

# PREPARING LAND USE PLANS FOR SMALL GROWERS AND DEVELOPING AREAS

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## Abstract

An approach to land use planning is outlined. Two types of plans for developing areas are described. The first is for use where large areas are developed as single or multiple block enterprises, and the second where groups of small growers are the principals and have agreed to co-operate in some form of extraction system and protection system of their existing small field boundaries. The materials and maps required for each system are described. The UNIGIS system is used to establish a terrain model so that slope categories can be determined and mapped. Use of the model to plan field work is shown and recommendations for work to be implemented are discussed. Setting out main haulage routes, and selecting loading zone sites and road patterns are illustrated. The costs of putting the systems into operation and the problems and benefits to be expected are discussed.

## Introduction

There has been an increase in the area of sugarcane land planted by small growers both within and outside the traditional cane belt of South Africa. This has resulted in a need to produce Land Use Plans (LUPs) to serve as a guide to millers who are developing areas for small growers. The plans are essential tools for both the developers and the small growers, as they enable accurate feasibility studies to be made and show access routes into areas previously thought to be inaccessible. The use of a Geographic Information System (UNIGIS) provides a fast and accurate method of slope analysis, thereby indicating clearly the agricultural potential of land for sugarcane production.

The LUPs facilitate the calculation of field work required and the formulation of budgets for development projects. With these estimates, both the large developer and the individual growers are better able to determine the potential of an area of land.

## Land use planning approach

An LUP comprises a soil conservation network, a cane extraction network and a production management programme, all based on the soils, slopes and climate of the area. The soil conservation works provide the framework for the field roads and breaks for all LUPs. Integrating agronomic practices, mechanisation, climate, soils, water and topography of a farm unit into the management plan allows best economic crop production. Different parts of a farm may require different types of management, and these must be balanced in the working plan so that each unit of land produces its economically optimum yield. Although best yields are sought, it is important to ensure that, adequate protection of the natural resources on the farm is maintained. The sugarcane crop is generally an exceptionally good conservation agent and, together with the field works, ensures that soil and water losses are kept to a minimum.

## Land Use Plans

An LUP normally contains details and specifications for:

- soil conservation structures and grassed waterways
- roads (major and minor) and loading zone sites
- strip replanting and minimum tillage
- trash management
- areas suitable for mechanisation
- areas suitable for irrigation
- areas requiring drainage
- protection of natural stream banks and indigenous bush areas.

The implementation of a plan can be phased in over a period suited to the grower's planting programme.

In many cases there are four main steps in the preparation of an LUP:

- complete farm assessment
- drawing the plan
- checking the plan
- implementation programme.

Certain essential mapping aids are required to facilitate planning; these usually include:

- quota maps
- aerial photos or orthophotographs
- soils maps
- contour maps.

Often quota maps or detailed soil maps are not available for small growers and developing areas, and 1:10 000 orthophotographs and recent aerial photographs are then used as the planning aids.

There are two basic types of LUPs.

LUPs for large, consolidated areas

These areas may consist of numerous individual cane farms consolidated into one unit (Figure 1), and are planned so that the area can be divided into smaller economic units to be settled by individual growers (Figure 2). Planning the total area initially provides a common extraction system and a more uniform conservation layout (Figure 3).

## Method

- Collect all available maps of the existing cane lands and obtain the relevant contour maps.
- Join the contour maps into workable sections and mark the existing cane areas onto a clear overlay and place it over the contour maps.
- Plan these areas by indicating the positions of all conservation works, extraction roads and loading zones, taking into consideration the soils, slopes and management practices envisaged.

After the LUP has been completed, the area is divided into the required individual units. Crest lines, extraction

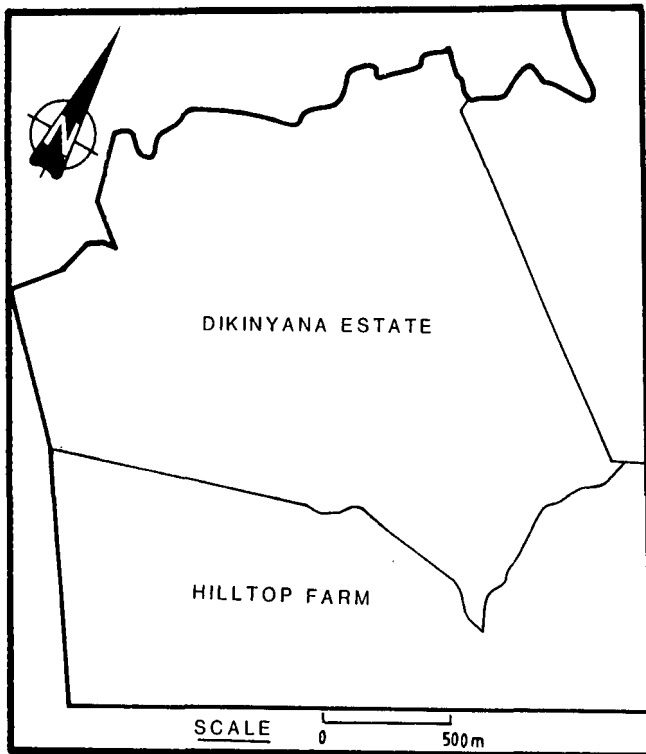


FIGURE 1 A portion of an existing farm before division into small grower units.

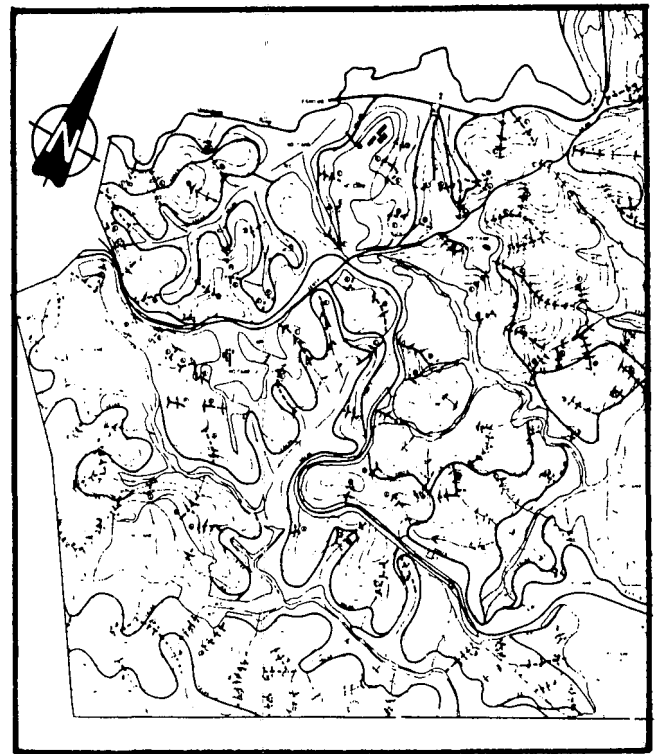


FIGURE 3 The consolidated plan of all grower units showing connected terraces, waterways and extraction roads.

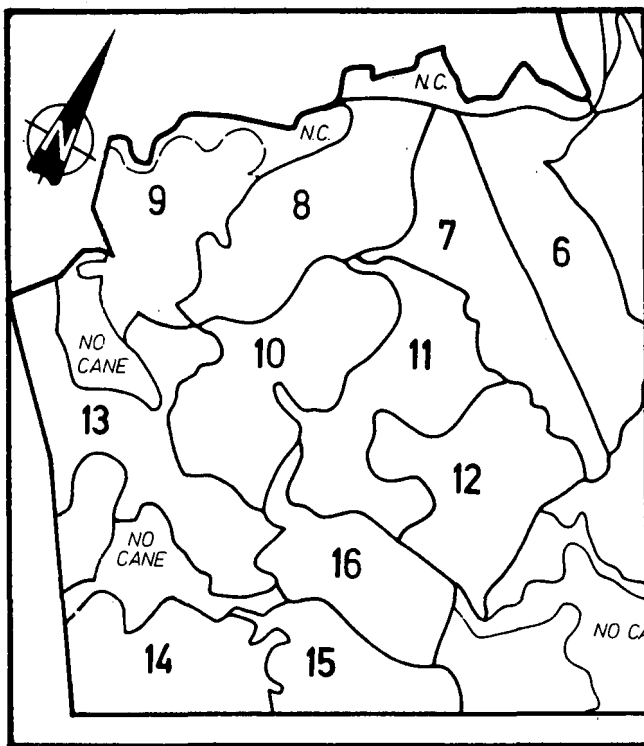


FIGURE 2 The shapes and positions of the small grower units are set by existing roads, rivers and topographic features.

roads, streams and other natural barriers are used as subdivision boundaries. Clients normally specify areas for individual units, which are based on economic factors of cane production.

The resulting LUP will consist of a contour map base, a conservation layout and extraction system and individual small grower units.

#### Planning large undeveloped areas

In undeveloped areas or where there are a number of small cane growers (Figure 4), there is usually no common extraction system or conservation network. The major problem encountered by the growers is the extraction of harvested cane from the field.

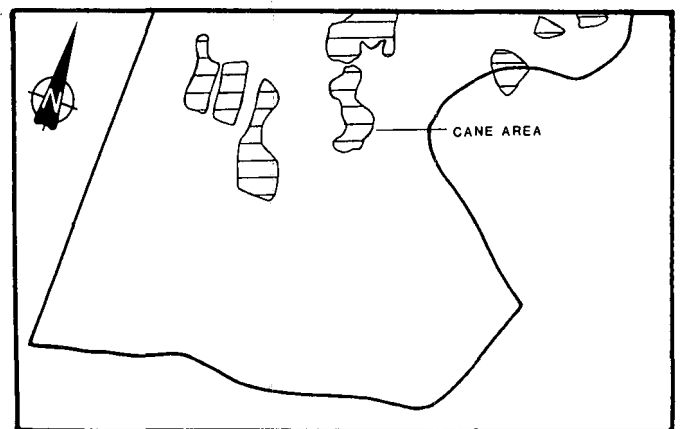


FIGURE 4 Scattered existing cane lands spread out in random fashion in a large area.

Planning these areas requires relevant 1:10 000 ortho-photos, which show topographic details. Identified by visual appraisal, areas of potential development are first marked, and the contours are then digitised into the computer and processed. A slope analysis is done with a Digital Terrain Model generated by the computer (Wallace, 1993) (Figure 5). A cut-off slope percentage for the slope analysis is set from the SASA nomograph and in conjunction with the KwaZulu Department of Agriculture.

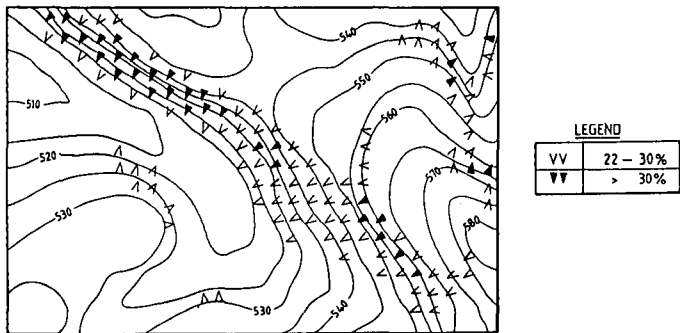


FIGURE 5 A computer-generated slope analysis showing the position of steep areas.

The potential cane areas are then planned by placing a clear overlay over the maps, drawing in an extraction system and adding the conservation layout (Figure 6). Extraction systems are designed to provide the shortest possible routes to the loading zones on the flattest possible gradients. Road gradients are limited to a maximum of 12% for infield roads and 8% for main haulage roads. Loading zones are sited, with consideration given to topography and the need for an average haul of 1 km from field to zone. The best positions for loading zones are in saddles or the top of hills and as close to the main roads as possible.

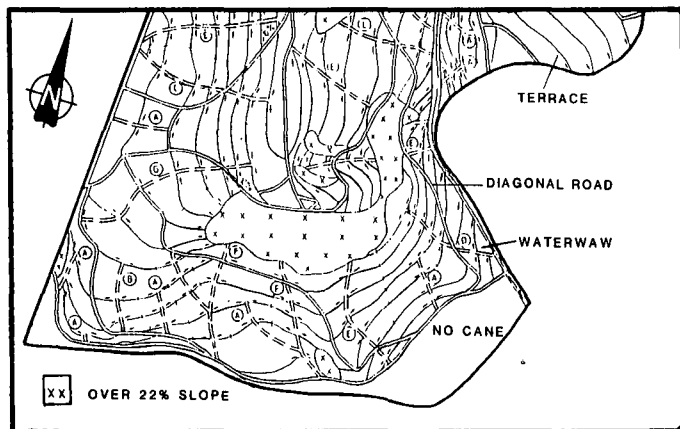


FIGURE 6 Area plan for potential development. Steep areas have been excluded and existing cane areas expanded.

The resulting LUP will consist of a contour map base with a slope analysis overlay showing potential cane areas with their extraction plan and loading zones.

#### Calculating costs

When the plan has been drawn, the cost of implementing the proposed works is estimated. Because much of the physical work is often done by contractors, costs are required for comparison of tenders and for financial planning by owners and developers. Costs are estimated by measuring the total lengths of the various structures on the LUP with an odometer or a measuring wheel, and then calculating the cost per kilometre to construct the different works (Table 1).

Other specific costs, for example river crossings and loading zones, are estimated. The number of crossings and loading zones required are totalled from the information provided on the LUP (Table 2).

Table 1

Cost of structures for a 1 263 ha development			
Structure	Km	R/km	Total cost (R)
Valley bottom cut-off roads	120	1 000	120 000
Access roads	15	1 000	15 000
Diagonal roads	38	2 800	106 400
Crest roads	37	2 200	81 400
Hilo roads	11	3 000	33 000
Terraces	200	2 000	400 000
Waterways	80	3 500	280 000
<b>Total</b>			<b>1 035 800</b>

Table 2

Cost of crossings and zones			
Structure	Unit cost (R)	No. required	Total cost (R)
Crossing	44 000	4	176 000
Zone	7 000	11	77 000
<b>Total</b>			<b>253 000</b>

Cost per hectare can then be estimated by adding the totals from the tables and dividing by the total potential cane area calculated from the slope analyses. For example:

Total cost = R1 288 800  
 Cane area = 1 263 ha  
 Cost per ha = R1 020

#### Difficulties with LUPs for large areas

Where cane is already grown there are often existing roads with random grades and positions and, if the topography is steep, re-routing is often impossible. Existing housing may block the path of potential conservation works and make it necessary to reposition terrace banks, which will then not conform to the spacing necessary for erosion control. Problems may also be encountered with the manner in which contractors implement an LUP. Control and good communication are essential when constructing field works. Different interpretations of the plan can be made depending on ground conditions, and quick decisions often have to be made on site. It is important to ensure that all parties are present at meetings where the plan is discussed, especially in the early planning stages. Where existing structures are in place and cannot be moved, the LUP must be adapted to fit around them. Houses which have to remain in place can be accommodated in a plan, possibly by spilling water away from them and diverting roads around them.

#### Benefits of an LUP

- It provides a detailed conservation network for the protection of natural resources
- It shows a detailed extraction network, indicating the types of road needed and positions of loading zones
- A budget for the works required and the costs involved is prepared
- Potential cane areas, according to slope and soils, are assessed
- Natural resources are protected
- Easier access into the area encourages upliftment of the whole social structure.

### **Conclusion**

The planning of developing areas must involve all parties, especially in the early stages of the process. In populated areas, careful thought is required when positioning conservation works and the cane extraction system. The plan must be accepted by all the people living in the area, both cane growers and non cane growers.

The LUP is an indispensable tool in the decision making process. It provides all the details required for decision making before any earthworks take place. It enables both developers and growers to gauge accurately the potential of an area for cane production.

### **REFERENCES**

Wallace, M (1993). Digital surface modelling: applications in the sugar industry. *Proc S Afr Sug Technol Ass* 67: 107-108.