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Royal Norwegian Ministry of Foreign Affairs
on behalf of
African National Congress (SA)
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DEVELOPMEN
CENTRE,
DAKAWA
TANZANIA
DEVELOPMENT PLAN
-k Land Use Plan
-k Development Control Plan
VOLUME 1
Oslo Norway. Sept. 1984
NORPLAN A/S CAB

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Royal Norwegian Ministry of Foreign Affairs
African National Congress (SA)
DAKAWA, DEVELOPMENT CENTRE
rDevelopment Plan
DRAFT FINAL REPORT
VOLUME 1
Oslo, Norway
1984.09.20
PREPARED BY:
A . CONSULHNGENGWEERS.ARCHWECIS _
N O RPLAN /S MANAGEMENT CONSULYANTS 2; ECONOMI; 1 s
Bygdzy And) 5 Oslo 2. Norway - Tel. (4 7 2x 56 56 90/5 T!:v.,_19361 n

PREAMBLE

During 1983 it was agreed that a new community for about 5.000 persons should be developed for the African National Congress (ANC) on abandonned farm land at Dakawa, about 55 kilometres north of Morogoro in central Tanzania. Later in the same year NORPLAN A/s, Consulting Engineers, Architects and Economists were commissioned to prepare development plans for this new community, to prepare the necessary maps and to initiate a groundwater exploration progamme. Work by NORPLAN on preparing the plan started in November 1983.

It should be noted that African National Congress technical and administrative staff from Mazimbu have made substantial contributions to the planning work. These contributions have taken the form of reports, working papers and technical notes (see Technical References immediately following the list of contents) prepared by ANC staff, advice given to NORPLAN and discussions between ANC and NORPLAN. In particular, ANC staff have been responsible for the development of physical standards, for forecasts of population build-up and for definitions of the main elements of the Plan. ANC’s contributions axe acknowledged at the appropriate points in the text.

During the course of the planning work visits have been made to Oslo by Mr. Spencer Hodgson, Architect-Planner, and Mr. Finn Flensted Nielsen, Farm Manager, to assist the NORPLAN team in the planning work.

A preiiminary Status Report was submitted in two volumes. by NORPLAN to ANC on 9 March 1984. This Report set out the main elements of a Land Use Development Plan and some preliminary thoughts on the economic activities proposed and on a programme of construction and development. The Report was based on Visits to Dakawa by NORPLAN civil engineers, an architect/planner and an agricultural expert. Since March more work has been carried out on the communtity’s development plan and building types and these have been approved in principle by ANC technical advisers. There is therefore agreement on the broad principles behind Dakawa’s future development pattern. In addition the NORPLAN Agricultural Expert has had the chance to examine the site during and after the rainy season, and to prepare more detailed recommendations and specifications. Since March NORPLAN has also held consultations with forestry experts in order to draw up preliminary plans for the development of a tree-planting programme. Further work has also been carried out on . developing a plan for industrial and economic act1v1ty and on preparing proposals for establishing av local municipai administration for Dakawa.

The present report therefore represents an up-dating and an expansion of the Status Report. It represents the most current thinking on the development of Dakawa and contains the plans and proposals which have been agreed with the technical advisers of the African National Congress. This Report is submitted in September 1984. A draft of the report was submitted to ANC in early September 1984 and thoroughly discussed and thereafter amended accordingly. The Report is submitted in three volumes. The first volume describes the main elements of the Land Use Plan. The second volume consists of a series of 6 appendices on various aspects of the Plan including administration, economic activity and a land use schedule. The third volume contains the principal drawings i.e. land use plans for the community, master plans for infrastructure and model layouts for the main centre area, primary school and villages.

Oslo, Norway
1984.09.20

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1.2
INTRODUCTION

Background to_The Projegt

The purpose of the Report which follows is to set out Norplan’s proposals for the deveiopment of the Dakawa site as a new community. As presented here, Dakawa will develop as a complete community of about 800 houses and 5.000 population with related agriculture, industry, services and infrastructure over the next 5-10 years.

In July 1983 Ardhi presented a plan proposal for the development of Dakawa. In October 1983 Norplan A/S of Oslo, Norway, were contracted to carry this initial work further. The company was requested to prepare a Development Plan at scale 1:5000, sketch designs for villages at scale 1:1000 and a written report setting out the detailed proposals. These were to be completed by February 1984.

Work began in November 1983 on preliminary field reconnaissance and consultations with ANC staff were completed early in January 1984.

During the planning work ANC have worked continuously to provide NORPLAN with background data and with policy guidance. ANC has provided guidance on the main elements of a development programme and has worked out details of certain buildings/institutions. Papers and drawings on the Development Centre, the vocational training centre, the student orientation centre etc. have been prepared by ANC and incorporated into the plan by NORPLAN.

The proposals and plans presented in this Report have been discussed with ANC staff in December 1983, January, March and May 1984 in Dakawa and Morogoro in Oslo in June 1984. The physical development plans and housing types presented have been discussed with ANC’s project architect, Mr. Spencer Hodgson in 0510 in June 1984.

Project Objectives at Work Programme

The principal objectives of the Development Plan for Dakawa which is presented in this Preliminary Report are as follows:

- Preparation of a physical development plan for the Dakawa site at scale 1:5000 scale to accomodate about 5000 persons requiring re-settlement.

1.3
- Preparation of overall community infrastructure plan at scale 1:5.000 showing road access, internal roads, water sources, supply distribution and disposal, sewage disposal, solid waste arrangements, domestic and industrial electrical supply systems etc.
- Preparation of designs for the villages and the town centre at scale 1:1.000.
- Preparation of forecasts on population, employment and economic activity.

These objectives have been achieved with the active assistance and co-opertaion of African National Congress techincal staff who have been of great value to the Consultant.

In the course of the planning work it has become very clear that a primary purpose of the Plan is to specify generally recognised standards of material/ construction and performance etc. ANC can then use these standards in order to specify materials, equipment etc. for Dakawa which meets the specific needs of the community, and not the needs of a particular manufacturer/prodUEEr. This important issue is explained more fully in Chapter 3.1 below.

The work on the preparation of the various plans and this Report has been undertaken between November 1983 and June 1984 with visits to Dakawa by an Architect/ Planner, an Agricultural Specialist and a Roads Engineer, as well as the Project Leader. Mr. Tore Johnsen. As proposed in the Status Report of March 1984 further work on the agricultural proposals has now been undertaken with visits to Dakawa after the rain period by NORPLAN’S agricultural expert and with a visit to Oslo by ANC’s Farm Manager for Mazimbu who has been able to offer NORPLAN useful practical advice.

The Layout of This Report

The present chaptex, Chapter 1, introduces the reader to the project. Chapter 2 describes the piesent situation at Dakawa in particular the main physical characteristics of the site. The Report in Chapter 3 goes on to set out the principal plannin criteria and standards for the main elements of t e plan. Chapter 4 gives a brief written description of the Settlement Development Plan, describing the main elements for which land is to be allocated. This is

supported by Appendix 6 #Land Use Schedule- in Volume 2. Infrastructure proposals for roads, water supply, sewerage, refuse disposal, electricity at telecommunications are described in Chapter 5. Chapter 0 describes the consultant’s proposals for agricultural development at Dakawa. These will be reviewed from time to time. The preposals for population and social standards for housing, education and employment are set out in Chapter 7. Volume 2 sets out in more detail proposals on possible industrial products for Dakawa, proposed "project packages" for the financing of first phase development at Dakawa, and a detailed Land Use Schedule for Dakawa.

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2.2
THE PRESENT SITUATION

Physical Chagacteristics

The area allocated to the African National Congress for the development of a new community at Dakawa covers an area of about 2.800 hectares (i.e. 28 square kilometres). It is roughly 4 kilometres by 7 kilometres in extent. The area is known locally as Dakawa and lies about 55 kilometres northwest of Morogoro, adjoining the new main road linking Morogoro and Dodoma.

The site lies in the gently undulating plan of the upper Wami River, about 800 metres above sea level. The gradient on the site is between 0,4% and 0,5% and it drains towards the south-east. On the north-east the site is bounded by the Wami Prison Farm. On the north and north-east are a number of farms, some of which have been abandonned. On the west the site is bounded by the Mbigili Sisal Estate, and on the south by Mabana Village. It should be noted that much of the site is formerly agricultural farming land which is therefore fertile and well suited for farming.

The pattern of rainfall at Dakawa is unreliab1e so that domestic water supply has been derived almost exclusively from groundwater sources. Groundwater occurs at various depths because of the variation in sedimentation and the distribution of sand and clay deposits. Dakawa is located in the Mkata-Wami Basin. Most of the local viliages are underlain by loams and clays which are not water-bearing. These sediments are flood plain deposits of the former Mkundi River. The Magole River which passes through the Dakawa area is perennial. This river is a potential water supply source. The Mkundi and Magole Rivers existed as separate rivers up to 1978-79, when the Mkundi River was captured by the Magole River just downstream of the Morogoro-Dodoma highway.

geological and Hydrological Congitions

Our understanding of the hydrogeologicai conditions at the Dakawa site is based on following reports we have received:

- Sections from "Morogoro Domestic Water Supply Plan Report" of August 1980 worked out by the Netherland Consultants DHV.
- "Study for Domestic Water Supply and Irrigation Purposes, ANC Dakawa" by Dip1.ing. Rudolf Hupfei of 16 February 1983.
- "Swedish Report" unpublished, undated (during 1983) and on a preliminary draft level.

2.2.1
2.2.2
Geologx
The Dakawa site is located within the Wami River basin. The River Wami flows in a north easterly direction. The basin has a width of 20-25 km and is limited by a system of near parallel rock faults. One fault is close to the Wami river. A second fault system consists of a double fault system which lies about 20-25 kilometres north-west of the river Wami. The zone within the double fault has a width of 1-2 km. The bedrock within this double faulted zone is located about 100 m deeper than within the rest of the basin. The bedrock within the basin represents a downthrow in relation to the surroundings, depths to bedrock within the main parts of the basin are in the range of 50-60 m. The basin is filled with sediments, most of them finegrained. Coarser sediments are found in the river bed of Wami and near the area of the double fault. ’
A number of smaller. not perennial, rivers run in south easterly direction from higher areas outside the double fault and merge into the Wami. Somewhat coarser materials are found around such rivers, as Magole and the now non-existing Mkundi River.
It is not clear if the sediments in the basin are deposits from rivers or from lakes. It is not possible to say if lenses or veins of coarser materials exist, representing potential aquifers. Information from talks with local people indicate the existence of coarser materials, aquifers, at a depth of 20 to 30 m in the Magole River plain just north at the ANC area.
The possible existence of aquifers in the Magole River plain within the ANC area should be investigated. The most promising investigation method would be a combination of different types of geoelectrical investigations possibly followed up by some drilling.
deroloqx
The balance between precipitation and evaporation in the area is very close to zero. The groundwater level varies 2-4 m over the year, probably indicating that the recharging of the groundwater is supported mainly from sources outside the area, however the reports studied do not give sufficient information to evaluate a groundwater budget (infiltration-potentials, permeability. connection between aquifers, safe yield etc.) in the area.
Some shallow wells exist in the area. The Wami River is perennial.

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Chemical and Geophxsical Investigations
The groundwater taken from wells in the area shows varying degree of salinity, some wells in the area having been abandonned due to increasing salinity.
The interpretation of geoelectrical investigations of the type VES (Vertical Electrical Sounding) is difficult due to varying salinity in the groundwater with depth, laterally and over time.
In some places fresh water resources seem to be located above saline groundwaters.
Generally the distance between geoelectrical investigations is 2 km or more.
Water Resource ProsEects
The safest and probably best source of quality water will be from infiltration wells in the river bed of Wami river. However the distance from such wells to the ANC-farm is about 10 km and the height difference from the river to the farm is 40-50 m.
For other groundwater sources to be developed some essential points should be considered due to the facts mentioned on hydrological balance and on groundwater salinity.
If wells are developed in the basin, care should be taken to control the groundwater level with time, and to control the salinity. In particulai measures should be taken to avoid complete exhaustion of fresh water resources which lie above saline water deposits - such fresh water will normally be depleted very fast.
From previous investigations there are indications of an aquifer of coarse materials reaching shallow to medium depths around the river Magole. A possibility may exist to establish a subsurface dam in order to raise the groundwater levei upstream of this threshold and thus to produce a larger groundwater reservoir than presently existing.
In the area north of Magole-Dumila a swampy area has existed. This swamp which previously fed the Mkundi River, was drained when the Dodoma highway was built. The area is now feeding Magole River.
Rainfall and evaporation are almost in balance within the area.

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The Wami and Magole Rivers are the only known perennial rivers near the ANC-area. Wami River will give a safe source of domestic water utilized by infiltration wells near the river bank and by pumping to the area.
The groundwater in the area is mainly of saline character, and many wells have been abandonned. When drawing fresh water, the danger exists that saline water from below will replace the fresh water. In developing groundwater within the area, it will be essential to control groundwater levels and salinity over time. Previous investigations have been performed at very irregular intervals.
Investigations should be undertaken to verify the possibility of developing and aquifer consisting of suitable materials around the river bed of Magole. The development could be the construction of a subsurface dam near the downstream border of the ANC-area.
Drainage
The SW part of the site drains towards Magole river. The central region of the site receives drainage water from several large and small drainage areas to the NW, N and NE. Two of these are particularily large. Drainage water often floods the SE portion of the central region. Vegetable material carried from other portions by the drainage water has been deposited in this area and formed thick deposits of vegetable soils.
Climate
The following observations on temperature are derived from information from the Building Research Unit in Dar-es-Salaam, dated 1981 which is used in the design of buildings in Tanzania.
TemBerature
As regards Day Comfort, day temperatures may exceed those of coastal Tropical and Intermediate Tropical Zones. The annual mean maximum temperature is from 270C ti 310C. Exposure to direct sunlight causes discomfort most of the day and people will seek shade during the hottest hours. Staying inside a climatically adapted house will reduce radiation and offer more relief. During the cool months of June, July and August, annual mean minimum temperature is from 150C to 190C.

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Comfort conditions at night vary considerably within the year. During the hot season nights can be cold and chilly. However, indoor heating seems not to be required.
Rainfall has been recorded at between 1100 mm and 1400 mm per annum.
DeveloBment Areas
Since it was first settled in 1982, the population at Dakawa has been fluid and varied considerably from time to time. Thus far, the majority of the population has consisted of students at the Student Orientation Centre, as these are best suited to the early "pioneer" life. There are 4 other small settlements including a reception centre for new arrivals. To facilitate the work, a programme has been drawn up for all and whilst agriculture has started in a small way, the entire population has been engaged in digging the 5 km trench needed for the temporary water supply.
The majority of people are housed in tents and a few in existing structures. Pit latrines have been erected, water is transported and cooking at the 5 residential areas is done on wood fires. Every effort is being made to improve the quality of life. For example a small library has been set up in one of the tents. Classes under the trees are being hold both at the Orientation Centre and at the Residence for returned students.
The development centre is planned to accomodate approximately 5.000 people engaged primarily in agriculture, small industries, handcrafts, education, maintenance and other supporting activities.
Because of the need for great flexibility in the growth rate of the centre and other factors, the population will be decentralised in Villages of about 300-360 people, who, once settled, will be able to consolidate themselves as a close-knit, well organised community. Apart from housing, each village will contain administration offices, common rooms, supplies distribution, sport fields and equipment storage for communal work.

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2.6

Agriculture
CroE Husbandrx
Presently vegetables and maize are under cultivation on a small scale. Both exhibit high potential. Crops could also be produced on plots adjacent to inhabited areas. Crops such as sunflower, sorghum, legumes, maize, sweet potatoes and cotton have been recommended from preliminary analyses. The amount of crops which can be produced at the moment is limitied by the state of land drainage. No major agricultural effort can take place until better land drainage is organised. This is explained in detail in Chapter 6 of this Report.
Animal Husbandry
No cattle rearing or animal husbandry has been started yet on the Dakawa site since this will have to await the completion of the Agricultural Centre. This is elaborated in Chapter 6. In the meantime difficulties have been experienced with nomadic Masai cattle herders using the Dakawa site for grazing. There is therefore an urgent need for fencing of the whole site and the development of grazing paddocks. This is discussed later in the Report.
Pogulatiqn
The eventual future population of Dakawa Development Centre is impossible to predict with any accuracy since it will depend on Circumstances peculiar to the African National Congress as a liberation movement. It is expected that the existing ANC population at SOMAFCO, Mazimbu and Morogoro will level off at about 2.500 persons. However a minimum of 5.000 persons is being planned for at Dakawa Development Centre to accomodate refugees and others. Over the next five years, it is expected that the population will grow by between 300 and 500 per year in terms of new arrivals. Thereafter the population is expected to grow to around 5.000 within 10 years (by 1994) through new arrivals and through the natural increase in the population already established there. It should be noted that the existing populatibn of the Magole Ward in which Dakawa lies was 16.386 at the last Census in 1978.

Dakawa Development Centre is not to be regarded as a traditional refugee camp where the inhabitants are to be engaged only in simple agricultural tasks and crop cultivation. It is to be viewed as a fully developing society with integrated agricultural and industrial production activities. The African National Congress plans to develop multipurpose projects involving training and production which depend on a high degree of mobility amongst trainees both within Tanzania and outside. This means that account has to be taken of ANC’s community development goals as well as Dakawa’s straightforward land-carrying capacity.

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PLANNING CRITERIA

Preligagx

This Chapter sets out the main planning criteria on which a Development Plan for Dakawa has been based. These criteria have originally been developed by ANC technical staff. on the basis of experience at Mazimbu and on the known needs and wishes of the future community at Dakawa. In addition the criteria have been derived from studies of other reports and plans (the Ardhi Plan and other field investigations). The main physical planning criteria which follow were therefore originally developed by ANC and subsequently modified or extended where necessary by NORPLAN.

ANC in the development of Dakawa. Henceforth the criteria for purchasing goods or services for the Dakawa Development will be whether there is a documented and specified need for the goods or services. It is thus ANC’s intention to put as many as possible of its purchase contracts to competitive tender on the basis of Clear technical specifications. It has been noted in the past that, in a country like Tanzanial with few internal resources of its own, there has been too much uncritical acceptance of outside assistance (without any consideration for the quality of or the need for that assistance). This has resulted at times in the squandering of resources and the "dumping" of industrial goods from developed countries. ANC will thus insist that suppliers provide goods and services in accordance with detailed technical specifications worked out by ANC or its consultants, and not on the availability of the suppliers’ product.

The Inhabitants

The Dakawa centre will accommodate approximately 5.000 people when it is established. The inhabitants will be of different ages and professional backgrounds. The ANC representatives suggest the Dakawa centre population will consist of:

	Children without Barents	Children with Barents	Total
Creche	150	150	300
Nursery	300	300	600
Lower primary	200	200	400
Higher primary	200	200	400
Secondarx	400	400	800
	1250	1250	2500
Village adults/working people			2400
Vocational Training Centre (VTC)			200
Student Orientation Centre (SOC)			250
Total inhabitants at Dakawa centre			5350

3.3 Educational Needs

This section sets out the principal educational needs for primary, secondary and vocational training at Dakawa.

3.3.1 Primarx Schools

As indicated in section 3.2 above, approximately 800 primary school children will require primary school facilities when the Development Centre is completed in 10 years time. However the build up of primary school students is likely to be as follows:

Year 1: 50 children
Year 5: 350 children
Year 8: 600 children
Year 10: (1994) 800 children

It is therefore recommended that two primary schools to accomodate 400 children each are conmstructed at Dakawa. The first school should be started on in 1985 and completed by 1988. The second should start construction in Year 6 i.e. 1990.

3.3.2 Secondarx Schools

One secondary school to accommodate 800 pupils should be constructed. This.shou1d be ready to accommodate pupils from Year 5 i.e. 1989. In the interim arrangements should be made to introduce an expandable building system which allows the development of indvidual classrooms, to meet the growing pOpulation of secondary school children between 1985 and 1989.

3.3.3
3.3.4
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The Vocational Training Centre

A vocational training centre is being established to train 220 students and is capable of expansion to 300 students. This project is seen as a priority towards promoting the construction and other skills needed to develop Dakawa. The VTC will contain classrooms and workshops for construction, carpentry, plumbing, electrical work, mechanics, auto mechanics, leather work, tailoring etc. The details of the brief for the Vocational Training Centre so far, have been worked out by the African National Congress technical staff.

A sketch scheme including a site plan and detailed sketches for the buildings in phase 1 have been prepared. These include the administration block, a classroom block, a dormitory block and an ablution block. Overall standards are generally reduced in comparison with Mazimbu with no provision for covered connecting verandahs, 6 students sharing a bedroom with one common room for each 54 students. Total dormitory floor area is 3,5 m2 per student compared to 7 m2 per student in Mazimbu. It is intended to adopt this standard for all dormitory accomodation at Dakawa. These drawings have been used by the ILO as a basis for seeking tenders from prefab suppliers and final plans will be modified according to the system chosen.

The Student Orientation Centre

Students arriving from South Aflica need a period of assessment (6-12 months) before they can be placed at secondary school or at the VTC. During this period they receive upgrading classes to ensure that when they start school at the beginning of a new academic year, or in the second term, they are fully equiped to cope. The students are assisted to overcome the traumatic effects of sudden uprooting, in particular by receiving introductory classes in the history of the liberation struggle.

The orientation centre will need to accommodate an initial student population of 150 and must be capable of future expansion.

A sketch plan for the student orientation centre has been prepared as the development and expansion of this project is an obvious priority. The proposal envisages a total of 168 students and expansion to 252 students is possible. A detailed brief for the centre have been developed by ANC technical staff in co-operation w1th NORPLAN.

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The Adult Pogulation
Section 3.2 above indicates that the total available adult workforce at Dakawa, when the Development Centre is fully developed after 10 years, will be in the region of 2.400 persons. It is not practical that all of these will join the formal workforce as at least will be mothers of small children who will not have time to work in industry, agriculture or the services. If we assume that approximately 400 individuals (neaily all women) will not participate in the workforce at any one time, then it is apparent that 1.200 men and 800 women will require employment. Later in this Report it is estimated that about 300 jobs can be provided within agriculture, about 1.000 can be provided in service industry and that a further 700 jobs will have to be provided in productive industry and construction to provide the total of 2.000 jobs necessary to occupy the available adult population when the Development Centre reaches its full population of 5.000 persons. The sections which follow describe the different elements of the Development Plan.
Agricultural Production
It is depended to base agricultural production on an Agricultural Centre whose components and functions are described in detail in Chapter 4.13 of this Report. The Centre will require the following manpower:
- Crop Production: 15-30 persons, up to 70 during the season
- Vegetable/fruit production: 30-40 persons, up to 150 during the season
- Animal production: 15-30 persons
- Dairy/abbatoir: 15-25 persons
- Workshop: 10-15 persons
- Agricultural administration: 10 persons

This gives about 150 full time positions with up to 300 or 350 during harvesting seasons.
Sport ang_gga1th Facilities
Detailed proposals for sports and health facilities have not yet been worked out and specifications will be prepared in connection with the detailed planning of the separate Villages and Village Centres.

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Cultural and Graphics Centre
ANC is firmly committed to the promotion of all forms of cultural expression. Music and dance, the performing and graphic arts, writing etc serve to enhance the quality of life. At Dakawa it has an important role to play and the centre will include:
- library
- small theatre, with stage, lighting facilities and change rooms
- studio for graphic artists and sculptors
- silk screen workshop
- photographic dark room
- facilities for film editing
- handicraft workshops

Rehabilitation Centre
The centre is intended for the social rehabilitation of people suffering from the effects of torture, alcohol and drug related problems. It should accommodate 60-100 people and include workshops for occupational therapy. It should be situated in a quiet area.
More detailed plans and specifications have been prepared for the Centre in a separate study by ANC technical staff, and this will be the basis for further work on the project.
Religious Facilities
The disposition and character of religious activity at Dakawa will be left to private initiatives.
A suitable site for a cemetery has been located and provision has been made for it on the plans.
The Communitx Administration
A central administration complex will be sited centrally at Dakawa. This will provide complete administrative facilities for the construction and operation of Dakawa. Preliminary proposals for establishing a local municipal administrations at Dakawa are set out in Appendix 1 to Volume 2 of this Report. These proposals have still to be considered by the ANC representatives dealing with Dakawa. However the main elements of the Community Administration Complex will be:

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- Offices
- Stores
- Clinics capable of expansion to a health centre
- Administration/management training centre

The SUEElX Centre

The purpose of the Supply Centre is to provide wholesale and retail distribution services of all goods, especially foodstuffs required by the inhabitants of Dakawa. This must be situated in a central location and will require good road access.

Industrial Development

It is estimated in section 3.4 above on the Adult Population that about 2.000 persons will require full-time employment when development is completed at Dakawa. Some 300 will be employed in agriculture, 1.000 in service trades and 700 in industry. A primary task will therefore be to provide some 700 industrial jobs as soon as possible.

Industry is already established at Mazimbu and ANC cadres can generally provide a high level of different industrial skills, e.g. construction, manufacturing, mechanical, electrical worK and metalwork.

It has therefore been agreed that Dakawa’s industrial development will have to begin with the construction sector. It is estimated that between 500 and 600 persons will be living on the Dakawa site by the end of 1984. Some will be involved in infrastructure work i.e. roads construction, water supply, land drainage, some will be involved in simple preparatory agricultural and forestry planting work and some will be involved in simple industrial tasks i.e. carpentry, brick-making and block-casting.

Industry will therefore start with construction-related activity based on local materials of sand, clay and any available metals. The first industries are therefore likely to be the following:

- Building elements in wooa (panels, rafters, joists, wooden beams etc.)
- Wooden doors, windows, framing etc.
- Concrete blocks
- Floor tiles
- Wooden knock down furniture
- Simple metalwork/casting etc.

All these products should have a ready market in Dakawa and elsewhere in Tanzania. It is estimated that such industry could provide 500 more or less permanent industrial jobs for the iesidents of Dakawa by the time development is completed.

In their most recent discussions ANC representatives and NORPLAN have agreed that there is considerable potential for more sophisticated industriai development once the construction related industries have been considerede by ANC and NORPLAN:

- Leather products, shoes and clothes
- Weaving of clothes and materials
- Clay tiles
- Ceramic products/crockery/utensils
- Glass and stoneware
- Wooden furniture, tables, chairs etc.
- Soap production
- Canning of agricultural products: jam, pickles, fruit, jiuce etc.
- Metai products, galvanising workshop/smelting oven
- Mechanical workshop for equipment maintenance
- Workshop for building ironmongery
- Mechanical workshop for all-purpose welding
- Galvanising yard/foundry: smelting scrap iron
- Fibre glass production for piping and agricultural equipment: biological toilets

NORPLAN have already discussed the establishment of a factory to produce polyester piping and tanks for agricultural and domestic purposes. The range of products are storeage tanks, piping, kitchen sinks, storage bins and septic tanks and solar cookers. One large Norwegian manufacturer has been approached for technical assistance and possible investment participation.

In addition NORPLAN has investigated the possibility of establishiong a furniture factory at Dakawa and their initial findings are set out in Appendix 2 to Volume 2 of this Report.

It should be emphasised that industrial development at Dakawa must be permitted to expand in accordance with the available skills amongst the population. Clear limitations should be placed on industry as far as noise, smoke, dust and toxic fumes are concerned.

Other industrial products (in the longer term) which have been considered for Dakawa are as follows:

- Biotoilets
- Solar Water heaters/solar air conditioners
- Solar cookers
- Manual agricultural equipment, ploughs/trailers/ barrows etc.

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Energx Potentials
Wood fuel is the most common source of energy used in the Dakawa area today. However this source is getting scarcer and scarcer and people have to travel further and further every day to collect it. Wood fuel is also a very inefficient form of energy.
There seem to be several energy potentials for Dakawa. Electricity from the national TANESCO grid is one possibility which seems practical, although negotiations are not complete. The use of diesel generators is very common on relatively remote sites like Dakawa. However, one shouid bear in mind the difficulties involved in supplying diesel oil. The same problem occurs with petroieum products.
Other non-conventional sources of energy, although still at the experimental stage, may be worth trying at Dakawa. These should include the use of methane bio-gas made in a bio-gas generator from animal manure, the use of various solar collectors to generate solar heating, and the use of wind-power in various forms. Windmills are working well in Shnyanga to the north of Dakawa.
Initial investigations have been made on the development of the so-cailed "energy forest" to be planted at Dakawa so as to provide fast-growing fuelwood plantations for the Local population. This is described in more detail in Chapter 6 of this Report.
The Villages
Village Txges
On the basis of earlier work cariied out by ANC’s Technical Department, on the plan by the Ardhi Institute, and on the identification of agricultural land by the Agricultural Department, plans for proposed land use have been drawn up at scale 1:5.000. In addition model layouts for basic village types have been drawn up at scale 1:1.000. These are shown in Volume 3.
The ANC representatives assum each village wiil have about 300-360 inhabitants occupying approximately 80 houses. According to the proposed Norplan layout of the area villages are grouped together in twos with a distance of about 300-500 metres between them.

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Progosed House Txge

Whilst prefabrication is being considered for much of the housing, a sketch proposal has been prepared by ANC technical staff for a conventional 3 bedroomed house. This house type has been subsequently modified by NORPLAN in consultation with ANC. The plan, which could be adapted to prefabrication later, is similar to the Mazimbu duplex house, although the total area has been reduced fiom 95 m2 to 61 m2 so as to reduce costs. Such a house can be used as single or married accomodation.

Inter-Village Centre

General

Apart from housing each group of villages will contain an intervillage centre with a village hall, simple sport facilities, tuckshop etc. The capacity of the village hall should not be constructed to fullfil the maximum need for all inhabitants, but say 200 people approx. Expensive sport facilities like a football field, swimming pool, tennis court etc. should be centralised. Norplan has been requested to work out a plan for the intervillage centres, including the cost of such centres. In all 5 centres are needed to cover the 10 villages.

Workshops and TransEort

The motor vehicle maintenance workshop, the transport administration and car park, the fire station and a petrol station will be placed centrally.

Infrastructure

Priority is being given to the provision of electricity, roads and water supply, in accordance with discussions held between ANC and Norplan.

Water SUEElX

Water supply for irrigation purposes will be handled separately, both regards to quality and capacity. Potable water should With respect to quality at least comply to WHO International Standard for drinking water. It is assumed that water for cattle should meet the same standard requirement. Subsequently tap water should, if available in sufficient quantities, be used also for feeding cattles.

The basic water requirements are to be calculated aseu-ing that conventional water toilets are in use. giving a per capita demand of 135 l/pers. day.
In addition to regular supply the reticulation system should have a fire fighting capacity of 10 1/8.
Water storage will have to be provided taking into account the long and sensitive supply system.
The storage system should cover the following requirements:
- Emergency storage, 12 hrs. max day consumption
- Fire fighting storage, 10 1/3 for 2 hrs.
- Equallizing storage, 25% of daily consumption

In addition to the main emergency storage the storage volume should be distributed over the consumption centres to avoid excessive pressure variations and subsequent disruptions in supply.

3.17.2 Sewerage

Because of the flat terrain, it will not be possible to have a single sewage system. Depending on the quality of the soil at the various project sites, it may be possible to employ septic tanks and soak pita. However. this will require detailed on the spot tests and where it is not possible we will have to consider other alternatives including biological and pit toilets.

3.17.3 Electxicitx

Electric power will be the main energy for Dakawa. When assessing the power demand the following shall be assumed:
- Hot water heating for residentlal use by SOlar water heaters.
- All thermal energy demand at the Agricultural Centre and related industrial schemes covered by biogas. charcoal and wood chips.

For planning purposes the gross estimated electric power demand will be in the range of 2.000 kVA, calculated as peak demand. The net, or average demand figure will be substantially lower, but above fi ure will be used when deciding total installed at ect.

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Discussion with TANESCO, the Tanzanian company responsible for a public electricity supply show that they can supply up to 500 KVA from the public supply to Dakawa. Thereafter Dakawa must supply its own power from diesel sets or from a bioenergy source. The general energy supply situation fox Dakawa is being investigated at the time of writing, and is discussed in more detail in Chapter 5 beiow.
TANESCO has however indicated that for power in excess of 500 KVA ANC will have to build a 55 km transmission line from Morogoro. This would not be economically feasible for ANC alone, but may be acceptable in combination with other potential users.
Telecgggghigation
The Dakawa settlement wiii when fuiiy developed, be a modern, highly complex society. For efficient operation adequate teiecommunication systems Wiil have to be installed both for external and on-site communications.
The exteggai connection shOUid in the future be by a minimum of 10 lines connected to the TPTC network, as well as telex.
The immediate situation is that lines are not available, and the local exchange ought to be connected to the TPTC radiocail system, as weii as having installed a short wave radio connection allowing communication with SOMAFCO and the ANC office in Dar-es-Salaam.
The local exchange should have connections to switchboards, or single telephones at the following locations with proposed switchboards capacities.
- Village Clusters, each 10 lines
- Student’s Orientation Centre, 5 "
- Agricultural Centre, 5 "
- Main Administration Centre, 10 "
- Supply Centre, 5 "
- Transport and Workshop Centre, i0 "
- Health Centre, 5 "
- Cultural Centre, 5 "
- Secondary School, 5 "
- Vocational Training Centre, 5 "
- Primary Schools, east and west, each 3 "
- Rehabilitation Centre, 3 "

Sub-distribution of lines from the local switchboards will be a matter of detailed allocation.

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Agricultuggl Centre
Genergl
This project will contain a farm machinery yard, crop storage and feed mixing station, administration and research centre and will guide all agricultural activities at Dakawa. These activities will include crop production (maize, beans, sorghum, sunflower, rice, soyabeans etc.), livestock (cattle, goats, sheep, pigs, chickens, ducks, rabbits, bees and possibly fish), horticulture (fruit and vegetables). The centre will also be utilized in the practical training of agricultural students.
ConstructignL Rlenning_and Progresg
A sketch plan for the agricultural centre has been prepared as the development and expansion of this project will haVe a high priority. It is suggested that the centre W111 require approx 10 ha of land. A possible expansion of the area is included in the plan.
Of the different units first priority will be given to the building of the office block, workshop and garage for tractors, machinery and tOOlb, storage fOl fertilizer seed and agricultural chemicals. A second phase of the building programme will be stoxage facilities like siloes and a feed mixing house. The third step will include buildings for dairy cattle, pigsty, poultry and a slaughter house. Adjacent to these buildings a place for storage of manure has to be constructed including a bio-gas plant.
With land being available, it seems the planting of en energy forest will be feasible. The boundaries of available land on the west side of Magola river will have to be established. Further samples for analysing the soil characteristics will have to be carried out to allow determination of the species of trees most likely to give the highest yield.
A nursery for producing seedlings for an energy forest, fox hedge planting, for fruit trees and shade trees should be established immediately. Excellent facilities for the raising of seed ex1st at ANC Mazimbu. About 20.000 plants should be raised for the energy forest and a fu1ther 20.000 tor the fruit and shade L 1 cos .

It should also be mentioned that a soil sampling programme has been worked out for the whole ANC land in Dakawa. Altogether 24 samples will be taken. Arrangement for analysing the samples has been agreed upon with the University of Dar es Salaam, Faculty of Agriculture in Morogoro. The ANC is responsibie fox this exercise. Norplan provided necessary chemicals for the analysis and soil sampling equipment.
If ground water is found in Al, it should also be utilised for ranching purposes.

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THE SETTLEMENT DEVELOPMENT PLAN

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4’4 LEGEND: -,Village Cluster t-Short
MIDSupply/Transport EEducation
Main Centre
General
The above figure illustrates the principle of land use and the location of main centre and the residential areas.
The road network consists of the main road starting from the trunk road Morogoro/Dodoma in the NE corner of the land. It sets off in a curve to the south reaching the middle of the area where the road goes in West direction for a few kilometers. Then it turns in a curve to the NW. Access to villages, Student Orientation Centre, Rehabilitation Centre etc., will be on secondary roads from the main one. Close to the main road is the Central Administration Centre, Children and Schooling Centre, Centre for Cultural and handicraft, Vocational Training Centre and the Agricultural Centre. The main road will be of high standard, 7 metre wide with footpath on both sides. Roads in the villages will be of a lower standard, 3 metre wide and no footpath.
Villages
As stated elsewhere in this Report, development at Dakawa will be based on a settlement pattern whereby population is grouped in 10 distinct Villages. These Villages will be clustered in groups of two to create 5 clusters in all.
Each village will consist of approximately 80 to 100 houses, recreational facilities, community facilities and an industrial area. Clusters of two villages will share nursery school, creche and sports facilities.

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4.2.3

The Residential Areas

The optimum number of houses per village is put at between 80 and 100 houses, based on modules of about 16 houses in each local neighbourhood. Housing will either be detached or semi-detached, and individual plot sizes will be around 400 m2.

About 80 da. is allocated to each residential village which will include about 10 da. space f01 recreation, playing field and meeting rooms. A further 40 da. is allocated to industiial space for each village.

The Village Centre

The Village Centre will measure about 100 metres by 100 metres and will contain simple local sports facilites (basketball/volleyball/soccer), and a meeting hall for the inhabitants of the village. The meeting hall will incorporate a Supply Centre.

Infrastructure

Each village will be carefully landscaped and surrounded by greenbelts. planted where feasible with fruittrees (see suggestions for fruit in Chapter 6). Green areas will be communally maintained by the Dakawa Agricultural Department.

Each village cluster will contain an elevated water storage tank, and each house will have an individual water connection. Septic tanks with soak pits will be used where possible, otherwise pit latrines or biological toilets will be used. An electric transformer will be provided in the industrial area for each village cluster.

It should also be noted that the community will require a telephone service, and it is proposed that each Village is equipped with at least 3 telephones.

The Inter-Village Centre

As villages will be clustered in twos, two villages will share an Inter-Village Centre. This will contain a creche and a nursery school for children under the age of 5 and these are designed to encourage participation by all people in the local community. Otherwise the Inter Village Centre will contain space for sports facilities or gardens.

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Schgpling and Education
Creches anq_NurseEy Schools
The Dakawa Development Centre will accomodate some 300 childeren in creches and 000 in nursery schools. There will be five creches (one in each Inter-Village Centre) each of which Will accomodate up to 60 children. There will be five nursery schools each of which will be able to accomodate up to l20 children.
Primary Schools
Two primary schools will be built at Dakawa, and eacn will accomodate 400 pupils between the ages of 6 and 15. The western primary schOOl will serve children from Villages l, 2, 3, 4, 9 and 10 whilst the eastern primary school will serve Villages 5, b, 7 and b.
Secondarx School/Vocational Training Centre
Dakawa Development Centre will have one secondary school and one vocational training centre, and these will share a site in the central area of the community to the south of the main spine road. The school and the centre will make joint use of facilities like dormitories, housing, parking and dining halls etc. The secondary school will be designed to accomodate 800 pupils whilst the Vocational Training Centre will accomodate 200-300 pupils.
Student Orientation Centre
After discussion it has been agreed that the Student Orientation Centre be located on a relatively remote site on the north-western boundary. It has an important function in assisting in introducing newcomers to community life at Dakawa and will be used to assist students for the first SlX months after they have arrived at Dakawa.
The Rehabilitation Centre
This is referred to in Chapter 3.8 above. Because of the need for rehabilitation it is allocated a relatively quiet and isolated site on the south side of the community.

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The Central Sgort Area

The African National Congress attaches comelderable importance to sports activities, in particular, athletics and soccer. A stadium of international standard is therefore proposed for all sports, and primarily football and athletics. A 25 metre swimming pool is proposed as part of the complex. In addition allowance is made for a full-size soccer field together with a number of smaller playing fields designed for informal ball games.

Health and Public Services

These will be sited centrally and will include the following elements:

Health Centre " in and out patients
Maternity Clinic
Public Administration bu1lding
Library
Post Office

Provision is made for these in the cential area to the north of the main spine road.

The Cultural and Graghics Centre

This will be situated adjoining the Health Centre and will provide faCllities for exhibitions, cinema, theatre, library, public mass meetings and smallscale handicraft production, sale and demonstratiOH.

Central Administration Area

This will consist of offices for the central municipal administration of the new community, storage warehouses (with refrigeration where appropriate), a supply centre where whole-sale and retail goods are bought and sold and a bakery. The supply centre should adjoin an industrial area. The area will include a police station.

Trade and Small Industry

Most trade- and small industry will be located within the villages and not in a central location.

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Workshog and TransEort Centre
This will include the f011owing:
- Public Works Department for repair and
maintenance of all public property.
- Petrol filling station
- Fire Station
- Bus/transport station
Cemeterz
A site of about 40 da. is allocated on the south side
of Dakawa for a cemetery.
The Agrigg1tural Centge
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LEGEND
AG-CENTRE:
1.Phase
Chapter
The purpose of the Agricultural Centre is to provide
all services, equipment and facillties for a
diversified crop and animal husbandry agriculture
operated on a completely communal basis.

The general lay-out is given in above figure and the different components of the Centre are described in detail below. They have been worked out by NORPLAN'S Agricultural Expert after two visits to Dakawa and Mazimbu, and after thorough consultations with ANC'S Farm Manager at Mazimbu. The Agricultural Centre's design reflects the agricultural plans set out in Chapter 6 below. Figure 4.1 gives a functional lay-out proposed for the AGC.

4.13.1 Administration Building

The Administration building will have offices for the Farm Manager, accountant and secretaries. The offices will require a telephone and toilet facilities.

4.13.2 Workshog for Tractors, Trucks and Farg_gachinegx and Welding Workehogs

This will be used both for the repair and maintenance of all vehicles, but will also incorporate facilites for welding which can be used for other functions on the Dakawa site. The Workshop will be equipped with two greasing bays, office for the workshop manager, toilets and bathroom, store room for spare parts, tools, oil and lubricant. Adjacent to the Workshop a filling station for petrol diesel and kerosene will be built. '

4.13.3 Garage for Tractors, Agricultural Machinerx and Heagx Dutx Egulgnent

It is expected that the f01lowing items/equipment will be required for Dakawa's agriculture at full development. Provision must therefore be made to accommodate these in one garage building:

- 6 tractors at 100 HP
- 9 tractors from 50-75 HP
- 2 bU11dozers (for bushclearing)
- 4 pairs tractor hoes for weeding
- 3 silage highlift trailers
- l grader
- 4 plough; (6 part disc ploughs)
- 6-8 high capacity planting machines (because of short season)
- 4 combine harvesters

high capacity 12 metre wide Sprayers
mobile water tank (2.000 litre capacity)
harrows (6 metre. wide)
trailers (6-8 tonne capacity)
manual threshing machine
hay press baling machine
I
Precimraw

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4.13.5
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- 4-5 knapsack Sprayers for berries
- 2 precision sowing machines for vegetable sowing
- 2 grass/silage harvesters
- 3 fertiliser machine
- 2 fencing machines
- Minor tools e.g. spades, rakes, forks etc
- 650 m2 parking area

Most of the equipment stored in the garage will be heavy duty for robust large scale farming use.

Stores for Fertiliser, Chemicals and Seed

The capacity of the store will be for about 400 tonnes of fertiliser, seed and chemicals. The store should also incorporate an area for hay and straw storage. The fertiliser store should be open and can be used for corn drying. This should be separated from a closed chemical and seed store which should be locked for security reasons. These stores must be dry and rat and insect proof. The store should also include facilities and equipment for fumigation.

A small area, say 25 m2, should be set aside as a cool room fitted with air-conditioning for the storage of vitamins, minerals, certain seeds, chemicals and medicines which require special temperature conditions.

Grain Produce Storage

The major grain to be stored here will be maize and a silo of about 1.500 tonnes capacity will be needed and will be kept free from humidity, rats and insects.

529d Mixing Centre

A feed mixing centre must be built next to the grain siloes. Concentrates will be prepared here for feed for cattle, pigs and poultry. The Centre should also include a maize/grain mill for flour production for hunon consumption, milling equipment, a seeu oil press and facilities for seed cake production.

Supplementary feeding materials may have to be provided for the ranching areas for the drier periods of the year.

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Handlin Storin Facilities for Cro s and Ve etables

A building will be required for the post-harvest handling of crops and vegetables e.g. threshing, shelling, cleaning, packing and other forms of processing. Products will first be sorted, graded, cleaned and then packed for further distribution. Some products will then be frozen, cooled or stored under controlled conditions. Some products Will be distributed fresh to the ANC Development Centre. Other products will be sold locally in fresh condition.

Dairxing Facilities

Dakawa is expected to have 2.500 children when fully developed. 80 that all children can have at least 0,5 litres milk per day, a dairy for 200 cattle has to be built (assuming milk production per cow of 2.500 litres per annum). The dairy will need a milking release system at storage tanks where milk can be kept at a temperature of t 40C for some time. The dairy will need an office, toilet and bathroom.

The Pigstx

This will be dev1ded into two; a unit for 100 sow with young and a feeding house for 600 piglets. The feeding house will have an annual capaCity of 1.800 animals (600 animals three times a year). The pigstry should have simple offices, toilet and washroom.

Poultrx House

This will be devided into two separate units. a poultry house for egg production and a building for broiler production. To meet the egg requirements at Dakawa, about 5.000 egg layers will be required and these will need about 1.000 m2 of free range space. Annual meat production from broilers will be about 35.000 kg which will require about 10.000 broilers with 5 feeding periods a year. The unit should produce its own chickens for egg and broiler production. Incubators and other minor equipment will be needed. The Poultry House will have an office, an area for handling and packing eggs, a store room for eggs at temperature 3-500 and a toilet/washroom. This assumes a death rate of 10% and a loss of 30% on the dressed weight of 1.500 grams due to the removal of bone, fat and other unused tissue.

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Storage of Manure and Biogas Production
Until detailed policy has been clarified, no recommandation are necessary at these point.
Slaughter House
Details of this component has not been worked out and will require further consultation with ANC. However there seem to be three alternatives open, and these are that;
a) The slaughter house is built at the Agricultuxal centre, and that all slaughtering/butchering takes place there, and that processing such as sausage making is carried out so that products can be delivered directly to the Supply Centre. This will incorporate separate units for poultry and cattle, pigs and small stock. It will include facilities for handling and dressing, cooled and cold store. The slaughter house will be capable of processing slaughter-house waste.
b) Slaughtering takes place at the Agricultural Centre, but that the carcases are delivered for butchering to the Supply Centre.
c) A joint slaughter house be established for Mazimbu and Dakawa.
We would, however, recommend that a full scale feasibility study be carried out into these questions as soon as possible. An Agricultural Economist and a Veterinary Expert should carxy out the study. The study should include assessment of possibilities for meat production and the use of slaughter-house waste.
Timing and Further Action
To carry out the programme outlined for the agricultural development of Dakawa it will be necessary to expedite the construction and equipment of the Agricultural Centre as soon as possible. It seems necessary that the Centre should be fuLly operational by about October l985, at the beginning of the first major production season - first planting to take place in the December rainy season. This means to say that the detailed planning an design of the Centre must get underway at once. The following items are needed immediately.
- Preparation of more detailed design brief/block diagram for briefing architects
- Preparation of a procurement/equipment list for costing for potential donors

Figure 4.1 FunctionallLay-out Diagram Proposed for The AGC
3.
Garage for
Tractors,
AgricuLturaL
Machinery and
Heavy Duty
Equipment
2.
Workshop for
Tractors,Trucks
and Farm
Machinery and
Stores for FertiLiser
Chemicals and Seed
7.
HandLing/Storing
FaciLities for
Crops and VegetabLes
HeLding Work-
shop
8.
Dairying
FaciLities
5.
Grain Produce
Storage
12.
Slaughter
House
6.
Feed Mixing Centre
11.
Storage of
Manure and
Biogas
Production
9
. 10.
The Pigsty
PouLtry House
1. Phase of
buildin-
Square meters of
Buildin-S1Total area
1 150 150/625 m2
2 750 400/1700 m2
3 900 500/2000 m2
4 300 200/1000 m2
5 700 400/1000 m2
6 600 400/1000 m2
7 750 750/1965 m2
8 2200 1500/5000 m2
9 1400 700/3000 m2
10 2050 1200/3500 m2
11 600 600/1575
200/500 200/1000

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INFRASTRUCTURE
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4’4 LEGEND: - Local Main Road
..._ Access Roads
..u. 1Tacks/Pedestnan Lane
Road N_etwo rk
The above figure illustrates the principle of the road network.
Roads determine the structure of the settlement scheme. The proposed system does link efficiently activity areas with the community centre. Access to these areas is easy and the system allows other infrastructure like water supply, and power lines to be provided in the area with ease. Main access road to the Morogoro-Dodoma trunk road, for security purposes should be limited to one, so as to control who is coming in and out ot the development centre.
The settlement will have four types of road network:
A. A local roag as the main road in the settlement.
B. Six access roads to various activity centres to link the village houses together in clusters.
C. Village roads
D. ggcess paths to have direct links between villages. These will also be the main roads in the crop fields, ranches and along the boundary.
For access to the site it is proposed to build a 2-lane, 7 m wide main road, leading from Morogoro-Dodoma highway to the west end of the Main Centre.

5.2
5.3
48
Where this road passes through the Main Centre bicycle/pedestrian lanes are proposed on both sides of the main road.
From the main road connections to the villages and other activity centres are proposed fox single lane Loads. A carriageway width of 4,5 m is pr0posed to allow occasional passing.
The roads are constructed as gravel roads (bitumen seal coat can be placed after edding a thin base layer).
Drainage
The proposed lay-out of drainage is shown in draw1ng no. Al02 -12A, see Volume 3. The main drainage system consist of two main drainage canals, one west and one east of the community centre area. The main purpose of these canals is to cut off existing drainage water streams from areas N and NW of the ANC site and to lead the water away from the development areas and the central agriculture areas (A2, A3 and A4). In addition 2 main drainage ditches will be constructed for the collection of run-off water from the Main Centre area. The existing drainage ditch through agriculture area A7 and A2 will be upgraded and extended.
Eater SUEEIX
At present a number of students are housed in tents at the proposed SOC site. A temporary water supply to the Vocational Training Centre has been planned to supply additionally also the SOC, the ANC construction base camp at V3/I3 and the camp close to the prospective Primary School East site.
For permanent water supply two preliminary investigations have been conducted. Both indicate promising possibilities. The report by the Austrian Engineer refers to the existance of a large underground basin situated approax. 12 km to the NW of ANC land at Dakawa. The report by the Swedish Engineeis confirms the above, but points out that it would be economic to sink boreholes along the river near the well at the SOC site. However, they point out the danger that considerable and sustained draining of sweet water from this area could lead to the infiltration of salt watei lying further away. The Swedish Engineers are also of the oginion that there is a large underground basin at t e Al ranging area.

Based on these reports Norplan has been asked to do more detailed tests, costs and capacity analysis of the 3 possible alternatives to identify the optimal solution. The analysis should also include water for irrigation purposes.

Watei wilL be required for several diffeient purposes;

- Domestic water supply
- Industrial water supply
- Cooling water
- Irrigation water

The two first requirements will be covered by the same system. Cooling water will probably be required only to a limited extent and to same extent kept in a more or less closed circuit.

Irrigation, or farm water, will be a separate system.

Domestic_Water Supply

There are 3 obvious prospective sources for the domestic water supply:

- Ground water/infiltrated water from the river bed of Magole River, located on the NE river bank from the SOC.
- Ground water from the fault zone north of Magole village.
- Ground water from the fault zone by Wami River, approximately 10 km SE of Dakawa.

Supply from the wells by Wami Prison is of lessex importance due to high salinity.

The water requirement is expected to be in excess of 1.000 m3/day, and it is doubtful whether shallow (possibly horizontal) wells by the Magole river will have the required capacity during dry seasons. At any rate intrusion of saline water from the surrounding clayy SOilS must be anticipated.

It is also expected that the Magole River bed as water source will be susceptible to pollution. This pollution will both orginate from upstream and on-site sewerage and agricultural activities.

The 2 latter ground water resources are both expected to give adequate and dependable water supplies. Taken at sufficient depth, the ground water from both sources is expected to be both bacteriologically safe and safe from increases in salinity at moderate exploitation levels.

Using surface water from Wami River has been found not feasible due to the need for chemical treatment.

It seems practical to base the permanent water supply on deep wells in one of the 2 fault zones. The treatment seems likely to be limited to aeration and disinfection.
Distribution Will be from a water main with alignment parallel to the main road. From the water main, branches will lead to the different village groups and othex consumption centres. The site lay-out does not allow a ring connection except for the 4 western villages and the Agricultural Centre, where connection to a loop seems feasible.
A main reservoir should be located close to the northern periphery of the built-up area. It should contain a minimum of 50% of the daily consumption, plus firewater reserve.
Elevated distribution tanks should be located in each village group and at each end of the centre area.
Limits of supply;
Based on a total population of 5.350 persons, and calculating schools, industry, heaLth centre and agriculturai centre as capita equivalents, the ultimate water demand has been calculated to 1.220 m3/day as a maximum day consumption, referance is made to figure 5.1. The maximum day consumption versus population growth is shown in figure 5.2
Storage tank capacity.
Assuming 12 hr. emergency storage capacity the ultlmate storage capacity has been calculated to.
Emergency storage 12 hrs.. 610 m3
Fire fighting storage 10 1/5 x 2 hrs. 75 "
Equalizing storage 25%; _g$5_f7
Total storage volum. 1.000 m3
The total storage volume should be devided into the following storage tanks;

No	Location	Volume	Ultimate poputation
1	I4	50 m3	300
2	Main storage	V4 275 "	1.000
3	IL	100 "	2.000
4	110	100 "	3.000
5	Main storage	V4 275 "	4.000
6	17	100 "	
7	15	100 "	5.350

Refer also figure 5.3.

Total Population 5350
Personal use 4900
Schools 250
Industry 575
Health Centre 50
Agriculture Centre 250
Total 6025
Fire Water
Design capacities
CONSUMPTION
Max.consump.
Specific Average day Max. day
l/sec
consumption
Ultimate design capacity : 1220 m3/day.
t
Figure 5.! Water ansumgtion.

POPULATION x1000
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POPULAHONX
5350 IN
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HABHANTS
1 2 3 4
MAX
1220 m3/day
5 e 7 e 9 10 n 12
DAY CONSUMPTION, m3/day x100
(:) : With use of Bio-toilets
(:): With use of water closets
FIGURE 5.2 MAX. DAY CONSUMPTION VS.
POPULATION GROWTH.
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FIGURE 5.3
HABHANTS
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AL SYORAGE TANK VOLUME. m3: 100
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io-toilets and 24 hrs. emergency storage
"# 12 hrs.
WATER STORAGE REQUIREMENTS V S.
POPULATION GROWTH.
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5.3.2 Farm/Irrigation Water Supply
5.4
The future requirements for farm water (irrigation), cattle dips, non-potable water for Agricultural Centre), are not yet finally identified.
Soft non-alkaline surface water should be used Lou irrigation.
The main source for irrigation water seems to be the Magole River with sub-surface and pond storage for use during the dry season.
Construction of a sub-surface dam across the Magole riverbed south of village Vl/V2 allowing sub-surface storage during the dry season will be checked for feasibility.
The feasibility of combining pond storage and fish cultures will be checked. Location of ponds to be established after the land use plan has been agreed on.
Water for watering cattle and for cattle dips will be supplied either from the domestic water supply system, or from shallow wells in the ranging area, using mobile pumping units.
Sewerage
The terrain is quite flat NE-Sw-wards, but is falls about 15 metres Nw-SE-wards in the development aiea. Due to this Circumstance it may not be possible to have a single sewage system. Instead, it may be possible to employ septic tanks and soak pits, depending of the quality of the sub soil. This will require detailed tests carried out by Norplan.
Norplan has also been requested to consider other alternatives like biological and pit toilets.
Decisive for the proposed sewerage system will be the choice of toilet system. 3 alternative options exist;
- Conventional water closets
(Main Centre, Education Area)
- Biological toilets and
- Pit latrines for the residential areas
In addition there will be polluted waste water from the Agricultural Centre, mainly from the piggery, the dairy production units and the slaughter house.

It is assumed that a conventional sewer system including several pump stations will have to be constructed along the centre road for collection of industrial waste waters and sewage from the Health Centre etc., as well as the Agricultural Centre.
Waste water effluent from the slaughter house should be treated separately to allow protein reclamation for use as animal feed. Disposal of treated waste water will be togethei with treated domestic sewage.
The Development Plan will be finalized with 2 main alternative toilet systems.
Use of water closets will imply conventional sewage reticulation and treatment. We foresee certain conflicts between treated sewage disposal and downstream ground water interests. Paxticular precautions will therefore have to be instituted.
Use of biological toilets in all residential areas and for certain institutions will significantly ieduce the reticulation system and the disposal problems.
Washing water may be disposed on the individual plots, or in the close vicinity of the villages through re-absorption/infiltration ditches.
Refuse from biological toilets may be disposed together with cow dung in appropriate farming areas.
A decision on whether to use a non-conventional toilet system should be taken after testing of appropriate biological toilets have been conducted on site (see separate document).
Garbage Collection and DisBosal
The centre is planned to accomodate approximately 5.000 people. Obviously a garbage collection and disposal system is needed. ANC has been asked to look into the possibilities of sorting the garbage into two categories, organic and unorganic garbage.
The organic garbage could go into compost heaps.
It is assumed that a differentiated garbage disposal system may be organized.

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Inorganic wastes and organic wastes which may not be used should be collected and disposed of in a conventional sanitary land fill.
Fill area to be selected in the N or SE parts of the site where there are low permeability soils. Best alternative would be to use one of the previous borrow-pits for the Morogoro-Dodoma highway, or a future borrow-pit for the internal road system.
Both seal material and cover soil will be available on site.
Use of the non-reclaimable part of the garbage as fuel for steam production has been assessed, but found non-feasible at this stage.
Energy Supply
Elegttigit _$uEply
Norplan has been requested to prepare a proposal and cost estimate for the permanent main electricity supply to Dakawa. In the meantime ANC should find out how much power Dakawa can get from TANESCO.
Norplan has also been asked to look into other energy resources like solar energy and wind mills.
The total estimated requirement for electiic power is 2 MVA. Out of this TANESCO may supply 500 kVA from the 33 kV line by Wami prison.
A new high tension line from the Tanesco 33 kV system has to be built. The length of the line, which will be an overhead line on wooden poles, is about 3 km.
On the near end of the common area i.e. next to the fire station etc a main transformer and distribution station will be built.
From here an internal high tension reticulation system has to be established.
Additional power will have to be supplied either by installing a 2 kVA turbine generator, or by finding a feasible solution to TANESCO’s proposal for a new high tension line from Morogoro.
Transformers has to be situated as follows.
- l to cover 2 villages
_ 2 to cover the central part
- l to cover the SOC
m ’FJK)U
Sum transformers

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The internal reticulation system should preferably be built with cables in the ground. To have an overhead high tension system within the village area is not advisable.
The metering of the electiicity will be at the main transformer point. There will not be separate meters put up anywhere else.
There will be emergency generators installed to supply cooling/freezing equipment in case of power failure.
A street lighting system will be provided along all the roads.
A low tension reticulation system will be built as overhead lines installation. A fuse board will be put up in each house to cover lighting, cooking, refrigerator.
gil Products
The main available mineral oil products in Tanzania are; gasoline, diesel oil, gas and kerosene. These are mainly used in transportation, cars, trucks, tractors etc. Kerosene is used for cooking and lighting. Gas is used for both domestic and industrial purposes.
Solar Heating
The most efficient means of utilising solar heat is to produce hot water by using sun collectors. Hot water is a necessity in every house, workshop, hospital, school and industrial building. A solar hot water system will produce water with a temperature of from 50-6OOC. If higher temperatures are needed e.g. in a hospital or a laundry, additional heating will be required. At Dakawa it is estimated that, by using solar water heaters it would be possible to reduce energy consumption (of other energy types) by about 2-3 million kWh with a reduction in peak loads of up to 800 kw.
Wind Poweg
Normal wind speed at Dakawa is low. Most medium and high energy wind turbines currently available on the market. The potential for wind power at Dakawa are

therefore pretty limited. However, for special purpose, e.g. for the pumping of water from wells situated at some distance from Dakawa, direct driven wind pumps are of some interest. These wind pumps must be designed for low wind speeds, and the necessary starting toque has to be small. Normai power output would be in the region of 5-10 kw. Such windpumps are already on the market and some are already being used in East Africa. They are simple to construct and easy to repair.

Biogas Energy

A fermentation plant for animal wastes (and possibly human wastes) will generate a great amount of energy-rich biogaSe. This biogas consists principally of 60% methane (Ch4) and 40% carbon dioxide (C02). Biogas can be used for the following purposes:

- hot water or steam production in gaSefiied boilers
- hot air generation for drying purposes
- heating of bakers’ ovens
- heating of forges
- energy for the canning industry

Biogas production per animal unit varies with a great many factors. From European experience, the gas production from the waste from one cow is between 0,8 and 1,2 cubic metres per day. In terms of gas production, one cow is equivalent to 10 pigs and to 100 chickens. One cubic metre of biogas is equivalent to the energy from 5,9 kWh or about 0,5 litres of oil.

The best way of using biogas at Dakawa would be if the Agricultural Centre needed as much energy as the biogas could produce. In distributing biogas surpluses from the Agricultural Centre consideration has to be given to the economics and to security. There are several ways of distributing biogas surpluses. In the first place it is possible to distribute the gas by pipeline from the digester plant to nearby consumers. However it is important that pipelines are not too long because of potential leakages and explosions.

Secondly gas can be distributed in gas bottles which gives greater flexibility since the gas can then be used anywhere in the domestic areas. The disadvantage with this is the need for a complicated processing plant to produce a clean methane gas under high pressure. A third way of distributing the gas is to distribute the waste to several small digesters close to the consumers. This is probably the best solution from economic and security viewpoints.

.6.6
5.7.1
Forest Energx
As this Report shows there is likely to be a shortfall of electricity and energy for the community’s requirements. An interesting way of making up this shortfall is to try to meet at least some of Dakawa’s energy needs from an "energy forest" which would provide the population with fuelwood. About 150 hectares of land is considered suitable for planting an energy forest at Dakawa. This area could produce fastgrowing tree species for fuelwood, building materials and maybe animal feed. NORPLAN have suggested experimenting with the Filipino fast-growing tree Ipil-Ipil (Leucaena Leucocephala) which has been experimented on at the Faculty of Forestry in Morogoro.
NORPLAN have prepared some preliminary thoughts on developing a forest planting programme and these are set out in Appendix 3 in Volume 2 to this Report. This shows that it ought to be possible to start a tree nursery at Dakawa by January 1985. Such a nursery should also provide floweLing plants and trees for decorative and landscaping purposes.
Telecommunication
The only external telecommunication source that is relyable at the moment for Dakawa, is radio. However, an internal telephone communication system should be looked into by Norplan.
Teieghone Igstallation
Installation of an internal telehpone communication system based on international standards must be taken into consideration.
The system will consist of exchange equipment and telephone sets, connected with self supporting telephone cable, mounted on poles de81gned for road-lighting and electrical low voltage supply.
In order to project the internal telephone communication system, an evaluation the number of telephone sets in service, and where to place them, is needed.
Radio Installatiog
In order to develop a radio system, information about existing radiostations, which are able to communicate with a new equipment installed at Dakawa, is needed.

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THE AGRIC
PROPOSALS
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Introduction
This Chapter, dealing with the proposals for agricultural development at Dakawa, has been revised and up-dated since the earlier report of March 1984. In addition more detailed proposals have been worked out for the content and the main components of the Agricultural Development Centre and these are shown in Chapter 4.12. The initial observations and recommendations on the agricultural deveiopment plan for Dakawa in the March Report were based on a brief visit made to Dakawa during the dry season in early December 1983. This has now been supplemented, as recommended, by a subsequent Visit during the rainy season. This has enabled the Consultant to make more detailed preposals as to the phasing and the contents of the agricultural development programme.
NORPLAN’s Agricultural Expert visited Dakawa from 9 to 15 May 1984, after particularly heavy rains in the region. This was in order to gain a better first-hand impression of the area’s general agricultural potential, to obtain results of soil analysis and to discuss the possibilities of developing energy forest. In addition discussions were held in Oslo between NORPLAN and ANc’s Farm Manager, Mr. Finn Flensted Nielsen on 29 and 30 May 1984 on detailed proposals for initial investments in agriculture at Dakawa (these are described in Chapter 4.13 of this Report).

This Chapter therefore sets out NORPLAN’s principal findings on the agricultural development of Dakawa and these are then incorporated in the "Project Packages" described in Volume 2. This is then followed by the observations on the principal crops and pasture production which were described in the March Report and recommendations on the development of different areas for different crops and livestock.

EiinciEal Findings

Because of a lack of chemicals, soil analyses of Dakawa’s agricultural potential are still incomplete. However preliminary results now indicate that soil quality is likely to be good throughout the site so that the original plans fox agriculture are fully justified. In addition it is now clear that the area has adequate rainfall most years to justify extensive rainfed cultivation.

There is therefore an urgent need to go over now to detailed planning of the Agriculutral Centre which shall serve as a base for all development. This implies preparing and presenting to ANC block diagrams of all facilities in the Centre with capacities. dimensions and a complete equipment list (as indicated in Chapter 4.12). This work should enable design to proceed so that the Agricultural Centre is fully operational in time for the growing season which would start in February 1986 (about 18 months from the time of writing). Before the completion of the Agricultural Centre it is unrealistic to attempt any large-scale production of crops, although some isolated cultivation may, of course, take place. However, a major economic strategy at Dakawa will be to operate large-scale agriculture so as to produce an agricultural surplus which will provide jobs and income.

A competent Farm Manager for Dakawa needs to be appointed and needs to be located as soon as possible. Funds should be found now to allow ANC to recruit a Farm Manager to start work at Dakawa in January 1985 at the latest. He should be involved at all stages of the construction of the Agricultural Centre and would be fully responsible for its operation. Funds should be secured around September 1984 and the individual recruited by January 1985.

Before any major, large scale crop agriculture can start a comprehensive programme of land drainage must take place. Provision for this is made elsewhere in this Report under the plan for infrastructure.

In general it is considered to be unrealistic to be able to operate Dakawa's agriculture at full scale until the 1986 season when planting would take place in February 1986 and harvesting in May/June 1986. This means that the Agricultural Centre must be completely constructed and equipped by October 1985. A few minor, preliminary measures, however can be taken. In the first place, it would now appear that sizeable areas along the Magole River are probably very suitable for high value, irrigated rice production. It is estimated that at least 70 hectares of land in Area A.5 is well suited to rice production if properly irrigated. An expert or a volunteer expert in the planning and development of irrigated rice production should be identified immediately and funds found to employ him to produce a plan for rice production and the necessary irrigation schemes.

It would be preferable to find an experienced volunteer from a voluntary organisation or from within the ranks of ANC itself. Secondly the area of A.4 immediately to the south of the proposed Student Orientation Centre seems particularly well suited to intensive vegetab1e production at any early stage. ANC should therefore start experimenting immediately with 2-3 hectares of land in this area with water from temporary wells in the area for the production of a variety of vegetab1es for immediate domestic consumption. In the third place, work should start on fencing the first pasture areas describe beiow in section 6.11 on "Areas for Animal Production". This involves the fencing in of about 1.100 hectares of pasture land for protection from further deterioration. This will require pressure impregnated fencing posts 1,5 metres high and fencing wire. The sections which follow, and sections 6.9 Animal Production, 6.10 Areas under Crop Production, 6.11 Areas for Animal Production in particular, form the basis for the detailed agricultural areas at Dakawa for different purposes. At the moment no further planning is required. The detailed planning of each agricultural area at Dakawa should be the responsibility of the Farm Manager, after the detailed soils analysis results are available and after fuller details on the availability of water for irrigation. It would appear that Area A.2 will be the priority area for cultivation and this would give the new community at Dakawa some 200 hectares of mixed crops i.e. maize, vegetables, soyabean and hay for example which cou1d give a good base for immediate self-sufficiency by 1986. The detailed planning of this area could take place during 1985 so that adequate seed and minor tools and equipment were purchased in good time for land preparation and planting.

.2

Production Characteristics

Dakawa is characterised by two rainy seasons, a shorter one in December and January and a longer one between March/April and May. The period between the short and long rains i.e. February is a pronounced dry season. The other, long, dry season lasts from June to October. Figure 6.1 sets out precipitation and temperature data for Wami Prison, about 2,5 km east of Dakawa. Mean annual recorded rainfall is 968 mm and average temperature is about 250C. Potential evaporation is as high as 2.230 mm per annum and exceeds rainfall for 10 out of the 12 months. Owing to the climatic characteristics, agricultural planning should be based on rainfed crops and a dry period. The dry period can be improved by irrigation.

Rainfed Production

Because of the dry season, planting in November or December can be risky and most farmers prefer to plant out maize in February just before the rains. Beans should be planted before the short rains as they are sensitive to high humidity, although they do not need much rain. The two rain seasons are, of course, best combined with an irrigation system.

Irrigated Production

Very little plant production is possible at Dakawa during the long dry period from June to November. Irrigation at Dakawa can help to make up for this and can also help with the production of different crops like potatoes, cabbages and tomatoes etc. which are difficult to grow in the rainy seasons because of humidity and fungal problems.

Crog Production

The climate and soil at Dakawa permit the growth of a wide range of crops and fruit trees. They have a wide range of different requirements as to length of cropping season, fertiliser applications, chemical components, tillage and cropping systems, plant protection, harvesting and storage facilities. The following sections give a presentation of the main crops and fruit trees recommended for Dakawa. Fuller details are found in the Report of March 1984.

6.4.1 Cereals

The most important cereals at Dakawa will be maize, sorghum and rice with wheat in drier parts of the site and in the dry season.

A.

Maize (Zea Mays)

Planting should take place in February before the long rains and care should be taken to avoid water-logging in the first 4-5 weeks. Soil drainage is important in areas where water is present e.g. plot numbers A2, A3, A6 and A7). A yield of 4 to 5 tonnes per hectare should be possible with good soil management, tillage, cropping systems, disease control and harvesting methods. The content of carbohydrate in dry grain is 71%. Protein content is about 10%, but includes little of the essential amino-acids, lysine and trytophane.

Maize is also a major green fodder crop of importance to dairy production. Maize harvested as green fodder for silage will yield between 20 and 60 tonnes per hectare. The dry matter content will be about 20% with a crude protein content of O,7%.

Sorghum (Sorghum vulgare)

Sorghum is drought resistant and therefore better suited to arid areas than maize. Minimum anual rainfall required for sorghum is 250 mm, but good yields are not obtained with a preciptation under 600 mm. Sorghum can withstand waterlogging to some degree. Abundant sunshine is necessary. Sorghum yields well in poor soils because of its efficient root system. Crops coming after sorghum usually show a reduction in yields because of soil exhaustion and N-fixation when the stubble is ploughed in. Sorghum needs about 120 days from planting to harvesting and grain yield may reach 3- 4 tonnes per hectare when carefully husbanded. Sorghum can also be grown as green fodder and can be ratooned 2 or 3 times after cutting the plant crop. Sorghum as a fodder crop will yield from 30 to 50 tonnes of green matter per hectare (20% dry matter). At Dakawa, sorghum should grow well both as a grain as well as a green fodder crop.

C.

Rice (Oryza sativa)

Rainfed rice is grown with a monthly rainfall of between 160 and 300 mm. An irrigated rice crop requires from 1.200 to 1.800 mm including water for land preparation. Yields will amount to around 0,8-1,2 tonnes per hectare. The starch content of white rice is 90%, protein content 7-8%. The oil content of the bran is 16-22% and the bran is a component of concentrated feed for cattle. Otherwise rice straw can be made into baskets, mats and ropes by home industries. And the straw can also be used for making litter in dairies and pigsties.

There is no doubt that rice can be grown at Dakawa during the rainy season and the best area seems to be the southern part of Plot A.5 which is about 70 hectares. The area is close to the river Magole from which water can be extracted for irrigation purposes.

Wheat (Triticum aestivum)

It is proposed to grow wheat at Dakawa under irrigation, although wheat is usually considered as a temperate zone crop. It should be grown On a small scale at the beginning. Wheat needs a minimum of 250 mm rainfall per annum. The crop is drought tolerant but when plants are at the early initiation stage water supply is critical. High temperatures (38-400C) can retard heading and may cause crops to ripen prematurely after flowering. At Dakawa wheat should therefore be tried on Plot A.5 after rice.

The growing period varies from 120 to 210 days depending on the variety used. Most wheat is converted to flour. Germs, bran and shorts are admixed into cattle concentrate. The starch content is 63-71% and pxotein content is 8-10%.

6.4.2
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Legumes
In this chapter brief introductions will only be made to the following crops; beans, cowpeas, soyabean and groundnut since they might have the highest growing potential at Dakawa.
A.
Beans (Phaseolus vulgaris)
Beans are not drought resistant, ideally they need moist soil througout the growing period. High temperature might cause poor fruit setting. Beans demand free draining soils with a reasonable high nutrient content and respond well to fertilizer applications. Liming is necessary if the pH is less than 4,6 at sands and less than 5,0 at sandy clays. The yield of dry beans per hectare may reach 2 tons under good management.
Cowpeas (Vigna unguiculata)
The leaves, pods and the grain are used. There are two types, large creeping and small erect. Cowpeas are drought resistant and can be grown on acidic soils. They are usually intercropped. The yield of seeds is between 0,5 and 1,0 tons per hectare. It is believed that new high yielding varieties will be introduced in the near future.
Soyabeans (Glycine max)
The general climate requirements are approximate those of maize. A rainfed crop requires about 600 mm of well destributed rainfall with sunny periods in between. Dry weather is needed during maturing and harvesting. Soya beans have great adaptability to temperature. In terms of soils too, the requirements of soya beans are more or less the same as those of maize. A high calcium content of the soils is favourable.
Soya bean is a suitable crOp in rotation with gramineous crops like maize, sorghum, wheat. It should not be grown after tobacco, due to the possibility of transmitting diseases. The growing period vary from 80 to 160 days. In the tropics in general about 120 days. The yield of dry beans vary between 0,5 to 1,5 tons a hectare. Under irrigation the yield might reach 2,0 tons per hectare.

D. Groundnut (Arachis hypogea)
A rainfed crop of groundnut needs from 400 to 800 mm of well distributed rainfall. Dry weather is needed during maturing and harvesting to ensure quality. Light textured soils are most suitable. Heavy soils, if well drained, may also produce high yields, but harvesting is difficult. Groundnuts are just as sensitive to salinity as most other leguminous crops. Rotation with other legumes and tobacco is to be avoided, because of the high risk of disease transmission. The growing period is from 90 to 150 days, depending on the variety. The yields vary from 0,7 to 2,0 tons per hectare. Potentiai farmer’s yields range from 2,5 to 3,0 tons a hectare under irrigation.

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A. Sunflower (Helianthus annus)
A rainfed crop can be grown with a rainfall from 300 to 800 mm. A good supply of moisture during flowering is important. Maturation requires dry, warm weather. Heavy or poorly drained 50115 are not suited. The crop is moderately salt tolerant. To avoid the build-up of diseases sunflower should not be sown in the same field more than once every 4 years. The grow1ng period is from 90 to 150 days. The yield varies from 0,7 to 1,4 tons per hectare. With optimum rainfall and under irrigation yields may be as high as 2,0 tons per hectare.
The crop can also be harvested in an early stage as green fodder (25-50 tons per hectare) and processed into silage.f Sunflower seed should be processed for edible oil and cattle cake, and this should be carried out in the Agricultural Centre.

6.4.4 Fiber Producing Crops

A.
Cotton (Gossypium spp.)
A rainfed crop requires at least 450 mm of rain. Sufficient soil moisture is essential during the flowering period. Abundant sunshine is required during flowering. Cotton can be grown on heavy soils (black cotton soils) provided they are well drained and have a groundwater depth of over 50 cm. Depending on variety and climate, the growth period ranges between 160 and 220 days. Normally the crop stands on the field for 6 months.
Present seed cotton yields vary between 1,0 and 2,0 tons a hectare. The 1int percentage varies between 30 and 40% ?CCTFdiki :w variwwies.

Root and Tuber Crops

Among the root and tuber crops suitable for Dakawa are cassava, sweet potatoes and potatoes.

A. Cassava (Manihot esculenta)

An advantage with this crop is that harvesting can be spread over several months by leaving the roots in the soil. Cassava needs a minimum of 500 mm of well distributed rainfall. It is also drought resistant, but if a drought continues f01 several months this will affect the yield. The crOp responds well to soils with a good structure, a good internal drainage and a high organic matter content. Fairly light soils are needed for root formation. The growth period varies between 12 and 24 months. In case of direct consumption, cassava is usually lifted about 12 months after planting. The average world yield is about 10 tons per hectare, but varies greatly, from 7,5 to 16,7 tons a hectare.

B. Sweet Potato (Ipomea batatas)

The sweet potato is more tolerant than most other tropical root crops to a wide range of edaphic and climatic conditions. It is mainly a dry-field crop, intermediate in its optimal habit between cassava at one extreme and taro at the other. The crop can be harvested after a growing period of 3 to 6 months which is quite short compared with most other tropical root crops. Yields reported under tropical conditions are exceedingly variable, from 5 tons to as much as 40 tons per hectare. Under tropical conditions sweet potatoes are extremely prone to waste. However, various simple storage techniques have been evolved in different parts of the world, and some of these may well be of interest to Dakawa.

C. Potato (Solanum tuberosum)

Potatoes require 100 mm of rainfall per months during the growth period. Even short periods of drought cause a reduction in yield. The optimum daily temperature is between 15 and 180C. Average daily temperature above 210C reduce tuber formation, but big differences between day and night temperatures improve tuber formation. Potatoes can be grown on all types of soils, provided drainage is adequate. Heavy soils

restrict tuber formation and complicate harvesting. Potatoes are susceptible to salinity. The growth period varies between early-, medium- and later maturing varieties which take, respectively, 3, 4-5 and 6-7 months to mature. In the tropics the growth period is usually 3-4 months. The yields differ very much. At higher altitudes in the tropics the yields are 25 tons per hectare, and in the subtropics under irrigation from 10 to 15 tons a hectare.

6.4.6 Vegetable aqd Fruit Crops

A.

Recommended vegetable crops

The following vegetable crops are recommended at Dakawa; Chinese cabbage kBrassica chinensis), white cabbage (Brassica oleracea), lettuce (Lactueu sativa), spinach (Spinacia oleracea), onion (Allium cepa), sweet pepper (Capsicum spp.), cucumber (Cucumis satives), carrots (Daucus carota), beans (fresh and dry) (Phaseolus vulgaris), tomato (Lycopersicon esculentum), egg plant (Solanum melongena), peas (Pisum sativum). Many of these vegetables should only be grown in certain periods of the year, due to temperature requirements, pest and disease problems. Despite this limitation, conservation, techniques, such as canning, deep-freezing and freeze/drying have made vegetable available all year round. It is recommended that such techniques should be developed at Dakawa.

Vegetable production is capital-intensive, involving not only high inVestments (land, buildings, machinery and equipment, irrigation and drainage facilities), but high recurrent costs as well (seeds, fertilizers, plant protection chemicals, tOOlS and packing material). Vegetables are highly susceptible to pest and diseases. An intensive spraying programme with chemicals is therefore required and a strict rotation scheme is imperative, in particular for the control of nematodes.

Banana (Musa spp.)

Bananas have a high water requirement. They need 1500-2000 mm of well distributed rainfall per year. Optimum temperature is between 25 and 300C. Light, fertile soils with a high organic-matter content and good internal drainage are very suitable for bananas. The LOOt system is shallow. The crop starts producing after 9-12 months. Short periods of drought (1-2 months) can be tolerated by bananas. Longer dry spell require irrigation.

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C. Citrus (Citrus spp.)
Well known citrus fruits are the orange, tangerine, grape fruit, lemon and lime. Citrus require a minimum annual rainfall of about 1100 mm, preferably supplemented to 1800-2000 mm with irrigation. A fairly high humidity of the air induces a thin skin and a high juice content of the fruit. Citrus needs deep, well drained soils, sandy loams are the most suitable. 0n sandier soils organic manuring is essential. Citrus trees are sensitive to salinity.
D. Other Fruit Crops
At Dakawa some other fruit trees like mango (Mangifera indica), pawpaw (Carica papaya), avocado pear (Persea americana), guava (Psidium guajava) and pineapples (Ananas comosus) are recommended to be grown.
Crop Rotation Principles
The main cr0p rotation principles for Dakawa will be.
1) The continuous growing of cereals or pulses should be avoided.
2) Leguminous crops should not be sown in sequence, even if one crop is for seed and the other forage.
b)
Crops with common root diseases should not be sown in succession. For instance, tobacco should not be planted following tomatoes.
Arable CroEBing
The following arable cropping systems will be relevant at Dakawa:
Shifting Cultivation
By shifting cultivation is meant the production of food crops for subsistence, alternated with vegetative fallow. The length of the fallow period depends on the population pressure. In shifting cultivation mixed cropping is often applied i.e. the growing of two or three crops together on the same piece of land with the objective of securing a yield, Of obtaining the highest return possible with minimum efforts and of making the best use of soil, light and rainfall.

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Single Crogeing

Single cropping in the case of annuals means that the crop covers the land for only part of the year and is then followed by fallow. In the case of perennial the crop covers the land throughout the year.

MultiEle nggping

Multiple cropping involves the cultivation of two or more crops in succession or with some overlap within a period of year. Double cropping is practised where water for crop production is available in sufficient quantities from rainfall, irrigation or both.

IntercroEEing

During the period of establishment of perennial crops, such as citrus trees or bananas, interplanting of cach crops or food crops is usually practised. This will provide some income during the period in which the perennial crop is still unproductive. At a later stage, these inter-planted crops are replaced by cover crops in order to maintain soil fertility, to suppress weeds and to control soil erosion.

In the situation of Dakawa it is suggested that the farming systems of single cropping should be practised according to the use of land, crops involved, the availability of water etc.

Pasture_gpoduction

The areas reserved for ranching and livestock production at Dakawa represent a very important part of the agricultural production being grazing areas for cattle, goats and sheep.

Natural Vegetation

In order to achieve an intensive use of grasslands at Dakawa proper management practices should be observed like:

1) Adjustment of stocking rate to carrying capacity.
2) Periodic resting of the grassland from grazing during the critical growth periods.
3) Bush control.
4) Special provision fro dry season feeding.

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These requirements can be met by adopting a system of rotational or seasonal grazing. The pasture should be fenced into paddocks, each of them provided with water supply. These are grazed in rotation in a manner that provides for periodic rests and burns, and ensures that sufficient grass or standing hay is available for the stock all the year round.

Intensive Use of Natural Grassland and Cultivated Pastures

Natural grassland can be utilized in a more intensive way. At Dakawa a suitable system of rotational grazing will improve the pasture and its carrying capacity as compared to continuous grazing. To obtain additional food an attempt should be made in the growing season to make hay from surplus feed.

Seed

The use of good quality seed of suitable varieties is one of the most important factors in obtaining good crop yields, and also limits the risks of crop failure.

The Availabilitl of Seed

To keep the purity and uniformity of the seed varieties up to the required high standard, new breeder and foundation seed has to be constantly produced. This is the case with hybrid varieties like maize. To a lesser extent this is true for synthetics. The purety of self pollinated crops, which are to a large degree homogeneous, is the simplest to maintain.

Dakawa Seed Production

The seed should be bought from certified seed companies like TANSEED and not produced at Dakawa. Since the availability of seed is unstable, the Dakawa Agricultural Centre should have facilities for storing quantities of seed.

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Animal Production
The main animal products will be meat from cattle, pork, sheep, goats and broilers, milk for cattle and egg from poultry.
Meat Production
A.
Cattle
In the production of beef the zebu breeds are used to advantage. Both pure-bred zebus, cross-breeds and new-breeds should be used extensively for beef production at Dakawa, since they are adapted to the environmental conditions. They are poor milkers, often producing little more than that needed by their calf. The adult live-weight of males varies between 400-900 kg and for females 300-500 kg. To meet a requirement of 20 kg beef a year per person approximately 500 cattle have to be slaughted a year. A number of 1500-2000 cattle of different ages may be required to reach such target. According to the conditions of vegetation in the ranching area this will be the maximum number of grazing cattle the area can take. With good grass management, iriigation and fertiliser however, it would probably be possible to increase the number of grazing cattle to achieve higher meat production.
Sheep and Goats
A sheep may produce 0-4 kg/year of wool/hair. The live-weight of an adult varies between 20-90 kg, giving from 8 to 40 kg of meat. Goats may produce 20-200 litre milk per year and the meat production varies from 6 kg to 35 kg per animal. The number of sheep/goats at Dakawa may be as many as 500 animals giving as much as 3,5 tons of meat a year. They should be kept in the livestock/ranching area.
Broiler
The production of meat from broilers ought to be approximately 35 tons a year to meet the requirement of 7 kg per person a year. To reach the dressed slaughter weight of 850-1500 9, it takes 6-9 weeks. To reach the required amount of broiler meat it will be necessary with approximately 10.000 chickens for 5 feeding periods a year in total. For this purpose the Dakawa Agricultural Centre should produce its own chickens.

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D. Pork
The production of meat from pork should reach as much as 70 tons a year, which will give as much as 15 kg/person a year. To be able to reach this amount the Dakawa Agricultural Centre has to feed as many as 1.000 pigs a year.
gilk Production
It is proposed that the Holstein-Friesian breed should be used for milk production. Provided good management, correct feeding and healthy animals, the dairy cows may produce from 2.500 to 5.000 litres of milk a year. Assuming that every child need approximately 0,5 litre milk per day, the Dakawa Dairy should have about 200 dairy cows. The Holstein-Friesian breed is probably preferable in terms of milk production to cross-breeds which could otherwise be considered. It is the experience of our experts that Holstein-Friesian will adapt easily to Tanzanian environmental conditions and pure breeds will be cheaper to start with. Perhaps cross-breeds could be considered at a later stage.
Egg Production
Modern breeds for egg production produce between 250-280 eggs a year. To meet the egg requirement of 14 kg per person a year, the Dakawa egg production unit may need as many as 5.000 egglayers.
Areas under CroE Production
As has been described in paragraph 6.4, a variety of different crops and fruit trees have been proposed to be grown under different rotation and management systems. In this paragraph proposals are made in which plots the crops ought to be grown. The proposals are made tentatively. The final advise will be given after the area has been examined duxing the rainy season 1984 and results from analysis of soil samples are available.
Areas under Rainfed Conditions
Plot A2. The cropping area is approximately 200 hectare. A rectangular part of it of approximately. 117 hectares will be suitable for maize production in rotation with legumes like soyabean, groundnut, cowpeas and beans. Once every 4 years cotton can be grown in this plot. Areas close to the main road appear to be too wet for successful cropping during the rainy season.

The triangular part of plot A2 is about 83 hectares. It is proposed that areas around village 8 should be planted with citrus trees, mangoes, avocado pears, while the southern part could be used for hay-making by improved grass/legume cultivation as supplementary fodder in the dry season to the grazing animals in the ranching area. Before the fruit trees become productive, vegetable crops could be intercrOpped.
Plot A3 totals 113 hectares. A rectangular area of 75 hectares is suitable arable land. The area should be used for cereal production like sorghum and/or maize in rotation with beans, groundnuts and soyabean. Every 4 years sunflower is proposed to be grown in the plot. The area north and south of village no. 9 of 32 hectares could be included in the same type of cropping program. Alternatively the area between village no. 9 and the cemetery, which is approximately 9 hectares, couid be used for fruit tree production intercropped with vegetables.
Plot A7 has an arable land of about 137 hectares. To be able to have a variety of crop rotation systems it is proposed to divide the area into two approximately equal plot areas. In the north-eastern part a rotation system of maize/sorghum and legumes should be established. Each every 4 years sunflower should be grown. In the south-western plot the same rotational program is proposed. But instead of growing sunflower every 4 years, cotton may be suitable. In some part of the field a drainage system has to be developed.
Plot A5 situated in the western part of the area is approximately 200 hectares. At this time the south/western part of plot A5 is the most developed area for crop production. The plot which is approximately 67 hectares, is very flat with its boundary to the river Magole. The area is the most suitable part of Dakawa for rice production in the rainy season. The specific growing conditions of rice may lead to a complete destruction of the soil structure which makes rotation with other crops unsatisfactory.
Plot Ab with an acerage of 90 hectares, appears wet, especially the centre. This is due to the sloping terrain from village no. 1 and 3 and from the outside area ending in a ditch between them. From the agricultural point of view it will be necessary to have the water under control by means of a drainage system. Otherwise, the plot should be suitable for fruit tree production like bananas along both sides of the water channel and citrus trees, papaya, avocadoes, and guava on drier land intercropped with vegetables.

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Plot A4 of 123 hectares has to be cleared of bush leaving some trees around village no. 10. The cleared area should be developed into arable land for cereal crop production, maize/sorghum and legumes/ sunflower in rotation.
Plot AE. At present the northern part is bush, but should be developed into crop production after clearing the land. The crop production on the 64 hectare wide area should be used for fresh fodder crop production, silage, and hay-making in rotation mainly for dairy cattle at the Agricultural Centre.
A developing crop production program Shonid have the following priorities in terms of plot preparation; A5, A2, A3, A6, A4, A7 southern part, A6, A4 and A5 northern part.
Areas under Irrigation
The studies of domestic water supply and irrigation purposes at Dakawa indicate that the available water for irrigation is probably limited both in quality and quantity. Untii further investigations are made, water for irrigation should strictly be used for vegetable and fruit production in the proposed areas.
Summarz of CroB Production
The tabLe below summarizes the crop production programme proposed for Dakawa.

Plot no.	Culture	Area ha	Numbergof crops auyegr	Yield-forcast in tonnes
A2	Maize	58	l	230
A2	Soyabean	59	l	60
A2	Hay, silage	83	2	1200 1)
A3	Sorghum	56	l	170
A3	Beans	28	i	40
A3	Groundnuts	28	1	33
A4	Maize	61	l	210
A4	Sunflower	b2	1	90
A5	2) Rice	67	l	80
A5	3) Vegetables, wheat, root and tubers	73	2	Various
A5	4) Gras, silage, hay	b4	2	L900 3)
A6	Citrus, banana, other fruits	90	1	Various
A7	Cotton	68	l	100
A7	Maize	69	L	240

1) Dry matter yield 4) N of AGC
2) SW of AGC 5) Dry matter field
3) NW Of AGC

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Areas for Animal Production
The main areas for animal production should be used for beef and meat production from cattle, sheep and goats.
Areas under Rainfed Conditions
Plot Al and A8 are situated in the north-eastern part of the area, with boundary to the main road Morogozo-Dodoma. The areas are 1.373 and 120 hectares respectively. The terrain is quite flat, covered with bush and natural grass species. It is suggested that the cariying capacity of the land is between l-2 cattle per hectare. The total ranching/livestock area should have a capacity of approximately 1.800 cattle including some 500 goat/sheep. To utilize the pasture area to its optimum, it will be necessary to fence it into at least 4 paddocks. Such an arrangement will make it possible to graze one paddock while the others are resting for regrowth vegetation. Each paddock must have water supply for animals and irrigation. Water is also needed when treating the animals against tick-borne diseases. A convenient site for dipping or spraying baths should be constructed in the ranching area.
Areas under Iriigation
Because the grass stops growing in the dry season, there is a marked seasonal variation in the carrying capacity. To be able to maintain the beef production during the dry spell it would be of great advantage to have some 30 hectares irrigated in the ranching area. This depends, of course, on the availability of water, which is not known in detail at the moment. It is proposed to supply irrigation water from a possible aquifer beneath the ranching area north of the RHC.
Overall heat Production
With the proposals set out in this Chapter, the annual per capita meat consumption will be around 45 kgs at Dakawa. This will consist of 20 kgs beef, 10 kgs broiler meat and 15 kgs pork. This is equivalent to nutritional levels and comsumption levels in most developed countries.

7. POPULATION CHARACTERISTICS

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7.3
POPULATION CHARACTERISTICS
General
This Chapter sets out bLief forecasts and assumptions concerning the likely development of p0pu1ation and its structure at Dakawa. These are used in estimating the number and sizes of different types of community facilities and in determining the occupational structure of the community population. These have been derived from planning standards worked out by African National Congress technical staff.
Population in The Villages
These are estimates of persons living in fixed house-holds. In addition a further 1250 children (without parents) will live in residential care in the villages. One village contains about 80 household.
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Unmarried households : 40 160 -
Married households -:_.40 -__ A QQ__V-1,,1291
T o t a 1 80 240 120
In 10 villages 800 7 1M, 2400 1.1299
The ChiLQigmiat 192
Creche 2- 3 years 2 0,11 of 120 2 15
Nursery 4- 6 " 2 0,22 " " : 30
Primary school 7-12 " : 0,33 " " : 40
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Vocational Trainin Centre and
Students Orientation Centre
Vocational Training Centre:
210-300 students 1 ca 8 family houses : 200 students
Students’ Orientation Centre:
168:g%01g;udegtsuf ca 8 faqi1x houses a 250
T o t a l 450 students
Total Pogglggion of ANC Develognent Centre
Working people/village adults (7.2) 2400
Children (7.3) 2500
Studgnts 1__ A . (7.4) 450
T o t a l 5350
Q1fferent Service Occugations
____. - - _- _ _____Ee_09ie__
Mechanics 20
Drivers 30
Catering 60
Managements 50
Secretarial staff 100
Clarks, accountents 30
Stores 30
Supplys 30
Children care/nursery 200
Teachers 100
Laundry 30
Boarding (masters) section 40
Healths 40
Maintenance 30
Culture ____1 00
T o t a 1 830- 850
Total_ManEowg5
Different occupations (7.6) about 1000
Farming " 300- 600
Industgx_ _- _ " 1000
T o t a 1 about 2300-2600

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PROJECT PRIORITIES
Priorities
Apart from the infrastructure and the vocational training centre which is already proceeding, a number of other priority projects are emerging. These include the student orientation centre, the healthpost, a village and primary school facilities and agricultural buildings.
Construction Base
It is intended to start setting up a construction base including planning and administration offices, stores, workshops etc, early in 1984.
Construction Methods
It will be necessary at Dakawa to employ a combination of prefab construction and conventional building methods. As capacity increases with the winding up of construction work at Mazimbu and with the graduation of skilled workers from the vocational training centre, it will be possible to increase the potential for convential construction at Dakawa. Certain bulding types e.g. farm buldings, workshops require large spans, and are more readily constructed with conventional or semi-convential methods. On the other hand, particularly in the early stages it will be necessary on some projects to use prefab structures which offer advantages of low cost and swift delivery, quick erection with minimum skill, possible "turn key" delivery. Their use will free the workforce for projects requiring a more conventional input.

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