COST/BENEFIT ANALYSES FOR THE DEVELOPMENT OF HIGH-VALUE GAME PRODUCTION AND QUARANTINE OPERATIONS IN COMMUNAL AREA CONSERVANCIES

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EXECUTIVE SUMMARY

A feasibility assessment has been undertaken on the breeding of buffalo, roan and sable in northern Namibia. A number of locations and options of production were considered for this including the Nyae Nyae Conservancy, the Mangetti quarantine farm and game camp and a game area near Otjituuo. The analysis suggested that the area at Nyae Nyae was the best area from a veterinary perspective, a logistical one and the presence of existing facilities. Community input on this is still required as no community consultations were undertaken. On the basis of this an assessment was made of the veterinary possibility of moving these 'clean' animals (free of FMD and other potential threats) to other areas in Namibia or to countries like South Africa. This is theoretically possible and has been done elsewhere in the sub region. It is not clear if this will be permitted in Namibia and this would be one of the next important steps in this project.

An operating procedure has been proposed which could ensure risk free movement out of the controlled area. In order to achieve this, the roan and sable will need to be sourced and facilities erected for their keeping and management. A framework has been developed for this and the items required have been costed. It is proposed that a system of 6 sable and 6 roan camps as well as an additional 3 600 ha buffalo camp, costing approximately N$7,5 million, will be required. This will include the erecting of 2 quarantine facilities, the camps, basic equipment, source the animals and test and move the 'clean' animals.

This has been developed in an Excel model, which allows for some input variables to be altered such as initial introduction numbers, the year of the introduction, their expected performance, the expected selling price and an option to vary the annual off-take untill the animals reach their target population. The model indicates that at a herd growth rate of 15% for all three species and with an initial population of 82 buffalo, 60 sable and 60 roan and a selling price of N$80 000 per head that the project will be viable (IRR of just under 16%) and should produce a profit in year 4 under a moderate harvesting regime.

The annual overhead costs are relatively small at about N$550 000 per annum, these are mostly for 4 staff including a manager, foreman and two labourers. The annual variable costs include boma maintenance, feed, veterinary and other expenses, these increase to a peak of about N$770 000 by year 12. The gross income peaks at about N$4,3 million also in year 12. The project will still remain viable at prices of N$50 000 per animal but not below N$43 000, if the cost of capital is included.

The breeding camp has been working in Nyae Nyae for the buffalo but is untested for sable and roan and here caution may be advised and after a check on the viability of sourcing the breeding stock, then perhaps only two viable groups of each species should be tried initially, if these perform well, then the project could be expanded, if not, then it could be modified or even parts of it abandoned.

Hunting and tourism may add some value to the project, but their main benefit will be from increased jobs and adding some value and diversity to existing businesses.

There is scope to bring partners into the project and an institutional framework for establishing a Section 21 company has been explored. This is one option, but others could be used. The best form will depend on who invests in the project and what the outcome of the different parties are.

There are however several issues which do need to be addressed before this can be taken forward, these are:

1. Sorting out the veterinary authorities perceptions of the plan and it depends on their approval and co-operation.
2. Ownership of the animals in the area.
3. Community support for the project.
4. Finding funders and partners to assist in developing and managing the project.

This report is merely a financial and 'veterinary' feasibility of the best options, which may be available to implement the project but it is recognised this is part of a wider decision making framework, which may have different goals and expectations to those presented in this report.

INTRODUCTION

The value of rare and certain species of wildlife within Southern Africa has clearly been demonstrated by the high demand, relatively limited availability and high purchase and hunting costs of these species. The main driving force for the value increase has been the ability for private individuals to own and therefore sell these species. South Africa, Zimbabwe, Namibia and to some degree Botswana are some of the few countries where game can be owned and sold and the value of these animals are therefore defined mainly by the forces within the market. Disease and other factors limit the trade opportunities between these four countries and the others in the sub-region.

The wildlife industry in South Africa is strong and enjoys little support in the form of direct or indirect subsidies and is valued at hundreds of millions of Rand (R880 – million in 2000). It is also the biggest market for export and import of game. This is the result of relatively well defined import and export regulations and the ability to move species within the borders of South Africa. Both Namibia and Botswana have much stricter movement regulations, especially relating to movement of game from controlled areas like the foot and mouth control zones. Both in Botswana and Namibia movement of, specifically cloven hoofed wildlife, is restricted totally and this will influence their value as a commercial game species.

This report will make recommendations for potential quarantine, veterinary requirements and management options for 3 rare or commercially valuable game species with various costs/benefit economic models to explore business opportunities for the potential movement and sale for the export market and the Namibian free zone (commercial/ community farms). It is stressed that these are recommendations, which will rely completely on the compliance of both conservation and veterinary and/or other movement restrictions by concerned parties (either internally in Namibia or export to a different country).

SCOPE OF THE REPORT

The consultants were tasked to evaluate the feasibility, both from a financial and veterinary perspective, of 'breeding' three valuable species, namely buffalo, roan and sable antelope in Namibia. The objective was to establish if it is feasible and if markets could be found where these animals could be sold as disease free animals, to realise their financial value. Three areas were identified, namely the Nyae Nyae conservancy, the 42 000 ha Mangetti Game Farm and associated quarantine station and a 32 000 ha game proof camp in the surveillance zone between Tsumkwe and Otjituuo regions. The full detailed terms of reference are attached in Appendix A.

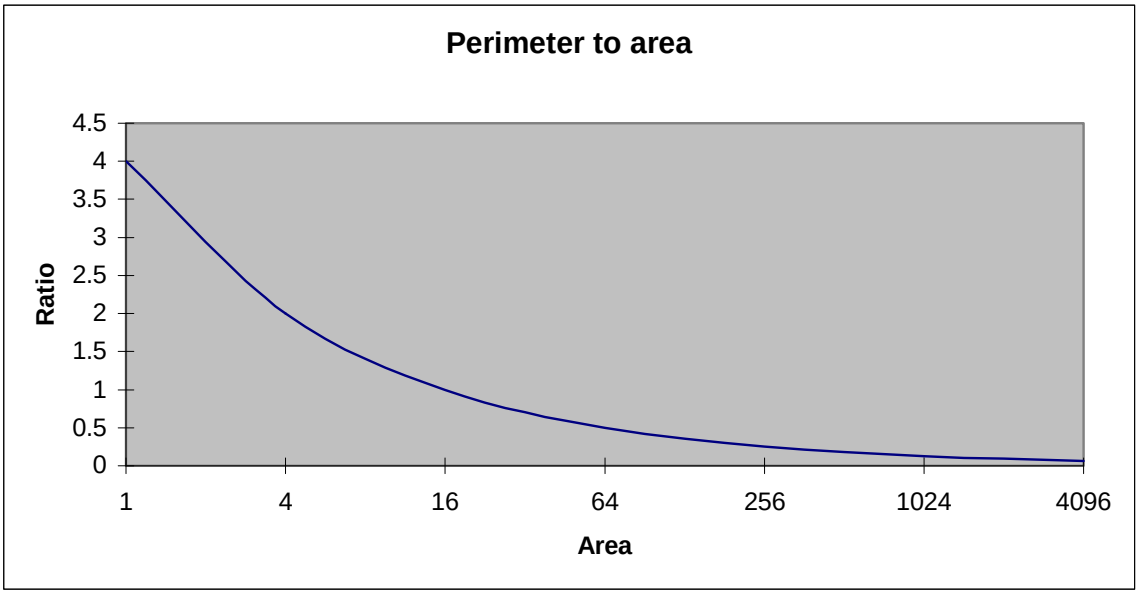
This report is based on a visit to Namibia between 12 and 17 October 2003 by Markus Hofmeyr and Richard Davies. The visit included meetings with various officials from MET, consultants and other interested parties in Namibia as well as a visit to the buffalo camp near Tsumkwe in the Nyae-Nyae conservancy, the Mangetti agricultural quarantine farm and the Mangetti Game Camp in the Grootfontein/Okavango region. No visit was made to the area of the 32 000 ha game proof camp in the surveillance zone between Tsumkwe and Otjituuo regions, time and distance did not allow for this.

POSSIBLE OPTIONS FOR UTILISING VALUABLE GAME IN THE STUDY AREAS.

Various options exist for 'intensively breeding[1]' these valuable species within Namibia. There are essentially two extremes, these being a large system (over 10 000ha), while the other is very small (about 20 to 50ha) and highly intensive, between these extremes lie a number of varying combinations of the two. The first two will be explored with their dis/advantages.

LARGE SYSTEM

An extensive camp could be developed which would be more than sufficient an area to meet the habitat and social requirements of the different animals. This camp could be in excess of 10 000ha or could be as large as 40 000 or even 50 000 ha. Assuming this camp is relatively square in shape there is likely to be an efficient perimeter to area ratio. The larger an area the smaller the ratio of perimeter to area as indicated in the figure below.



This has large implications for the cost of fencing which can cost as much as N$60 000 per kilometre depending on the type of fence. Larger areas are more efficient to fence. However in an environment where elephants cross the landscape, an enclosure this large is more likely to be damaged by elephants wanting to cross the area. These and other breakages could be more costly to repair as any one break is likely on average to be a long distance from the office and technical support facility. Managing known groups or individuals in an area of this size is also likely to be difficult as they will be hard to locate for monitoring and general surveillance. Use of telemetry may assist but close monitoring will still be difficult. Those species which have large home ranges, such as roan (up to 100km^2) will only occur at low densities as they will naturally occupy large

[1] Intensively breeding in this context means increasing the recruitment and survivability of the species so that their numbers can increase faster than would be possible in free ranging situations. The important consideration is that the breeding must be financially viable and practically achievable.

areas. This may be less relevant with sable and probably less so with buffalo. The natural selection processes are likely to prevail in these situations as it more closely simulates a wild situation, growth therefore may be lower than a more closely monitored group.

Minimum staff requirements for large areas will be difficult to asses and will depend on the scale of activities that will be linked to the production of rare and high value species. At least a manager and a team of labourers and a driver will be needed for basic management. Additional expertise will have to be hired in when required (mainly capture and veterinary work, associated with a helicopter and its associated costs).

Large areas are therefore probably more suited to National Parks, game reserves or reserves, where biodiversity, tourism or even hunting are more important as objectives.

SMALL INTENSIVELY MANAGED RESERVES

These can be as small as 5 to 10 ha but not likely to be larger than 50ha. These areas offer sufficient area to the animals to 'roam freely' but are inadequate to supply their feed and nutritional requirements. Feed would have to be supplemented and social interaction closely monitored. In these small areas close daily surveillance of the animals is usually very easy and the animals can become habituated to humans if feeding and other conditioning is used. Here records can easily be maintained of individual performance and any problems immediately seen and dealt with. This approach however is expensive as good management expertise is required to ensure good herd growth and vigour, feed is a large expense, disease can be a problem if animals are stressed from crowding, fencing must be good to prevent animals escaping.

This is a common form of management applied for roan and sable in South Africa. Very few commercial farms have free-range sable and roan as they do not do well under the current game farm conditions prevailing in South Africa. Disease-free buffalo being bulk grazers are either managed extensively, semi-intensively or very intensively especially those bred for the live game market.

Proper storage of feed is critical and has to be managed extremely well as any spoiling of food could result in decreased production, disease and even loss of animals.

Fence management and construction will have to be of a very high standard as predators will have to be fully excluded and elephants (in Namibia) have to be deterred as any break in of predators or elephant will have deleterious effects on the buffalo or antelope species in the camp.

Advantages of this system

- Minimum staff requirement will include dedicated manager, at least one labourer for each group of animals, tractor driver to distribute food up to twice a day
- Buffalo, sable or roan can be individually managed and monitored.
- Decisions on off-take/sale can be done at an individual level, allowing for the best selection of animals to be kept and/or for movement.
- Facilities can be designed to allow for handling or splitting of the herd passively and thus gives the manager full control over the herd.
- Production can be maximised as numbers can be manipulated to allow for this, disease control can be easily implemented and maintained.

- Relatively little capital is needed because facilities are small but a high level of maintenance (feeding) and management will be required.
- For smaller systems very few staff will be needed as the area to be cleaned and monitored is small.

Disadvantages of this system

- Management staff will require basic animal husbandry skills training
- Needs intensive (at least daily) and a high degree of qualified management input.
- Social stress and interaction must be well understood and managed.
- Veterinary input will be needed, often at very short notice.
- Feed costs will be high and storage and management of the feed and feeding must be well managed.
- Infrastructure must be well planned, designed and maintained.
- Coccidiosis, tick born diseases, internal parasite build up, trauma related injuries and calving problems related to high energy food can occur and the management will need training on handling basic procedures and preventative measures for the mentioned conditions and other conditions associated with intensification.
- Animals may need rehabilitation to extensive conditions before being released .

The disadvantages are critical to the success of this venture. The costs of mistakes can be very high and the margin for error therefore very low. Intensive management systems will not succeed unless dedicated personnel are employed to manage the facilities and animals and should only be considered if such personnel can be put in place.

SEMI-INTENSIVE PRODUCTION

The situation in Namibia and especially the areas investigated in this study suggest that larger areas are likely to be more suitable than small areas primarily because of the relative abundance of land. However, very large areas and the problems associated with managing individual animals or groups in these areas suggests that the area must not be too large, also because of the problems created by elephants. Logic would suggest that smaller camps would be more suitable especially for roan and sable, where social interaction would otherwise require large camps for several herds to be kept in one area. Management input would need to be increased in small areas, but would be required in any event to ensure growth and production.

The economic carrying capacity of the area of about 30ha per Large Stock Unit (LSU) and the ideal group size of 12 to 18 animals for roan and sable would suggest a camp of about 400ha to be an optimal size. Here supplementary feeding could be supplied in dry years or in the dry period to improve animal condition and hopefully production. This would be large enough to burn a small area periodically for grass vigour and disease control if necessary. It would also be relatively easy to monitor animal performance.

For buffalo it may not be practical to split them into groups of 8 to 12 animals and to place them in small 400 ha camps. Their social structure and organisation does allow for larger groups and it may therefore be more costs effective to have larger camps where groups could be larger. If the camps are increased to about 1 000ha then the advantages of a small camp for management are likely to be less. In this instance it may be more practical and cost effective to allow the camp size to increase to obtain the perimeter to area advantages of the relatively reduced fencing costs. It is suggested

that 2 500 to 5 000 ha may be a suitable camp size for buffalo. Some herd performance may be lost but smaller camps would possibly increase the management costs and not necessarily have a corresponding increase in production.

There is unfortunately no firm evidence to support these recommendations as these projects are not common, especially in this environment, but discussions with people during the visit concurred with the reasoning behind these proposals.

Advantages of a semi-extensive camp system

- Minimum staff requirements will be manager, at least 3 labourers and driver as a lot of driving will be involved with this management system
- Animals can be easily monitored especially if water is restricted.
- Limited management of the population is needed because most of the year free range conditions can be maintained as long as the stocking density of the area is limited to economic carrying capacity.
- It is possible to manipulate the environment to best suite the species because competition can be reduced, strategic feeding and mineral addition can be given and water provision can be modified to assist with management.
- Feeding will be required but can be restricted to the end of the dry season periods or during drought years, phosphorus and game licks should be supplied throughout the year subject to dung analysis.
- Passive capture sites should be erected permanently to allow game to stay habituated to the structures.
- Infrastructure should be easily maintained because of the relatively small area and small number of watering points needed, however, the relative cost of a semi-intensive and extensive camp management will probably not differ greatly in real terms because similar numbers of staff and activities will be needed.
- Predators could be managed easily if a predator proof fence is erected and proper monitoring of the area can be maintained (removal by trapping or shooting).

Disadvantages of a semi-extensive system

- Cost relative to area managed will be high and population management will have to be maintained, which could be a problem if movement restrictions on animals is maintained.
- Other species should ideally not be introduced in the same camp because of competition and possible higher disease transfer risks if there is a breakthrough in disease like F&MD in the buffalo.
- If predators enter the camp they will have a dramatic impact and may not be detected until a lot of damage is done.
- Elephant damage will pose a real threat for water management and security of the camp as the impact on the camp and infrastructure will be high.
- High level of dedication of management staff is needed because monitoring of individual animals will be required but due to size may not be possible on a daily basis, so problems may only be detected after loss has occurred.

All of the above-mentioned disadvantages could be reduced if there is a concerted effort made to manage the animals and their environment (ownership of the project lies with an individual/s).

THE PROJECT AREAS

NYAE-NYAE/TSUMKWE BUFFALO PROJECT

Currently there are between 80-86 buffalo in the 2400Ha buffalo camp (Dries Alberts pers. Comm.). The disease status has been clearly determined as recently as late 2002 (H-O Reuter, Nov 2002). A number of relatively recent workshops, consultancies and resulting reports *(Buffalo management workshop, July 1998; Management plan for the Nyae-Nyae buffalo, August 1998 G Stuart-Hill, Report on the disease testing of buffalo in the Nyae Nyae conservancy, Nov 2002 H-O Reuter; An option Assessment for the Marketing of live game from communal area conservancies, January 2003 Leon van Rooyen)* have been published with recommendations but in spite of these there appears to be little progress on implementation of these recommendations or proposals. Most of the recommendations in this report are based on the above-mentioned reports.

The number of buffalo in the camp is approaching or has exceeded the economic carrying capacity suggested by Greg Stuart-Hill (if there are 80 animals in 2400ha, then the current stocking rate is 30HA/LSU, this excludes the eland, which are also present). The suggestions, analysis and recommendations of this report therefore come at an appropriate time because the condition of the buffalo need to be monitored carefully so that stocking rate related problems can be managed timorously.. This report does not deal with the carrying capacity of the area or the suitability of the habitat for the three species.

As a word of caution from experiences in South Africa in Botsalano Game Reserve in 1994, Willem Pretorius Game Reserve in 1997 and the drought of 1991/1992 in the Kruger National Park, nutrition and overstocking related mortalities took place suddenly. In Botsalano Game Reserve 18 out of a total population of 90 buffalo died in a space of 5 weeks, approximately 30 out of 90 buffalo died in a few weeks in Willem Pretorius and 50% of all buffalo in the Kruger National Park died during the dry season of 1992 (Ian Whyte personal communication). In Botsalano additional feed was provided for the buffalo during this period but they did not eat it. These examples highlight the need to be proactive when managing these animals and not to allow the buffalo to become nutritionally stressed, especially in small areas.

The major recommendation on best use for these buffalo would be to sustainably harvest them from the camp periodically as was suggested by G Stuart-Hill in the workshop on buffalo management (off-take figures were suggested at that workshop).

From a disease perspective and from the discussions held with various role players, it appears unlikely that buffalo will be allowed to move to the agricultural free zone in Namibia in the immediate future. There is, however, a small opportunity for export to South Africa or other international destinations (including zoos) should the authorities in Namibia agree to this.

For this to happen specified quarantine procedures will be necessary for the animals to be allowed into the respective countries. A more detailed discussion will be held later in this document where South Africa's requirements will be presented, as that market will be the most likely one in the near future. Any movement to South Africa will need to be approved by the Department of Agriculture of South Africa and issuing of movement permits both by the state veterinarians and respective conservation authorities.

Live sales can be managed in a number of ways but all buffalo moving out of this area will have to undergo disease testing before they can move away from their area of origin as the buffalo are currently behind the F&MD (Foot and Mouth Disease) controlled red line.

MANGETTI QUARANTINE AGRICULTURAL FARM AND MANGETTI GAME CAMP

The Mangetti Agricultural farm and the Mangetti game camp were also visited. From the discussions we had with Leon van Rooyen and Theunis Peterson it is clear that politically the Mangetti Game Camp has a lot of support and it would be good to use the area for high-value game production and quarantine operations. This will ultimately be a decision for the relevant role players.

THE MANGETTI QUARANTINE FARM

This farm is used for quarantine of livestock coming from restricted zone and most are destined for the abattoir at Oshakati. Some small stock leaves this quarantine facility to the free zone after standing quarantine for 21 days!! No cattle are allowed into the free zone from this facility.

Within the quarantine farm there is a specific quarantine camp that was originally designed for wildlife research. This facility has a double fence around it and 100HA paddocks. There are also camps for short term holding of wildlife for quarantine. These facilities would need some repair if they are to be used but overall all facilities are in place for a possible quarantine facility. In addition to the above, this quarantine camp is in the surveillance zone and not in the restricted zone.

We had very good discussions with Mr Faan van der Merwe (Chief Veterinary Control Officer, Grootfontein and Otjozundtupa areas). The farm itself is still effectively functioning as a quarantine area but the following concerns would make it a less preferable area for quarantining wildlife than newly erected facilities either in the Waterberg or nearer to Tsumkwe:

- Large population of people living on the farm, with possible high incidence of tuberculosis associated with HIV/AIDS.
- Frequent movement of livestock onto and from the farm. If a F&MD outbreak should occur then the whole farm will be quarantined to the detriment of the wildlife being held on the farm.
- CBP has been diagnosed in cattle and this could pose a risk especially to buffalo (buffalo have been artificially infected with CBP)
- Both buffalo populations that are currently disease-free and the roan from the Bushmanland area and Kaudom could be placed at higher risk here then where they are in Bushmanland.

After visiting the farm and referring to the above-mentioned risks we recommend that quarantine in the surveillance zone should ideally be situated in an area where wildlife and livestock can be separated from each other. For the Tsumkwe buffalo we suggest that a quarantine area closer to the Bushmanland redline boundary (band area) be erected or ideally in the Waterberg for the final stage quarantine. This will probably be the most acceptable area of export quarantine for any cloven hoofed animal because it is in the free zone, poses very little risk for the livestock industry due to its geographic location and there are already “clean” buffalo, roan and sable on the plateau.

Subsequent discussions with Dr Roy Bengis (Senior State Veterinarian, Wildlife Unit, Skukuza Kruger National Park) confirmed our concerns about increasing the risk of animals coming from the Tsumkwe areas. He confirmed that the Waterberg will be the most

acceptable final stage quarantine as it is in a free zone and this has significant implications with regards to movement control internationally, i.e. import permits are more likely to be issued from the "clean" area than from a surveillance zone and definitely not from the behind the control zone.

If the quarantine farm is the only site where quarantine in the surveillance zone will be allowed then the above mentioned risks must be seriously considered and that a section of the farm must be separately fenced with access control and only project dedicated staff allowed into the area where the wildlife will be held. The quarantine holding facility will have to be as far from any boundary as possible (ideally in the centre of that area).

THE MANGETTI GAME CAMP

A short visit was undertaken to the camp preceded by a brief discussion with the regional warden, Ruvunus Mukosho, who gave us his idea of the plausibility of using this area for high value game production and quarantine operations. The area that we saw was extremely encroached and this in itself will be a limiting factor for both roan and sable who do not like heavily encroached bush (Rowan Martin's report on Roan Sable and Tsessebe for the transboundary program, 2003). Buffalo would probably adapt to the area. Due to the dense vegetation any semi- or even extensive production orientated management will be complicated because observation, capture or hunting of these species will be difficult. A better ecological assessment by persons with experience of that area would be required. There were also indications that the management of the area were struggling to keep the infrastructure in good working order. Elephant damage to the fence and water points were clearly evident and this would pose serious threats to other species as well.

This camp may well lend itself to initial introduction of sable from the Mahango area (with the respective quarantine and testing at capture) and the offspring could then be captured and quarantined on the farm in the same quarantine facilities suggested for the Nyae-Nyae project and then be sent to an appropriate surveillance area quarantine or to the possible Waterberg quarantine area. The offspring could also be sent to semi-extensive camps in the Nyae-Nyae area were the terrain was more open and certainly would make production orientated management a lot easier and where the animal disease risks were much less than at the Mangetti game camp. We make this statement because the Mangetti game camp exists in an area where there are many more people and livestock than in the Tsumkwe area and closer to the nearest infected buffalo herd (in the Mahango). Buffalo moving from Mahango are far more likely to get to the Mangetti Game Camp than they are to get to the Bushmanland area.

The community involvement in Mangetti could be better than in Tsumkwe but the risks are higher and all of these factors with the habitat suitability will have to be assessed before animals are introduced into that camp.

As a last point, an injured sable bull was found at Dubbelpan water point in the camp. There was no ability to help it but due to its severe foot injury and very depressed sate, the prognosis for survival was not very good. Should production orientated management be considered for this camp then there must be some mechanism in place to handle an injured animal like this one. This was not the case during our visit.

ROAN FROM NYAE-NYAE CONSERVANCY

Roan and to a lesser degree sable are highly social animals and any production oriented management must take this into account. They are difficult animals to catch and management should therefore aim to deal both with their social behaviour and difficult capture management.

The agricultural farm at Tsumkwe could lend itself well for semi-extensive management systems as the infrastructure is in place. Camps ranging from 100 – 500 HA can be developed and a family group of roan can be released in this paddock. Water management and feed can easily be manipulated to obtain maximum production from such a group. This system will be large enough to allow for the hierarchy of females not to interfere with the ability of the roan to produce and a single male will adequate for 10-15 females (see Sable and Roan below).

The same advantages and disadvantages as described for the semi-extensive buffalo management systems hold for both roan and sable. The main difference is the social interaction between the females and between the males, that needs to be managed under these semi-extensive systems. In South Africa one of the main causes of sable and roan production loss is trauma from social altercations in these smaller camps.

Considering the information supplied in Rowan Martin's Transboundary Species Report on Roan, Sable and Tsessebe and from observations in the Kruger National Park it will certainly make sense to try and secure some roan populations under semi-extensive management systems as the extensive option does hold great risks for the long term survival of this species in the semi-arid and marginal habitat in most of Bushmanland. The final decision will obviously be made after analysing recent monitoring data and must be carefully considered as the release back into the extensive system from an intensive or semi-extensive system is not always successful. The Kruger National Park has released a number of roan out of semi-extensive camps only to find that these animals are killed easily by predators. On the other hand if the species is only marginally surviving extensively in any case then there is a strong case to rather manage them under semi-extensive or intensive management systems.

The capture of roan in large extensive areas will not be easy so it is advised that roan should be sourced in areas where they are common and mainly younger animals should be captured and transported as roan are notoriously difficult to move due to their aggression to each other in confined spaces. It is recommended that a capture specialist is asked to give a realistic assessment of the viability of capturing roan cost effectively in the extensive Bushmanland area before any production orientated plans are considered for this species from the Bushmanland area.

Sable can be managed very similarly and certainly if the Mangetti game camp is earmarked for any of these species then that camp with some improved management can act as extensive breeding nucleus for buffalo, roan and sable. An ecological survey will have to be done to determine if the habitat is indeed suitable for roan and sable, buffalo should easily adapt there.

From the South African experience it is clear that sable and roan do not do well in free range areas because most of the areas fall in the low rainfall areas and certainly the dry weather will suppress fertility and fecundity of these species so the management option used most frequently for both these species is to farm them in intensive systems as the animals can be individually managed and populations can be manipulated to produce optimum growth. With the intensification obviously come a whole lot of diseases that affect both roan and sable namely *Coccidiosis* (protozoa affecting

the intestinal tract), *Theileriosis* as a tick borne disease and the straight trauma due to social fights. Good management is required at the individual animal level for such a management option to succeed.

Moving the buffalo

The procedure for the capture of the buffalo for movement will be the same for all three proposed systems as they will all have to be quarantined and tested before movement will be allowed. The recommendations for this procedure will be described later in this document

The advantages of increasing the camp size are:

- No population management will be required in the medium term (depending on the size of the expansion) and relatively low input from management staff will be required.
- The buffalo will need very little individual management except identifying the old bulls that can be used for trophy hunting.
- Game licks and phosphorous may be the only additional feed requirements except in drought years where additional feeding may be necessary.
- Maintenance costs per unit length of fence of the camp should not be significantly greater than that of smaller camps.
- The relative impact of other game breaking into the camp (e.g. elephant) could be mitigated by installing an electric fence, which is already planned for the current camp.
- Fire impacts will be less dramatic if this camp has well managed fire breaks and is divided into blocks

The disadvantages of this system:

- A capital outlay for the labour and materials to increase the camp size.
- Predators may establish themselves in the camp (predator proof fencing will be add to the costs and will not keep out leopards and hyenas) and will be difficult to manage as both detection and capture will not be easy. Even a small number of efficient predators in such a camp can impact heavily on rare and high value game species.
- Individual monitoring of the buffalo or other rare species will be very difficult and will need dedicated effort if production related off takes are planned.

The above-mentioned disadvantages could be reduced if there is a dedicated effort made to manage this camp. This may become more cost effective as the size of the project grows.

As part of the terms of reference for this consultancy we were asked to determine if the 32 000ha camp in the surveillance zone between Tsumkwe and Otjituuo would be suitable as an alternate camp or an additional camp for buffalo. We did not get an opportunity to visit the area but consultation with Dries Alberts and Leon van Rooyen, who have knowledge of the area, it was clear that there would be no advantages of moving buffalo there as water is a problem as well as access. The only potential use of that area could be to have the final stage quarantine for export to South Africa (discussed later in the document) but again water and access will be limiting factors and therefore rules this option out.

The buffalo are currently being fed “droogte korrels” which is a Lucerne based drought feed. They are fed daily in two 1,5m square containers. The accepted feeding distance in South African intensive systems is 1m per animal as this prevents social competition and allows all animals access

to the feed instead of the more dominant animals overeating and less dominant animals not eating this additional feed, possibly causing more nutritional stress than if no feed is provided. It is recommended that the feeding of the “droogte korrels” is fed in more troughs in smaller amounts. Consideration can also be given to feed every second or third day in higher volumes rather than every day as this will help prevent animals standing at feeding troughs and not foraging optimally in the camp.

VETERINARY CONSIDERATIONS

STANDARD QUARANTINE RECOMMENDATIONS WITH SPECIFIC REFERENCE TO EXPORT TO SOUTH AFRICA

As mentioned earlier in this document whatever management system is opted for, movement control will exist for any cloven hoofed species moving from the F&MD control zone to any other area outside of the red line. The movement will be subject to test results for a number of diseases, which will be stipulated by an import permit from the Namibian or importing countries veterinary departments. This section will deal with the recommendations for the import of wildlife to South Africa as this will most likely be the main export venue initially for any of the 3 species discussed in this document.

QUARANTINE REQUIREMENTS

Buffalo are the only known wildlife vectors for foot and mouth disease (which is an endemic disease in Africa) and also carry corridor disease (CD) (another endemic African disease, which is transmitted by the brown ear tick), both of these diseases have severe implications for the cattle industry – F&MD because it affects production and also influences the export status of the a country, corridor disease because it is highly fatal in cattle. Two other diseases that are significant in so much that buffalo can carry and transmit them to cattle and humans are bovine tuberculosis (BTB) and brucellosis – both these diseases originally entered buffalo populations from infected cattle mixing with buffalo. They are exotic diseases and both can cause clinical disease in buffalo.

South Africa, Namibia and most meat producing countries have very strict veterinary control measures for all of these diseases. In addition to the above-mentioned diseases, contagious bovine pleuropneumonia (CBP) and anthrax also occur in Namibia. They are controlled diseases in South Africa and in most meat producing countries. Any import of livestock or wildlife will require some aspect of control of these diseases as well. CBP is not a wildlife associated disease and tests are unreliable so management for this disease will rely on prevention of exposure to the disease from infected cattle and developing the production centres in areas where CBP has not been diagnosed (i.e. the Tsumkwe and Waterberg regions).

Lastly most countries will have external and internal parasite control requirements before livestock or wildlife will be allowed to enter the relevant importing country or region.

The quarantine period is therefore aimed at allowing tests to be done on animals before they are moved, where the animals are in isolation and transmission to and from the animals in quarantine is stopped because they must have no contact with any other animal, access control is very strict so that only known people can work with the animals. Should there be a problem, decisions can be made on the fate of the animals without compromising other animals in the immediate vicinity.

The import to South Africa of buffalo in particular will have to be approved by the Department of Agriculture (of South Africa) and this will be done on a state to state level and will most certainly be subject to risk analysis either on request by the South African department to the Namibian department or they may send an official specifically to investigate the risk.

There is a clear policy in South Africa on the movement of buffalo in the country but there is not a standard policy for the import of buffalo. Our recommendations for the quarantine facilities will

therefore be based on the South African scenario. The requirements should satisfy the Namibian officials as they will enforce whatever the South Africans (or other importing country) require as long as it does not compromise their own safety in terms of disease control measures. The final import requirements into South Africa will most likely be assessed on a case to case scenario until a standard protocol for Namibia is developed.

Below is the movement control and testing protocol for buffalo in South Africa as per the Disease Risk Management Directive for Buffalo in South Africa, complied by the buffalo committee for the veterinary department of South Africa (draft 21, Sept 2002):

MOVEMENT CONTROL OF BUFFALO IN SOUTH AFRICA

BUFFALO-FREE ZONES

- A buffalo-free zone of at least 100 meters (including FMD buffer zone where applicable), which separates FMD carrier or CD carrier buffalo from FMD/CD free buffalo, must be maintained. This includes all relevant international borders.
- No land within the buffalo-free zone will be registered for the keeping of buffalo.
- All buffalo kept in the surveillance zone must be separated from the infected and or buffer zone and certain international borders by at least 2 electrified fences of which the outer two are at least 100 meters apart.

BUFFALO DISEASE TESTING SCHEDULE (Testing of buffalo before movement)

All buffalo that are to be translocated will need to be tested for the following diseases:

- **Known FMD carrier buffalo** must be tested for BTB and brucellosis (they are already positive for FMD and Corridor disease).
- **Known Corridor carrier buffalo** must be tested for FMD, BTB and brucellosis (they are already positive for Corridor disease).
- **FMD/CD -free buffalo must be tested** for FMD, Corridor disease, BTB and brucellosis.
- **Outside of CD and FMD control areas, a single negative test will generally suffice. However, in certain high-risk situations or areas, multiple testing and quarantine may be required. For FMD this will include two tests 14 days apart.** (*If allowed this will be the situation for international imports*) For CD this will include two tests a minimum of 30 days apart. In the case of BTB this will include three tests (Gamma TB and intra-dermal tests) with three-month intervals. In the case of CA it will be three tests with two-month intervals.

TESTS

- For FMD, the blocking ELISA is the standard test for all 3 SAT-serotypes.
- For CD, a panel of tests including smear examination, fluorescent antibody, PCR and DNA probe are required.
- In the case of TB testing, the comparative intra-dermal test is the golden standard. Outside of BTB endemic areas, the gamma-interferon test may be used under direction of the Provincial Veterinary Head Office. In the BTB endemic areas, three to five successive negative skin tests three months apart (in quarantine) are required depending on the status of the source herd, as determined by the Provincial Veterinary Head Office.
- In the case of brucellosis, any serological titre using the standard complement fixation test (CFT) will be considered a positive reactor. All SAT titres or Rose Bengal reactions should be treated with suspicion.

(*All of the above test results apart from the comparative skin test will only be accepted if done at the Onderstepoort Veterinary Institute in South Africa)*

Contingency protocol

If an animal reacts positive to any one of these diseases, the farm/reserve of origin will be placed under quarantine and disease control measures for the specific disease(s) will be implemented. See also each disease Contingency plan. Unless the National Director of Animal Health determines otherwise, the following will apply to infected farms/reserves.

- <u>FMD positive reaction to test</u>
  - All buffalo on the property will be destroyed under veterinary supervision, OR at the discretion of the Provincial Veterinary Head Office, the buffalo may be transported to a registered FMD infected buffalo farm / reserve in the FMD infected zone.
- <u>Corridor disease positive reaction test</u>
  - All positive buffalo on the property must be translocated to a registered CD farm/reserve or be destroyed under veterinary supervision. The remaining negative animals must be re-tested twice under quarantine conditions, starting a minimum of 30 days after the removal of the positive animals, with a 3 month interval, and under tick-free conditions, to confirm their negative status. The negative animals must be moved to a CD free farm.
  - The farm or used camps must be rested of cattle and buffalo for a minimum period of 2 years.
- <u>TB or CA positive reaction to test</u>
  - Under free-ranging conditions, if BTB or CA is diagnosed, then the farm or reserve must be placed under quarantine. Positive animals may not be moved off the property, but negative animals may be moved at the Provincial Veterinary Head Office's discretion, after appropriate re- testing. Testing of all animals and slaughter of positive animals is recommended.
  - When dealing with confined buffalo in projects, all positive reactors will be destroyed under veterinary supervision. All remaining negative animals must be retested (five consecutive negative tests at appropriate intervals in the case of BTB and three consecutive negative tests in the case of CA.).
  - The carcasses of all positive BTB reactors must be subjected to *Post Mortem* examination by a State Veterinarian.

In South Africa the costs of disease testing will be borne by the State. This however excludes the costs related to capture, immobilisation and transport of the buffalo. If the farmer is found to have caused an outbreak through non-compliance or negligence, then all costs will have to be borne by the owner. In Namibia all costs will have to be covered by the owner.

BUFFALO MOVEMENT REQUIREMENTS

General Requirements

- Movement of buffalo will only be allowed if all prescribed tests are negative. In terms of Regulation 20 of the Animal Disease Regulations a movement permit is required for all movement of live buffalo in all Provinces of South Africa. In addition, buffalo may only be moved to farms / reserves, which are registered for the keeping of buffalo of similar disease status.
- All farms, from which buffalo are to be moved / translocated, must have an appropriate confinement facility for holding, manipulating, testing and identifying the animals to be moved. All buffalo that are to be translocated must remain in isolation between the day of blood sampling and the day of movement.
- All buffalo, which are to be translocated, must be micro-chipped for permanent identification. Primary microchip transponders must be implanted at or before first test, high up on the neck behind the left ear, and any secondary microchips must be implanted between the shoulder blades.
- All buffalo confined for serial testing must also be ear-tagged during the testing period prior to movement. Tags may be removed during immobilisation for the last qualifying test prior to movement. Branding of buffalo (hot or cold) is optional.
- It is the responsibility of the owner to provide the equipment, facility and opportunity for effective micro-chip reading.
- Auction facilities, through which buffalo are to be marketed, must be registered for buffalo. Prior to registration, the structure of the facility needs to be approved by the Provincial Nature Conservation authority. All buffalo being moved to an auction facility must have been subjected to the required disease screening protocol with negative results. The movement to the auction facility must be covered by a red-cross permit. Following the auction, these buffalo may be moved back to the farm of origin, or to a registered buffalo farm or facility of matching disease status. This movement must also be covered by a Red Cross permit.
- A veterinary official must be present during all FMD/CD carrier buffalo capture operations.

Movement Protocol for buffalo

- All movements must be authorised in writing by the PDVS at origin and destination, prior to the movement taking-place.
- All movements must be by way of a red-cross permit and in sealed trucks. All buffalo must be micro-chip read by an official at the time of loading. If the official is familiar with the buffalo - farm / project animals, and if the animals to be moved are in a separate isolation facility (all in / all out) and are ear-tagged or branded, then he may at his discretion read the micro-chips at the time of the last blood sampling. He must then re-check (audit) the number and sex of animals and the tag /brand numbers at loading. All buffalo must be free of visible live ticks at the time of loading.
- The SV at origin, after receiving authorisation for a buffalo movement, will inform the SV at destination, and they will determine a date for movement.
- On the date of movement, the SV at origin (or his AHT) will visit the farm, and after reading and noting the transponder number of each animal, will count and load the buffalo, seal the

truck, and issue the red-cross permit. The registration number of the vehicle, both buffalo farms registration numbers and the seal number must be written on the permit. A list of the micro-chip numbers must be attached to the permit.

- The SV at destination must be notified of the estimated time of arrival, the truck registration number and the seal number.
- The SV or AHT at destination will receive the animals on arrival, check the seal number, truck registration number, and the number of animals. If everything is in order, he will break the seal, offload the buffalo and certify in writing on the permit that he received the animals on that date and sign it. He will then inform the SV at origin of the arrival of the animals. Re-reading of micro-chips may be required at offloading by the PDVS.
- If the movement did not comply with the stipulated conditions, the animals will be sent back to the farm of origin under veterinary supervision, in sealed trucks, after informing the SV at origin.
- Unless special arrangements are made with the responsible officials, buffalo movements should take place during acceptable daylight hours, and not over weekends or public holidays.
- The movement of FMD carrier buffalo are restricted to the Kruger National Park and adjacent infected zone.
- The movement of CD carrier buffalo are restricted to the CD control areas of KwaZulu-Natal and to registered CD projects.
- After required testing, FMD/CD-free buffalo may move to any farm registered for buffalo of this status. Buffalo with FMD/CD-free status will however have to be re-tested for every subsequent movement, unless the whole group were subject to official quarantine since arrival.
- If FMD/CD-free buffalo are moved into the FMD surveillance zone, CD control area or BTB endemic area, they will lose their free status. Their disease status will have to be re-confirmed by appropriate multiple testing before further movements out of these zones or areas can be considered. No movements of FMD/CD-free buffalo will be allowed into the FMD infected zone.

As mentioned before import into South Africa will be viewed on a case to case scenario but the strictest movement protocol will be applied namely quarantine and testing at source and then movement to suitable quarantine facility in the surveillance zone for additional testing and quarantine and then movement to a suitable quarantine area in South Africa for further quarantine and testing.

Diseases over and above that what was listed in the movement protocol above would be CBP and anthrax. Testing will have to be done for CBP (unless they are from an area where CBP has not been diagnosed for a specified period – probably a year) and treatment or vaccination for anthrax will also be required.

Treatment for external and internal parasites will also be required with quarantine requirements to prevent external parasites from re-establishing them on the quarantined animals.

Quarantine facilities

Both the holding facilities at source (place of capture) and subsequent facilities in the surveillance zone and/or free zone (e.g. Waterberg plateau) can be of similar design. Basic recommendations will be given below:

- Actual facilities must be in a buffalo/livestock free area with at least 100m from the closest perimeter with other animals from the inner boundary of the facility. At Tsumkwe it should therefore ideally be outside the current buffalo camp and the agricultural farm lends itself to quarantine facilities because of the ability to place the facility inside one of the paddocks in the greater area. The 100m buffalo/livestock free area will most certainly be required in the surveillance and free areas but may not be a definite requirement in the restricted area, but a distance of 20m will be required between the inner and outside containment fence in such cases.
- Actual facility can be of differing structure but what will be most cost effective will be a well build fence camp, 100x100m divided into 4 quarters. The height should be 2.4 m to accommodate a variety of species. The fence must be covered with plastic or Hessian to make it an affective visual barrier. Electrification on the inside will improve effective containment of most species but a well constructed fence with cables may negate the need for this.
- A wooden boma (at least 15mx15m) can alternately be built with a minimum of 2 compartments to allow for cleaning and movement of animals but will most likely cost the same as the fence camp. Larger camps from my own experience are less stressful than small bomas for most gregarious species.
- A 5 m strip of ground must be cleared of vegetation next to the inner fence (on the outside) to prevent ticks from entering the facility. All grassy vegetation and small shrubs must be removed from the actual holding facility.
- The actual holding facility must be surrounded by a fence of minimum height and structure to prevent other animals from entering the quarantine area and the fence should be a minimum of 10m from the inner facility – the box within a box concept. The outside of this fence must be suitably electrified to prevent elephant, predators and other large species to enter the facility. The fence should also restrict entrance of smaller mammals. As discussed above, if the facility is in the same camp as where the animals originate then the distance must be 30m.
- Access to the holding facility must be strictly regulated and only employed personnel may enter the facility. All gates must be locked and keys must be strictly controlled. Visitor access must only be allowed under supervision and restricted to the outside fence of the facility (outside box).
- At least one labourer for each group of animals must be employed and the facility must fall under the supervision of a dedicated manager for the area or project. All cleaning staff must be tested for TB. Only TB negative staff should be employed otherwise a risk of TB infection (including human TB) to animals in the pens exist.
- Feed for the quarantine facility must be stored inside the facility in a shed (or sheltered facility) with good ventilation and rodent and insect control is necessary.

The design of the quarantine facility can be the same in any area (source area, surveillance area or free area) but final plans should be based on local experience in Namibia and must ultimately fully comply with import requirements as stipulated by the relevant veterinary authorities. We also strongly recommend that visits to existing quarantine facilities in Namibia and South Africa should be undertaken to visualise the concept and also to determine the most practical and cost effective design for the area where it will be erected.

EXAMPLE OF SOUTH AFRICAN SCENARIO

Through the truly beneficial relationship built up over the last 30 years between South African National Parks and the wildlife unit of the State Veterinary Services (Department of Agriculture)

based at Skukuza, dramatic advances have been made to understand the epidemiology of the major wildlife diseases like F&MD, corridor disease, bovine tuberculosis and brucellosis. The understanding of F&MD and other important diseases in buffalo led to the joint "disease-free" buffalo breeding project between SANParks and State Veterinary Services in Kruger.

The project aim is to, through a process of rigid quarantine stages preventing young buffalo of becoming infected with any of the important diseases and in so doing allowing them to be translocated to the controlled disease-free area and where they can be released on to our newer national parks without threatening the disease status of the country for export and with no threat to the neighbouring farmers and their livestock.

The project starts by taking pregnant adult female buffalo, placing them in quarantine and weaning their calves before **F&MD** is transmitted to them. The calves have a natural maternal immunity to the F&MD virus, which only wanes between the ages of 7-9 months. The calves are then isolated from adult buffalo so that F&MD is not transmitted to them. The other important diseases like **bovine tuberculosis** and **brucellosis** are excluded in the calves by selecting the adults that do not have these diseases. **Corridor disease** is prevented by ensuring strict external parasite control, i.e. the tick vector that is needed to transmit the disease from the adult to the calf is removed and the calves therefore are free of the disease as long as they are kept tick free during the quarantine period.

Once all the calves have tested clean for the above-mentioned 4 diseases they then move as a group (all in/all out concept) to the surveillance zone, where they have to undergo another 2 F&MD tests 30 days apart and two more negative TB tests and one negative brucella and corridor test. On completion of these tests and quarantine they can then be moved to the "free" zone where they again have to stand quarantine for 30 days and have the final test for all 4 diseases. Once they have successfully passed through that stage they can be released on to registered buffalo farms or reserves.

To date SANParks has successfully translocated more than 250 "disease-free'" buffalo from the Kruger National Park to Vaalbos and Marakele National Parks. In Marakele N.P. SANParks are also mixing buffalo originating from Addo, Kruger and offspring of buffalo from Umfolozi/Hluhluwe. There has been no disease break through and the addition of buffalo has added significantly to the ecological status of the area and it has increased the commercial and tourist values of the reserves.

Below is a summary of the test requirements for these "disease-free" projects as taken from the 21st draft of the DISEASE RISK MANAGEMENT DIRECTIVE FOR BUFFALO (*Syncercus caffer)* IN SOUTH AFRICA developed by the buffalo committee of the state veterinary department of South Africa:

DISEASE TEST SUMMARY FOR BUFFALO CALVES ORIGINATING FROM THE FMD INFECTED ZONE

			TESTS REQUIRED				
Quarantine **stage**	Location of **Facility**	Duration of quarantine **/retention**	**FMD**	**CD**	**TB (a)**	**CA**	Other **Requirements**
Stage 1	**FMD infected zone**	**Variable :- until first negative test**	**X**	**X**	**X Blood**		**Effective tick Control**

		results			**Test**		
Stage 2	**FMD surveillance zone**	**Minimum 30 days after arrival at the facility**	**X**	**X**	**X Blood test**		**Effective tick control**
Stage 3	**FMD surveillance Zone**	**Minimum of 30 days after Stage 2 tests**	**X**		**X Blood Test**		**Effective tick control**
Stage 4	**Outside the FMD & CD control areas**	**Minimum of 30 days after entering the 4th Stage facility.**	**X**	**X**	**X Skin Test**	**X**	**Minimum age of 9 months. No tick control**
Stage 5	**Free range on same property as Stage 4 facility**	**12 months**	**X**	**X**	**X Skin test**	**X**	**Unprotected – full brown-ear tick exposure**

(a) (a)= not for calves under 3 months of age.

In summary, no matter which breeding system is used, each calf must have three consecutive negative tests for FMD and BTB and two consecutive tests for CD, while in the disease control area. This is followed by 30 days quarantine with retesting for all diseases (including the first CA test) outside of the disease control area. Thereafter, all calves are subject to a retention period of 12 months under free-range conditions and brown-ear tick exposure (if in a vector area). Finally, following the completion of the retention period, a full panel of negative tests for all four diseases will be required before the animals are released from the breeding project.

South Africa experienced 2 F&MD outbreaks in the free zone in 2000 and 2001 respectively. One was caused by feeding infected animal swirl from a ship to livestock in KwaZulu Natal and the other was from infected cattle that entered a feedlot near Middelburg in Mpumalanga. Both outbreaks were quickly retained and South Africa has been declared “disease-free” again within months of the second outbreak having been contained. No disease outbreaks have been associated with buffalo outside the controlled red zone.

The protocol followed for movement control of buffalo in South Africa is far stricter and better regulated than cattle so the risks to the livestock industry are minimal. The reverse is more realistic – infected or diseased livestock pose a greater risk to wildlife (especially buffalo) and this in our opinion is also true for the two “disease-free” buffalo herds in Namibia

FINANCIAL AND ECONOMIC ASPECTS

The general veterinary considerations for the movement and keeping of buffalo, roan and sable have been outlined above. These perspectives are from a vet working in South Africa and it is realised that these do not necessarily represent the official position of the Namibian or South African Governments in regard to 'diseased animals'. As a result of this it must be stressed that there are a number of unknown administrative and other issues which could arise and place severe constraints on the overall viability of the options and financial feasibility study set out in this report. It is unclear what the Veterinary Services will allow in Namibia regarding moving animals over the 'Red Line' and if the animals are exported what the formal position of the importing country will be for the three species. The financial models are therefore based on the most likely possible outcomes which would be expected or could be permitted, but these are not absolute and may require revision. They do not attempt to pre-empt any decisions in this regard.

This section does not deal with the 'ownership' issues relating to these species and the overall management of these populations at a macro-population level in Namibia. Although Management Plans for these species are being drafted, they were not accessible to the authors of this report. All of the above factors may in some way significantly affect the findings and general recommendations of this report.

This section therefore presents what issues may need to be addressed, these have been costed and where possible practical proposals suggested as to what could be further explored with other stakeholders in Namibia and an importing country if the animals are exported.

QUARANTINE FACILITIES

The assessment above suggests that the Mangetti quarantine facility may not be suitable for holding buffalo and possibly roan and sable. Working on this assumption a quarantine facility has been designed and costed. It may be necessary to erect two of these, one on either side of the 'Red Line', but this will be determined by the veterinary requirements.

The facility consists of a 120m X 120 m square enclosure. This outer fence will be a normal game fence, i.e. a 2,4 m structure with Bonnox[2] and electrification (3 stands with each live wire having an earth wire) on the outside, preventing animals entering the facility. This would enclose another camp which would be 100m X 100m, also 2,4m high. The ground between these enclosures must be kept free of vegetation to prevent ticks crossing the area. This internal camp would be divided into 4 equal sized camps, with interleading sliding gates and each with its own water and feeding facilities. Depending on the area, if there are no shade trees in the inner camp, some shade will need to be supplied. The outer camp will allow access to the inner camp via a loading ramp on one side with a gate on the other opposite boundary. These facilities will need to be near a food store as game will need to be supplied with a complete ration while they are held for a minimum of 21 days. Daily supervision will be essential. A list of materials for a typical quarantine facility is provided below.

[2] Bonnox is the commercial name for a fence which is a 'square' wire mesh, with the mesh size smaller at the bottom and larger at the top.

External fence			**Cost/unit**	**Total**
120m X 120m	**Type**	**Total**	**Namibian $**	**Namibian $**
Straining poles	3,6 m 175 mm	41	$120	$4,920
Poles	3,6 m 125 mm	75	$73	$5,475
Droppers	2,4m	60	$8	$480
Bonnox	1,8X30	5	$741	$3,705
anchor wire	2,5 mm	3	$37	$111
binding wire	2 mm	3	$36	$108
Wire 8 gauge		3	$35	$105
Gates	8		$600	$4,800
Cement		38.67	$50	$1,933
Stone&sand		38.67	$20	$773
Electrification	1			$11,100
Clear strip	30 m wide +int	1300.00	$1,300	$1,300
Transport	2	1600	$8	$25,600
Total				**$60,411**

Internal Boma			**Cost/unit**	**Total**
4 by 50X50	**Type**	**Total**	**Namibian $**	**Namibian $**
Straining poles	3,6 m 175 mm	80	$120	$9,600
Poles	3,6 m 125 mm	154	$73	$11,242
Droppers	2,4m	150	$8	$1,200
Bonnox	1,8X30	6	$741	$4,446
anchor wire	2,5 mm	3	$37	$111
binding wire	2 mm	3	$36	$108
Wire 8 gauge		3	$35	$105
Sliding gates		12	$4,000	$48,000
Drinking troughs		4	$1,000	$4,000
Feeding cribs		8	$3,000	$24,000
Feeding troughs		8	$2,000	$16,000
Game plastic	per m	600	$10	$6,000
Shade		4	$2,000	$8,000
Cement		78	$50	$3,900
Sand & Stone		81	$20	$1,620
Transport	2	1600	$8	$25,600
Total				**$163,932**

The costs for most of the above items have been obtained in Namibia and are therefore based on 2003 values. The total material cost for the facility is estimated at N$225 000, this excludes erection costs. It is estimated that an additional N$20 000 can be added for the erection of the facility, this assumes other fencing will be done as proposed in this report and therefore the establishment costs of the contractor will be spread between the projects. The erection costs will be influenced by the location, it is suggested that it is erected in a sandy area, both for management of the animals and this may make erecting it cheaper, however access is important as heavy trucks must be able to access the site and thick sand may make this more difficult.

Two of these facilities may be required, one could be built near the buffalo, roan and sable camps as proposed in this section in the Nyae Nyae Conservancy and one would need to be built possibly in the surveillance zone near Nyae Nyae. No exact location has been proposed in this report as no

other sites were visited. There may be an option on private farmland in the surveillance zone which may be appropriate.

BUFFALO FACILITY

An assessment was made of the different options and it would appear that the most cost effective and most practical to implement will be to add an additional 3 600 ha or a 6km X 6km facility. This could be added onto the existing camp which is 4km X 6km. It would abut onto the northern boundary, saving 6km of fencing. The common boundary fence between the two camps must not be removed, but a double gate must be installed between the two camps to allow for the animals to be moved. It is proposed that the existing herd is split in two groups, one of about 30 animals, which will remain in the existing camp and the larger group moved to the new larger camp. The double fence between the herd will maintain their disease status, even if one herd gets infected by TB or FMD, it will also make management easier. The Table below gives the materials and costs per km for a double fence around the facility.

			Namibian $	**Buffalo**	**Wire**	**Bonnox**
	Type	**Per km**	**cost/unit**	**11-strand**	**stock fence**	**stock fence**
Fence costs						
Straining poles	3,6 m 175 mm	8	120	$960	$624	$576
Poles	3,6 m 125 mm	50	73	$3,650	$2,373	$2,190
Droppers	2,4m	666	8	$5,333	$1,576	$337
Wire	2mm X 2100m	11	411	$2,153	$979	$0
anchor wire	2,5 mm	37	37	$1,369	$685	$342
binding wire	2 mm	36	36	$1,296	$648	$324
Wire 8 gauge		35	35	$1,225	$613	$306
Bonnox	1,8 X 30	10	741			$5,000
Sub total				**$15,986**	**$7,496**	**$9,076**
Clear strip	**30 m wide**	**$1,300**		**$1,300**	**$1,300**	**$1,300**
Erection costs	**Per km**					
Wages & rations	$7,000			$7,000	$3,5000	$3,5000
Travel	$1,100			$1,100	$600	$600
Tools & Equip	$600			$600	400	400
Insurance	$150			$150	$80	$80
Total	**$8,850**			**$8,850**	**$4,580**	**$4,580**
Electrification						
B1600 energiser		0.1	5500	$550		
Wire, 3 strands + bobbins		1	25	$25		
Panel and regulator		0.1	5200	$520		
Total electrification				**$2,195**		

The costs used in the Table have been obtained from Namibia and comply with the fencing standards for game set out in the Official Gazette of South West Africa No 4238, 6 August 1980, sections 147 and 148. It includes an internal 11-strand fence with an external 6-stand wire stock fence or external Bonnox stock fence. The Bonnox fence is about N$1 500 more than a conventional wire fence per km. This additional cost is probably not required as it is unlikely that the extra design will reduce losses to the buffalo, although for the fence it is only an extra N$50 000, if the existing 6km common boundary fence is upgraded as well. If it saves one buffalo it may be cost effective, but it is unclear if this will be a deterrent to predators.

The erection cost is estimated at N$8 500 per km for the inner game fence, this is based on a quote for a similar fence erected 800km from Windhoek in 2001, these costs were inflated by 10% per year to adjust for inflation in the intervening period. The costs to erect the outer stock fence is estimated at N$4 580 per km. Electrifying the external fence with 3 electric stands (each with a live and earth wire) is estimated at N$2 200 per km, while clearing a 30 m wide cut line is an additional N$1 300 per km. Thus the total costs for an internal 11-strand game fence with a 6-stand electrified external fence is estimated at N$42 000 per km. The total cost for the 18km is estimated at just over N$760 000 for the entire fence.

SABLE AND/OR ROAN FACILITY

The social organisation of these two species suggests that they are best kept in smaller camps to optimise the area available per group and for ease of management. Their group size is also usually less than 20 individuals. The ideal camp size may therefore be in the region of 2km X 2km square giving an area of about 400ha per group of 10 to 20 animals, this would work well for a stocking rate of about 1LSU per 40ha. It is proposed that a minimum group size of 6 to 8 animals is used for the initial stocking. This would include an adult male with accompanying females and their young. It is not recommended to mix females from different groups as there may be fighting and stress which may result in loses. To meet with the FMD and other veterinary requirements these will need to be kept in an area with a double fence inside the 'Red Line' to prevent contact with other animals in the area, once they have been tested and proved to be free of FMD and other important diseases.

The most efficient method of keeping them would be to create a 'checker board' system of camps, where common boundaries could be shared. This would reduce fencing, but as with the buffalo a double fence between the herds may be added security in the event of any outbreak of an important disease. In addition if the same species are kept in neighbouring camps, the bulls, if they come into visual contact, will fight 'through' the fence. Double fencing is therefore essential. If possible roan and sable should be kept in adjoining camps to prevent conflict between the same species.

The nature of these two species, their size and their habit of hiding their young makes predator proofing more important. For this reason it is proposed that Bonnox fencing is used for both the internal and external fence. The internal fence should be a 2,4m high game fence, while the outer fence is a 1,2m high Bonnox stock fence. The outer fence must have at least two electric stands and the inner to have one on the top of it to keep out elephants and as an additional protection against predators. The costs per km for this fence is presented below.

			Nam $	Sable/roan	Bonnox
	Type	**Per km**	**Cost/unit**	**Bonnox**	**stock fence**
Fence costs					
Straining poles	3,6 m 175 mm	8	120	$960	$576
Poles	3,6 m 125 mm	50	73	$3,650	$2,190
Droppers	2,4m	666.67	8	$5,333	$337
wire	2mm X 2100m	11	411		$0
anchor wire	2,5 mm	37	37	$1,369	$342
binding wire	2 mm	36	36	$1,296	$324
Wire 8 gauge		35	35	$1,225	$306
Bonnox	1,8 X 30	10	741	$7,410	$5,000
Sub total				**$21,243**	**$9,076**
Clear strip	**30 m wide**	**N$1,300**		**$1,300**	**$1,300**
Erection costs	**Per km**				
Wages & rations	$7,000			$7,000	$3,500
Travel	$1,100			$1,100	$600
Tools & Equip	$600			$600	$400
Insurance	$150			$150	$80
Total	**$8,850**			**$8,850**	**$4,580**
Electrification					
B1600 energiser		0.1	5,500		
Wire, 3 strands + bobbins		1	25		
Panel and regulator		0.1	5,200		
Total electrification			**2,295**		

The costs of clearing the cut line, erection and electrification are the same as for the buffalo fence described above. The fences however are more expensive due to the use of Bonnox (wire mesh) as the fencing material. The estimated cost per km is therefore estimated at about N$46 000. The cost per 400ha camp is estimated at about N$380 000. If the other camps are built adjacent to this, then each camp will save 2 km of fencing, thus every additional camp adjoining the first will cost N$285 000.

There is an existing cattle camp near the buffalo camp outside Tsumkwe. This consists of a 6km by 6km area divided into 36 by 100 hectare camps. The outer boundary is a 22 strand wire game fence, while the inner camps are divided by 6-stand stock fences. No detailed inspection was made of the entire facility but areas that were visited had been damaged by elephants. Permission would need to be sought from the Department of Agriculture who currently administer this facility. Although this is an existing facility, it would need some substantial upgrading, the perimeter would need to be repaired and definitely electrified to keep out the elephants. The internal fences will need to be removed in some camps to make each camp 400ha and not 100 as is currently the case. It is proposed that this new internal boundary (2km X 2km) has a 2,4 m Bonnox fence erected around it.

The wisdom of ‘re-tooling’ this facility is not immediately obvious. The poor standard of the existing fence and the need for erecting an internal game fence and removing internal fences may be as costly as building a new ‘specifically designed’ facility. The presence of cattle may also have some extra disease risk. If roan and sable were more abundant it may be worth using the existing facilities and seeing how the animals performed, but their scarcity would suggest that it is done properly from the outset.

OTHER CAPITAL AND EQUIPMENT COSTS

It is unclear what other facilities will be available for use in the Tsumkwe area, but it is assumed that a manager will need to reside there to oversee the project. In addition some labour support, equipment and a storage shed (with office and toilet facility) will be required, especially for feed for the quarantine boma. A shed and possibly some houses do exist at the agricultural facilities described above and the option of using or renting these should be explored. Provision has been made for these items and the following amounts have been budgeted, it is assumed the vehicle will be replaced every 7 years at 80% of its purchase value. These will all be incurred in the first year of the project.

Capital & equipment			
	No	**Cost per unit**	**Total**
Managers house	1	$349,000	$349,000
Rangers/labour accomm	3	$9,966	$29,898
Office and shed	1	$200,077	$200,077
Boreholes and water	2	$39,100	$78,200
4X4 vehicle	1	$280,000	$280,000
Basic tools	1	$15,000	$15,000
Fridge/freezer	1	$2,500	$2,500
Furniture and general equipment		$30,000	$30,000
Total			**$984,675**

GAME ESTABLISHMENT COSTS

In addition to the capital development items and equipment, provision must be made for acquiring the animals.

Buffalo

The buffalo group will need to be split into two groups of approximately 30 and 50 animals each, with the larger group moving to the larger camp. It is unclear how this will be achieved; there are basically 3 options, namely:

- To establish a ‘passive capture’ boma near the water/drinking area in the current boma, once the animals are in the area this could be closed and the selected individuals can be darted, inspected, tagged and transported to the new area.
- A capture site could be developed and the buffalo driven into it by a helicopter, once in they could be loaded and transported to the new camp. If required they could be immobilised, inspected, tagged and then moved.
- Finally it may be possible to drive the animals directly into the camp by using a helicopter and the gate between the two camps as the exist from the capture site. This may not work as the buffalo may not want to move to the fence, as they are familiar with the area. This could be overcome by building a capture boma with its top end opening into the new camp.

the last option is possibly the cheapest but with the highest risk of failure, it may be worth attempting it if the capture crew who will be on site think it will work. If this is not an option then the other two must be considered. For costing purposes the option of driving them into a capture site, immobilising and inspecting them before transport and release has been used. Any other option is likely to be cheaper. The cost per animal for this operation is estimated at N$5 600, this includes the costs of the capture team, helicopter time and vet expenses, as well as transport to the new camp. If 50 animals are relocated the total cost could be as high as N$280 000, but it includes some vet tests, however other options may reduce this amount. Any mortalities during the operation of buffalo have not been costed, this is a real risk and loses are very likely.

Sable and Roan

It is unclear where in the Nyae Nyae Conservancy/ Kaudum the roan are situated. This makes costing very difficult as the vastness of the area could add significant costs to this feasibility analysis as firstly the groups will need to be located, then captured and moved to the quarantine boma. This has been difficult to cost, but a fee of N$5 600 per animal has been used with an additional N$300 per animal for transport costs (one hour flying time plus drugs and other staff costs). It is highly likely that the animals (especially the roan) may have to be individually immobilised and ferried out of the area using a sling and a helicopter, hence the high fees per animal. These fees could double or even triple depending on how long it takes to find them, how far away they are from road access and how large the groups are. A similar requirement applies for the sable.

Once the animals have been captured they will need to be placed in quarantine and tests conducted to assess their disease status, this is estimated to cost N$2 760 per animal including vet fees, laboratory tests, feed and other 'boma' costs. The total costs to get the animals could be in the region of N$9 000 per animal, but as mentioned this could increase depending on capture conditions. A breakdown of these costs id supplied below for both buffalo and sable and roan.

Quarantine "1"	**Per buffalo**	**Per sable/roan**
drugs & tests	$3,500	$1,000
VET fees	$1,000	$1,000
Feed	$840	$455
State vet fees	$300	$300
Total	**$5,640**	**$2,755**
Quarantine "2"		
Drugs & tests	$2,500	$1,000
VET fees	$1,000	$1,000
Feed	$840	$455
Transport	$500	$300
State vet	$300	$300
Total	**$5,140**	**$3,055**

Initially only one quarantine will be required, but once the animals are removed from the breeding camps they will need an initial quarantine behind the 'Red Line' and then another from there to the surveillance zone. The two costs are similar, expect for transport and the tests for the buffalo may be cheaper as they may only require FMD checking at this point. If the strict disease protocol is applied to the export market in South Africa then the costs will be the same per buffalo in the

different quarantine camps. These costs will fluctuate depending on the test requirements set out by the veterinary import permit.

OPERATIONAL COSTS

Once the bomas and holding camps are established and the animals introduced, the project will require annual maintenance, although this is expected to be low as it is essentially an 'extensive' system. The first and possibly the largest annual item will be for staff. It is assumed that even though the management system is semi-intensive, competent input will be required. For most of the year the system will maintain itself, but in the event of a problem, issues could escalate rapidly if they are not identified and solved as soon as possible. Elephants breaking into the camp, predators, fire and disease are some of the many random events which could strike at any moment. Thus the need for management input creates a stronger case for keeping the different projects in one area, as the management overhead costs can be more effectively spread, than projects scattered over a wide area. Staff will be required to assist with fence and boma repairs and cleaning, feeding and other activities. It is proposed that a manager on a package of N$250 000 is resident on site and will be responsible for day to day management issues including inspections, maintenance of all facilities, ordering supplies, providing reports on the status of the populations and if necessary recommending management actions or interventions. The manager would be supported by a foreman/driver who would provide backup while the manager is away or on time off, this package is costed at N$18 000 per annum. Two labourers are also provided for at an annual package of just under N$10 000.

A 4X4 1 ton vehicle is indispensable in a project of this nature and this would account for the second largest overhead. Provision must be made for the maintenance of buildings and other infrastructure and other overheads such as electricity, water and communication need to be accounted for. Professional input may be required from time to time for different support, this has been costed at about N$70 000). It is assumed that no provision will be made for insurance against loss of the animals, this could add a large cost if it is. A detailed breakdown of these costs is provided below.

Fixed overheads	Annual amount Namibian Dollars
Staff	
Manager	$250,000
Other staff	$38,400
Electricity/water	$8,000
Communications	$6,000
Office supplies	$6,000
Bank and audit fees	$12,000
Professional fees	$69,080
Vehicle (running cost)	$90,000
Other costs	$50,000
Boma and other building maintenance	$22,117
Total	**$551,597**

The other costs include the variable costs of production, these include supplementary feed while the animals are in the camps, a fixed fee per animal for veterinary costs, the costs per animal associated with quarantine before the animals are removed from the area and a camp fence maintenance fee. The feed for the animals while in the quarantine camp is based on 0.4 of a bale of Lucerne and hay (*Eragrostis tef*) plus 1 kg of game pellets per buffalo per day and 0.2 of a bale of Lucerne and hay with 1kg of game pellets per roan and sable. A breakdown of these is provided below.

Allocatable costs	No of days	**Year 1 amount N$**	**Year 10 amount N$**
Buffalo fence maintenance		$28,827	$28,827
Roan& Sable fence maintenance		$10,625	$23,042
Vet fees		$8,400	$27,420
Feed buffalo	75	$52,920	$94,500
Feed for roan	90	$8,497	$44,420
Feed for Sable	90	$8,497	$44,226
Sub total		**$132,408**	**$813,566**

The variable costs increase as the number of animals increase, they start initially at about N$132 000 and increase to just over N$813 000 by year 10, where after it stabilises.

INCOME

The income generated by the project will be driven primarily by two considerations, i.e. the number of animals in the project and the price received for the animals. The relative performance of the animals is also critical, but this is still driven by the number of animals available for use. All the species are potentially high value, provided they can be sold for 'disease free' prices.

A production model has been developed for the three species based on their expected performance. The most likely scenario for all three species, assuming relatively good management and herd structure, should be between 12 and 16%. Higher rates may be possible if management is good and mortalities can be prevented. The buffalo in both the Waterberg and at Nyae Nyae have grown well. The Waterberg population started at 44 in 1988 and by 2000 had reached 184, this is an annual compound growth rate of 12,66%; while the Nyae Nyae population started with 29 animals in 1996 and these have grown to 82 in 2003, this equates to an annual compound growth rate of 16%. The Waterberg population in fact grew at over 23% in their first 4 years; this may have been due to a distorted age and/or sex ratio in favour of adult females. The growth of roan and sable could be higher than buffalo as the females breed earlier and the intercalving period is shorter, although they live a few years less. It must be stressed, however that although the 'general consensus' of people interviewed suggested the area was suitable for the three species, there is no guarantee that, especially roan and sable, will perform in the area.

A population growth model has been developed for buffalo, roan and sable. The model allows for adjustments in annual expected growth rate and allows the annual harvesting quota to be altered to allow the population to grow or even shrink until they reach their target number, i.e. to harvest at maximum sustained yield, below or over this. It also allows for the setting of a target population and once this is achieved the annual growth rate will be harvested, it assumes the animals are stocked at economic carrying capacity, management is good and growth rates are as expected. The model does require knowledge of the area and some understanding of how populations increase. Stocking rates in excess of 1 LSU per 40ha are unlikely to keep the population growing, this stocking rate includes all game in the camp.

The model also makes provision to feed all the game for 90 days per annum, the feed is the equivalent of 25% of the quarantine ration, i.e. a group of 10 buffalo would be fed 1 bale of lucerne

and 1 bale of hay with 2.5kg of game pellets per day while a group of 10 sable or roan would be fed half a bale of lucerne and hay and 2.5kg of game pellets. These must be supplied in feeding cribs which allow for 1m of space per animal for the both the sable & roan and buffalo. The feed must be spread over this distance to prevent dominant animals taking most of the feed. It may be necessary to supply licks with phosphate and other minerals, but these should be determined after dung analysis and only to meet nutritional deficiencies. This has been costed in 'Other costs' in the fixed overhead expenses.

FINANCIAL MODEL

As mentioned above a financial model has been developed based on the issues discussed in Financial and economic aspects and Income. The model does not make provision for inflation, as it is assumed that the expenses and income will vary consistently with inflation, it would therefore be a constant in the model and would only confuse the issues.

The model is based on the two camps for the buffalo and the important assumptions are set out in the table below.

Buffalo	**Camp 1**	**Camp 2**	**Total**
Start no	32	52	84
Target pop number	60	90	150
Year of introduction of 'Start no'	0	1	
Selling price N$	$80,000	$80,000	
Growth rate	15%	15%	
Area (ha)	2,400	3,600	6,000
Carrying capacity (ha/LSU)	40	40	
Total LSU	60	90	150
Buffalo per LSU	1	1	
Total buffalo LSU	60	90	150
Total Buffalo	**60**	**90**	**150**
Proportion of increase harvested	0.50	0.5	

In the model the starting and final population number, the year that the population is introduced, the rate of increase and the proportion of the annual increase which is harvested can be adjusted. The proportion harvested affects the income flow, as if the population is allowed to grow fast (the proportion harvested set to '0'), the income in the early years will be low, but high numbers will be harvested sooner as the population will reach its target size earlier. On a more aggressive removal quota (proportion closer to '1') the target population will take longer to be reached but the earlier income will commence.

Similar models have been developed for roan and sable, the principles are exactly the same as those for the buffalo. The sable and roan, however, have smaller camps and more of them. As the number of camps increase so the development and operational costs will increase in the model. The roan and sable models are presented below.

Sable	**Camp 1**	**Camp 2**	**Camp 3**	**Camp 4**	**Camp 5**	**Camp 6**	**Total**
Start no	10	10	10	10	10	10	60
Target pop number	18	18	18	18	18	18	108
Year	1	1	2	2	3	3	
Selling price N$	$80.000						
Growth rate	15%	15%	15%	15%	15%	15%	
Area (ha)	400	400	400	400	400	400	2,400
Carrying capacity (ha/LSU)	40	40	40	40	40	40	
Total LSU	10	10	10	10	10	10	60
Sable per LSU	1.9	1.9	1.9	1.9	1.9	1.9	
Total sable LSU	9.5	9.5	9.5	9.5	9.5	9.5	57
Total sable	18	18	18	18	18	18	108
Proportion of increase harvested annually	0.50	0.50	0.5	0.50	0.5	0.5	

Roan	**Camp 1**	**Camp 2**	**Camp 3**	**Camp 4**	**Camp 5**	**Camp 6**	**Total**
Start no	10	10	10	10	10	10	60
Target pop number	18	18	18	18	18	18	118
Year the 'start no' is intrd	1	1	2	2	3	3	
Selling price N$	$80,000						
Growth rate	15%	15%	15%	15%	15%	15%	
Area Ha	400	400	400	400	400	400	2400
Carrying capacity (ha/LSU)	40	40	40	40	40	40	
Total LSU	10	10	10	10	10	10	60
Roan per LSU	1.7	1.7	1.7	1.7	1.7	1.7	
Total roan LSU	10.6	16.5	10.6	10.6	10.6	10.6	69
Total roan	18	18	18	18	18	18	108
Proportion of increase harvested	0.50	0.50	0.5	0.50	0.5	0.5	

The model then allocates variable costs and income according to the number of animals/camps which have been developed. It will add development costs for camps as more groups are added. It assumes that 2 quarantine bomas are required and that the fixed overheads of 3 staff, a manger, their accommodation and office and shed are required irrespective of the number of camps. This is likely to remain true for the options presented, i.e. up to 2 buffalo camps and up to 6 sable and roan camps each..

Finally the development costs, the annual operational costs and the income are allocated per year and projected up to 20 years. A final cash flow is calculated and from this an internal rate of return (IRR) for the project is estimated. The model does not deal with interest charges, taxation, inflation or depreciation, these are accounting concepts and the interest component is to some extent catered

for in the IRR calculation as the timing of any cash flow is critical for this measure of return. The IRR provides an indication of the viability of the project. If this is high enough, given the risk the investor may be willing to take, then probably a financial analysis would be done where interest on borrowed funds, use of equity partners, own funds, taxation etc would all be examined. The model does not cost the price of land, or the buffalo already in the camp or the game 'on the hoof' which will need to be captured to start the project.

The model output based on the assumptions for the roan, sable and buffalo presented above and using the expenses presented in the previous section returns an IRR of 15.41%, this is very good for projects of this nature, most livestock models offer much lower returns. The projected net cash flow (in Namibian $)(after expenses) for the first 8 years is presented below.

	1	2	3	4	5	6	7	8	12
Net cash flow	**-$3,932,955**	**-$1,815,867**	**-$1,375,172**	**$418,733**	**$495,398**	**$646,006**	**$853,786**	**$1,521,138**	**$2,894,459**

The net cash flow continues to rise to year 12 where after it stabilises at just under N$3,0 million. The first three years the project requires funding, mostly for development, where after it should start to return a profit. Years two and three are mostly start up costs for the staggered roan and sable introduction, which are completed by end of year 3.

The average income per animal is estimated at N$80 000, this may be high for a bull but could be considered a low price for a female, especially for roan. It is expected that they may sell for slightly cheaper than the prices obtained in South Africa, as there will still be costs and risks associated with finally establishing the animals in South Africa. The model is sensitive to price obtained for the game and the prices used (N$80 000) is a conservative figure, as prices may fall, there is no certainty of what risks the market may perceive with these animals and it is an after cost price.

SENSITIVITY ANALYSIS

A sensitivity analysis is an important mechanism as it provides an indication of what will happen to the viability of the project should certain factors change. It should assist management in identifying what factors need to be considered when operating the project and what the effects of increases or deceases in input costs or selling prices. The IRR and the cumulative gross income were used to measure the sensitivity of the model to changes in expenses and price scenarios. The IRR is a better measure as it reflects the overall impact on the viability of the project and includes expenses and income. The base case assumed that all the sable and roan camps were stocked initially to 55% of their target population, the buffalo started at their current number (82), the harvesting proportion was 0.5, the growth rate was 15% and the price for all three species was N$80 000.

The sensitivity has revealed some important issues regarding the performance of the project. Firstly it has demonstrated that a fall in the price of the animals will affect the viability more than a price rise will improve its performance. A 50% fall in price reduces the IRR by over 112%, while an increase boosts the viability by 77%. The gross income merely reflects the added income. At a price of N$40 000 per animal (for all three species) the IRR falls to almost –2% and the project is therefore not viable at this price. The approximate price to get the IRR positive is about N$43 000 per animal. This suggests that prices below N$50 000 would make this project not viable, while between N$50 000 and N$60 000 it is competitive with livestock, over this figure and the project performs very well.

	Price of animals falls to N$40 000	**Price of animals increases to N$120 000**	**Rate of increase falls to 10%**	**Rate of increase increases to 20%**	**Proportion of animals harvested is kept a 0**	**Proportion of animals harvested is kept a 1**
IRR	-112%	77%	-83%	75%	52%	138%
Cumulative gross revenue	-50%	50%	-45%	44.9%	49%	1%

Similarly if the rate of increase of the animals falls by 33% then the IRR decreases by 83%, but increases by 75% if the rate of increases is boosted to 20% (or a 33% increases). The harvesting proportion is more complicated. The IRR rises relatively fast from 0 to 0.3 proportion harvested, where after it remains relatively stable until about 0.7, where after it rises quite fast. The cumulative gross revenue is relatively static and high between 0 and 3.5, after which it declines rapidly. The IRR, which reflects the overall efficiency of the project and the time value of capital, supports an aggressive approach to harvesting the animals. This is not surprising as $1 today is worth more than $1 tomorrow. The cumulative revenue supports building the population or moderately harvesting at about 0.3 and then selling the increase from a larger stock. Perhaps the optimum lies between these two and should also be influenced by other factors such as the Management goals for the different species in Namibia (See Other management implications below).

OTHER MANAGEMENT IMPLICATIONS

The model has provided a very rough interactive tool to try and understand the relationship between the costs of establishing and managing the project and the impacts of potential uncertainties. The ultimate choice will reside with the 'owners' of the stock and the investors in the project. The 'best' solution may be a combination of the ecological, social and financial aspects, this can only be judged against the objectives of the project. This report in no way attempts to do this but rather points out the narrow financial and perhaps some economic implications. There are a number of other issues that must be considered when adapting the model for the real situation, some of these are described below.

The initial sable and roan introductions are likely to be demographically distorted, probably with a high proportion of females and some young of mixed sex. This is likely to have a positive effect on the growth of the group and the 15% growth for the herds could therefore be low for these species. This ratio will have to remain distorted as the males will have to be removed by the age of 2 or 3 at the latest. The young females should be left to breed. Here management of the groups is important. Registers must be maintained of all the animals which includes their sex, age, parentage and calving status. By careful management and harvesting growth can be kept high by removing unproductive cows and cows over 8 or 9 years of age, which could be reaching the end of their productive life (the age groups of 4 to 8 are likely to be the most productive years). These animals could be

grouped together and sold with a mature bull and young bulls. Ideally it is preferable to let the herd grow to their maximum number and then remove 4 or 5 of the oldest or unproductive females, then allow the herd to recover. Here the group can be kept intact and this may help maintain their productivity once removed.

The young bulls once removed could be placed in the buffalo camps where they could be allowed to grow out in bachelor herds. This would form the breeding pool of the camps. It is important that the bulls are identified so they are not released back into their natal herd. Some of the bulls could be hunted in the camps if they are good trophies and cannot be used for sale or breeding. Every effort must be made to sell as many bulls with the cows as possible as this will add value to the herd. Live prices are less for bulls and trophy hunting may offer good returns. Bulls should not be left with the female herds for more than 3 to 4 years, to prevent breeding with daughters.

The prices of all three of these species have seen rapid increases in the past 10 to 12 years, the average prices at auctions in South Africa is presented below (SA Wild & Jag, December 2000):

Year	Roan price in Rand	Sable Price in Rand	Buffalo price in Rand
1991	R 17,000	R 25,286	R 28,812
1992	R 29,000	R 18,281	R 16,391
1993	R 28,000	R 19,163	R 17,250
1994	R 38,500	R 15,667	R 23,750
1995	R 33,625	R 13,480	R 47,163
1996	R 26,400	R 17,250	R 65,038
1997	R 48,200	R 24,892	R 74,854
1998	R 94,097	R 32,460	R 101,784
1999	R 86,389	R 48,774	R 74,607
2000		R 53,580	R 114,246
2001			R 81,411[3]
2002			R 116,624
2003	R 92 300	R 122 000	R 147,000[4]

All three species have seen dramatic growth in the prices paid for them. These prices present the gross auction value and exclude to costs to the seller of capture and transport to the auction (not for catalogue sales), feeding in the boma, any mortalities, auction commissions and other costs. The seller may therefore received 10 to 20% less than this depending on costs and mortalities. It should be noted that past performance is no measure of future prices and here projections must be conservative. The buffalo in particular could see a drop in price as these animals are becoming more numerous in South Africa. The two authors estimate that there could be as many as 500 new animals available on the market in South Africa in the near future, as breeding and 'disease-free' projects breed more stock. This coupled with any changes in legislation relating to the movement and sale of these species, but especially buffalo, could have serious risks on the viability of this project, especially the buffalo component. There is also a possibility that any or all of the herds could get infected with FMD or other diseases, which are prevalent in the area. This could potentially destroy the project and the investment. Any action which increases the risk of this happening should be evaluated and appropriate action taken. It is ironic, however that the high costs imposed on this project are to safeguard livestock; when in fact they could pose a severe threat to this project and wildlife in the area generally. It may be worth considering that the area is declared a stock free area and any livestock movement strictly controlled! The figure used in this

[3] Prices for 2001 to 2003 from Wild & Jag, September 2003.
[4] Prices for 2003 from Game and Hunt, December 2003

analysis of N$80 000 is therefore conservative and a lower baseline value. The sensitivity analysis examines this in more detail.

The buffalo have some track record on which to assume their future performance, this is not the case for the roan and sable and here a word of caution must be added. There is no evidence to suggest either of these two species will perform as predicted in the model, only implementing the model will prove this. To not overcapitalise it is proposed that initially the area is flown to more accurately determine the location and number of animals available and the potential likely capture costs and if it is even feasible. If this is possible then only 2 camps for each species should be built. If these are successful then more camps could be considered subject to availability of additional stock and the performance of the initial camps. To ensure the project is viable a group of one bull and 5 to 8 breeding adult females should be obtained, smaller groups could not prove viable.

Tourism is another potential add on bonus to the project. It is doubtful whether the project would act as a significant major attraction to the area, but once tourists are in the area, controlled visits to the camps may add value to this product. The area generally is scenic and attractive and offers a cultural experience. The through road to Botswana has also improved the tourism opportunities. It is hard to quantify the role of tourism in the project, but if it could keep each tourist on average a half day or one day longer these benefits could be immense. If there are 30 beds in the area with an average occupancy of 40% and an average length of stay of 2,5 days, then an extra days visit would add an additional 1 500 visitor days. This could add an additional N$500 000 to the turnover of the tourism businesses in the area.

Hunting is another option which may not necessarily add to the net income as the hunting prices, especially for the roan and sable, are likely to be lower than the live price. The buffalo may be comparable. If these animals can be included in packages with some plains game and perhaps some elephant, then a very good attractive packages will be on offer. It is anticipated that there could perhaps be between 2 and 4 roan and sable and up to 6 or 8 buffalo from the breeding project available annually once numbers are up at their target populations. These could add up to over 100 'hunting days' of packages if they are marketed correctly and added to other plains species. This could significantly add to the turnover from the project and add up to 6 to 10 hunting season jobs.

Assuming that the buffalo hunt would be a 7-day hunt, with some plains game and roan or sable included, this would make up 84 days of hunting at US$1 000 per day. This represents a gross income for the hunter of over US$84 000 for the year or almost N$1 million. This would be earned by the hunter and a proportion of this would be paid to the community. The trophy fees for buffalo when added to this at U$5 000 is an additional US$40 000, or almost N$300 000, this represents a good return to the owners of the game. The trophy fees for sable and roan are likely to be in the region of US$2 000. These fees, however cannot be added to the income already calculated as their value has already been included in the average live sale fee.

INSTITUTIONAL ISSUES FOR MANAGING THE PROJECT

The ownership of the animals is not clear at this point, this is an issues which needs to be clarified as it underlines who the beneficiaries and the controlling entity of this project will be. It is critical however, that for this project to work then management must be good. Management entails daily visits to the animals to check on their water and feed availability and for the roan and sable at least once a week check on the breeding herds. This must include a detailed count of the animals

including their condition. For the buffalo this must be done at least every 2 to 3 weeks but more frequent will 'habituate' the animals and improve the overall performance of the herd. It is recognised that this will be more difficult in the larger camps which the animals are in. Monitoring of the condition of the animals as well as the veld will be critical if they are to stay in peak condition. Any decline in performance must be followed up with an action, either at the individual animal or population. Feeding in dry times must be carefully monitored. Fence patrols to check on the status of the fence must happen daily.

This management regime calls for a well resourced and capable team, which ideally should operate on an incentive for performance, which is expected or even above expectations. The need to act rapidly and if necessary mobilise resources is a critical component of this project. The involvement of the community must form an integral part of this plan as it is proposed to be developed on their land and possibly using their animals. The role of Government is also critical because the need for approval of permits and other requirements.

The wide number of role players and the need for a good flexible management team would suggest that some form of institution may need to be established to deal with this. The authors are not experts on structuring these type of arrangements in Namibia, but one option which may prove worthwhile is a Section or Chapter 21 Company. This is a special company which is still regulated by the Companies Act and therefore has excellent supporting legislation detailing how it must be operated.

If this model is followed the principles of its operation could be as set out below:

1. The Memorandum of Association must detail what is expected from the company (the main purpose describing the main business and the main object). The primary objective must be to breed these three species so as to maximise their production so that the members can use them as they deem fit. The members may have different uses for the animals, but this must not detract from the main value to maximise their production in the semi-intensive breeding conditions set out in this report. To properly address this it may be necessary to draft a Management Plan detailing what needs to be done and what the goals are for the different animals. The Plan may need to assign responsibilities, obligations and rights to different parties depending on their involvement.
2. The Memorandum must also detail what will happen to the assets of the project at its dissolution or winding up, this will need to be agreed between the 'owners' and investors in the project.
3. The Articles will describe in more detail how the business will be operated and regulated. The first issue, which will need to be addressed is who the Members of the Company are. This is difficult to quantify at this point as it will depend on how the project is structured but it should be based on the following principles:
    a. Those who 'own' assets or legitimately represent members who 'own' assets within the project would form the underlying core of the Members. Their voting and powers must be in proportion to their 'ownership', provided that those rights of minorities 'owners' are also accommodated. The number is limited by the Companies Act. It is important that when drafting this agreement that there is some flexibility in allowing for its operation, but ideally the Memo and Articles should not be changed and altered regularly and this is where the election of the members is critical.
    b. The next critical issues revolves around the appointment of Directors. These would be the people who would be responsible for ' making the project work' Ideally there should be some separation between the Directors and the Members as the Members

will exercise ultimate control over the company. The number of Directors must be sufficient to carry out the functions of the Company, importantly they must not impose high administrative costs and absorb the benefits of the company. Their remuneration must be defined.

c. The most critical issue will be to define the duties and powers of the Directors especially regarding the use and application of any income generated. Here the Articles must define how this will be used and applied.

The issues described in this report have not indicated where or how assets will be acquired. This is a critical issue as it will determine if this project works or remains a 'paper project'. There are four main elements which are required, namely animals and land (initial stock and grazing area), capital investment (fences and equipment), working capital (for the early years for operations) and management expertise if this project is to be initiated. These four elements may provide some guidance as to how the Members and perhaps Directors of this Company should be appointed, if the Section 21 Company route is followed. Whoever provides these four elements should be beneficiaries from the proceeds of the project. It may be that certain parties may cede their rights to others in this process, that is an issue for them to resolve. Clearly the communities are a significant asset holder through their land and animals. The private sector may be best positioned to carry the risks of management and associated working capital costs. They receive an income for achieving a target performance, higher performance is strongly rewarded with benefits while poor performance is penalised via the agreement.

The capital assets and the working capital could be acquired by the communities through loans and agreements with lenders, but it is not clear to what extent this type of sophisticated expertise (which would be required) lies within the communities, or even if the financial institutions would support such an initiative. NGO's could provide some support, mentorship and leadership in this process along with Government. The option of raising donor or Government funds for the capital and working funds is an option which could be explored. The private sector may also be encouraged to invest in this regard through formal agreements. They may be able to provide capital and importantly the expertise and equipment to run and operate the project, especially if this can be done via a strong incentive for achievement of targets of production. This would define how the benefits are shared amongst the 'owners/investors' in the project if a Section 21 Company route is pursued.

It is strongly advised that legal input is obtained in drafting and registering the Memorandum and Articles of Association. This report has just touched on some of the areas of these documents, which will require special attention and input and where the legal team will need to be advised on what is expected.

SUMMARY RECOMMENDATIONS AND SUGGESTED ROLE PLAYERS

Much of the Veterinary discussion and recommendations were based on what is permitted in South Africa with buffalo, roan and sable; as many different protocols exist and wealth of knowledge has been obtained with the development of production and quarantine operations with these species. The discussions and the cost/benefit analysis should assist the Namibian role players in managing some of their rare and high value game species for the benefit of the country and its communities. The ultimate success of the project is however contingent on all of the following:

1. Agreement to move animals permanently across the 'Red Line', either into Namibia or a another country for sale.
2. Agreement from the community to use their land and animals for the purpose set out in this report.
3. Agreement to capture the animals and keep them in a camp and use the offspring for sale.
4. To mobilise the funds to build the facilities, acquire equipment, capture, move and test the animals.
5. The operational working capital to fund the project through its first few years of operation while stock are increasing.
6. The project requires expertise if these results are to be achieved, ideally the private sector is best suited to this where they can operate on an incentive. The community and Government are not likely to have strengths in this area.
7. If partners are involved to reach agreement on defining their roles and responsibilities as well as their benefits.

It is recognised that there are a number of 'political' issues which may influence decisions and most of these can only be solved by the relevant Namibian role players. This report is intended only as additional information for the discussions that will follow on the conservation and utilisation of roan, sable and buffalo in Namibia.

For any of the production systems to become functional the following role-players will have to be consulted:

- Namibian veterinary authority (key role player)
- MET (key role player)
- Conservancy communities (key role player)
- Namibian livestock industry
- Namibian private wildlife industry
- Relevant NGO's involved with conservancies and conservation
- South African Department of Veterinary Services (Department of Agriculture) – without a valid veterinary import permit for any of the species no export to South Africa will be possible (key role player)
- South African Conservation authorities if export to South Africa is intended

Below are some of the most important recommendations:

- **The disease-free buffalo herd at Tsumkwe is a valuable national asset and should safely be used to provide buffalo to Namibia and other countries if the correct quarantine procedures are followed.**
- **Semi-extensive production orientated management systems will under the current management constraints be most cost effective to achieve maximum production.**
- **Such management systems can be achieved successfully at Tsumkwe for all 3 species.**
- **The Mangetti Quarantine Agricultural Farm is not considered ideal for quarantine of wildlife because more risks are added to the disease scenario than where they are currently.**
- **The Mangetti Game Farm could be used as effectively as the Tsumkwe areas but a more detailed ecological analysis should be done to determine the suitability for roan and sable. Other management constraints exists which also have to be mitigated.**
- **Visit to South African buffalo, roan and sable production systems is recommended by MET, veterinary department and community members.**

- **The viability of the project is good provided capital and game (roan and sable) can be acquired, the necessary expertise obtained and the prices and performance targets set out in this study achieved. These production targets are conservative and should be achievable.**

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INTERVIEWS

1. Chris Weaver, Greg Stuart-Hill and Theunis Peterson – L.I.F.E. program WWF Namibia
2. Ben Beytall, Pauline Lindeque, Dries Alberts, Ruvunus Mukosho – MET
3. Leon van Rooyen – ex MET, currently private wildlife consultant Namibia
4. Faan van der Merwe – Chief Veterinary Control Officer, Otjozundtupa and Grootfontein, Namibian Veterinary Services
5. Dr Olivier – private veterinarian, worked for department of Veterinary services for 16 years

APPENDIX A

(Attach as separate file.)