ENVIRONMENT MANAGEMENT HANDBOOK

DARNALL ENVIRONMENT COMMITTEE

June 1990

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(Cont....)

FOREWORD BY MR IAN GARLAND

ENVIRONMENTAL RESPONSIBILITIES

Introduction

I consider it an honour to have been asked by the Darnall Environment Committee to write this foreword and contribute some thoughts for this valuable handbook. I have lived in Zululand for the past 45 years, and have watched the wetlands disappear, and the reeds encroach into silted lagoons, with the resultant "poor fishing" along the coastline. Now the tide has turned, exploitation has turned to rehabilitation, and there is a sudden realisation that if we want to survive we must understand how nature works, and learn to work with nature and not against it. There is no doubt that if we obey the laws of the natural environment, that the long-term fertility and profitability will return to the land.

Soil the Medium and Water the Life-Blood

Every farmer who has the privilege of managing land is the custodian of two precious resources - namely Soil and Water. Soil is the medium in which we grow our commercial crops. Water is an unpredictable commodity, it can either be our friend and ensure the growth of our crops, or it can be our foe and wash away our crop-medium. Obviously we would prefer water to be our friend, rather than a raging tyrant — uncontrolled and destructive; and so it is necessary to manage our volatile ally. Indeed, successful crop farming depends on judicious water-management. It is not surprising therefore, but nevertheless commendable, that the Sugar Association Experiment Station produces Land Use Plans for the farms, which are designed for maximum control of water firstly, for the soil to absorb and retain water, and then for any runoff to be guided so that there is minimum displacement of sediment.

Wetlands systems and their Functions

Sediment-free runoff eventually finds its way into the wetlands, and drains through the swamp-forests, papyrus swamps and marshes into natural streams, whose banks are stabilised by trees whose root-systems are especially adapted to high water-table conditions. In a natural well-conserved situation, water travels down a deep narrow channel with a minimum exterior area to the volume of water. This is nature's way of moving water most economically from one point to another, i.e. with minimum resistance to that volume of water. In that situation too, there is a minimum area of surface-water that is exposed to the air thus ensuring minimum evaporation taking place.

Finally, a deep narrow stream situation incidentally provides the most stable living conditions for aquatic organisms.

Controlling Water Velocity

Tree roots not only stabilise stream-banks, and thus prevent soil erosion, but some tree root-systems have the ability to form root-weirs — which play a very important role in controlling water velocity. It should be appreciated that if the velocity of a stream flow doubles, the soil-carrying capacity of that flow is increased by thirty times. In flood situation, where the velocity is increased ten or twenty times or more, the soil-carrving capacitv increases three hundred, or six hundred times the normal soil-carrying capacity or more. So it is very obvious that we should plan for the worst situation and ensure well treed wide margins along stream-banks, thus ensuring minimum sedimentation and permanent deep natural streams. Remember too that water with a low sediment load has a high scouring ability, which ensures that any silt in the system will be removed from the stream-bed, and the essential depth maintained.

The Need for Catchment Co-operation, and the Importance of Lagoons and Estuaries

It is vital that the farmers in a catchment should collectively make use of Land Use Plans, conserve their natural wetland communities, and manage their natural streams properly so that the combined conservation effort results in clean water entering lagoons and estuaries — thus maintaining the depth and viability of the nursery areas for juvenile marine organisms. Many of these fishes, crabs, prawns and eels are born at sea, and swim up river mouths into "nursery areas" where the water is both warmer and calmer than the sea, and where food has drifted down and accumulated from the catchment basin. These nursery areas provide optimum growing conditions for the marine organisms, which grow rapidly in strength and size until they are ready to swim back to the sea, to feed on the vast nutritional resources of the ocean. and mature into a very valuable natural high-protein food resource.

Indeed, farmers applying sound environmental management principles not only ensure the maximisation of long term profits for themselves, but also ensure the continued viability of natural marine food resources, as well as the recreational viability aspect of our beautiful coastline.

The Darnall Environment Committee is to be commended in taking a wide holistic view of the environment — not only is the agricultural aspect a focal point, but it is important to control industrial effluent, air pollution, and alien weeds. On the positive side too, attention is being given to the beautification of the urban areas by the creation of parks and planting of attractive trees. It is also noted that environmental education is a matter of concern. This, of course, is absolutely vital — if the young people of today are made aware of the importance of a healthy and beautiful environment, with clean bubbling streams and sweet air, then conservation of natural resources and concern for the surroundings **will** become a part of the philosophy and life-style of the citizens of tomorrow. Environmental education is the key to a better quality of life for everybody.

My warmest congratulations go to the Darnall Environment Committee for producing a very effective **Environment Management Handbook**, which will be of great value to the broad community of the Darnall District.

IAN F GARLAND
"Twinstreams"
Mtunzini

June 1990

ACKNOWLEDGEMENTS

The Darnall Environment Committee acknowledges the following with thanks:—

— IAN GARLAND for his thought provoking and comprehensive Foreword.

— SILVERAY FILES (PTY) LTD. for their contribution to the cover files of the handbook.

— TONGAAT-HULETT SUGAR LTD. for their assistance and contribution to the printing of the handbook.

— Those people who have showed concern for our environment long before it became currently fashionable.

Chapter I

INTRODUCTION

The Darnall Environment Committee was formed in December 1989 with the following objectives:—

1) to promote awareness of conservation responsibilities of all natural resources (air, water, soil, fauna and flora) of rural land owners and dwellers in the Darnall Mill supply area,
2) to encourage the implementation of conservation standards to ensure a co-ordinated approach from the field to the sea, and
3) to promote the image of the Sugar Industry as custodians of natural resources.

The primary aim of the Committee is to strive for greater active commitment to high standards of environment management.

All quota growers and the Darnall Health Committee have been grouped into the Tugela, Sinkwazi, Upper Nonoti and Lower Nonoti catchment areas to form the basis of representation to the Darnall Environment Committee.

The conservation of natural resources and our surroundings should be part of our philosophy and lifestyle. Further, the application of environment management principles ensures the maximization of long term profits. Basic resources are preserved for future years' production, and costs of repairing damage caused by unacceptable practice are minimized.

The Darnall Environment Committee has drawn up recommended guidelines and standards for the management of our environment in this handbook. It's aim is to present these guidelines for the attention and implementation of inhabitants of the Darnall Mill supply area. These recommendations are endorsed by members of your community who are members of the Darnall Environment Committee. Therefore, it is hoped that this Environment Management Handbook will enable the practical and profitable implementation of conservation in everyday life and farming practice.

Chapter II

FIELD PRACTICES

Experience has shown that farming with current recommendations of field layout, strip farming, minimum tillage where appropriate, and suitable varieties produces more cane at a lower cost.

The S.A. Sugar Association Experiment Station at Mount Edgecombe and the Lower Tugela Conservation Committee have promoted the concepts and implementation of soil and field conservation for many years. The implementation of a Land Use Plan ensures the following advantages : —

a) compliance with the provisions of the Conservation of Agricultural Resources Act, 1983,

b) the minimization of soil erosion with implementation of strip harvesting and strip crop re-establishment,

c) better cane yields through better water conservation and the establishment of correct varieties in appropriate situations between a valley and hill-top, and

d) efficient land use because of the optimim spacing and configuration of road systems which results in the optimization of transport distance and cost.

The determination of a Land Use Plan and field lay-out is dependent on a number of factors such as soil type, slope, method of re-establishment, trashing or burning at harvesting and the construction of conservation structures. These are embodied in a nomograph which is a system of graphs which enables one to determine the vertical interval and the surface width of panels for different soil types and agricultural practices in the Darnall area. Guidelines are shown in Table 1.

It should be stressed however that the basis for an optimum field lay-out is a Land Use Plan, obtainable from the Experiment Station.

The Lower Tugela Conservation Committee has implemented the use of Farm Assessments to monitor progress with respect to field layout and strip farming. This will be encouraged as the means to improving the quality of applied conservation.

This section has dealt with the appropriate field lay-out which is conducive to the best infield control of excess water. The next Chapter deals with the control of water from the field to the natural drainage lines.

TABLE 1

NOMOGRAPH GUIDELINES FOR DIFFERENT SOIL TYPES

(Strip harvesting has been assumed throughout this table)

(A) SOILS RESISTANT TO EROSION

SOIL TYPE

Parent Material

TABLE MOUNTAIN SANDSTONE (Mistbelt)
DOLERITE

Form

Inanda
Shortlands, Hutton

Panel Width

Conventional (Conv) or Minimum (Min) Tillage

	Conv	Conv	Conv	Min	Min
Slope	10%	15%	20%	25%	30%
Vertical Interval	7	9	10	13	13
Surface Distance (approx) (metres)	70	60	50	55	45

Tillage Method

Conventional tillage is acceptable on slopes up to 20%. In steeper areas minimum tillage (chemical or hand chipping) must be practised.

Conservation Structures

It is safe to construct water carrying terraces (roads) on these soils. Waterways and drainage lines must be stabilized **first.**

(B) MODERATELY ERODIBLE SOILS

SOIL TYPE

Parent Material	Form
MIDDLE AND LOWER ECCAS TABLE MOUNTAIN SANDSTONE (Minimum clay content 20%) (Minimum depth 750 mm)	Milkwood, Bonheim and Rensburg Glenrosa/Trevanian
GRANITE	Glenrosa

Panel Width

Conventional (Conv) or Minimum (Min) Tillage

	Conv	Conv	Min	Min	Min
Slope	10%	15%	20%	25%	30%
Vertical Interval	6	7	11	12	12
Surface Distance (approx) (metres)	60	50	55	50	40

Tillage Method

Minimum tillage (chemical or hand chipping) is necessary on all slopes greater than 15%, i.e. on most hillsides.

Conservation Structures

Spillover roads are recommended. Water carrying roads on these soils should only be considered **after** strip planting, minimum tillage and the stabilization of waterways and drainage lines.

(C) ERODIBLE SOILS

SOIL TYPE

Parent Material
DWYKA TILLITE
RED AND GREY RECENT SANDS

Form
Glenrosa, Westleigh
Hutton, Fernwood

Panel Width

Conventional (Conv) or Minimum (Min) Tillage

	Conv	Min	Min	Min	Min
Slope	10%	15%	20%	25%	30%
Vertical Interval	5	8	11	11	11
Surface Distance (approx) (metres)	50	55	55	45	40

Tillage Method

Minimum tillage (chemical or hand chipping) is necessary on all slopes greater than 12%, i.e. on most hillsides on farms in the Darnall area. Strip planting is essential.

Conservation Structures

Spillover roads on contour are recommended.

(D) VERY ERODIBLE SOILS

SOIL TYPE

Parent Material
TABLE MOUNTAIN SANDSTONE (Ordinary)

Form
Cartref, Mispah, Fernwood

Panel Width

Conventional (Conv) or Minimum (Min) Tillage

	Min	Min	Min	Min	Min
Slope	10%	15%	20%	25%	30%
Vertical Interval	5	8	11	11	11
Surface Distance (approx) (metres)	50	55	55	45	40

Tillage Method

Only minimum tillage should be used. Strip planting is an absolute requirement.

Conservation Structures

Spillover roads on contour are **essential.**

Chapter III

DRAIN, STREAM AND RIVERBANK MANAGEMENT

This Chapter provides broad guidelines for the stabilization and long term maintenance of systems to adequately deal with excess water that flows from cane growing areas. These guidelines comply with the terms and spirit of the Conservation of Agricultural Resources Act of 1983. Finer detail of design, stabilization methods and revegetation of drainage lines can be obtained from the Extension Officer of the Experiment Station.

The progress of water from the field to the sea is dealt with in three sectors, infield waterways, natural drainage lines and large streams and rivers.

1 INFIELD WATERWAYS

The design and construction of infield waterways is part of the establishment of an optimum Land Use Plan. These should be placed strategically within canefields to lead excess water to the natural drainage lines. Natural drainage lines are defined as rivers, streams or depressions which have perennial or intermittent water flow or are constantly wet during summer in normal years. It is recommended that all infield waterways should be trapezoidal in shape. This ensures an even flow of water across the base of the waterway, thereby preventing gulley erosion. The dimensions and shape are shown in Figure 1.

These waterways are planted to grass. This may be done by planting a continuous carpet of sods or by planting tufts. The latter method will generally require protection from erosion with barriers of cane tops. The grass species that are suitable for this kind of waterway are given in Table 2.

TABLE 2

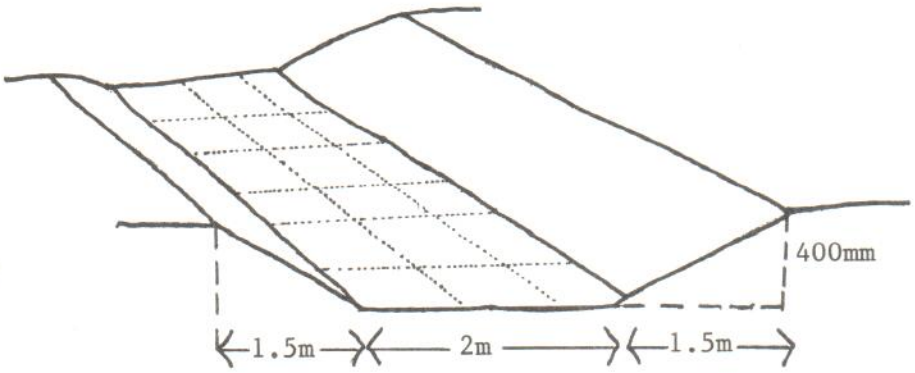
Grasses suitable for Waterways

Botanical Name	*Common Name*
Cynodon dactylon	Couch grass
Stenotaphrum secundatum	Coastal Buffalo grass
Stenotapnrum dimitiatum	Buffalo grass
Pennisetum clandestinum	Kikuyu
Imperata cylindrica	Silver spike
Eragrostis capensis	Heartseed lovegrass
Eragrostis lappula	
Andropogan appendiculatis	

Since waterways generally remain dry, they are best maintained by mowing or slashing in conjunction with the maintenance of cane breaks or roads.

FIGURE 1

Recommended Shape and Dimension of Trapezoidal Waterways



2 NATURAL DRAINAGE LINES

Natural drainage lines are defined as rivers, streams or depressions which have perennial or intermittent water flow or are constantly wet during summer in normal years.

During the last few years, increasing attention has been given to the adequate protection of natural drainage lines. It was generally found that during the floods of September 1987 and February 1988 that current conservation practices described in Chapter II and in the section above dealing with waterways, were adequate. However, natural drainage lines were very often badly damaged. This has focused attention on those areas which do not have the correct vegetation for optimum conservation and protection.

As a general rule, it is suggested that in any catchment of greater than 40 hectares or where it is consistently wet during summer in normal years, the drainage line should be treated as follows:—

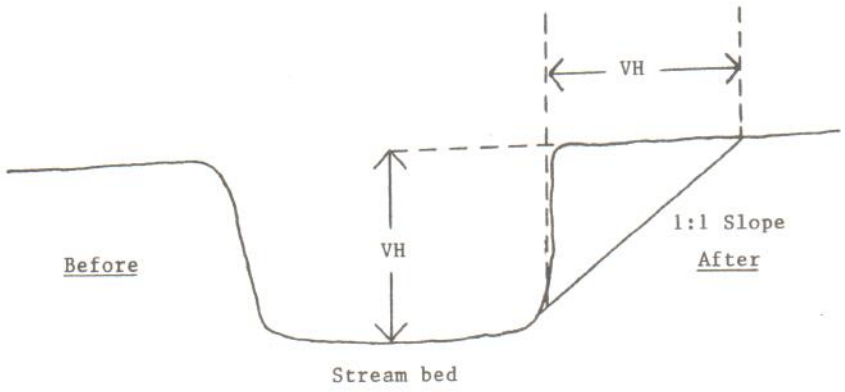
a) Stabilization and Maintenance of Stream Banks

A bank is considered unstable if it is vertical or nearly vertical, undercut or collapsing and is without a full cover of suitable vegetation. This vegetative cover must provide surface cover as well as binding the soil with a fibrous root system. The streamline is also considered unstable if cultivation or cropping is taking place within 4 metres from the water's edge.

Every effort must be made to reduce the slope of unstable banks to **at least** a 1:1 ratio, i.e. 1 metre vertical to 1 metre horizontal. Once the slope has been corrected the rhizomatous grasses must be planted to protect the disturbed soil on the bank. Suitable indigenous trees and shrubs can also be planted. The sketch in Figure 2 gives guidelines to the correct shape of a stream.

FIGURE 2

Correct Shape of Stream Banks



Note: Banks that are steeper than a 1:1 ratio, that are stable with a full cover of suitable vegetation should not be reshaped. Tree planting should be considered to provide long term stability.

The correct grass species to plant are those in Table 2 for the dry parts of the bank, with species listed in Table 3 for the parts of the stream that remain wet or damp throughout the year.

Obstructions in natural drainage lines caused by fallen trees or flood debris should be removed to ensure free movement of water.

TABLE 3

Grasses Suitable for Wet or Damp Stream Beds

Botanical Name	*Common Name*
Acroceras macrum	Nile grass
Leersia hexandra	Wild rye grass
Ischaemum arcuatum	
Digitaria swazilandensis	Richmond Finger grass
Hermarthria altissima	Red swampgrass
Echinochloa crusgalli	Barnyard millet, Hippo grass

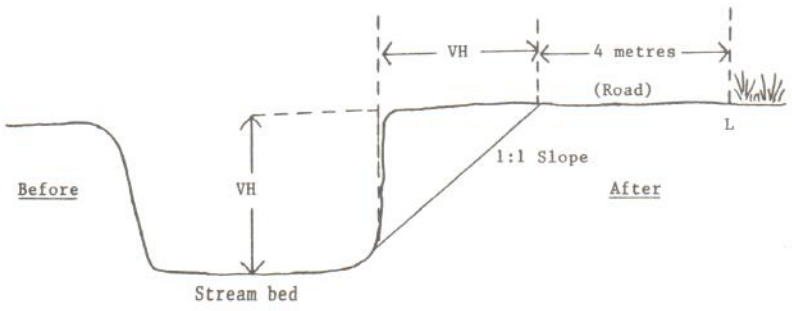
b) **Cultivation Limit Line**

It is recommended that sugar cane be removed a specific distance away from the edges of the drainage lines or streams. This is calculated as L=VH+4m. L is the Limit Line and VH is the Vertical Height of the bank. This formula gives the minimum width needed if creeping grasses are to be used for a protective cover. If it is intended to re-establish indigenous trees then a much wider area must be left from the shoulder of the shaped bank. Figure 3 shows the limit line for natural stream lines.

Experience has shown that there are advantages in using the 4 metre break between the stream bank and the sugar cane as a road. This ensures easy access to the stream and an area of mowed grass between the canefield and the stream. The 4 metre road also assists in the stabilization of the whole stream system.

FIGURE 3

Cultivation Limit Line (L) for Natural Stream Lines

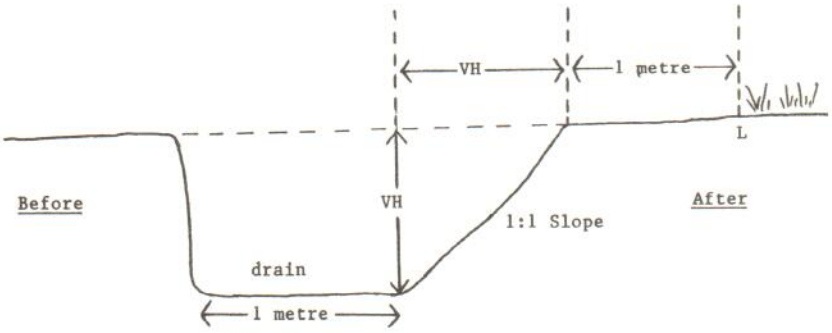


It may be necessary to drain small areas within a field to remove or lower the water table. In this case the establishment of an **artificial** drainage line should have a limit line as follows L= VH + 1m. This is shown schematically in Figure 4.

It must be stressed that the making of drains of any sort in undisturbed wetlands is a contravention of the Conservation of Agricultural Resources Act.

FIGURE 4

Cultivation Limit Line (L) for Artificial Drainage Line



c) **Suitable Vegetation**

The establishment of indigenous species of grasses, shrubs and trees in the natural drainage lines must be carefully planned. The primary aim must be to first establish those species which rapidly cover the ground such as the grasses. In many cases the stabilization of the banks with a well grown mat of grasses together with the removal of sugar cane from the area immediately adjacent to the banks is sufficient. Once the grasses have provided surface cover then a programme can be started which introduces pioneer tree species, which again are fast growing.

These pioneer species attract wild life which in turn will bring in more long term species. It is recommended that staggered rows of trees be planted 3 to 4 metres apart on opposite banks of the stream. As the plants become established they will start to take over surrounding areas along the watercourse where conditions suit their particular requirements.

Clusters of trees should be concentrated on the pressure points within a stream. These pressure points occur where there is a change in direction of the flow of the stream resulting in pressure on the outside bank. Particular care should be taken in planting these areas with grass and trees with vigorous rooting systems.

The hazards of fire on riverine vegetation cannot be over emphasised. As the valley bottom areas are most frequently burnt during the winter, extra care must be exercised to ensure that the fires do not destroy this sensitive area.

The grass species that have been planted or are growing naturally should not be slashed indiscriminately. It is recommended that no slashing or very selective careful slashing should be undertaken. This will avoid the destruction of seedling pioneer and tree species which will start to grow naturally. However, alien invader plants should be removed. This is the subject of a later Chapter.

Table 4 lists suitable tree species for the Darnall area.

TABLE 4

Indigenous Trees Suitable for Afforestation of Watercourses

Botanical Name	*Common Name*	*Zulu Name*
Trees with vigorous rooting characteristics		
Bridelia micrantha	Mitseeri	umHlalamakwabe
Phoenix reclinata	Wild date palm	iSundu
Raphia australis	Kosi palm	umVuma
Rauvolfia caffra	Quinine tree	umHlambamanzi
Voacanga thouarsii	Wild frangipani	umKhadlu
Syzygium cordatum	Umdoni	umDoni mhlope
Macaranga capensis	Wild poplar	iPhumela
Ficus natalensis	Natal fig	umThombi
Ficus sur	Cape fig	umKhiwane
Harpephyllum caffrum	Wild plum	Umgwenya
Acacia robusta	Splendid thorn	umNgamanzi
Rhus chirindensis	Bostaaibos	iKhathabane, umHlokoshiya
Barringtonia racemosa	Fresh water mangrove	Ibhoqo
Trichilia emetica	Natal Mahogany	Mkuhlu
Halleria lucida	Tree fuschia	iMinza
Syzygium guineense	Red Umdoni	umDoni bomvu

Pioneer or precursor trees

Acacia Karoo	Sweet thorn	uMunga
Trema orientalis	Pigeonwood	uBhatini
Albizia adianthifolia	Flat crown	umGadenkalou
Antidesma venosum	Tasselberry	isiBangamlotha
Croton sylvaticus	Forest croton	umHlalanyoni
Celtis africana	White stinkwood	umVumvu

Trees with commercial and medicinal value

Apodytes dimidiata	White pear	umDakane
Podocarpus latifolius	Real yellowwood	Khoba
Podocarpus falcatus	Outeniqua yellowwood	umSonti
Millettia grandis	Umzimbeet	umSimbithi
Ocotea bullata	Stinkwood	umNukane
Warburgia salutaris	Pepper-bark	isiBhaha
Bersama lucens	Glossy bersama	uNdiyaza
Curtisia dentata	Assegai	isiNama
Olea woodiana	Forest olive	isiHlulambaga
Ptaeroxylon obliquum	Sneezewood	umTate
Bridelia micrantha	Coastal Goldleaf	umHlalamakwabe

Ornamental and flowering trees

Strelitzia nicolai	Natal strelitzia	isiGude
Erythrina lysistemon	Common coral tree	umSinsi
Calodendrum capense	Cape chestnut	umBhaba

3 LARGE STREAMS AND RIVERS

The basic principles given for the stabilization and preservation of natural drainage lines apply to those for large streams and rivers. It is difficult to provide anything more than broad guidelines to the management of large stream and river banks. It is suggested that professional advice from the Experiment Station should be sought to determine appropriate cultivation limit species.

Chapter III has dealt with the stabilization and preservation of drains, streams and river banks. These are important and sensitive conduits of water from the field to the sea. The next Chapter deals with the conservation of wetland areas within this chain.

Chapter IV

WETLANDS

Wetlands are often defined as all areas which support the complex journey of water from catchment areas through vleis and swamps to streams and rivers leading to estuaries and lagoons. In this Chapter a more narrow definition of wetlands will be used to include vleis, swamps and lagoons. The interleading water courses have been dealt with in the previous Chapter.

Vleis or swamps can be defined as flat, moist areas where shallow standing water remains more or less permanently. These areas were once abundant in the Darnall area but drainage programmes have drastically reduced their number. However, small areas of fresh water vleis and swamps do remain within the Darnall supply area as well as several lagoons.

In terms of the Conservation of Agricultural Resources Act of 1983, no existing vleis, swamps or lagoons may be drained. Whilst it is not suggested that areas that have been drained should be returned to a pristine wetland condition, every effort should be made to conserve the wetlands that do exist. Small, troublesome wet areas should be considered for development into mini wetlands.

Wetlands, as defined, provide the functions and value of water storage, stream flow regulation, flood attenuation, watertable maintenance, water purification, soil erosion protection, drought relief and wild life protection. The wetland areas and their catchments need careful management. The prevention of soil erosion in the catchment above wetlands needs the most careful attention. The damming and drainage of wetlands alters the character of these areas. The effects of fire, grazing domestic stock and timber plantations in the proximity of these wetlands require sensitive management. The edges of wetlands are subject to alien invader plants which need to be removed. This is dealt with in the next Chapter. The Natal Parks Board and the SASA Extension Officers are able to provide advice on the management of these sensitive areas.

The wetlands of the Darnall area need to be identified and preserved for their intrinsic and educational value.

Chapter V

NATURAL BUSH PRESERVATION AND ALIEN INVADER PLANT CONTROL

Before the establishment of sugar cane the coastal areas of Natal and the Darnall area in particular, had a wide variety of forest and bush. This varied from thick coastal and riverine forests to bushveld in the drier areas. Most of this has been removed for the cultivation of crops. However, the remaining remnants of natural bush should be preserved and up-graded. The conserving of small units or patches of forest serve as an important contribution to the conservation of bushveld and particular forest species.

1 IMPROVING DEGRADED BUSH AND FOREST

Degradation usually takes place in two stages. First comes the removal of particular species, usually those of greatest economic value. Removal is always accompanied by damage caused by tree felling, hauling of logs, etc. Subsequent invasion by weeds, often vigorous aliens, occurs in the disturbed area.

The first step in restoration is to remove alien invaders. This will be further expanded later in the Chapter.

The second step is to encourage natural regeneration and this can be accomplished in a number of ways. In the case of bushveld, it may be sufficient to exclude domestic stock, especially goats, for a few years. The correct use of fire will also assist.

In the case of forest, total exclusion of stock and fire is essential. Regrowth of damaged areas is usually rapid provided that reinfestation by alien plants is prevented.

The Natal Parks Board and many knowledgeable fellow farmers can assist in programmes in restoring and improving degraded bush and forest.

2 ALIEN INVADER PLANT CONTROL

Alien invader plants are listed in Table 5. These plants are likely to be a problem in areas that are not intensively cultivated. These areas include road reserves, stream banks, timber plantations and natural bush.

The eradication of alien invader plants is often regarded as a daunting, uneconomic and impossible task. However, proper planning, the correct application of available control methods and persistent follow-up to prevent reinfestation are essential aspects to the management of invader plants. Table 5 gives an indication of the herbicides registered for use against invader plants. This may have to be supplemented by mechanical control methods such as slashing, digging out or removal by hand when the soil is moist. Triffid weed can easily be removed by pulling out after rain.

TABLE 5

Herbicides Registered for use against the most important Alien Invader Plants in the Sugar Growing Areas.

Alien Invader Plants	Herbicides				
	triclopyr (Garlon)	glyphosate (Round-up)	imazapyr (Arsenal/ Chopper)	tebuthiuron (Graslan)	picloram (Tordon)
Triffid weed (Gillespie, Paraffin, Chromolaena)	X	X		X	
Lantana		X	X	X	X
Guava	Xa		X		
Bugweed	X	X	X	X	
Pereskia	Xa				
Inkberry	X				
Sesbania	X	X		X	
Indian Laurel	X	X	X	X	
Syringa	Xa				
Ballon vine					
Mauritius thorn	X	X			
Mexican sunflower					
Peanut butter cassia					
Brazilian pepper	X★				

a = Research in progress to improve efficacy of chemical control
★ = Basal applications

The Cedara Weed Laboratory is becoming increasingly involved in research into methods of controlling alien invader plants. Useful information is also available from the Parks, Recreation and Beaches Department of the Durban Municipality. This information covers the identification and control methods of alien invader plants. The Extension Officers of the Experiment Station are also able to make recommendations.

Chapter VI

CONSERVANCIES

A conservancy may be described as a group of farms whose owners have combined resources for improved conservation and well-being of wildlife inhabiting the area. The term wildlife in this instance encompasses mammals, birds, fish, natural vegetation and all desirable natural life forms. Some of the advantages listed by the Natal Parks Board on forming a conservancy are:—

1) game becomes tamer and is more readily seen,
2) wildlife increases in conservancy areas,
3) fewer uncontrolled forest and veld fires,
4) marked decreases in stock and crop thefts,
5) harassment of local population is reduced,
6) local population usually supports the presence of game guards,
7) better control of stray dogs reduces the chances of rabies outbreaks,
8) vagrants tend to avoid a regularly patrolled area,
9) sport hunting improves,
10) land owners become more conscious of their wildlife,
11) the economic value of the area is improved due to increased numbers of wildlife, and
12) educational value for schools and local community.

The Natal Parks Board is actively promoting the formation of conservancies and can provide details on request in the form of a Conservancy Manual which provides guidelines for the formation of a conservancy, a draft constitution and management details.

The Sinkwazi Conservancy has been established in the Darnall area to protect the coastal area between the Nonoti and Tugela rivers. The benefits to the conservation of wildlife and the strengthening of relationships between the farming community and the Sinkwazi Health Committee are apparent. The Blythedale Conservancy is being formed to conserve the coastal area between the Umvoti and Nonoti rivers. The establishment of further conservancies should be encouraged.

Chapter VII

WATER POLLUTION

Chapter III dealt with the physical preservation and stabilization of streams and river banks to prevent water pollution by soil. Much of this Chapter deals with water pollution and treatment in an urban and industrial sense. However, it is important to realise that water pollution often occurs where streams and rivers are used for the washing of vehicles and equipment and for staff ablutions. Areas close to streams and rivers are often used for the disposal of unmillable cane, farm rubbish and agricultural chemical containers. Every effort needs to be made to prevent these practices.

A further source of pollution is the runoff of fertilizers and agricultural chemicals applied to the field. World trends indicate that this kind of pollution will become an issue in the next decade and therefore needs our consideration.

The rest of the Chapter deals with water use in domestic and industrial applications.

1 RAW WATER

Raw water comes from three main sources:—

a) Boreholes
b) Rivers
c) Dams

Virtually all river and dam waters are totally unfit for human consumption and have to be treated. Borehole water may have to be softened and chlorinated, but is purer than river and dam water.

To render the water fit for human consumption (potable), the suspended solids, colour and disease causing organisms must be removed. The standard process for river and dam water treatment consists basically of the following steps:—

a) Flocculation — to coagulate the suspended solids in the raw water into floc particles. The settling floc will also remove colour bodies. Alum is the most widely used flocculant.

b) Settling — a retention time of about four hours is required in standard settling tanks.

c) Filtration — the efficiency of this step depends on good flocculation and settling.

d) Chlorination is needed after filtration to sterilise the water. Sufficient chlorine should be added to provide a low residual chlorine level (0,1 - 0,3 p.p.m.) at the furtherest point in the reticulation system.

Chlorine gas or sodium hypochlorite solutions containing 15-20% chlorine (mass/volume) are usually used. Because of the extremely hazardous nature of chlorine gas, safety instructions must be strictly adhered to.

Treated water should be analysed regularly to ensure that the water is potable.

Technical assistance in water treatment and analysis can be obtained from the Darnall Sugar Mill staff.

2 STANDARDS

The quality of raw water for domestic and industrial use is dependent largely on the efficient control of discharges to public streams. The Water Act of 1956 (extensively amended in 1984) contains legislation concerning the responsibilities of industrialists and land owners in preventing water pollution. The amended Water Act requires registration of water care works and it specifies minimum training for operators.

The quality standards required for water (treated effluent) which is to be discharged to a public stream are updated periodically in Schedules in the Government Gazette, the most recent being in Gazette No. 9225 of May 1984.

These are:—

Chemical Oxygen Demand (COD)	max. 75mg/l
Suspended Solids	max. 25 mg/l
Free Saline Ammonia (as N)	max. 10 mg/l
Dissolved Oxygen	min. 75% saturated
pH	5,5 — 9,5
E coli	No typical faecal col/100 mls.
Temperature	max. 35 degrees C.

The particular standard which untreated sugar factory effluents exceed is the oxygen demand (the chemical oxygen demand (COD) must be below 75mg/l before discharge to a stream). The COD of raw factory effluents is about 1 500 mg/l and if this is discharged to a stream its high oxygen demand causes depletion of dissolved oxygen in the stream thus causing asphyxiation (not poisoning) of fish, bad odours and tainted water. The COD of molasses exceeds one million mg/l, so even minor spills can be serious.

One of the standards for treated effluent and drinking water is that no Escherichia coli bacteria must be detectable in a 100ml sample. The presence of these bacteria indicates recent pollution with human faecal matter. Regular tests for the bacteria are done on raw and drinking water from the mill and its estates.

If boreholes are protected from contamination by surface runoff they invariably provide water which is free from harmful bacteria and therefore requires no treatment.

3 TREATMENT

Effluents can be purified to the required standards in a variety of treatment plants, all of which basically involve mechanical oxygenation of the effluent in the presence of bacteria which "burn" the impurities to produce carbon dioxide gas.

There are two main types of biological treatment which may be used on their own or in combination :—

- Anaerobic (needing no oxygen)
- Aerobic (needing oxygen)

Darnall Mill operates an aerobic activated sludge plant for sewerage treatment and an anaerobic plant for factory effluent. The treated effluent is disposed of via storage dams as irrigation to cane.

Precautions are taken in choosing irrigation sites to avoid runoff into rivers and streams. For this reason, the watertable is also taken into account.

All streams between the Sinkwazi River and Nonoti River are sampled regularly to monitor levels of pH and COD as early warning of any possible pollution.

If the final treated effluent from a domestic sewerage plant is to be disposed of into a river, it must be chlorinated to kill any viruses or bacteria present. The amount of chlorine required depends on the "chlorine demand" and acidity of the water. As a general rule 3 grams of high test hypochlorite (HTH) applied to 1 000 litres of clear water will sanitise the water after 30 minutes.

4 SOLID WASTES

The incorrect disposal of solid waste, such as municipal refuse and boiler smuts, can cause pollution of streams and underground water. An Act to control solid waste disposal has been drafted. It is mainly applicable to large disposal sites and those handling toxic wastes but it does emphasise the need to avoid dumping solid waste near watercourses or on permeable soils.

5 ANALYSES

Most factories have the facilities for COD analyses but not for bacterial analyses. For a small fee the latter can be done by either the Sugar Technology Division of Tongaat-Hulett or by the Sugar Milling Research Institute in Durban. It is essential that the samples be correctly taken in sterile bottles.

Chapter VIII

AIR POLLUTION

The major sources of air pollution in the Darnall area are from factory emissions, cane burning and hormonal herbicides. The use of hormonal herbicides is currently restricted under a voluntary ban until the effects of the use of these herbicides can be firmly established. Therefore, this aspect will not be considered.

1 CANE BURNING

Research at the SASA Experiment Station has shown that there are advantages to be gained from trashing and the consequent trash blanket. These are:—

a) improved water conservation, soil conservation and infiltration rate,

b) suppression of weed growth,

c) prevention of soil capping and reduction in evaporation,

d) elimination of the need of burning, causing less air pollution,

e) reduction of the amount of P fertilizer likely to be fixed in acid soils, and

f) reduction of the liklihood of soil compaction.

All of these contribute to higher yields on the coastal lowlands. This is confirmed by the results of experiments in Table 6, which show the yield increases of a trash blanket and burnt tops scattered compared with a side raking and reburning tops to leave no mulch.

TABLE 6

Results of Trashing Experiments (tc/ha/annum)

Crop	High potential soils (deep loams and clays)			Moderate to low potential soils (grey sandy loams)		
	Trash Blanket	Burnt tops scattered	Advantages to trash	Trash Blanket	Burnt tops scattered	Advantages to trash
Starting in Summer	+ 10	+ 6	+ 4	+ 6	+ 5	+ 1
Starting in Winter	+ 4	+ 3	+ 1	Nil	Nil	—

2 CANE BURNING CODE OF PRACTICE

The following rules and guidelines should be followed:—

a) the Forest Act of 1984 gives the Minister power, annually, to determine conditions for the prohibition of burning of slash and fires in the open air for the Lower Tugela Magisterial District. During the past few years he has determined as follows:—

   i) no person shall, from 1 July up to and including 30 September, burn any plantation slash;

   ii) no person shall make or cause to make any fire in the open air or, if such fire has been made, allow such fire to continue to burn or add fuel thereto or rekindle it from 18h00 on Fridays to 06h00 on Mondays, save fires to facilitate the harvesting of sugar cane during the hours 18h00 Friday to 08h00 Saturday and 17h00 Sunday to 06h00 Monday,

b) caution should be taken to avoid any smoke crossing public roads. If there is any danger of this happening warnings should be given to motorists to approach smoke slowly,

c) zone burning or the burning of cane stacks in fields should be discouraged,

d) care should be taken of the direction of the wind during cane burning to avoid smoke and smut pollution in communities downwind of the fire,

e) care should be taken to avoid burning in May, June and July when temperature inversion causes smoke to linger at low altitudes causing poor visibility and pollution, and

f) the operation of the fire cells and the precautions against uncontrolled burning should be implemented during fire seasons and dry spells.

It should be noted that the burning of crop residues in Europe will be prohibited from 1992 because of smoke pollution. Undisciplined cane burning will result in similar prohibitions in the Darnall area. Therefore, all cane burning operations should be carried out with the potential nuisance of such operations in mind.

3 FACTORY EMISSIONS

South African legislation on the control of air pollution by factories is exercised through the regional Air Pollution Control Officer of the Department of Health for the Natal Region. In 1970, the sugar industry formed the South African Sugar Millers Air Pollution Study Group in collaboration with the Department of Health, and until 1984 this group was instrumental in achieving almost 100% success in the campaign to eliminate obvious emissions from sugar mill boilers.

This was achieved by the development of an extremely efficient type of wet scrubber, two of which are installed at Darnall.

The required air pollution standard, briefly stated, is that all boilers must comply with a maximum emission level of 200 milligrams of dry particulate matter (e.g. dust, smut and smoke) in every cubic metre of gas leaving the stack. This is equivalent to about one teaspoon of dust in an average bedroom!

This air pollution standard which was voluntarily agreed to by all sugar millers in 1984, at the final meeting of the Air Pollution Study Group, is better than the National requirement, which is 400 mg/cu.m.

4 NOISE POLLUTION

Noise from tractors, cane haulage vehicles and factories are offensive elements of modern life. Proper care to ensure reasonable maintenance of equipment in the form of proper silencing of vehicles and commitment to accepted standards will ensure that noise pollution is minimized.

The Sugar Milling Research Institute (SMRI) and Tongaat-Hulett Darnall Sugar Mill do have equipment to test for noise. The standard noise level which should not be exceeded is 85 decibels.

Chapter IX

CANE SPILLAGE

Frequent press articles highlight that cane spillage is another issue that requires management by the Sugar Industry. Cane spillage is unsightly at the edges of our roads, and it also blocks mitre drains. Large cane spillages have been known to be a traffic hazard and the cause of fatal accidents.

1 LEGAL REQUIREMENTS

Provincial regulations of Natal govern vehicle mass and dimensions, and the behaviour of vehicles on roads. This has been further reinforced in some Town Board areas by legislation requiring that loads have to be secured or covered to effectively prevent any part of the load being wind blown or falling or being discharged from the vehicle. This is specifically aimed at cane haulage vehicles.

2 METHODS OF AVOIDING CANE SPILLAGE

Farmers own the cane until it has been delivered to the mill yard. This confirms that the spillage of cane is a problem that must be addressed by the farming community. If current cane spillage is not reduced specific general legislation will be introduced in Natal which will result in increased costs.

Surveys conducted by the Experiment Station have confirmed that cane spillage is a problem that can be managed by the farmer.

The following suggestions and guidelines are given to ensure the minimum of cane spillage:—

a) Cutters should be encouraged to make bundles of suitable size to fit the configuration of the transport vehicle. The separation of cutting and stacking operations can assist in attaining a constant stack size.

b) Careful infield loading will result in tidier bundles. This will be facilitated by the construction of stacks over cable furrows where side loading trailers are used.

c) Crane or loader operator training is an important consideration. Attention should be given to ensuring that cane loaded above the spiller bar of the hilo is secure. Night loading often leads to a lower quality of loading due to lack of visibility, haste or tiredness. Spreader bars on cranes will help to maintain the bundle shape during loading.

d) All operators of vehicles leaving the mill yard or after unloading, should ensure that the vehicle is clean.

e) Good quality roads and zones ensure that cane spillage is minimized.

A conscious awareness by management for possible sources of spillage should be a top priority. Constant attention should be given to changes in conditions to ensure that cane is always neatly loaded with the subsequent minimization of spillage.

Chapter X

GENERAL INFORMATION

1 AWARDS AND CERTIFICATES

The Darnall Environment Committee acknowledges that the implementation of sound environment management practices depends on those who live in our area. It is therefore appropriate that the Darnall Environment Committee recognises the contribution made by those who are committed to environment management by way of awards and certificates.

The first step is the award of the Darnall Environment Committee's Certificate of Acceptance. This will be awarded to those who are committed to implementing the aims and objectives of the Darnall Environment Committee as set out in this handbook.

One year after the award of the Certificate of Acceptance, the Darnall Environment Committee's Environment Management Implementation Certificate will be issued to those who, in the opinion of the Committee, have implemented environment management programmes.

The Darnall Environment Committee will encourage the entry of farms for the Themeda Award. The objective of this prestigious award is to give recognition to farmers who have achieved a high and sustained conservation standard while implementing sound management practices on the farming unit as a whole. The nomination and evaluation for the award is undertaken by the Lower Tugela Conservation Committee.

The Lower Tugela Conservation Committee holds bi-annual competitions for the best conserved and most improved farms in the North Coast Region. These competitions are an ideal way for the agricultural community to judge their progress because the comments of the judges are very valuable indicators of progress.

2 LIST OF SCHOOLS IN THE LOWER TUGELA AREA

ASHVILLE PRIMARY	P.O. Box 693, Stanger	0324 - 7878
BANGISIZUNGU PRIMARY FARM	P.O. Box 53, Darnall	
H. BODASING PRIMARY	P.O. Box 457, Stanger	0324 - 23826
L. BODASING PRIMARY	P.O. Box 30, Kearsney	0324 - 23837
CIRCLE PRE-PRIMARY	Badiyat Street, Stanger	0324 - 21443
DARNALL PRIMARY	P.O. Darnall	0324 - 61352
DARNALL SECONDARY	P.O. Box 27, Darnall	0324 - 61327
DAWNVIEW PRIMARY	P.O. Box 792, Stanger	0324 - 22433
GLEDHOW PRIMARY	P.O. Box 742, Stanger	0324 - 22297
HULETT PRIMARY FARM	P.O. Box 87, Stanger	0324 - 7856
HULSUG PRIMARY FARM	Tongaat-Hulett, Darnall	0324 - 61555
LLOYD COMMUNITY SCHOOL	P/Bag 10630, Stanger	0324 - 23814
LOWER TUGELA PRIMARY	P.O. Box 2549, Stanger	0324 - 3554
LUBISANA PRIMARY FARM	P.O. Box 204, Stanger	0324 - 22268
MELVILLE PRIMARY	P.O. Box 636, Stanger	0324 - 99035
MBOZAMBO PRIMARY PUBLIC	P/Bag X10676, Stanger	0324 - 21947
NEW GUELDERLAND PRIMARY FARM	P/Bag X10610, Stanger	0324 - 21268
NEWARK PRIMARY FARM	P.O. Box 17, Darnall	0324 - 61463
NONOTI PRIMARY	P.O. Box 930, Stanger	0324 - 61586
NONOTI PRIMARY FARM	P.O. Box 4, Kearsney	0324 - 23791
NSONONO PRIMARY	P.O. Kearsney	031 - 218492
NTWASHINI PRIMARY FARM	P.O. Box 972, Stanger	0324 - 23557
PARUKABAD PRIMARY	P.O. Glenmill	0020 - 25
RAMLAKAN FARM	P.O. Box 153, Stanger	0324 - 92364
SHEKEMBULA JUNIOR SECONDARY	P/Bag 0003, Kearsney	0324 - 7737
STANGER COLOURED PRIMARY	P/Bag X10606, Stanger	0324 - 22166
STANGER PRIMARY	P.O. Box 44, Stanger	0324 - 21953
STANGER HEIGHTS PRIMARY	P.O. Box 1888, Stanger	0324 - 24305
STANGER MANOR PRIMARY	P.O. Box 638, Stanger	0324 - 24622
STANGER MADRESSA	P.O. Box 222, Stanger	0324 - 21920
STANGER SECONDARY	P.O. Box 68, Stanger	0324 - 21227
STANGER M.L. SULTAN	P.O. Box 203, Stanger	0324 - 25484
STANGER MANOR SECONDARY	P.O. Box 952, Stanger	0324 - 23416
STANGER SOUTH SECONDARY	P.O. Box 988, Stanger	0324 - 23400
STANGER HIGH	P.O. Box 5, Stanger	0324 - 21231/2/3
STANGER PRIMARY	P/Bag X10649, Stanger	0324 - 22441
STANGER PRE-PRIMARY	P.O. Box 1013, Stanger	0324 - 23328
STANGER TRAINING CENTRE	P.O. Box 1423, Stanger	0324 - 24725
SEWPAUL PRIMARY	P.O. Box 287, Stanger	0324 - 22794
SUNBURY PRIMARY	P.O. Box 183, Darnall	0324 - 61463
TSHELEBANTU HIGHER PRIMARY	P/Bag 0003, Kearsney	0324 - 7737
ZINKWAZI FARM	P.O. Box 1033, Darnall	0324 - 61419

3 TREE NURSERIES

The general interest in indigenous trees prompted by the need to revegetate degraded stream systems, is being promoted by the Dendrological Society. The Head Office address of this society, which promotes the knowledge, protection and propagation of trees and the preservation of tree dominated ecosystems, is P.O. Box 104, Pretoria 0001.

The SASA Experiment Station has produced a guideline paper entitled "Producing Tree Seedlings for Establishment in Riverine Situations" which gives practical instructions on the establishment and management of a tree nursery.

Some commercial nurseries which supply indigenous trees are:—

1. Mr. Wally Menne
   New Age Nurseries
   Empangeni
   Tel: 0351 - 24825 (Work)
   0352 - 692 (Home)

2. Mr. D. Barbour
   Top Crop Nursery
   P.O. Box 32
   Crammond
   Tel: 03393 - 643 and 811

3. Dunrobin Nurseries (Pty) Ltd.
   Bothas Hill
   Tel: 031 - 7771855

4. Haigh's Nursery
   298 Cliffview Road
   Bellair
   Tel: 031 - 455008

5. Val-Lea Vista
   Pietermaritzburg
   Tel: 0331 - 93527

6. N.E. Nel Grow
   P.O. Box 1742
   Port Shepstone
   Tel: 0397 - 860

7. Eddy Lee
   Port Edward
   Tel: 03930 - 32316

4 NEWSPAPERS

The following newspapers and journals are reporting environment management matters and events:—

Name of Publication	Telephone No.
S.A. Sugar Journal	031 - 3056161
North Coast Courier	0322 - 62430
Stanger Mail	0324 - 22042

5 PLACES OF INTEREST

The Natal Parks Board administers the Harold Johnson Nature Reserve in the Fort Pearson area. The Darnall Health Committee area is a proclaimed nature reserve. Besides these two officially proclaimed conservation areas, conservancies operate along the sea shore and the inland coastal forest areas from the Umvoti to the Tugela Rivers.

Many farms and facilities such as dams or areas of indigenous bush are available to invited members of the public or by appointment for the study and enjoyment of natural beauty. The Commitee will encourage the opportunity for farms to be visited in order that the substantial good work that has been done on many farms can be appreciated by the public.

6 LIST OF REFERENCES

This list of references is given to encourage further reading and interest. Many people have contributed to the general knowledge of environment management and to the contents of this handbook. Their contributions are acknowledged with thanks.

a) Act. No. 43, 1983. Conservation of Agricultural Resources Act, 1983 and supporting Regulations

b) SASA Experiment Station Information Sheets relevant to environment management:—

Information Sheet No.	1	Stool Eradication
	7	To Trash or Burn at Harvest
	8	Roundup for Cane Eradication
	9	Mole Drainage
	10	Cover Crops
	18	Cambered Beds
	24	Producing Tree Seedlings for Riverine Situations

c) The S.A. Sugar Technologists' Association has published the following papers on conservation farming :—

i) *"The Use of Strip Cropping on a Large Sugarcane Estate"*, by M.A. Barendse and J.E. Lonsdale - S.A. Sugar Technologists' Association, June 1986.

ii) *"Land Use on Steep Slopes on an Estate on the South Coast of Natal"* by O.P. Landrey - S.A. Sugar Technologists' Association, June 1978.

iii) *"Conservation Farming Pays"* by C.T. Wise - S.A. Sugar Technologists' Association, June 1978.

iv) *"Aspects of Strip Cropping of Sugarcane on the North Coast of Natal"* by R.A. Stranack - S.A. Sugar Technologists' Association, June 1990.

d) Natal Parks Board— Wildlife Management Technical Guides for Farmers:—

No. 7 Vlei Management
No. 13 Forest and Bush Restoration
No. 24 Indigenous Afforestation of Degraded Watercourses.

e) S.A. Sugar Industry Agronomists' Association — November 1989 AGM. Various papers on environment management.

f) Conservancy Manual — Natal Wildlife Conservancies Association.