Proposal

Water Supply and Irrigation

for the

Communty Farm

at Madikeleng

Limpopo

Client: Fanang Diatla

C/o Mrs Agnes Qwabe

Ga Mathabatha

Prepared by Nicholas Papenfus

PhD(WITS), MSAICE, MICT, Pr Eng

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Water Supply and Irrigation for the Communty Farm at Madikeleng

Background

On 7th and 8th September, at the request of Fanang Diatla, Dams for Africa inspected a tract of land adjacent to to the village of Modikileng on the far side of the Mphodiba river in order to gather information for determining the cost and feasibility of an irrigation system for a proposed community run commercial farming venture.

There is approximately 10 Ha of land that has been allocated for commercial farming, of which about 6 Ha is easily exploitable, as the ground is relatively even, and moreover lies about 3 to 10 m above the flood plain of the river, with the NW corner having the highest elevation. This area has been cleared of bush by the Limpopo Department of Agriculture (see figure 1). The remaining 4 ha of land lies on the flood plain of the river or undulating land leading down to the flood plain. However the local farmers say the as long as they can remember water has not flooded this plain, and the river remains in its normal channel even during heavy storms. (But it is probable that a 1 in 100 year flood would flood the plain).

The land is bounded by the river/flood plain on the east, a dirt road on the west, and dirt tracks on the north and south leading from the road to the river. There is a 1m high barbed wire fence on the northern boundary.

An 18m deep borehole is situated in the SW zone, but has never been equiped, other than with a 200mm steel casing that protrudes slightly above the ground (the opening has been welded closed to prevent stones from being thrown into the hole – see figure 2). According to the committee members the borehole's static head is high and the borehole has a very strong yield – although they admitted that no yield test has been done. If the borehole taps into a relatively permeable pebble formation, which is likely given its relatively close proximity to the river, then the chances of a strong yield are virtually assured. However, owing to the welded plate, the height of the static head could not be measured, but again, given its general proximity to the river, its is likely that this level will correspond to the level of water in the river – probably 4 or 5m down.

There are a number factors that appear to be favourable for developing some if not all of the land for commercial farming. These include the existance of an area of approximately 6 Ha of relatively even ground that has been debushed, soil that appears to be fertile, a borehole with a high yield (to be confirmed), the ready availability of labour from the nearby village across the river, the availability of a high voltage Eskom power line in the village for bringing in power to the borehole, and access to good roads to take the produce to market (either to nearby local outlets or metropolitan markets – Polokwane, Pretoria).

Given these possitive indicators a solution is proposed below that includes an irrigation system, a perimeter fence, the provission of power, as well as the cost of further preparation of the land in terms of ripping burried roots with a buldozer.

Irrigation System

Option A – 3 Hectares

Figure 3 details a plan veiw of the land as it will appear if 3 hectares are developed.

Figure 4 gives a typical section that shows the configuration of the burried and surface pipelines, beginning with the submersible borehole pump, and terminating with eight surface sprinkler lines spaced 12m appart, each having 25 impact sprinklers, also spaced 12 appart. The borehole pump has a capacity of 22,5m^3/hr and is capable of delivering a pressure of 3 bar per line at a time. It is powered by an 5,5 kW motor. The borehole pump/motor and its various controls and accesaries are protected against theft and vandalism by a high security reinforced concrete chamber. A pressure vessel is also located in this chamber to stop the pump in the event of a dead head. From here a 300m long burried 90mm pipeline takes water to the 8 sprinkler lines, which are also 300m long. Each sprinkler line has a shut off ball valve so that only one line is irrigated at a time. (The borehole pump has been sized so that it is able to pressurise 25 sprinklers at a time – and in this way sufficient water is delivered in one hour to the produce in that line – therefore it will take eight hours to supply all eight lines).

The practice of laying the pipelines on the surface is commonly used by commercial vegetable gardeners. The main advantage is that it allows the pipelines to be lifted up and ‘walked off’ to the side of the field after harvesting (this is a quick operation but a sufficiently large team should be organised to allow support every 10m) making the ploughing operation fast, allowing full utilization of the field, and ensuring that no damage occurs to the pipelines/sprinklers. After ploughing is complete, the lines are ‘walked on’ again. Fast coupling unions allow easy/quick reconnection. Steel stakes are then knocked into the ground to again secure the sprinklers in their upright orientation.

The supply and instalation cost is **R 187 434** incl VAT.

Option B – 6 Hectares

This is similar to option A, except that there are 16 surface pipelines instead of 8 as indicated in figure 5. The borehole pump now has a capacity of 45m3/hr and is capable of delivering a pressure of 3 bars to 2 sprinkler lines simultaneously. It is powered by an 11 kW motor.

The supply and installation cost is **R 310 134** incl VAT

Perimeter Fence

The proposed farm has a vast tract of land to the north which is a wilderness area and has many wild animals such as baboons, jackels, warthogs, etc. There are also numerous goats in the village. There is also the problem of unwanted thieves parking their vehicles next to the proposed gardens in the dead of night and loading produce.

It is therefore proposed that a 1,8m high fence be provided that has a diamond mesh configuration for the lower 1200mm and electification for the upper 600mm. The former will keep the goats and warthogs at bay, while the latter will safegaurd against baboons and thieves. The energiser for the electric fence may be safegaurded in the same security chamber that protects the borehole.

The fence will have one 4m access gate for vehicles and a pedestrian gate.

In the case of the 3 ha option the fence is likely to have dimensions of 300m x 100m, while this will be 300m x 200m for the 6 ha option.

The respective costs for the two options are **R 58 650** and **R71 650**, incl VAT.

Electical Power

There is a high voltage overhead line about 550m away, in the village of Madikeleng. Eskom have indicated that the cost of taking power from the high voltage line and then stepping it down to 380 volts at the borehole will be **R16 200** incl VAT. Note that this is a once off charge.

In addition to this there are also some monthly charges: The 'network coverage' charge is R270, the 'service charge' is R176, and if the 5,5kW pump typically runs for 200 hours in a month, then the consummed power charge will be R264. Thus the total monthly bill is likely to be **R 710.** It should be noted that these costs are considerably less than would be the case is a diesel powered pump were employed – an exercise has shown that Eskom power is approximately 50% that of diesel generated power.

Ripping

The farmers would also like to have a bulldozer come in to rip out the sub surface roots that still remain from the trees. Although the machine supplied by the Limpopo Department of Agriculture was able to clear the surface growth, it was not equiped with rippers, and in any case did not have the traction required for ripping. Ripping should be done in two orthoganal directions, and for this a D6 with three rippers is ideally suited, at an estimated cost of **R17 089** for the full 6 Ha area, incl VAT but excl establishment.

The major part of the cost of ripping is the cost to establish a bulldozer on site – which has been estimated at **R14 500**. It is sometimes possible to save on this item if there is already a machine in the area that can be diverted for a week or two.

If no ripping is done then plowing will be more difficult, and some of the trees and bushes with begin to grow again.

Legal Implications

Strictly a license is required from the Department of Water Affairs and Forrestry (DWAF) before water may be abstracted from a borehole, unless only small quantities are involved (in this case the quantities are considerable). However licensing can be a very slow and frustrating process, which may take years, with applications being lost or placed in some 'pending' file by DWAF.

An alternative approach may be to proceed without investigating the aspect of a licence, on the assumption that the Limpopo Dept of Agriculture would not have cleared the trees and bushes if there was no permission to use the water. Then, if challenged later by DWAF officials after the scheme is up and running successfully, a license may be applied for. Given that the beneficiaries are from the formally disadvantaged community, the application is likely to be successful – particularly if the farming operation is a thriving success. However, this approach is not without risk, and may be regarded as irresponsible, and therefore in my capacity as a professional engineer I cannot recommend this approach.

A third approach would be to budget say **R8 000** for 20 hours of a professional engineer's time to push DWAF and hopefully get the license relatively quickly.

Budget Constraints

If budget constraints exist, and sacrifices have to be made, then these should be made in the following order:

1. reduce size from 6 to 3 hectares (this has the largest effect)
2. do away with the ripping exercise
3. do away with the security fence
4. simplify the irrigation system to a furrow or dragline system
5. if the allocated funds are still insuficeint, it may be becessary to consider irrigating a smaller area, say one or two hectares.

It should however be recognised that with each budget chop (other than the first and fifth items, which will make te whole operation simpler) farming the land becomes increasingly more difficult. Note that the option of doing away with the *security chamber* is likely to result in the theft of the pump/switchgear and related equipment and should not be considered.

Conclusion and Recommendations

As a starting point, a full 8 hour yield test should be carried out to determine the yield of the borehole, costing **R3 400** incl VAT. Only then can the number of irrigable hectares be determined and clearly this influences the design and cost of the irrigation system.. Finally, as the sums of money involved in optionns A and B are considerable, a carefully worked bussiness plan should proceed the alocation of funds.

Figure 1 – Overview of land looking east

Figure 2 – The steel casing of the borehole has been sealed off

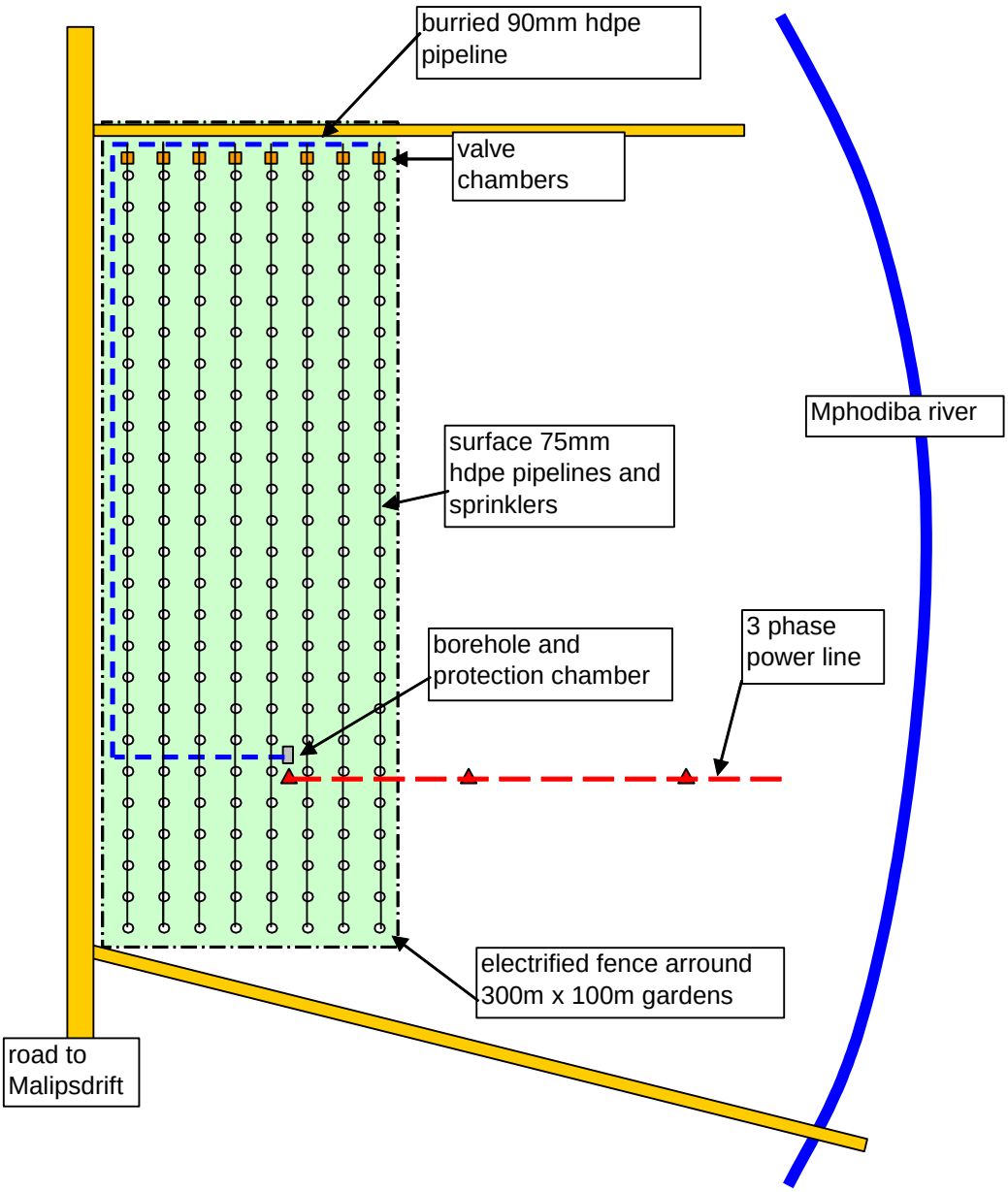

Figure 3 – Plan of Irrigation system, power supply, and fencing, assuming 3 hectare option

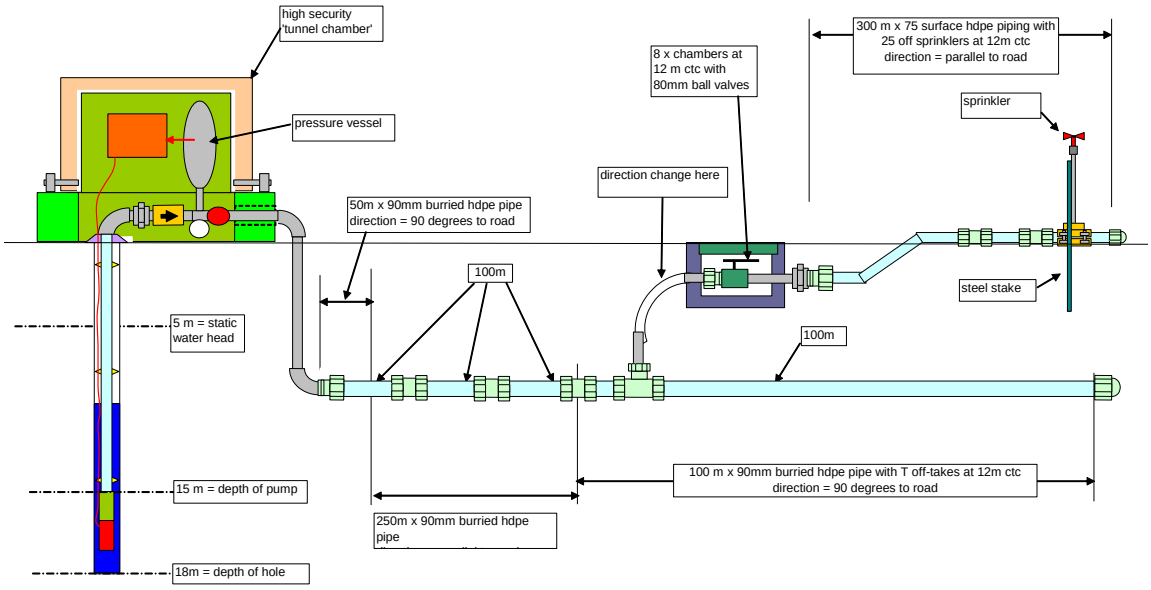

Figure 4 – Typical section of irrigation system

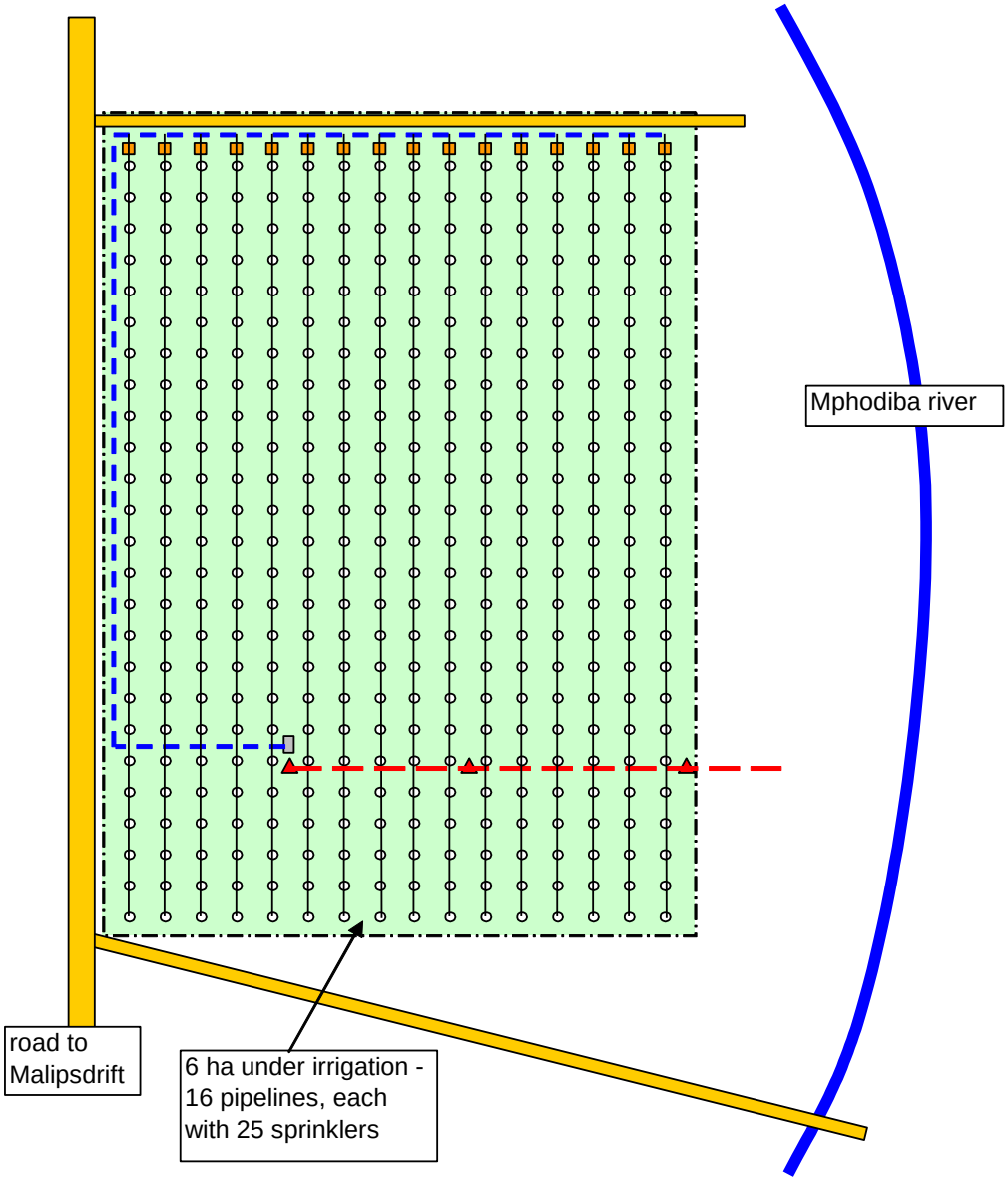

Figure 5 – Plan of Irrigation system, power supply, fencing assuming 6 hectare option

About Dams for Africa

Dams for Africa (Pty) Ltd design/construct/rehabilitate water related infrastructure to **empower communities** in remote rural areas. Typical projects include dam rehabilitation, canal, weir and reservoir construction, installation of pipelines, boreholes and irrigation systems.

DFA recognises the need to be **flexible** and will tailor its involvement according to each need, from minor consultations to relatively large turnkey projects.

DFA's contribution to a **typical project** may take the form of an initial feasibility study, followed by design and/or construction.

Whenever practical **labour intensive** methods will be used in the construction process, sourced from local community.

DFA is also in a position to provide the necessary hydrological, topographical, geological, ecological and social impact **studies**, and attend to the technicalities and legalities associated with water related infrastructure.

Dams for Africa fully appreciates the need to **network** and co-operate with partners such as:

1. *Community based organizations* that are in touch with the needs of the resident population.

DFA is aware of the importance of *community involvement* and is, if required, prepared to participate in all stages of this process. This would include a response-to-need request as the first step, assistance with visualization, participation in negotiations, recruitment and training of local residents for the construction stage, facilitation of training in subsequent agriculture and irrigation, and ongoing mentoring as may be required.

2. *Donors/funders* including government and financial institutions.

DFA is prepared to participate in *fundraising* for worthwhile projects, and in the production of 'bankable' documentation.

3. *Training organizations* who teach on farming methods, produce marketing, and who know the value of ongoing mentoring.

DFA would like to know that its engineering contribution is placed in the hands of a motivated community that has been *equipped* with the necessary skills to put the water infrastructure to good use for many years to come.

Tel 011 475 2764
Fax 011 475 8381
Damsforafrica@worldonlne.co.za