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SOME ASPECTS OF THE HYDROLOGY OF THE
MKUZE SWAMP SYSTEM

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ABSTRACT

The Mkuze swamp is an important component of the St. Lucia lake system. The swamp has several hydrologically distinct reaches. A channel was excavated from the Mkuze River near Mpempe pan to a point near Demezane pan in an attempt to reduce the high salinity of the northern end of St. Lucia. The channel has since been closed as the possible deleterious effects on the swamps outweigh the minimal advantages to the lake. Great care should be taken to prevent possible irreversable damage to the swamps which themselves play an important role in the hydrology of the St. Lucia system.

INTRODUCTION

West of the Lebombo mountains the Mkuze River is typical of the many rivers draining the area between the escarpment and the sea. However, its character changes completely when it enters the coastal plain to the east of these mountains.

The gradient of the river to the east of the Lebombo is controlled at the upstream end by the bed level in the Lebombo gorge, and thereafter by the mean sea level and the channel length between the gorge and the outlet to the sea. In geologically recent times the outlet has been via Lake St. Lucia and the channel length has been sensibly constant, but changes in mean sea level relative to the Lebombo gorge level must have played a role in determining the gradient of the river.

There are four fairly well defined reaches between the Lebombo and the sea. These are :-

- (a) The upper reach (gorge to Yengwene pan).
- (b) The delta (Yengwene to Ntshangwe).
- (c) The Mkuze swamps.
- (d) St. Lucia lake.

As the gradients in these reaches, and therefore their hydrological characteristics, are controlled by the elevation of their downstream ends the reaches are best considered in the reverse order.

St. Lucia

The mean lake level is controlled by mean sea level, the throttling effect of the estuary narrows, and the relative rates of evaporation and inflow. During periods of low inflow and high evaporation the water level in the lake falls below sea level.

The generally high salinity of the lake causes precipitation of the colloidal sediment fractions contained in the river flows entering it. Wind action has caused the formation of a prominent sediment bar at the northern end of the lake which forms a distinct boundary between the lake and the shallows to the north-east which include Selley's Lakes.

This bar also confines the point of entry of low flows from the Mkuze swamp into the lake to a well defined channel close to the western flank of the swamps.

It would be possible to gauge low flows in this channel except during high lake level (wind action may change the gradient and therefore the stage-discharge relationship), or high flows which would make access difficult.

The Mkuze swamp

The main swamp is clearly a northern extension of the lake which has become shallow enough to support rooted and floating vegetation. The natural bar at the southern end of the swamp inhibits the intrusion of saline water. The sediment was introduced by the Mkuze River and with time can be expected to raise the general

ed elevation as well as the southerly extension of the swamp.

A remarkable feature of the swamp is the small but well defined river channel down the centre. This is completely overgrown over most of its length. It is difficult to explain the processes which have maintained it, as it has the typical natural levees along its banks which isolate it from the rest of the flood plain which in turn must carry most of flow during floods.

There are four stretches of open water in the swamps. These are Ndlaka, Demezane, Mbazwan and Butterfly. Mbazwan is narrow and deeper than the lake itself and any of the other pans. It is directly opposite the Mkuze delta and is probably being maintained by the south flowing water from the northern section of the swamp's own catchment despite the easterly encroachment of the delta.

There is little difference in water level between Demezane and Butterfly. During dry periods a watershed may form in the vicinity of Mbazwan when the general water levels drop, and flows from the swamp catchment to the north of Mbazwan - mostly groundwater - may not enter the southern part of the swamp. More survey data and water level observations would be necessary to confirm this.

The delta

There is a fall of more than four metres between Ntshangwe and Butterfly, and between Mpempe and Ngwenya. This is clearly the result of delta formation where the easterly flowing Mkuze river enters the north-south oriented St. Lucia-Mkuze swamp system. The sharp break in the gradient could be due to the control exercised by the fossil dune system or an earlier higher water level in what are now the main swamps and were previously part of the lake.

The Delta swamps contain four open water lakes - Mpempe, Ntshangwe, Mdlanzi and Tshanetshe, and together they form an interesting ecosystem which is hydrologically separated from the main Mkuze swamp by two dry, narrow and steep sections at the toe of the delta. One of these sections contains the almost

insignificant river channel which is identified by the high trees along its course. A channel was excavated down the other leg from the Mkuze River near Mpempe to the small river channel in the main swamp near Demezane.

The upper reach

This is the section between the Lebombo mountains and the fossil dune system at the delta. Downstream of the mountains the river changes from a degrading to an aggrading stream. Its channel gradually narrows and an increasing proportion of high river flows inundate the adjacent flood plain. At the end of the delta the river channel is scarcely discernible.

The reason for this change in character is that the flat gradient cannot maintain velocities high enough to keep the coarser sediment in suspension. When high flows overtop the river banks deposition takes place on the banks. The narrowing of the channel increases overbank flow and accelerates sediment deposition of the flood plain. The lateral valley slope is generally away from the river bank. This accounts for the delta lakes being located on the sides of the valley and not in its centre.

The north-south oriented Mkuze and Yengwene lakes lie between the similarly oriented fossil dune system. The sediment deposits of the Mkuze River have blocked the mouths of the valleys in the dunes and so given rise to the lakes.

Hydrological observations

Hydrological observations in the swamps are very difficult because flow measuring devices within the channel would only have limited capacities and would be outflanked by higher flows. Water level observations are hindered by difficult access.

A concerted effort was made during 1973-74 to establish permanent observation stations within the swamps. Together with previously established stations, the system consisted of.

Mkuze River at Thrings Store	:	Recorder
Butterfly lake	:	Staff gauge
Ntshangwe lake	:	Staff gauge
Mpempe lake	:	Recorder
Mbazwan lake	:	Recorder
Ngwenya canal	:	Staff gauge
Demezane lake	:	Recorder
Demezane canal	:	Recorder
Ndlaka lake	:	Staff gauge
Airboat section	:	Ten staff gauges

By March 1974 high water levels cut off access to most of the stations and only the recorders at Mkuze River, Mpempe and Demezane continue to be observed. It is unfortunate that this has happened because the swamp water levels are abnormally high at present and must be close to historically extreme values.

Hydrological stability

The reduction in runoff into the St. Lucia-Mkuze system due to dam construction and afforestation is significant, particularly during periods of sub-normal rainfall. Agricultural encroachment on the swamp verges is also obvious. Despite these man-induced changes an analysis of the historical hydrological records shows that for most South African rivers the natural probable extremes of the past must have exceeded the present man-induced changes, and that any ecosystem must have a natural resilience to these changes in order to have survived.

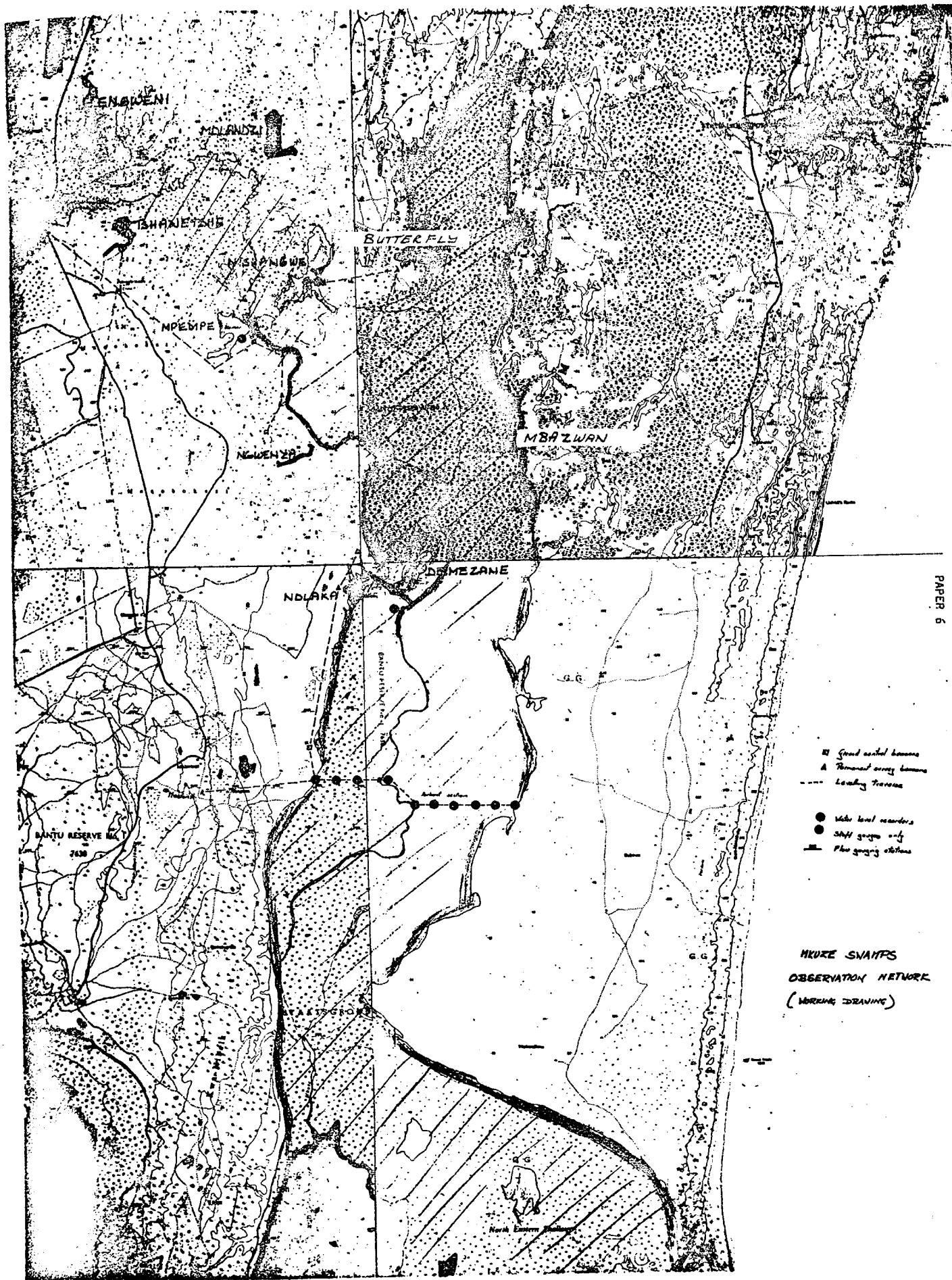
In my view we should express far greater concern at deliberate and possibly irreversable damage which could be caused by structures such as the Mpempe-Demezane canal. Because of the lack of survey data and an hydrological understanding of the system there was little chance of its achieving its objectives other than allaying public opinion that positive action should be undertaken to "Save St. Lucia". As a result there is a very real danger of destroying the delta swamp system if the channel which is already severely eroded is allowed to degrade back into the delta area.

FUTURE RESEARCH

Research within the swamps will have to rest heavily on hydrological data as water levels are the most important natural variables which control the ecological changes within the system. In order to collect and correlate the data the present bench mark survey will have to be extended. Transport within the swamps will remain the major difficulty. The airboat was very effective but cannot operate on dry ground. The "Catagator" used by the Department of Water Affairs was amphibious but did not have enough traction to force a passage through dense floating papyrus. The modified Land Rover could force a path through papyrus but was not amphibious. What is required is a large, heavy vehicle with flotation tyres. Such vehicles are available but will be expensive to purchase and maintain. In depth research in the swamps will not be possible without a much larger financial commitment than is now possible.

In conclusion, it is unlikely that the diversion of water from the Mkuze River or the swamp system will have a significant effect on alleviating the conditions in St. Lucia without having serious detrimental effects on the ecology of the swamps.

No further channels within the swamp system should be excavated until the consequences can be predicted with a fair degree of confidence. This prediction will not be possible without accurate historical hydrological data.



- Good control towers
- △ Terminal survey towers
- Leaking towers
- Water level recorders
- ⊗ Staff gauges only
- Flow gauging stations

**MKUZE SWAMPS
OBSERVATION NETWORK
(WORKING DRAWING)**