A framed wall is constructed from a frame of small sections of timber. Concrete or metal joined together to provide strength and rigidity, over both sides of which or between the members of the frame are fixed thin panel of some material to fulfil the functional requirements of the particular wall.

5.1.3 Bricks

The word bricks is used to describe a small block of burned clay of such size that it can be conveniently held in one hand and is slightly longer than twice its width. The great majority of bricks in use today are of clay. A brick wall has very good fire resistance, is a moderately good insulator against transference of heat, does not, if well built deteriorate structurally and requires very little

CHAPTER FIVE

Materials and Construction

Materials

Construction

Services

5.0 MATERIALS AND CONSTRUCTION

This chapter deals solely with the various types of materials and construction methods to be used in the proposed complex with particular reference to the walls, floors and roofs. In some cases though, the construction methods will require the services of an agricultural Engineer or specialist to handle these areas. Example of such cases include the hatchery, the Green houses, Dairy Centre.

5.1 MATERIALS

Materials to be used in the proposed complex for the construction of walls, floors and roofs are as follows:

Walls - blocks, burnt bricks, facing bricks, perforated bricks, glazed clay tiles and concrete.

Floor - Concrete, sand/cement screed, terrazzo, clay tiles timber and rubble.

5.3.2 Steel

Steel is a material that is used in the majority of framed structures, either by itself or in combination with concrete because of its good comprehensive and tensile strength and favourable strength to weight ratio. To this day the cheapest form of structure for single-bay buildings is a frame for lattice steel trusses on columns covered with profiled steel or corrugated asbestos cement sheets. This structural frame and its coverings provides basic shelter for storage and agricultural purposes.

Lattice steel trusses are fabricated from small mild steel sections bolted, riveted or wielded together to form a triangular symmetrical pitch roof frame. The advantage of this simple, single-storey, single bay frame is economy in material by the use of small angle, tube or flat standard mild steel sections for the roof trusses that can economically be fabricated and quickly erected on comparatively slender mild steel I-section Columns fixed to concrete pad foundations.

The disadvantages of the frame are the very considerable volume of roof space inside the triangular roof frames which cannot be used for any purpose other than

housing services such as lighting and heating.

5.3.3 Roof Coverings

Flat roof covering: The materials used to cover flat roofs are built-up bitumen felt, mastic asphalt and the non-ferrous sheet metals, lead, copper zinc and aluminium.

Built up Bitumens felt roofing

This is one of the cheapest and most commonly used roof coverings for flat and shallow roof slopes. The roof covering is built-up with two or three layers of bitumen roof gilt, three layers being used for flat roofs and two for pitched roofs. The three types of base material used for bitumen roofing are fibre, asbestos and glass fibre. The material of the base being fed and impregnated with bitumen. The surface of the underlayers is finished with fine mineral granules so that the bitumen does not bond in rolls and the exposed layer are sheets in a bath of molten zinc. The zinc protects the sheet from corrosion in proportion to the thickness of the coating.

5.3.4 Profiled Steel Sheeting

The advantages of steel as a material for roof and wall sheeting are that its favourable strength-to-weight ratio and productility make it both practical and economic to use

comparatively thin-light-weight sheets that can be cold roll formed to profiles with adequate strength and stiffness for handling and to support the loads normal to roof and wall coverings. The disadvantages of steel as a sheeting material are that it suffers rapid, progressive corrosion and has neglible resistance to damage by fire.

5.3.5 Lead

Lead sheets are used for roof to a limited extent. Lead is particularly suitable for curved or irregular surfaces, for it can be stretched easily and worked to fit such surfaces without cutting. It has a high coefficient of expansion and is difficult to hold in place, particularly on pitched roofs. It has a long life and need not be painted.

Galvanized Iron and Steel

Iron and steel are galvanized by dipping clean weather protection such as in green houses and wafe houses. The fire resistivity or flamespread resistivity of most plastics is somewhat limited; therefore, most codes do not permit more than a specified area on a roof.

5.3.6 Aluminium

Aluminium sheets are available for laying on sloping roofs with standing or batten seams to provide for the relative high coefficient of expansion. Aluminium sheets are finished in various colours. Aluminium should not be used in direct contact with steel, however, because of possible galvanic action. Therefore, asphaltum paint or felt strips should be placed between aluminium sheets and steel purlus. Aluminium fasteners such as nails should be used.

5.3.7 Asbestos - Protected Metal

Asbestos - protected metal consists of sheet steel covered first with a layer of asphalt, then a layer of asbestos, and finally a heavy water proof coating. It may be obtained in flat sheets or corrugated sheets of the same size and shape as the plain corrugated sheets.

5.3.8 Asbestos - Cement Board

Corrugated sheets made of asbestos fibre and portland cement under pressure are used in the same manner as corrugated steel. This material is a good non conductor of heat, and no trouble is experience with condensation. It is durable and does not require painting.

5.3.9 Plastics

Transparent and translucent plastic sheets are used for roofing, siding or skylight installations. These plastic sheets are used in roofing and siding installations which require light as well as weather finished with a mineral particle finish.

Glass fibre felts have excellent dimensions stability, are non-absorbent and will not rot and are used for good quality roofing work. Asbestos based felts have good resistance to damage by fire, good dimensional stability and are used as a base layer for fire resistance and in good quality work for both under layers and exposed layers. The cheaper fibre based felts have low dimensional stability and are used for low cost roofing work.

REMARKS

Floors: Solid ground floors - almost all the floors of buildings in this project will be constructed as solid ground floors with hard core, oversite concrete and a damp-proof membrane. The finishes applied will however be different from unit to unit depending on the function of each unit.

Floor Finishes

Sand Cement Screed: The purpose of this is to provide a smooth level surface on which other floor finishes like linoleum or plastic finishes can be applied. This floor finish is also used in areas where resistance to wear, freedom from dust and ease of cleaning are considered.

Terrazzo: This is used because of its higher resistance to wear, durability and ease of cleaning.

Clay Floor tiles: Clay tiles are used because of its high resistance to moisture, wear, durability and ease of maintenance.

Walls: Brick and block walls - to enable the walls carry the weight of the floors and roofs, stretchers bonds will be used for all the buildings.

Cavity walls - This is used for the nest of bins and for the bulk storage of grains to give and enhance a better resistance to the penetration of rain.

Structural Steel frames - Because of the long span of buildings like the workshop, tractor parking area, poultry, general storage area and cattle shed, steel portal grames will be used. The walls of the framed buildings are non-load bearing supported by the structural frame carrying the load.

Below is a schedule of finishes for floors and walls.

Units	Material	
	Floor	Wall
ADMINISTRATIVE BLOCK		
Entrance lobby	Terrazo	Rendering
Reception & Corridors	Clay floor tiles	-do-
Offices	Terrazo	-do-
Store	Sand/Cement screed	-do-
Toilets	-do-	Clay wall tiles
Exhibition Hall	Terrazo	Rendering
Store	Sand/Cement screed	-do-
RESTAURANT		
Dining	Encuatic clay tiles	Rendering
Kitchen	Clay tiles	Clay tiles
Servery	-do-	-do-
Locker room	Sand/Cement screed	Rendering
Toilets	Clay tiles	Clay tiles
Shop	Terrazo	Rendering
Food & Nutrition Centre		
Classroom	Terrazo	Rendering
Offices	-do-	Rendering
Laboratories	Clay tiles	Rendering & Clay tiles
Store	-do-	Rendering
Toilets	-do-	Clay tiles

Units	Material	
	Floor	Wall
RESEARCH CENTRE		
Laboratories	Clay tiles	Rendering & Clay Tiles
Offices	Terrazo	Rendering
Locker Room	Sand/Cement screed	-do-
Store	-do-	-do-
Toilets	Clay	Clay Tiles
STAFF QUARTERS		
Living Room	PVC Tiles	Rendering
Bedroom	-do-	-do-
Kitchen	Clay Floor tiles	Rendering/ Clay wall tiles
Store	Sand/Cement screed	Rendering
Toilet/bath	Clay floor tiles	Rendering/Clay tiles
Entrance lobby	-do-	Rendering
Courtyard	Sand/Cement Screed	-do-
TRAINEES' HOSTEL		
Sleeping rooms	PVC tiles	Rendering
Laundry	Clay tiles	Clay wall tiles
Common Room	Clay floor tiles	Rendering
Toilet/Shower	-do-	Clay wall tiles
Store	Sand/Cement Screed	Rendering

Units	Material	
	Floor	Wall
STAFF CLINIC		
Reception	Terrazo	Rendering
Offices	-do-	-do-
Doctor´s Room	PVC tiles	-do-
Treatment Room	Clay floor tiles	Clay wall tiles
Pharmacy	-do-	-do-
Ward	-do-	Rendering
Surgery	-do-	Clay wall tiles
Nurse´s Room	PVC Tiles	Rendering
Store	Saw/Cement Screed	-do-
Toilet/Shower	Clay Floor Tiles	Clay wall tiles
SERVICE YARD		
Workshop	Terrazo	Rendering
Tractor parking	-do-	-do-
Grains Mill	-do-	-do-
Staff Changing	Sand/Cement Screed	-do-
Equipment Store	Terrazo	-do-
General Store	Sand/Cement Screed	-do-
Pit	Clay floor tiles	Clay wall tiles
Offices	Terrazo	Rendering
Shower/WC	Clay floor tiles	Clay wall tiles
GRAINS YARD		
Nest of bins	Clay floor tiles	Clay burnt bricks
Bulk storage	-do-	-do-
Feed store	Terrazo	-do-
Office	-do-	Rendering
WC	Clay floor tiles	Clay wall tiles

Units	Material	
	Floor	Wall
POULTRY		
Birds house	Concrete	Clay burnt bricks
Feed store	Terrazo	-do-
Office	-do-	Rendering
Changing Room	Sand/Cement Screed	-do-
HATCHERY		
Reception	Terrazo	Rendering
Offices	-do-	-do-
Incubator Room	-do-	-do-
Birds & Egg Sortigrm	-do-	-do-
Disinfectant room	-do-	Clay wall tiles
Chick room	-do-	-do-
Locker room	Sand/Cement Screed	Rendering
Store	-do-	-do-
WC/Shower	Clay floor tiles	Clay wall tiles
POULTRY SLAUGHTER HOUSE		
Broiler room	Terrazo	Rendering
Slaughter area	-do-	Clay wall tiles
Cold Room	Sand/Cement Screed	-do-
Store	-do-	Rendering
Locker Room	-do-	-do-
Offices	Terrazo	-do-
WC/Shower	Clay floor tiles	Clay wall tiles
DAIRY CENTRE		
Milking Parlour	Terrazo	Clay wall tiles
Processing area	Clay floor tiles	-do-
Laboratory	-do-	-do-
Compressor Room	Terrazo	Rendering
Locker Room	Sand/Cement Screed	-do-
Offices	Terrazo	-do-
Store	Sand/Cement Screed	-do-

Units	Material	
	Floor	Wall
ABATTOIR		
Slaughter area	Terrazo	Clay wall tiles
Holding ground	Concrete	-
Cold Store	Sand/Cement Screed	Clay wall tiles
General Store	-do-	Rendering
Offices	Terrazo	-do-
Locker Room	Sand/Cement Screed	-do-
WC/Shoer	Clay floor tiles	Clay wall tiles
CATTLE SHED		
Animal Rooms	Concrete	Clay burnt bricks
Feed Store	Terrazo	-do-
VETERINARY CLINIC		
Reception	Terrazo	Rendering
Offices	-do-	-do-
Animal Rooms	-do-	Clay wall tiles
Surgery	-do-	-do-
Pharmacy	-do-	-do-
Laboratory	Clay floor tiles	-do-
Store	Sand/Cement Screed	Rendering
Toilets	Clay floor tiles	Clay wall tiles

5.4 CONSTRUCTION METHODS

WALLS

Bonding: In building a wall of bricks or blocks it is usual to lay the bricks in some regular pattern so that each brick bears partly upon two or more bricks below itself. Different types of bonds are usually employed in constructing walls.

Bricks are placed in a variety of positions in a wall. If they are laid on the bed with the end exposed, they are called headers, but if they are laid with the face (long side) exposed, they are called stretchers. In stretcher bond, the bricks are laid on bed with every brick showing a stretcher on each side of the wall.

English bond consists of alternate courses of headers and stretchers. The vertical joints in the header courses aligning or breaking over each other and the vertical joints in the stretcher courses are also in line while bisecting every other brick in the header course.

In flemish bond, each course has alternate headers and stretchers; the alternate headers of each course are centred over the stretcher.

Cavity Walls

If instead of building a solid wall with the bricks of blocks bonded along the length and into the thickness of the wall, two separate skins are built with an air space or cavity between them, the result will be a wall with better resistance to the penetration of rain. The vertical stability of the two separate skins can be, and always is, improved by building metal tiles across the cavity in such a a way that the ends of the tiles are bedded in the horizontal mortar joints of each skin. By virtue of the wall ties the cavity wall is nearly as stable as a solid wall of the same thickness as the two skins.

Solid filling of Cavity at Foundation: The purpose of this is to strengthen the wall. If the wall requires additional one and half block wall at the base with a cavity wall above. The likelihood is that the solid filling represents the almost inevitable accumulation of mortar droppings rather than a purposive addition to the wall.

Cavity Wall Tiles: There are three types of metal tiles in common use - the galvanized iron twisted tile, the double triangle tile and the galvanized wire butterfly tile. The twisted iron tile has fish-tailed ends to give good bond to

mortar and is twisted in its middle so that water cannot run across it to the inner skin of the cavity walls.

Ceramic Wall Tiles

Ceramic tiles are usually set in Portland Cement mortar when used on the interior of buildings. When the tiles are set, foreign matter, loose material and oiled or soiled material are removed. This method of setting permits a wall backing surface to be horizontally evened and plumbed before installation commences. This wall finish should extend 1.8m above the floor.

FLOORS

Concrete

Concrete wearing surfaces may be an integral part of the construction beneath, or it may be added as a separate layer. If the wearing surface is placed before the base has set, a thickness of 18 - 25mm is satisfactory; but if it is placed after the base has set, the thickness should be 25 to 38mm and the surface of the base should be roughened, thoroughly cleaned and coated with cement grout just before the wearing surface is placed. This is done to secure a bond between the wearing surface and the base, but the results are uncertain.

Sand/Cement Screed

The thickness of a screed and the mix of cement and sand depends on the surface on which the screed is laid. The cement-rich mix used in a screed will shrink as it dries out and the thinner the screed the more rapidly it will dry and the more it will shrink and crack. A screed laid on a concrete base, within three hours of placing the concrete, will bond strongly to the concrete and dry slowly with the concrete so that drying, shrinkage and cracking of the screed will be minimized. For this monolithic construction of screed, a thickness of 12mm of screed will suffice.

A screed laid on a concrete base that has set and hardened should at least be 40mm thick. To provide a good bond between the screed and the concrete, the surface of the concrete should be hacked by mechanical means, cleaned and dumpened and then covered by a thin grout of water and cement before the screed is laid. With a good bond to the concrete base a separate screed at least 40mm thick will dry sufficiently slowly to avoid serious shrinkage cracking.

Terrazzo

The mortar base for laying terrazzo can be placed directly on the concrete slab and bonded to it by first

cleaning this slab, thoroughly wetting it, and applying a thin coat of neat cement broomed into the surface for a short distance ahead of placing the mortar base. The mortar base is struck off at least 18mm below the finished floor level. Metal or plastic dividing strips are inserted in the mortar base before it hardens, in position which will control the cracking and conform to the design or pattern desired. The top of dividing strips should extend at least 7mm above the finished floor level so that they can be ground down flush with the floor surface when the terrazzo is being ground.

After the mortar base has hardened enough to stand rolling, the terrazzo mixture should be placed to the level of the tops of the dividing strips and struck off. It should be roled in both directions to a secure a thorough compacting.

After the terrazzo has hardened sufficiently to hold the aggregates firmly, it should be ground by hand or with a grinding machine, the floor being kept wet during the process. The material ground off should be removed by flushing with water. Any airholes or other defects should be filled with thin cement paste spread over the surface and

worked in. After the paste has hardened for at least 72 hours, the floor surface should receive its final grinding. it should be kept continuously wet for at least 10 days, scrubbed clean with warm water and soft soap, and mopped dry.

Clay Floor Tiles

Clay floor tiles is laid on a solid base of concrete. To accommodate relative movements between the concrete base, the screed and the tiles, it is good practice to bed the tiles over a separating layer, on a thick bed or on a thin bed adhesive. Where clay tiles are firmly bonded to the concrete or screed; there is a likelihood of differential movement between the base and the tiles causing tiles to arch or ridge upwards so causing failure to the floor. Tiles should therefore be bedded in such a way as to accommodate possible movement.

Wood Strip Flooring

Strips of hardwood or softwood of good quality, specially selected so as to be particularly free of knots, are prepared in widths of 90mm or less and 19mm, 21mm or 28mm in thickness. The type of wood chosen is one which is thought to have an attractive nature colour and decorative

grin. The edges of the strip are cut so that one edge is grooved and the and the other edge tongued, so that when they are put together the tongue on one fits lightly into the groove in its neighbour.

There is always some tendency for wood strips to twist out of flat, due to the wood drying out and to resist this the strips have to be securely nailed to wood battens which are secured to the concrete floor either by means of galvanized metal floor clips or in a cement and sand screed.

Raised Timber Ground Floors

A raised timber ground floor is constructed as a timber platform of boards nailed across the timber bearing on 1/2B walls raised directly off the site concrete. The raised timber floor is formed inside the external walls and internal brickwork partitions, and is supported on brick sleeper walls.

Sleeper walls are 1/2B thick and are built directly off the site concrete up to 1.8mm apart. These sleeper walls are generally built at least three courses of bricks high and sometimes as high as 600mm high. The walls are built honey-combed to allow free circulation of air below the floor. A d.p.c. should be spread and bedded on top of the sleeper

walls to prevent any moisture rising through the site concrete and sleeper walls to the timber floor.

Reinforce Concrete Upper floors

Reinforced concrete floors have a better resistance to damage by fire and can safely support greater super-imposed loads than timber floors of similar depth.

A monolithic reinforced concrete floor is one unbroken solid mass of between 100 and 300mm thick cast in-situ and reinforced with mild steel reinforcing bars. To support the concrete while it is still wet and plastic, and for seven days after it has been placed, temporary centering has to e used.

ROOF

Reinforced Concrete Roofs

All types of reinforced concrete construction described for floors can equally well be used for roofs and the details of construction and advantages of each apply also to their use for flat roofs. The loads on roofs are usually somewhat less than those of floors and the thickness of a concrete roof will usually be less than that of a floor of similar span. The concrete of monolithic reinforced concrete roof, and the constructional concrete topping of the other

three types of concrete roof, is usually finished off level. If the surface is to be laid to a slight slope or fall the concrete roof will be finished with a screed of cement and sand as described for concrete floors, with the top surface of the screed finished to the falls required. The lest thickness of screed will be from 20mm to 25mm.

A reinforce concrete roof provides poor insulation against loss or gains heat, therefore some material which is a good thermal insulator should be incorporated in the construction of the roof or a light weight concrete slab construction be used. The materials used to cover flat roofs are built up bitumen felt, mastic asphalt and the non-ferrous sheet metals. On flat roofs bitumen felt roofing should be laid to a shallow fall of at least 1:80 to encourage runoff of rainwater.

The method of application and fixing built-up bitumen felt roofing depends on the nature of the roof surface to which it is to be applied. The felt is laid across the roof with 50mm side lap and 75mm end lap between sheets.

Concrete Screed Finish

Cement screeds and particularly lightweight aggregate screeds on concrete roofs take time to thoroughly dry out

and may absorb rainwater so that it is likely that some water will be trapped in the screed once bitumen felt covering has been applied. The heat of the sun will then cause this water to apprise and the vapour pressure will cause the felt roofing to blister, crack and let in water. To relieve this water vapour pressure, it is practical to use a venting layer of felt on wet screeded roofs. This perforated layer of felt is laid dry on the screed and the three layers of felt are then bonded to it. Enough of the bitumen used to bond the first under layer to the venting layer runs through the venting layer to bond it to the screed. The venting layer allows water vapour to be released through vapour pressure releases at abutments and verges of the roof.

TIMBER ROOF

Trussed Rafters

Trussed rafter is assembled and connector plates are machine pressed across the junction of abutting members of the frame to form a strong rigid joint. The trussed rafters are erected and nailed to a timber wall plate bedded on the external walls, at centres to suit the roof covering. As the rafters are trussed three is no need for a ridge board or

intermediate support between supporting walls. The eaves of the roof may be finished with a flush eaves or an open or boarded projecting eaves in the traditional pitched roof construction.

Purlin or Double Roof

Another way of constructing pitched roofs with spans from 4.5 to 7.5m was to form a purlin roof. Purlins support the raffers mid-way between the ridge and eaves and they are supported by struts at intervals of about 1.8m along their length. The size of the purlins depends on the weight of the roof and their unsupported length between struts. With struts not more than 1.8m apart a 125mm deep by 50mm thick purlin is used for most raffers.

Timber Trusses

A strongly constructed purlin roof depends for support on loadbearing partitions conveniently placed and these partition often restrict freedom in planning the rooms of a building. A method of constructing pitched roofs so as to avoid the use of struts to support purlins, and loadbearing partitions to support the struts, is to use timber trusses. The timber trusses span between external wall and are spaced about 1.8m apart and they serve to support purlins which in

turn support the roof raffers. The timber of the trusses are bottled together and to make the connections rigid galvanized iron timber connectors are bolted between each two timbers at connections. The strength of the trusses derives mainly from the rigidity of the connections.

To reduce the quantity of timbers used the ceiling raffers are given support by means of hangers and binders. The hangers are nailed to the purlins and to these are nailed horizontal binders to which the ceiling joints are nailed or secured with metal plates.

STEEL

Lattice Truss Construction

Steel columns support the roof trusses that are spaced at from 3m to 5m apart with steel purlins fixed across the trusses to support roof sheeting and steel sheeting rails fixed to columns to support wall sheeting. The bolted, fixed to columns to the concrete foundation bases provides sufficient strength and stability against wind pressure on the side walls and roof, and wind bracing provides stability against wind pressure on the end walls and gable end of the roof.

For natural lighting a part of the roof may be covered

with glass or profiled clear or translucant plastic sheets which are fixed in the slopes of the roof to provide a reasonable penetration of light to the working surface in the building. As an alternative to steel columns to support the roof trusses, brick side walls may be used for single bay buildings to provide support for the roof frames, protection against wind and rain and solid resistance to damage by knocks.

The most economical span for symmetrical pitch roof trusses is up to about 12m and the most economical spacing of trusses and columns for economy in purlin and sheeting rail section, is from 3m to 5m.

Portal Frames

A portal frame is distinguished by the rigid connection of the raffers to the posts of the frame so that under load moments are distributed through the raffer and the post.

Short-span portal frames may be fabricated off site as one frame. Medium span portal frames are generally fabricated in two halve for ease of transport and assembled on site with bolted connections of the raffer at the ridge, with high strength friction grip bolts.

Many medium and long-span steel portal frames have the

connection of the rafters to the posts, at the knee, launched to make the connection deeper than the main rafter section for additional stiffness. Steel portal frames may be fixed to either fixed or pinned bases to foundation. For short-span portal frames, where there is comparatively little spread at the knee or haunch, a fixed base is sometimes used. A pinned base is made by securing the base plate, welded to the foot of the portal post, to the foundation with two holding down bolts, either cast or set into the concrete pad foundation. This pinned base allows some flexure of the post in relation to the foundation and is the simplest an most commonly used base for steel portal frames.

Gutters and Downspouts

Rain water that falls on a roof may run off and drip from projecting eaves, but usually it is necessary or desirable to collect the water in gutters placed along lower eaves. The water is carried in the gutters to vertical pipes called downspouts. Flat roofs or other roofs not having projecting eaves are drained by down-spouts placed at joints where the water is carried by the slight slope provided in the roof. The size of the gutters is determined

by the contributing area and by the intensity of rainfall.

Conductors or downspouts should be provided with strainers at their upper end so that debris cannot clog them. Exposed downspouts are commonly made of copper and galvanized steel. Copper, cast iron and steel pipe are used for concealed or interior conductors or where appearance is not a factor.

Parapet Walls

External walls of buildings are raised above the level of the roof as parapet walls for the sake of the appearance of the building as a whole. Parapet walls are exposed on all faces to driving rain, wind and frost and are much more liable to damage than external walls below eaves level.

Because parapet walls are freestanding, it is generally accepted that they should not be built above roof level higher than six times the least thickness of the parapet wall for the sake of stability. The top surface of a parapet wall is exposed directly to rain and to prevent water saturating the wall it is essential that it should be covered or capped with some non-absorbent material.

Parapet Wall d.p.c (damp proof course)

It is good practice to build a continuous horizontal

d.p.c. into brick parapet walls at the junction of the roof covering upstand or skirting with the wall. Bitumen felt and asphalt covering a flat roof is turned up against the parapet as a skirting 150mm high.

5.5 THE SERVICES

The site location of this project calls for the need for a proper analysis of the services. Such services include

Water supply

Drainage system

Electricity supply

Water Supply - The main source of water supply to the complex shall be through boreholes, wells and the stream that runs across the site. Boreholes would be sunk to provide good drinking water for the complex. Wells would also be sunk at necessary places for additional water supply to places not benefitting from the boreholes. The stream shall be of use to the animals during grazing and the crop farms for irrigation purposes.

Drainage

Roof Drainage- Rainwater running off sloped and flat roofs is collected by parapet gutters and discharged by pipes to drainage channels constructed around buildings. The rain

water pipes are such that they go directly inside the drainage channels to a depth of about 150mm. This is to avoid rain water splashing from the pipe directly to the ground and causing adjacent walls to be damp.

Surface Water Drainage - Paved areas are laid to gradients or falls towards channels that collect surface water and discharge through small channels to major drainage channels which in turn discharge into the stream.

Every building in the complex is well equipped with drainage channels to collect both surface water and water discharged from rain water pipes. All service roads are also equipped with drainage channels to avoid water logged roads.

Electricity Supply - Provision is made for a generator house to supply light to the entire complex.

CHAPTER SIX

General Appraisal of Project and Conclusion

Project Appraisal

Conclusion

Recommendations

Bibliography

6.1 PROJECT APPRAISAL

As an Architectural student, my contribution to the development of Agriculture in Nigeria is in the provision of infrastructural resources. Because of the important role played by infrastructures in agriculture, I decided to bring into focus how architecture can contribute to agricultural development. A combination of factors such as the right technology, education, research and other supporting facilities in our rural areas will go a long way in improving peasant agriculture in Nigeria.

The proposed Integrated Agricultural Complex took into cognisance facilities such as educational buildings, ancillary buildings, trial farms, staff quarters, agricultural facilities etc.

The first step taken in executing this project was to

find out the situation of rural farmers and their problems. After this, I went on to the State Ministry of Agric. and Natural Resources to also find out their problems and prospects concerning rural farmers. A detailed examination of these problems gave rise to the project topic - "Integral Agricultural Complex" for the rural farmer.

The project topic gave the project a direction. The next thing was data collection. Case studies of related agricultural facilities were taken and the problems of each case study noted. Some of these case studies are Barc Farms, Jos; Dan Farms Minna; Keita Integrated Development Project etc. The merits and demerits of these case studies helped in the determination of things like the project site, facilities needed and scope of project, location of facilities on site and the relationship of these facilities to one another.

A suitable site was chosen and analysed. The site analysis influenced to a great extent, the location of facilities on site. For instance, the slope of the site determined location of the livestock farm; the stream determined location of the grazing field, fish farm and crop farm. The scanty vegetation of the site also determined

location of the poultry farm and off-season farm (green houses).

The concept of this project - The isolated state concept of Von Thiinen influenced the choice of an appropriate site. To ensure a functional layout and control movement on site, the facilities provided were zoned into public, semi-public and private zones. Areas of intensive agricultural practices were located far away from the public whereas areas of less intensive agricultural practices like the fish farm, research project farm and poultry were located in the semi-public zone to act as a transition zone between the public and the area of intensive agricultural zone. The public zone consist of the admin block, shop, restaurant, exhibition hall, green houses, classroom, housing units, clinic and games area. Livestock and crop farms make up the private zone.

This was very necessary in order to avoid waste of land or overcrowding of facilities. Lastly, after space requirement, I had to study and specify materials and construction methods to be used for all the units. The nature of this complex and its location called for an analysis of services like water supply, drainage system and

electricity. These services were also properly explained in the project.

In conclusion, the wide scope of the project made it almost impossible to design all the facilities in detail. Spaces were however allocated to all the facilities and more time was spent on the layout. For some facilities to be properly designed and constructed, the services of an agricultural Engineer will however be needed to handle these areas. Example of such facilities include the hatchery, the corral system, green houses and dairy centre.

6.2 CONCLUSION

In the course of executing this project, I have come to discover how much role architecture has got to play in the planning and designing of infrastructures for the development of agriculture in Nigeria with particular reference to our rural areas.

However, experience has shown that the most effective way of both alleviating poverty and promoting overall economic growth is to raise the productivity of peasant farmers. One way of doing so is by providing an environment which permits more sustained attendance and concentration for training purposes. The suitable and more comfortable

classrooms provided in this project will ensure proper regular training of farmers as well as extension workers. The workshop provided help in mechanical training, production of simple locally made tools for farming, repairs and operation of farm machines. The food and nutrition centre will help the training of rural women on child care, domestic science, vegetable production, nutritional value and content of food produced on farm and other related courses.

The research farm is provided for research trials for trainees to try on new methods learnt so that they will have the assurance to try these methods on their individual farms with fear of failure.

The ancillary facilities provided will promote development and sustainability of the complex as well as act as incentive to staff and trainees.

In conclusion I would like to say that in as much as this project is meant to be a proto-type complex, no single prescription will be suitable for all rural societies. A careful understanding of existing rural institutions and local culture is needed in planning and designing a functional agricultural community. Much importance is

however to be attached to the provision of training, research and agricultural facilities if the desired goal is to be achieved.

6.3 RECOMMENDATION

To make this project complete, I would like to make some recommendations to the authorities concerned with the planning and monitoring of agricultural development in Nigeria.

The first recommendation I would like to make is in form of an appeal to the Government of Niger State to give this project a trial by providing the initial fund necessary to make this project a reality. It is my strong belief that this project will help improve to a greater extent, the quality of peasant agriculture in the State.

Secondly, peasant agriculture is often said to be characterized by inertia. Recent evidence however, suggests that the apparent inertia is simply the result of a lack of alternatives. If there's nothing better to change to, there is little or no point changing. Bearing this in mind I would like to call on the government to pump more money into researching into the problems of our rural farmers in order to boost their production.

Because of the large number of rural - urban migration of our young school leavers, the peasant farmers remaining in our rural areas are old and consequently not very productive. If the government will give this project a trial and take up a campaign session on how interesting farming can be with such a training, our young school leavers can be inspired to stay in the villages and take up farming as a means of livelihood.

Training in this complex should be made free for all, so that every member of a rural community have equal right to be trained. Funds can be generated to sustain the complex through sales of agricultural produce and assistance from the government.

Lastly if this complex is to function properly, one cannot ignore the need for a well organized administration. The government should therefore see to it that whatever body is going to take up the project is well organized and ready to give its best. Extension workers should also be given the opportunity of an in-service training to help increase and broaden their farming experiences and technical knowledge.

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