IMPROVING WATER ACCESS FOR CLIMATE-RESILIENT INTENSIVE HOMESTEAD FOOD PRODUCTION PRACTICES

1.1 THE CURRENT SITUATION

Homestead food production is an important aspect of the smallholder farming system. These systems are small (0,01-0,5 ha; or 100-5 000 m^2) plots adjacent to homesteads where participants plant a range of crops and fruit trees, with or without access to water for irrigation. The homesteads also host small livestock such as poultry and, in some cases, goats and cattle. A limited number of people also keep pigs. These plots are usually fenced. The large majority of smallholders plant for household consumption and sale of surplus.

Production is constrained by infertile and badly structured soils. Often, the smallholders live in areas where soils are not ideal for cropping. This situation is worsened by repeated shallow tillage (with hand hoes and/or tractors), without the addition of nutrients or organic matter, often over many years. The results are very low fertility soils, with many structural problems such as capping and compaction. This is now exacerbated by climate change, with alternating hot and dry conditions and heavy downpours adding extensive erosion of topsoil to the list of woes. Productivity is generally extremely low.

In addition, access to water for irrigation is an enormous obstacle for most smallholders, who battle to have enough just for household use.

Water management in an intensive food production system consists of:

- Reduction in run-off and water erosion; mostly through measures such as diversion ditches infiltration basins, contours, stone bunds, check dams and the like.
- Improved water-holding capacity; mostly through increased organic matter in the soil, mulching and microclimate management (such as improved shade and reduced wind).
- Improved water-use efficiency; mostly through irrigation management, drip irrigation and greywater management.
- Improved access to water; mostly through small dams, spring protection and drilling of boreholes.

Improved access to water can take several forms and interventions are generally conceived as large infrastructure projects implemented through government and municipal processes. In this report, we focus on increasing local level access through processes that groups of individuals can undertake within their communities.

1.2 GROUP-BASED ACCESS TO WATER SOURCES

Water is considered a communal resource and as such water projects need to accommodate all community members. For the large majority of rural settlements, water access is about household water needs and it is this aspect that government services focus on.

It is possible to conceptualise water provision for agriculture at a village level, where an interest group of smallholders undertake to manage and use a specific water resource, such as a spring, or a borehole, with consent from the local authorities and Water Service Authority representatives. We do not include rivers and perennial streams in this activity, as water offtake and management from these sources is socially, politically and environmentally a lot more complicated and does require the whole community to be involved.

Group-based water management options have the advantage that participants can “own” their scheme and thus have a lot more control over their water access. It also has the advantage that the group itself designs, implements, maintains and manages access for the members. The members are responsible for water use and management and are accountable to each other.

1.3 DEVELOPMENT OF THE CONCEPT

The institutional landscape for water provision is still mostly conceptualised as drinking water at a minimum level of 25l per capita per day. The equivalent in urban areas is 200l per capita per day. This mismatch is partly due to the conundrum of non-revenue water provision, which allows for 6000l per household per month – the free basic water amount, provided to households defined as indigent.

According to the Strategic Framework for Water Services (SFWS) of the Department of Water Affairs and, which is the executive strategy for the water acts, it is the responsibility of a Water Services Authority to ensure that "adequate and appropriate investments are made to ensure the progressive realisation of the right of all people in its area of jurisdiction to receive at least a basic level of water and sanitation services",[1] i.e. a universal service obligation. Actual delivery of the water and sanitation services is thus the responsibility of local government.

A National Water Policy Review (NWPR) by the Department of Water Affairs (2016) resulted in the prioritisation of access to basic water supply in the form of a yard connection to all households in the country, taking into account availability of water resources, financial challenges, geographical placement issues, servicing of vulnerable groups and addressing the backlog

When water supply is seen as a series of projects where the construction of infrastructure is the most important element, rather than the provision of a service, it is bound to be unsustainable. A service includes the initial construction phase but is predominantly an ongoing business of supplying (at a cost) water to consumers over a long period of time. Iterative, transparent, coordinated and cooperative planning through local government procedures can build capacity; can attract funding from other governmental and non-governmental sources and can promote convergence and pooling of resources.

A stronger link between planning processes and budgeting is extremely important, which is a major challenge amid numerous parallel operating planning processes by local government and by line agencies and other stakeholders operating through local government. Optimal water services institutions are therefore those that possess a combination of governance attributes (legitimacy, accountability, adaptability, effectiveness, efficiency) that will enhance prospects of achieving the objectives of Integrated Water Resource Management, appropriate water services, improved livelihoods and social integration.

Demand-driven approaches that are empowering communities through well-structured and informed campaigns and encouraging involvement in the decision-making process must be incorporated in the provision of water services. Sustainable water service provision should ensure that robust, on-going water conservation awareness and promotion interventions are part of the service provided.

There has however been little development of the concepts of multiple use options of water and due to the difficulties and expenses involved in bulk supply of water in rural areas, many of these areas still languish in supply systems provided before 1994 or without access to potable and irrigation water.

A typical household or community needs and uses water for different purposes even if a water delivery system is designed and managed with the aim of providing a service that meets the demand for a single water use. To be prepared for this manner of water use, the concept of multiple use services must serve as a departure point in developing appropriate norms and standards.

"*Wherever practical, water services and infrastructure must provide water for multiple use and accommodate mixed levels of service within communities, allowing consumers to elect a level of service which suits their needs, is affordable to them (within the prevailing subsidy framework), addresses inequalities, utilises appropriate and upgradable technologies, and is governed transparently, effectively and responsibly to ensure sustainability".*

[1] L.C.Dunker. 2015. Towards norms and standards for water services in rural South Africa. WIT Transactions on Ecology and The Environment, Vol 200, © 2015 WIT Press Water and Society III 183 www.witpress.com, ISSN 1743-3541 (on-line). doi:10.2495/WS150161

Within the latest policy process of DWA the following water institutions have been defined and are allowable.

Water Services Institution	Main Features
Water Services Authority (WSA)	• A municipality responsible for ensuring access to water supply and sanitation services • Must be a municipality and no other institution – category A, C or B (f authorized by Minister (DPLG)) • May itself perform functions of water services provider, or enter into contract/joint venture with another WSP
Water Services Provider	• Provides the water supply and sanitation services (physically) to (WSP)consumers under contract to the WSA • WSP function can be performed by municipality, water board, non-governmental organization, community-based organization, private sector company, or any other private or public body • No person may operate as WSP without approval of WSA
Water Board	• Is established by the Minister of Water Affairs & Forestry (WB) • Primary function: to provide water services to other WSIs • Is a public water services provider • May perform secondary activities if primary functions and financial standing not compromised – examples -Provide management services, training and other support services -Supply untreated water not for household purposes -Provide catchment management services -Provide water supply and sanitation services in a joint venture with WSAs -Perform water conservation functions - With approval of the WSA, supply water directly for industrial use, accept industrial effluent, act as WSP to consumers
Water Services Committees	• A statutory committee that may be established by the Minister should a WSA fail in its duty (WSC) • WSC does not refer to a community-based organization that performs a WSP function at community level (rural)
Water Services Intermediary	• A person or body providing water to people as a minor part of a contract (eg farmer to labourers, landlord of flats to tenants, mining company to employees in housing) • Only applicable where there is an obligation by one party to provide services to another as part of a contract

The avenue open to locality and group-based water management options are to serve as water service providers with permission from the water service authorities.

1.4 EXPERIENCES IN BERGVILLE- UTHUKELA DM.

uThukela Water is responsible for rural water provision in the Emmaus region (amaMgwane and amaZizi Traditional Authorities), where MDF has been operational. In these area Mahlathini, with assistance from sister NGOs and small injections of funding, has been working with water committees to provide group-based access to multi-purpose water in three villages between 2020-2023.

The water provision landscape in these villages is complex and fragmented, with small place based schemes, consisting usually of either a protected spring or a borehole with a storage tank have been provided by uThukela Water, but also by other concerns such as SAPPI, political parties, NGOs and communities themselves.

The official route for water services provision and management is to work through the ward councillor, in this case Mr ?Dladla, who is part of a ward committee where issues are raised and brought to the attention of the Project Management Unit based in Ladysmith. These technically oriented staff (3 members) have made it clear that all water provision and water quality aspects are under their management and control and that they are not partial to these small independent initiatives. Their

feeling is that if outside funding is provided, the resultant infrastructure should be handed over to them for management. They specifically felt that communities and their committees complicate matters as they believe they "own" the infrastructure, make unreasonable demands and are difficult to communicate with. They clearly stated that they can support water infrastructure projects with management maintenance unless those handed over to the Municipality. They mentioned that they also do support the NGO assisted water access to communities as often these small schemes and spring protection projects do not the requirements for water quality that they are obliged to meet.

CONSIDERATIONS

- Group based day to day management works best for groups of around 20 people. If groups are much larger (e.g.~50 households), intractable conflicts are much more likely to arise
- Allocation of roles such as daily opening and closing of valves, works best if this is rotated between group members rather than placing this responsibility solely on one person.
- In cases where pumping is required (e.g. from electrical borehole pumps), it works best to fill the tanks overnight, then open the valves once during the day in the mornings, before closing them again for refilling in the evening. Continual pumping is problematic usually both for the borehole in terms of potential over pumping and also the participants, as regulating water usage becomes almost impossible in these low-tech systems.
- For springs which are considered as public access water points in communities, spring protection can be done for localised groups only if an arrangement is made for the general community to also have access at the spring itself and drinking points for livestock are also considered.
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Despite this they have been unwilling or unable to provide an overall plan of water service provision to the area. Since 2020 when the spotlight started to fall on the fact that many of these villages have zero water provision and have had no support or services at all from uThukela Water since their inception, a number of ad hoc efforts have been seen in these villages. The positioning and implementation of these small water access points is however not discussed with the communities and in all cases services only a small, localised proportion of the inhabitants in these villages.

(In 2002 UDM and three other Category C DMs, took the matter of their not receiving equitable shares from national allocations to court – Some compensation was promised from National Government and it was also indicated that different organs of state could not take each other to court- but had to follow the outlined conflict resolution procedures.

Presently the UDM is under administration by COGTA, as the municipality is in debt. They have however received funding recently (April 2023) from DWS and are planning three multi million rand projects around the Okhahlamba area, one for Bergville and two more …..

The fledgeling Northern Drakensberg catchment partnership have been unable to secure their support or participation.

Advantages of group based water access as conceptualised

- Full participation of community members, traditional authorities and ward councillors allows for water schemes that are locally appropriate, locally managed and equitable
- A patch work of different locality based schemes can provide access to basic water to all households in a village, rather than only a small proportion
- The schemes bring water closer to households via either yard connections or taps and provide a minimum of 50L of water per household per day – usually between 100-200L (~50 l per capita)
- Aspects of sustainability are included in the design, operation and management and local training and awareness raising are included in the process

- Water is provided for multi purpose use. Water quality is tested upon inception and community members are training in citizen science methods and procedures for regular checking of water quality (E coli test kits).
- Participation in the local 'schemes' is group and membership based and these members pay towards ongoing management and maintenance of their system. The broader community, in the case of springs, is not excluded and access points at the protected spring are open to all as well as livestock if required. In the case of boreholes, this stipulation does not apply. All who want to use water, need to contribute financially.
- Traditional authority representatives generally have been very open to these processes and have thrown their weight behind these systems – which has provided a level of authority and legitimacy to the water committees and the rules and procedures outlined.

Disadvantages/difficulties of group-based water access options

- Financial contributions are unlikely to be enough to deal with major maintenance issues or replacement of infrastructure.
- Due to the localised nature of the water sources, there is a limitation both in the number of people wo can be serviced and the amount of water that can be allocated to each household on a daily basis. Individuals who do not respect these boundaries cannot be easily delt with.
- Local conflicts around payments are almost inevitable, as some individuals feel water should be accessible to all and should be free- as a constitutional right. This argument cannot be denied, but also leads to abuse of the systems
- Mostly, the difficulties come from people outside of the villages entering and helping themselves to large amounts of water- a situation that the locals cannot police
- There is a limit to how much effort community members can and will put in on a daily basis to ensure smooth operation of the water infrastructure. It has been found that daily operations are onerous for the individuals who are responsible, compounded by lack of support and respect from other individuals in the community.
- The process works well in communities that are socially coherent, but not in 'disturbed" villages where newcomers and strangers reside and fail to respect the processes and rules outlined.

VIMBUKHALO

Water walks and scenario development for Vimbukhalo

The process consists of the following steps:

- Discussions with CRA learning group and water committee to ascertain the need and motivation for action, followed by initial group walks to identify possible water sources
- A more formal water walk with the engineer of the most promising options. Springs that are not perennial, or too low down to be reticulated using gravity, or too far away from households, or where ownership is contested are removed from the list of options.
- The engineer develops scenarios for the development of the source and potential yield and reticulation. These options are discussed with the water committee and participants and final lists of potential participants are drawn up. Here it is determined who will be part of the scheme. Some households will fall outside of the physical range of the reticulation and different options need to be discussed with them. Some households will not want to join the group and make the required payments or undertake the labour themselves.
- Then, the work is outlined, and undertaken jointly between the group, the engineer and MDF's field team

MDF initially engaged in thinking through water access options with the Vimbukhalo community in 2019-2020 and a Water Committee was formalized. At the time no assistance had been provided by the authorities since 1994. Water access was through to small, localized schemes – a protected spring and a borehole provided by the Department of Agriculture and SAPPI respectively. Most

households collected, and still collect water form unprotected springs and small streams in the community. The discussions were picked up again in August 2022 and the following changes were noted:

- The SAPPI borehole with header tank, providing water for around 22 households is no longer operational as the pump stopped working
- uThukela Water, with the councillor for the area intervened and protected one spring and provided a header tank for that (on the steep slope away from the SAPPI plantations, which provides water for around 15 households)
- uThukela Water also provided a solar powered borehole for the school in the village.
- The Water Committee set up before does not represent the whole of the community, but only the section where uThukela water intervened and is made up of a number of members of the local ward committee.

Through discussions with community members, it has become clear that in Vimbukhalo there are a number of smaller informal water committees that are locality based, rather than a structure that represents the whole community. This complicates matters somewhat and provides for some competition and mistrust, but also allows for small locality -based group initiatives, which enables greater involvement and commitment for those specific groups. It does however not help with planning an overall patchwork of water access options that can benefit the whole community. The latter process has been kept in mind in the water walks undertaken by MDF but cannot be tackled coherently at present.

The initial water walk in July 2022, with the CRA learning group members and their localised water committee focused on the side of the community closest to the SAPPI plantation (east of the river). The walk showed that the SAPPI borehole, pump with one 5000l JoJo header tank is presently not operational – as the electricity trips. The community requested support first form SAPPI, who declined further support and then uThukela Water, who have not come to see the situation, but suggested households collect R100 from all participants to a minimum of R1900 for a new pump and also that they could only intervene if the community handed over the ownership of this borehole to the municipality.

These participants have been using this scheme for 10 years successfully, paying R5 per household upon request to the homestead where the electricity for the pump is connected. They mentioned that they used to pump every third day and that people would come and collect water while pumping was ongoing during the day and then later once the pump was switched off and the tank had filled up. This system seems to have worked well for this whole period until a malfunction with the electrics. There is evidence at the electricity box of trying to fix the connections and adding more insulation tape as attempts to fix the problem. Presently the households have to walk to the river, between 500-1000m away to fetch water.



Figure 1: Above Left: the header tank for the SAPPI borehole. Centre: the pump for the borehole and right: The enclosure built for the pump and electrical box.

A new borehole with solar pump has been installed at the school, further along the east side of the river by uThukela Water


Figure 2: Above Left: The borehole with solar panel at the school and Right: Looking towards the school from the wetland below

There is also some old infrastructure in the wetland below the school, originally put in by the Department of Agriculture in the mid 1980's. A small cement header tank with a tap slightly further down. The tank is still operational although it leaks, but the tap is presently situated in the middle of the wetland is highly trampled by cattle.

Figure 3: The old, protected spring with leaking header tank and inaccessible tap.

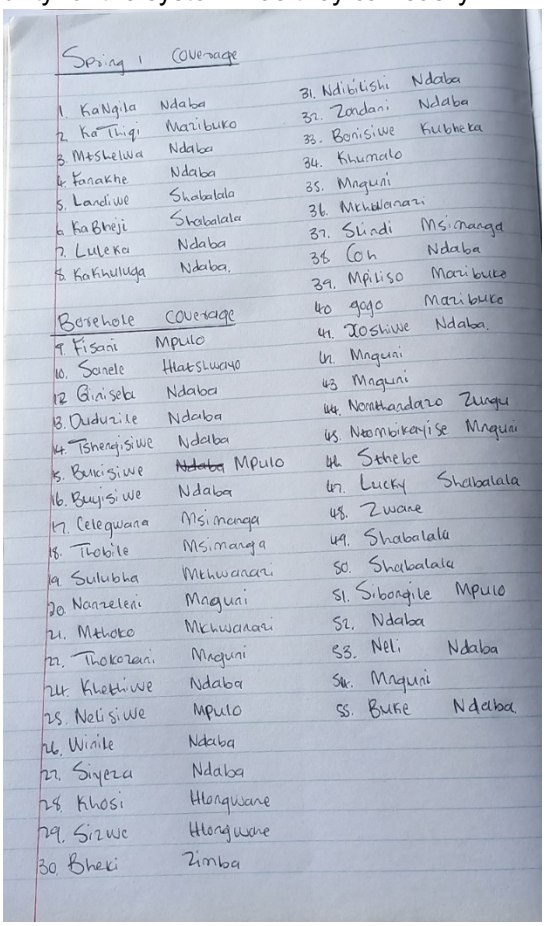
This walk was followed by more visits to local unprotected springs both within the villages and further away in the hills as more options were mentioned over time by the participants. Most of these options were not considered as the springs are small and far away from homesteads. A more formal walk with the engineer to survey the most promising options was undertaken.

The report is added as an attachment: ***'WWF_Vimbukhalo borehole and spring engineering report_ AM_20220905'***. The main recommendations here were:

- To refurbish the old SAPPI borehole: Do a borehole yield test, remove and replace the pump, consider according to strength and quality of water a reticulation plan that can include as many households as possible, and increase header tank capacity. Installation of communal taps is to be considered.
- To explore options for protection and reticulation of the spring in the bordering SAPPI plantation. This spring is higher up and can incorporate around 9-11 households that are situated above the borehole and are unable to access that water (Spring 1 on map) and
- Create a better water collection option for the old- protected spring in the wetland close to the school. (Spring 3 on map)

These scenarios, together with the maps were discussed with the Vimbukhalo community (21st September 2022). It was agreed there to commence with the yield testing of the borehole and to organise meetings with SAPPI to request assistance with potential spring protection on their land.

In addition, the letter of borehole ownership, obtained through SAPPI and delivered by the councillor Mr Bonginkosi Dladla is to be held safely by the committee until this refurbishment is completed. At that point the committee will make a decision as to whether they will 'keep' the ownership of the borehole with them or hand it over to the Municipality. Community members are loathe to hand over the ownership as they do not believe uThukela Water will assist them, regardless of this requirement. They are however nervous of having to take full responsibility for the system – as they can easily handle day to day management and maintenance, but cannot necessarily manage large expenditures, such as pump breakdowns. These issues will be further discussed.



Spring Coverage

1. KaNgila Ndaba
2. KaThigi Mazibuko
3. Mashelwa Ndaba
4. Kanakhe Ndaba
5. Landiwe Shabalala
6. KaBheji Shabalala
7. Lulekwa Ndaba
8. KaKhulula Ndaba.

Borehole Coverage

9. Fisani Mpulo
10. Sonele Hlatshwayo
12. Giniseba Ndaba
13. Duduzile Ndaba
14. Tshengisiwe Ndaba
15. Bukisiwe ~~Ndaba~~ Mpulo
16. Bujisiwe Ndaba
17. Celegwana Msimanga
18. Thobile Msimanga
19. Sulubba Mkhwanazi
20. Nonzeleni Mqwini
21. Mtoko Mkhwanazi
22. Thokozani Mqwini
24. Khethiwe Ndaba
25. Nelisiwe Mpulo
26. Winile Ndaba
27. Siyeza Ndaba
28. Khosi Hlongwane
29. Sizwe Hlongwane
30. Bheki Zimba
31. Ndibikishi Ndaba
32. Zondani Ndaba
33. Bonisiwe Khubheka
34. Khumalo
35. Mqwini
36. Mkhwanazi
37. Slindi Msimanga
38. Coh Ndaba
39. Mpiliso Maribuko
40. gogo Maribuko
41. Joshiwe Ndaba.
42. Mqwini
43. Mqwini
44. Nomthandazo Zungu
45. Nombikayise Mqwini
46. Sthebe
47. Lucky Shabalala
48. Zwane
49. Shabalala
50. Shabalala
51. Sibongile Mpulo
52. Ndaba
53. Neli Ndaba
54. Mqwini
55. Burie Ndaba

Figure 4: Right: The Vimbukhalo water committee participants identifying all households on the map and Far right: The list of participants in the scheme identified.

From this workshop there were 56 households proposed to be involved in the borehole scheme who could gain access, depending on the final results for the borehole yield test. In addition, 8 households were identified who could benefit form protecting the spring on the SAPPI plantation bordering the community.

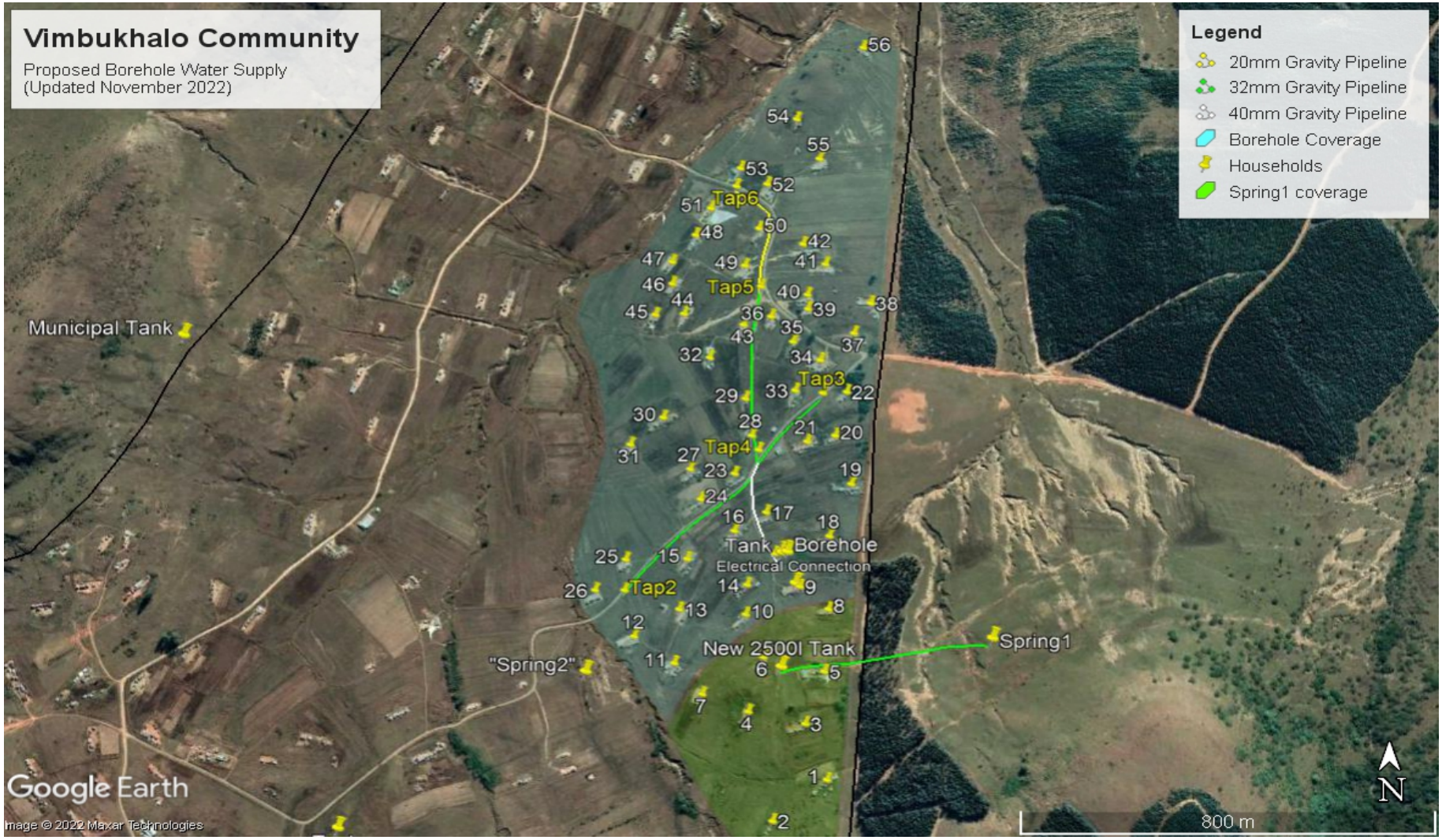


Figure 5: The map outlining the water sources in Vimbukhalo and the proposed scenarios for refurbishment of the borehole and development of a spring on SAPPI land bordering the community. The households that can receive water from these developments are numbered and marked in blue and green respectively.

This was followed by a committee meeting with SAPPI, on the 13th of October.

Figure 6: Meeting at the Vimbukhalo hall with representatives of the ward committee and water committee and SAPPI. Present were Zaphesheya Luthuli(SAPPI Representative), Erna Kruger(MDF), Michael Malinga(MDF), Hlengiwe Hlongwane (MDF), Zibonele Sithole(ward committee), Jerome Ndaba (SAPPI forum) and Mama Dlamini(SAPPI committee secretary)

Zapesheya Luthuli is the community representative for Vimbukhalo. She confirmed that SAPPi has a long history in Vimbukhalo, often conflictual and that looking at a water source other than the borehole could be a move forward. She did mention thaough that there may be difficulties in working with this spring as SAPPI is very protective of their land holdings and want to limit movement of people on their propreties. iShe undertook to speak to the relevant plantation managers to discuss this option and promised to convey a decision soon. The proposal has been shared with the Engineering and Environment Unit of SAPPI, who have done a site visit. A decision cannot be made immediately as the proposal involves the disturbance of land and water catchment area. Therefore consultation will be taking place in the last week of November 2022, will the other business units (legal, resources etc) in order to make an informed decision internally.

The work on the yield testing of the borehole was undertaken by Geocon Consulting and midlands Pumps and started in the week of 27th of October. This entailed a few different processes including a step discharge test, a constant discharge test and recovery monitoring, which took 3-4 days to complete. The community temporarily installed 2x 2500l JoJo tanks alongside the present header tank to ensure the capture of as much of this water as possible to use in the interim.

Figure 7: Right: The piping from the borehole yield testing is shown in the foreground. And Far right: Community members levelled platforms for the two extra JoJo tanks so that water could be stored temporarily for the community.

The technical report is attached ***'Vimbukhalo BH1 test pumping report_Midlands Pumps_20221101'***

The recovery of the water level for the 24hour recovery monitoring was poor and was only 61%. The recommended available daily abstraction is 6.40 kl/day within an 8hr pumping cycle, to allow enough recharge for subsequent pumping. A resting period of a day or two between pumping cycles would be ideal. Water quality was

classified as Class II, which is unfit for human consumption without treatment, due to higher than recommended levels of fluoride, coliform bacteria and general bacteria. It is recommended that another water source needs to be used by households to alternate the use of this borehole water, as long-term use of water with high levels of fluoride can harm recipients' teeth through discoloration. The other treatment option is reverse osmosis. Coliforms bacteria can be easily treated through boiling or adding of household Jik to the water. The consultant suggested a further quality test be undertaken to check if levels remain high or whether it is an intermittent issue.

A new pump is to be installed that can pump the suggested 6,4kl in an 8- hour cycle. According to the consultants, consistent use of this one borehole will not affect the basal flow of the underground water in this area negatively.

Installation and operation

The Vimbukhalo borehole scheme was finalised in the second week of December 2022. The scheme consists of:

1. The borehole pump box, linked to the homestead electricity supply of Mrs Fiasani Mpulo
2. The main 5000 l header tank with 1 tap close to the tank and 4 taps toward the bottom.
3. A 2nd 2500l header tank higher up with 1 tap.

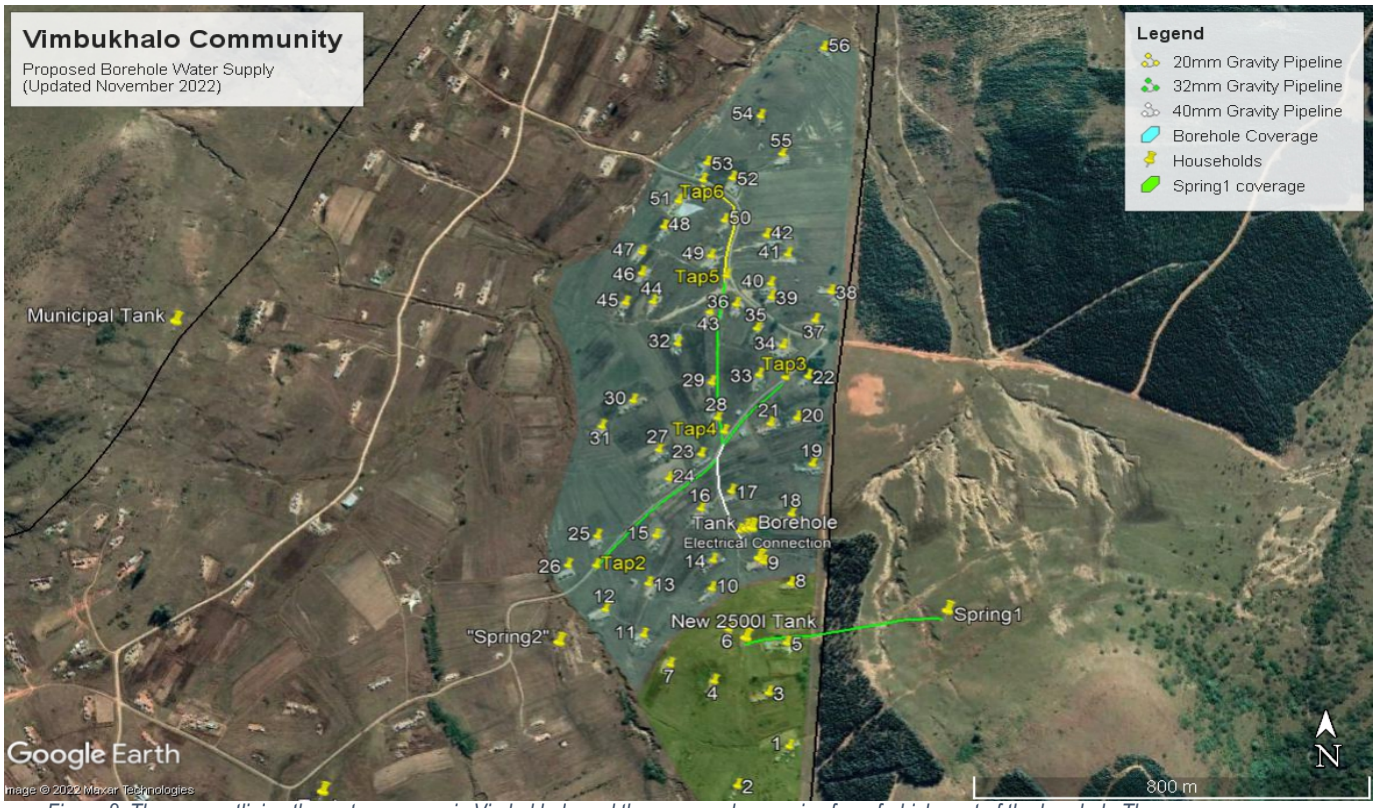


Figure 8: The map outlining the water sources in Vimbukhalo and the proposed scenarios for refurbishment of the borehole.The households that can receive water from these developments are numbered and marked in blue and green respectively.

The scheme services a total of 53 households. A community meeting was called on the 21st of January 2023, to finalised participants' financial contributions. Each participant household is to pay R200 to become a member of the water committee. These monies are to be held in an account for maintenance and labour related to the system. Each household also pays R10/ month for water provision to pay for electricity for pumping. Two people who were chosen to take money and record payments; one records payments from people below the road, the other records payments from people above the road.

In January around R210 was collected for pumping and in February the amount was R430. To start, the pump was left on throughout. Every 2nd day the valve is opened to fill the top tank – it is left open for a day and then closed again for a day.

Issues that arose were primarily around erratic electricity supply in the village as well as to loadshedding. Fiansai Mpulo has also requested assistance with opening and closing the valve for the top tank as it isn't close to her and sometimes, she forgets or is not around.

Some suggestions made to alleviate the challenges were:

1. That Mrs fiansi Mpulo needs to get a new, separate prepaid electricity box for the borehole pump, to separate this from her personal usage and
2. To request that the councillor assists with a solar electricity for the pump to alleviate the present supply difficulties.

Figure 9: Above Left to Right: the Pump connection, attached to Mrs Fisani Mpulo's homestead electricity supply, the 5000l header tank with tap and the top 2500l header tank with tap.

During the community deliberations in Feb-March 2023, the system was struck by lightning – requiring an assessment of the whole system and replacement of the electricity box, with lightning protection now included. In addition, the pipes servicing the two header tanks were also replaced with better quality, slightly larger pipes as the water pressure from this pumping system was too high for the initial pipes used.

Figure 10: The Midlands pumps work team repairing the electrical system and replacing input pipes for the header tanks in Vimbukhalo, with the water committee members looking on – end March 2023

SYSTEM INFORMATION

Previously electricity has just been added to the homesteads pre-paid arrangement for pumping, but in the present case community members haven't done the required calculations to understand whether this is still working and understandably some of the participants felt that maybe some of the electricity was going to household use. Mrs Fisani Mpulo, the pump operator mentioned that she never had to separate electricity as it was not an issue before.

Thus, a combined process with the Mahlathini facilitators was undertaken to do the calculations; a process complicated considerably by the rolling loadshedding in the area.

Figure 11: Community members present in the Vimbukhalo water meeting to discuss access and participation – 7th March 2023

The meeting identified households who fetch from each tap as follows:

- Tap 1 (up at the smaller tank): 7 HH fetch
- Tap 2 (below Mpulo/ near the borehole): 5 HH
- Tap 3 (Below Bukisiwe Mpulo's HH): 6 HH
- Tap 4 (just below the road opp tuckshop): 11 HH
- Tap 5 (in the middle, below the road): 16 HH
- Tap 6 (near Sbongile Mpulo's HH): 8 HH

To sum up, 13 households get water from the smaller tank at the top, and the big tank feeds water to 40 households, totalling 53 **h**ouseholds. 3 households do not pay the R10. From the 27th of January 2023 to the 22nd of February 2023, R430 worth of electricity was used. From this, R430/27days = R15,92 a day, which provides an average, but is not a fully reliable representation as the amount of electricity used per day may vary and is affected by how much water was used/how often water was fetched each day. Pumping has been sporadic due to both payment and loadshedding, but on average the tanks are now being filled every 2nd day.

The small table below summarises the water use for the two header tanks. This indicates that households can access 100l of water per day.

Tank(L)	No of HH	L/hh/day	Monthly water use (L/mth)	Annual water use (L/yr)
2500	13	96	37 440	
5000	40	62,5	75 000	
TOTALS	**53**		**112 440**	**1 349 280**
Averaging	**53**	**100**	**159 000**	**1 908 000**

Pumping details: The tanks had to be emptied and timed to fill up using a specific amount of money. Calculations showed that it cost R16,50 to fill both tanks (7 500L). This equals R0,32/hh/pumping x 15= R4,70/month, thus needing around R250/month if pumping is done every 2nd day.

Mrs Fisani Mpulo would like to leave the pump on, to avoid having to check all the time and risk empty tanks and annoyance from participants. The original specifications by the engineers however stipulated that pumping should not be done for more than 8hrs a day, to avoid over pumping the borehole. To fill both tanks (7500l) took 5hrs 30 min. **This means the tanks can be filled once per day and overall, this will cost R500/month**

It also means that each household can collect 2x50l buckets of water per day

At the end of the meeting, the participants agreed upon the following:

- Paying dates(R10): 9th and 10th of every month
- Those who are in the savings groups can pay (R10) at the savings meeting which is usually on the 10th of every month.
- The meeting participants committed themselves to pass on these decisions to the absent members.

A NOTE ON GOVERNANCE

These water committees are informal ad hoc localised groupings in the villages, usually with representation from the ward committees of the Traditional Authorities and the formal water committee representatives for the local Municipal Council. In Vimbukhalo this person is Mr Mkhize.

Two strategies exist for formalising the localised water committees – one of intensive upfront organisational structuring, election of office bearers and development of constitution and rules. The second is to develop this process over time, based on the experiences and motivation of the group. Mahlathini has opted for the second approach, as this allows the members of the informal groups to slowly formalize their institution as required by circumstance also provides weight to the decisions made in a participatory way. Governance improved over time. Although this process primarily works through resolution of conflict and instituting rules to avoid specific circumstance from occurring again, it is much more participatory and inclusive than the first strategy and generally leads to a more sustainable outcome.

Stulwane spring protection and reticulation planning and implementation November 2021-May 2022

1. BACKGROUND

The Stulwane community is located near Emmaus in the Drakensberg region and falls under the Okhahlamba Local Municipality within the Uthukela District Municipality of KwaZulu-Natal. Stulwane is approximately 8km and 25km travel distance from the centres of Emmaus and Winterton respectively.

Due to the more mountainous terrain the community is separated into a number of sections. Two of these sections form part of the project area being considered and comprise approximately 90 rural homesteads in total.

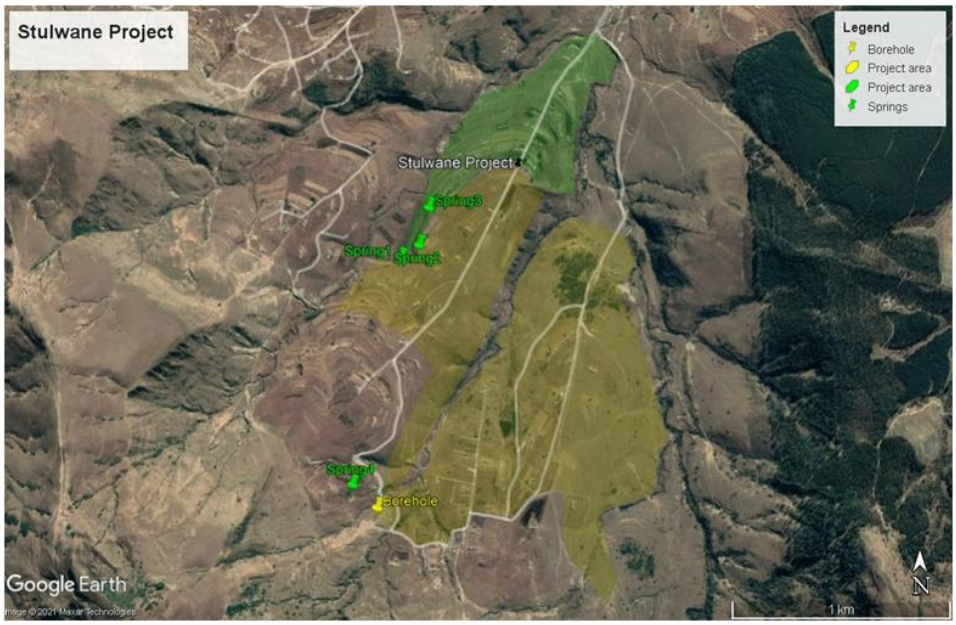
There is currently no reticulated municipal water supply in the area. Current water sources accessed by the community include:

- one municipal borehole and tank providing communal water access to one section (installed in Nov 2021)

- a spring fed tank and communal tap located away from any cluster of homesteads (installed in `2017)
- a community borehole with handpump (near the cattle dipping tank, installed in `2017)
- supply by water tanker
- a number of undeveloped springs

A number of potential water sources within, or surrounding, the project area were investigated and mapped by a hydrological team from UKZN in association with community members and the Stulwane Water Committee. These were narrowed down, due to various factors such as access, location and strength of supply, to a few sources for further investigation. These identified supplies include the borehole situated next to the dipping tank, the undeveloped springs (referred to as springs 1, 2 and 3) and the existing developed spring (spring 4).

Right: Map indicating the undeveloped springs with potential for reticulation



A further technical investigation was undertaken in November 2021, by an agricultural Engineer, Mr Alain Marechal, who joined the UKZN team and the water committee to assess the technical potential for developing and reticulating these identified sources.

The outcomes are briefly summarized below

1. Borehole with handpump next to dipping tank (Location: 28° 55’ 37.4”S, 29° 22’ 03.3”E)

The borehole situated next to the cattle dipping tank is equipped with a handpump and is operational. This is a community borehole and would be available to develop further. It is situated away from the main groupings of homesteads but at an elevation that would allow gravity reticulation to one or two sections of the project area. The borehole would need to be pump tested to determine its sustainable yield and whether it is feasible to install an electric pump. On the day of the site visit water samples were taken to get an indication of any issues with the water quality. One concern is the proximity of the cattle dipping tank to the borehole and any possible contamination of the groundwater.

2 Spring 1 (Location: 28° 54’ 57.7”S, 29° 22’ 07.7”E)

The spring referred to as “spring 1” is situated upstream of, and close to, springs 2 and 3. Of the three springs this one has the stronger flow and has two upwelling “eyes” evident. Indications from community representatives are that water is available all year round from the spring. There has been no development of this spring apart from a steel drum placed over one eye, and cattle and other livestock are able to access the water. A rough flow measurement was taken on the day of the site visit and indicates a possibility of being able to access at least 10 litres a minute. Water samples were taken to check the e-coli levels in the water.*Right: View of spring 1*

Spring 1 has a flow rate of 10 litres per minute. Reducing this to 7 litres per minute, as a more conservative figure, would give the possibility of accessing 10 000l per 24 hours. This equates to an amount of 500l per household on 17-20 households in the area of coverage below the spring.

NOTE: This is the spring that was chosen for development.

3 Spring2 (Location: 28° 54’ 55.7”S, 29° 22’ 10.8”E)

Spring 2 is situated slightly downstream of spring 1 and has a lower flow. A makeshift barrier / fence has been erected around this spring and a steel drum placed around the eye. Water samples were taken to check the e-coli levels in the water.

Tight: Spring 2

4 Spring3 (Location: 28° 54’ 49.7”S, 29° 21’ 58.8”E)

Spring three is situated further downstream of springs 1 and 2. A steel drum has been placed around the eye but no further development of the source has been done. A rough flow measurement taken indicates a possibility of accessing approximately 6-7 litres a minute. Water samples were taken to check the e-coli levels in the water.

Right: Spring 3

5 Spring4 (Location: 28° 54' 33.6"S, 29° 22' 07.7"E)

Spring 4 has been developed by the community and consists of two covered chambers (brick and concrete) built around two spring seeps / eyes. Water is piped from the collection chambers to two 2400l tanks that then feed a community standpipe. At the time of inspection the tanks were overflowing but the community representatives did indicate that when used the tanks do fill very slowly. A repair is required to a hole in one tank and fitting of float valves and replacement tank lids.

Right: Tanks fed form the spring and community standpipe

2. PROPOSED INTERVENTIONS

Discussions were held with the community representatives regarding the five water sources and possible development and use of each source to supply water to various areas of the community. Due to the lower elevation of springs 1, 2 and 3 within the project area it would be necessary to consider an additional source at higher elevation (the borehole or spring 4) in order to supply water to the higher lying sections. The outcome of these discussions was that the borehole and one of the undeveloped springs (1, 2 or 3) could be considered for the project. Spring 4 was to be excluded at this stage due its low flow. It was further recommended that only one of the undeveloped springs should be developed in order to avoid any community issues should the development result in damage and loss of water at the spring eyes.

The project team decided to consider further testing and equipping of the borehole (budget allowing) and protection of one of the springs (1, 2 or 3). Further to developing the water supplies three scenarios would be considered for supplying or reticulating water to the community:

- Scenario 1: Store water in (header) tanks and reticulate to smaller drums fitted with float valves at individual households.
- Scenario 2: Store water in (header) tanks and reticulate water to a number of communal standpipes placed around the community.
- Scenario 3: Store water in (header) tanks and feed centrally placed communal tanks within clusters of households.

For purposes of this report the following will be used to refer to the different areas / sections of the community being supplied:

- Section1: Area of supply coverage below and to the northeast of the borehole (Comprising approximately 17 households)
- Section2: Area of supply coverage below and to the north of the borehole (Comprising approximately 33 households)
- Section3: Area of supply coverage below the spring (Comprising approximately 38 households)

It should be noted that the layouts presented below showing the various reticulation options and extent of coverage are provisional and for planning purposes. The final layouts, including pipeline

routes, number of households to be supplied, tap and/or tank positions, will only be determined during the design phase. These would need to take into consideration, among other factors, the actual amount of water available from the developed sources, community input to positioning of tanks and/or standpipes, and proofing of the proposed pipeline routes.

3. DESIGN AND IMPLEMENTATION

A meeting was held with the water committee (Nelisie Msele, Dombi Dlamini, Nothile Zondi, Khulekani Dladla, Danger Khumalo and Thulani Dlamini, with 3 enviro champs present on 20th January 2022, to discuss process and decision making regarding the water access scenarios developed.

Right: Nothile, Nelisiwe and 2 of the enviro champs at the water committee meeting in Stulwane

Below is a summary of the main questions and decisions

1. Involvement of community

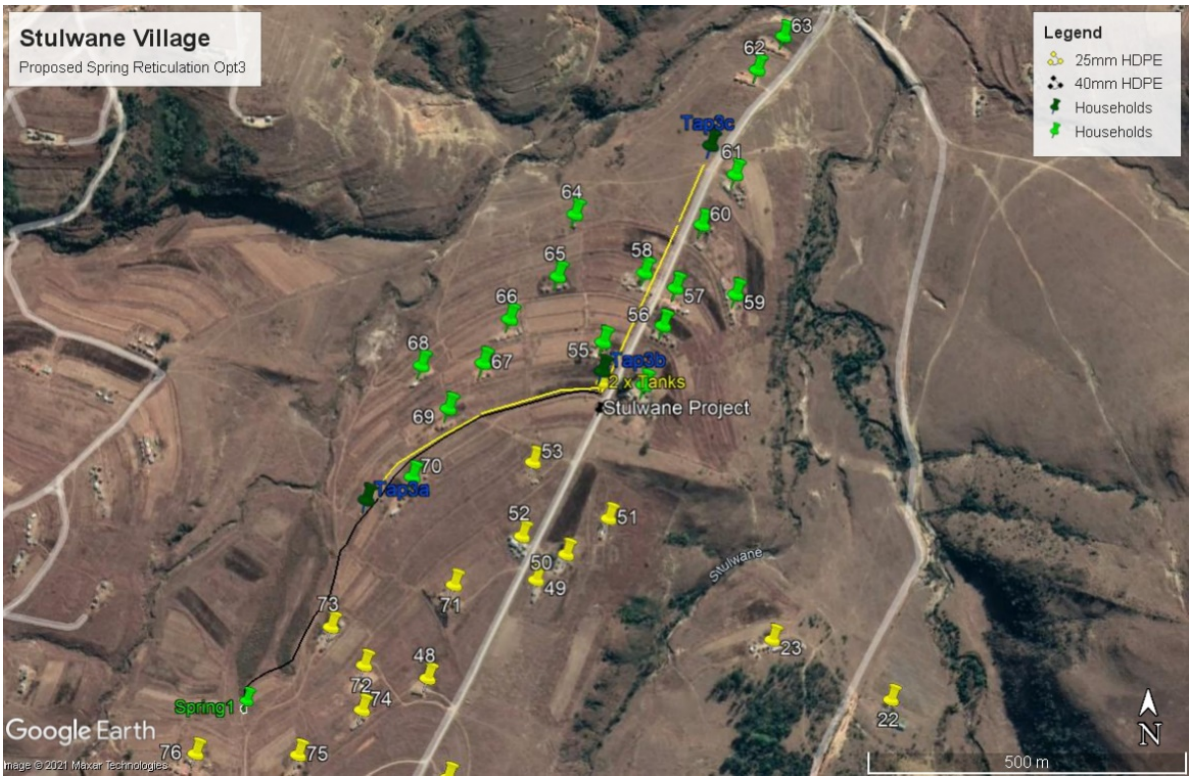
It was decided that a full community meeting be called to outline the reasoning for starting with the spring protection. Working with the borehole requires a pump flow test to ascertain strength which costs around 30K and due to distances from homesteads, the pump will need to be solar, also adding considerably to costs. There is around 50K in the WRC-ESS research budget that can be used for community implementation and with community contributions will be enough to protect spring 1 or 2, provide 2 header tanks and pipelines with 2-3 standpipes with taps.

The community will need to agree to the fact that there isn't presently funding to continue after the spring protection is done and so some people will benefit, and some will not. The spring cannot provide enough water for everyone, so the whole community cannot fetch water there.

Even the spring protection and the borehole if both can work and be implemented will not be able to provide water for the whole community.

- No Access: ~17 Households
- Borehole Section 1: NE.~17 Households
- Borehole Section 2: N. ~ 33 Households
- Spring 1 (Scenario 2: OPTION 3): 10 000l/24hrs.~30 Households Thus for the 17 hh below the spring around 500l/day at a distance of 200-400m for one of three taps. If those who are nearby, but without easy access to taps are also included, the no of hh goes up to around 28 and then around 210l/ day.

The committee decided on option three of the spring protection scenarios, as those households close to the spring also need access.



After the committee meeting and the full community meeting, the group who can benefit from the spring protection need to have a meeting to discuss access, payment, labour contributions, a committee of their own, decisions, and ongoing water management. There will need to be daily opening and closing of valves and checking of water availability and decisions regarding maintenance etc will also be ongoing.

A map with pins for households was used with the group to make a list of those who would be involved. This map was updated again after implmentation to take into account the addition of newcomers nad removal of some inactive households. The list as at May 2022 is shown below

Above Left: the committee working on naming the homesteads shown on the small map

Table 1: Final list of participants involved and where the collect water (23 households), May 2022

Pin no	Name and Surname	Access arrangement
48	Mzwandile Khumalo	Fetch from V-box
49	Thembeni Dubazane	Removed – no involvement
50	Sipho Msele	Tap
51	Mthethwa Mpinga	Tap
52	Baskiti Dubazane	Removed – people not around
53	Yaka Gumede	Tap
54	Nelisiwe Msele	Tap

55	Mr Dubazane	Tap
56	Hlaleleni Duma	Tap
57	Baloza Dlamini	Tap
58	Thembi Mpinga	Tap
59	Ntombenhle Mkhize	Tap
60	Eunice Khumalo	Tap
61	Zakhele Nyoka	Tap
62	Mwelase	Tap
63	Zikode	Tap
?	Robert Mpinga	Tap – joined later when relaized water would be close
64	Leliwe Hlongwane	Tap
66	Mlamula Khumalo	Tap
67	P Nyoka	Tap
68	S'nothi Mazibuko	Tap
69	Maminya Msele	Tap
70	Dubula Msele	Tap
71	Dumisani Msele	Reomved- inactive
72	Delani Duma	Fetch from V-box
73	Reserve Msele	Fetch from header tanks
74	Soleni Khumal	Fetch from V-box

Protection of Spring 1 or 2

The committee discussed the issues of closing off a spring, both for cultural reasons and also for individuals to have access at the source. They felt that as people and livestock can still access water from the other springs in the wetland and the wetland itself, it would be okay for everyone. They did say that spring 2 is much more reliable than spring 1, which does dry out sometimes. Although there wasn't agreement – some members felt that the spring just goes mainly underground in drier months.

The following two suggesitons made were taken inton acocunt in the implmentation:

1. Need a standpipe nad tap at the spring which will not affect the filling of the header tanks
2. Lay the pipe in a way that will make it easy to swap to spring 2 if needed.

HEADER TANKS AND STANDPIPES

The committee likes the idea of the 2 header tanks next to the road. There should be no access at these tanks. There was a lot of discussion around other people coming in and stealing water and the committee are aware of the possibilities of abuse of taps and the difficulties with this. They finally suggested 3-4 taps, close ot homesteads where they can be wathced nad monitored.

LOGISTICAL ISSUES FOR DISCUSSION

Mr Marechal also supplied a number of issues for discussion. These are summarized below.

For discussion:	
1. Suitability of the central position proposed for the tank/s. This position is near the village main access road but finalisation depending on land ownership and suitable positioning (advised by community). Note: The pipeline to the tanks drops from the spring but then starts to rise again from roughly midway along the route. The tank position is showing on Google Earth as lower than the spring but we can't really position it any higher than where currently shown.	Yes, suitable. Next to the road. Close to Nelisiwe Msele's homestead. No taps at header tanks

2. Pipeline route from spring to be confirmed on site taking into account homesteads, cultivated fields, terrain etc	Yes, seems fine, Participants have agreed, that pipes can cross fields etc, but will need to discuss on the ground as well
3. Option 1: Tanks and access point in one central position. Most housholds around this point are within 400m of the tank position. Household by spring and lower households by bridge are around 600m from this point.	
Option 2: Tank position same as in option 1. Water reticulated to two access points (or more) to reduce walking distance. The layout shown reduces walking distance to the households to be served to within 400m	
Option 3: Would be similar to option 2 with a third access point to reduce walking distance to within 200m (water supply guideline).	Yes, this includes most people – but maybe not taps, but tanks, or lockable taps…
The spring proposed for development is the larger of the three. Perhaps some more discussion around community issues with use of this point particularly regarding livestock.	There was some discussion as to whether this spring dries up during drought years. Spring 2 definitely the most reliable.
Availability of local rock to fill behind spring protection wall / chamber	Yes, in riverbed. Enviro champs will assist with labour and building.

2. COMMUNITY MEETING DISCUSSIONS AND AGREEMENTS (27 JANUARY 2022)

On the 25th of January a full community meeting (~55 participants) was held to discuss progress and get the go ahead from the whole community to focus on protection and reticulation of Spring 1 for the moment only; also with the understanding the funding for the proposed work on the borehole may or may not materialize. In addition, community agreement needed to be firmed up, that water access for the spring one system, would only be for members who can benefit from this- not for everyone in the community and definitely not for people form outside. Spring 2 which is used heavily in the community will be left as is to ensure open access and livestock can easily access water from the wetland and stream surrounding these springs. Thus, the spring protection and reticulation does not remove community access but improves infrastructure and access for those involved who have contributed both with labour and financially.

For the Spring 1 protection, all community members who could benefit from this gravity fed system were called to a meeting on 27th January. Here the following issues were discussed and decided upon after introduction of the WRC-ESS process and progress with planning to date. It was reported that around R50 000 could be allocated from this budget for the spring protection work Community members would need to contribute both financially and with labour to dig the ditches and the enviro champs would assist with the spring protection and reticulation work as well. It was emphasized that only those 26 people on the list are part of this process.

Right: Spring protection meeting with 27 community participants and the 9 enviro champs present.

There was a lot of discussion around people coming in with bakkies to take water and also people from other parts of Stulwane and Emadakaneni feeling that they would also have a right to this water. Participants felt it would be difficult to enforce this. It was emphasized that participants would need to fetch water at the 3 proposed taps and not try to connect pipes and hoses to fill tanks at their homes. It was also emphasized that people would need to do their washing at home and not at the taps. Then it was discussed that the two header tanks would provide 10 000l of water per day. They would need to fill up overnight. This would mean around 380l of water per household per day. Some households are much larger than others with small units in the homestead so they would have more than one person collecting water. It was also discussed that the spring committee could provide access to water to people for specific circumstances such as funerals, but that this water could not be used for irrigation or building.

The following was decided

- Each participating household would pay R230 towards the water scheme. Monies will be placed in a bank account and used by the committee for small maintenance tasks. Slips of all expenditure are to be kept to be reported to the membership.
- If larger sums are required for any reason, this will be discussed with the participants and further donations agreed upon.
- The header tanks and taps are to be place on the road, next to or very close to someone's homestead, so that those people can keep an eye on the infrastructure. People thought it would cause trouble to have these in the households.
- It was agreed that the spring committee and any participants interested would join the engineer and team to finalize the route of the pipes, to ensure they do not cross fields or property that would become problematic. For the most part these pipes need to follow the paths and roads.
- It was proposed that there are locks placed on the taps and that each household who has paid their fee, will be provided with a key for the tap.
- Participants undertook to collect water only during the day to allow the tanks to fill up overnight.
- All households undertook to be part of the labour force, or to employ someone who could help with digging if they were unable themselves.
- Mr Dubazane offered his tractor to start the process of loosening the ground for the digging of the ditches, to make that process easier.
- It was emphasized that the youth team are not from the Council, but through MDF and the community should not issue them. They are there to do agreed upon resource conservation tasks, not just anything the community might need.
- It was also emphasized that the committee is made up of volunteers and that everyone should work together and respect each other – as it is everyone's responsibility to ensure the system works, not just that of the committee.

Here, they decided to elect a spring committee:

Name and Surname	Contact details
Baba Dubanzane	0826282627
Mxholisi Mkhize	0760790738
Nelisiwe Msele	0731504405
Hloniphile Sishi	0728158921
Phekelaphi Nyoka	0828697437

Roles of committee members:

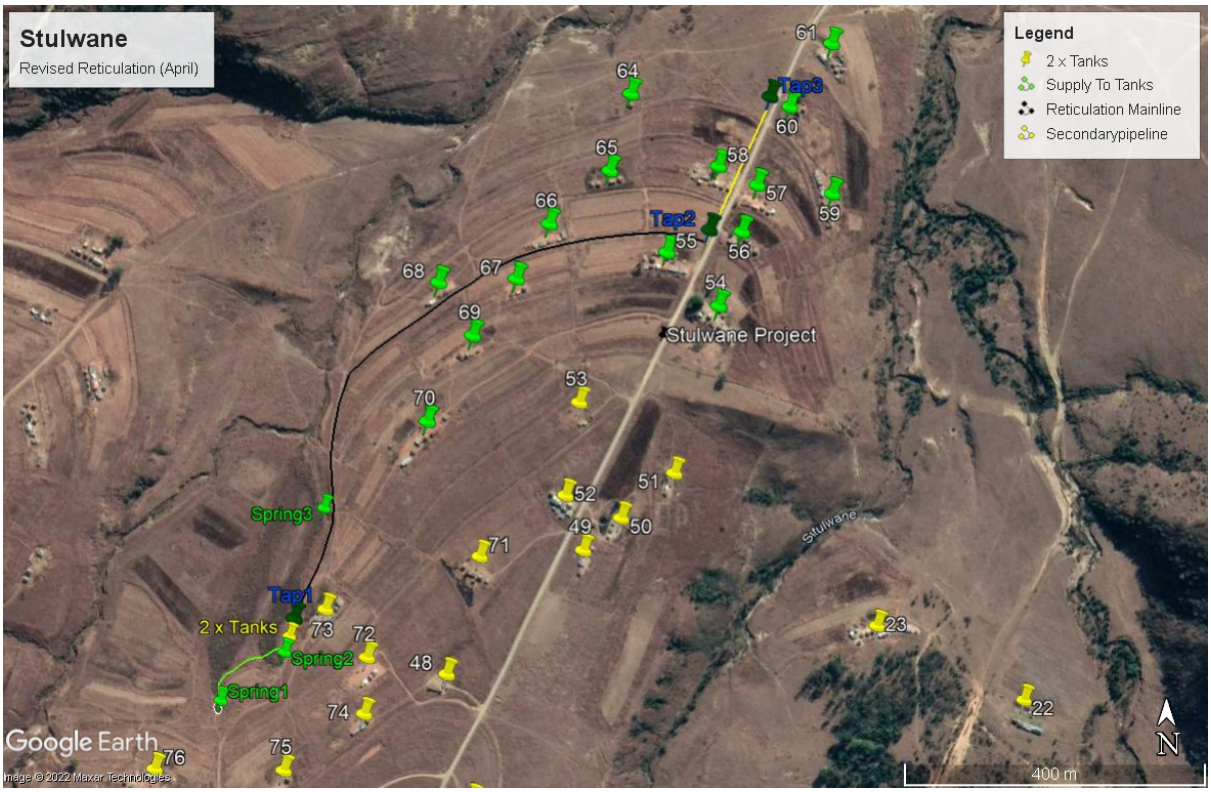
- Responsible for any issues arising with the water scheme
- Fix problems with any people not following the rules
- Allocate the use of water and ensure everyone who is eligible gets
- Check regularly that the system is working and used properly
- Open a bank account for the financial contributions and undertake small maintenance activities.
- Call meetings with membership to report on usage, maintenance issues and get permission to use funds for specific activities.
- Communicate with the community level water committee and also the Traditional Authority and councilor.
- Request assistance from community level water committee for issues they cannot solve.

A discussion was held about the role of the Nkosi and councilor. The Nkosi has a representative, Mrs Hlongwane in the village. The Spring committee undertook to inform her of this process and ensure she is onboard. They felt that permission would not need to be obtained as the TA is only responsible for land and it is a good idea for the community to start setting up structures themselves, to manage their resources, as neither the TA nor the councilor will do this for them. They felt that as long as these role players were well informed, they would not object or feel the need to interfere.

2. Stulwane spring protection and reticulation scheme

This localised community owned system, was initiated prior to the commencement of this project. A similar community level process of allowing the community to frame their request and start the process by setting up a water committee and doing the initial ‘water walks” and surveys was use. Here a spring in a wetland was protected and reticulate d to 5000l header tanks with 4 taps downstream (one added a little later by participants themselves. As it is a gravity fed system, ongoing financial contributions are not required. 28 Households have been supported.

The spring supplies around 10 000l/24hrs.Thus for the 17 hh below the spring around 500l/day at a distance of 200-400m for one of three taps. If those who are nearby, but without easy access to taps are also included, as well as the participants linked to the 4th tap, the number of households goes up to 28 with an allocation of ~200l - 380/day.



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- Allocate the use of water and ensure everyone who is eligible gets
- Check regularly that the system is working and used properly
- Open a bank account for the financial contributions and undertake small maintenance activities.
- Call meetings with membership to report on usage, maintenance issues and get permission to use funds for specific activities.
- Communicate with the community level water committee and also the Traditional Authority and councilor.
- Request assistance from community level water committee for issues they cannot solve.

This scheme has been in operation since May2022. A document outlining the full process is provided in Annexure 1. (“Stulwane committee spring protection and reticulation overall process including operation and maintenance”).

Figure 12: Right and Far right: A view of the spring when ithe v-box was constructed in may'22 and more recently in Feb'23, showing also that the spring was subsequently fenced.

Figure 13: Below Left and Right: The 2 x5000l header tanks at installation and recently in Feb'23 – also fenced.

A conflict arose in January 2023, where a few households closest to the protected spring became unhappy with their lack of easy access to the spring and to water. It was decided then to add two more taps to the scheme (one at the spring and one at the header tanks, to allow reticulate access to these households (4). They were previously expected to collect water from the spring itself and from the header tank overflows but were not happy with this arrangement. These small changes were supported through this project.

In a workshop on water and resource conservation mapping and action planning in April 2023, the issue of water provision for the rest of the Stulwane community was raised. Further spring protection and reticulation of the borehole close to the dip tank are to be considered.

A NOTE ON GOVERNANCE

The spring committee in Stulwane has bene functioning well and has been actively supported by the traditional ward councilor, Mrs Hlongwane. To date all participants have followed the broad instructions and have also assisted in ensuring that people do not come from outside the village to use this water. In the beginning people came from eMadakaneni and Eqeleni with bakkies to load up with water. All participants in this scheme are satisfied with the scheme and with their access to water.

The spring committee has been very active. The small conflict around taps however did indicate that for some levels of conflict and decision making still require a respected 3rd party with 'authority" in this case Mahlathini, may still be required to make decisions and ensure positive actions and outcomes.

3. Water quality testing

Community members have been trained in using E coli testing kits (procured from Praecautio laboratories in Hilton) to assess the quality of water in their water schemes. The eco champs (youth employed part time to undertake resource conservation work in the communities) have been responsible for administering these tests.

Water samples are incubated in pre-prepared test tubes in a "hotbox" for 24 hours. Colour reactions indicate the presence of coliforms (brown) or E coli (green).

Figure 14: Right: An example of three E coli tests taken in the Stulwnae spring protection scheme in 2022/ These have turned green indicating the presence of E coli.

Stulwane	E Coli test results		
Date	**Time**	**Place**	**Colour**
2022/02/17	12:03	S2	Clear
2022/02/17	12:11	S1	Clear
2022/02/17	12:56	E	Clear
2022/02/24	10:00	S2	Clear
2022/02/24	10:13	S1	Clear
2022/02/24	10:20	E	Clear
2022/03/04	09:13	S2	Green
2022/03/04	09:17	S1	Green
2022/03/04	09:22	E	Green
2022/03/10	09:22	S2	Clear
2022/03/10	09:27	S1	Clear
2022/03/10	09:56	E	Clear
2022/04/21	09:07	S1	Clear
2022/04/21	09:15	S2	Clear
2022/04/21	09:20	E	Clear
2022/06/16	08:06	E	Clear
2022/06/16	08:15	S1	Clear
2022/06/16	08:29	S2	Clear
2022/06/23	09:10	E	Clear
2022/06/23	09:25	S1	Clear
2022/06/23	09:32	S2	Clear
2022/09/14	09:56	E	Clear
2022/09/14	09:59	S1	Clear
2022/09/14	10:03	S2	Clear
2022/12/05	09:15	S2	Clear
2022/12/05	09:18	S1	Clear
2022/12/05	08:25	E	Clear
2023/03/03	09:54	S2	Clear
2023/03/03	10:01	S1	Clear
2023/03/03	10:05	E	Clear

KEY:
S1- is the protected spring with V-box
S2- is the spring lower down
JT3 – are the header tanks of the protected spring

After the contamination of the spring and water system in March 2022, the community undertook to build a swale above the spring in the wetland, as they noticed that urn-off from the surrounding areas flowed into the spring intake area and felt that this is what caused the contamination. Subsequently the tests have all been clear.

1.5 SPRING PROTECTION AND RETICULATION IN EZIBOMVINI, BERGVILLE (KZN)

The Climate Resilient Agriculture learning group in Ezibomvini consists of around 36 members. They have implemented Conservation Agriculture practices for their field cropping and intensive household food production for vegetable production. Access to water in the village is extremely limited, with one or two municipal boreholes with hand pumps providing household water. Not unusually, access to this water is inconsistent, as pumps break and are not fixed, or the boreholes become unreliable and the situation is not rectified. Access to irrigation for farming is non-existent. Most community members also get water from local springs, which are unprotected and shared with the livestock in the area.

There are informal arrangements in the community about access to these springs, and almost everyone in the immediate surroundings has access.

The learning group, under the proactive leadership of their local facilitator, Phumelele Hlongwane began discussing the possibility of protecting a few of these springs and piping water to their households to facilitate their vegetable production efforts, as the spring is far away, requiring about a 1 km walk with buckets. This has severely limited their production ability.

The group presented their concept to MDF and requested assistance with planning and implementation. Each member who wanted to be involved gave a financial donation of R1 000 and agreed to provide the labour for digging trenches and installing pipes and tanks.

Numbering issue!!!!!!Background

This process was initiated in August 2018 and was suggested by the Ezibomvini learning group as a way to provide both household water and agricultural water for the homestead gardens.

A survey of the local springs and potential options was conducted with assistance from an agricultural engineer. A process was initiated for the group to come together and collect monies, which would be matched by a grant from MDF, to provide for a small fund to protect and reticulate one of the springs, with a simple gravity fed system to participants' homesteads.

The participants undertook to provide R1 000 per household. This process took some time and by September 2019 an amount of R8 000 had been put together. MDF then decided to continue with the process. Phumelele Hlongwane, the local facilitator and the main driver of this process, promoted the initiative tirelessly throughout this period. She initially put down R7 000 and also offered her 2 200 litre JoJo tank as the header tank. She has subsequently been paid back most of this money.

Nine participants paid and comprised the water committee: Lungile Sithole, Cabangani Hlongwane, Phumelele Hlongwane, Phumelele Gumede, Goodman Dlamini, Landiwe Dlamini, Hlengiwe Nkabinde, Mantombi Mabizela and Devu Dlmaini/Velephi Zimba.

1.1.1. Progress in July 2019

Conflict emerged early and needed to be resolved. In one homestead there were two participants and an agreement was reached that both needed to pay. Those who had paid but decided to withdraw had their monies returned to them. Another participant, Landiwe Dlamini, requested that water be provided at her new homestead site (across the road and much further downhill than the rest of the group). It was reiterated that water provision was limited and that it was for homesteads and gardens only. For a time, people believed that after elections the municipality would deliver the promised centralised water provision to the area. This did not materialise. Petty squabbles around turf and trust also delayed implementation. Actual work on the process started in September 2019

1.1.2. Phase 1: Protection of the spring and laying of the main pipe to the header tank

The spring is typical of the area, in that the eye is situated in a bank quite close to the streambed.

Local participants have dug out a small catchment dam for the spring, from which people collect water and from which cattle also drink.

Figure 15: Left: The spring's catchment pond with evidence of use by cattle and people. Right: The catchment pond dug out to make a bigger pond and small dam wall.

It was thus important that this part of the spring could still be shared by the community, as the water group did not directly "own" the spring.

Consequently, the design included an offtake from the spring consisting of a slotted pipe buried in a trench filled with gravel and stones below the main catchment dam for the spring. This trench could be completely closed up and covered with soil to avoid any damage and tampering. And it left a source of water from which those not involved in the project could collect their water.

Figure 16: Left: The capped end of the 1 m length (50 mm diameter) slotted pipe that provides for the below-ground offtake of water from the spring. Right: The fittings linking this slotted pipe to the main pipe (50 mm HDPE) (from Chris Stimie – RIEng).

Starting on the trench for the slotted pipe, below the spring and pond

Deepening and widening this trench to 50 cm x 50 cm x 1,2 m

The trench with slotted pipe installed in a bed of gravel, covered by shade cloth and rocks with a small furrow leading water from the spring to this trench

The trench damaged by livestock before it could be properly covered and closed.

Figure 17: Photographs showing the process of installing the slotted pipe for collection of water from the spring

The spring is situated in the veld above the village and thus allows for a gravity-fed system. Because this is a low-pressure system and the main pipe to the header tanks is around 350 m long, it is important that the ditch for this pipe be placed on an even slope. If this is not done, the water will not flow – which the group found out the hard way when they initially just dug a ditch and tried to lead water from the spring.

Following the contours of the land, with the pipe rising and falling accordingly, could lead to air bubbles that stop the flow of the water. These airlocks are extremely difficult to remove without having release valves at the correct points in the pipe. An even gradient for the pipe removes this problem.

Figure 18: Left: measuring the gradient for the main pipeline using a dumpy level. Right: Adjusting the line for the pipe to avoid some of the larger dongas and rough terrain, while keeping it on an even gradient.

The ditches were dug around 30 cm wide and 40 cm deep – evenly throughout the length of the pipe. These ditches were dug by the learning group participants as their contribution in kind to the process.

A header tank with a ball valve (in this case a 2 200 L tank with a drinking-trough ball valve) is placed, ideally at the group's highest homestead. For this group, however, it was placed at Phumelele Hlongwane's homestead as she was the leader of the group and prepared to do the daily opening and closing of taps to provide water to the rest of the learning group members.

Figure 19: Left to right: Group members digging the ditch from the spring to the header tank. The header tank at Phumelele Hlongwane's homestead – which was not installed on a level platform and has subsequently been corrected. Initial rough layout drawing of the flow of the water to participants' homesteads.

Once it was ascertained that the water actually flowed into the header tank, the time taken to fill it was carefully recorded over a few days. In this way, the water flow and overall capacity of the spring was determined. This was then used to work out the daily water allocation for each of the nine participants. As at November 2019, due to dry conditions in the area and low flow of the spring (2 200 L in seven hours, thus ~300 L/hr), participants were allocated 200 L drums with ball valves. These can be filled twice a day – once in the morning and once in the late afternoon.

1.1.3. Initial comments after installation

Summary of observations:

- Water was being decanted from the 2 200 L header tank straight into participants' 200 L drums before the tank was full.
- The water was somewhat muddy due to the damage caused in the offtake trench by cattle.
- The water was running very slowly, which was disappointing for the participants who were hoping for more water.
- Participants suggested making the small pond/dam bigger. It was explained that this would not increase the flowrate of the spring.
- One participant also suggested closing up the whole spring to get more water. It was stressed that the spring was communal and that removing access entirely was likely to cause conflict in the community. Participants also mentioned an old community belief that when you completely close a spring, then the "water owner/spirit" will it dry up and move it to another place.

The facilitation team stressed by that this was an experiment in working together and taking responsibility for management of a local resource. There was no precedent. This meant that they would need very clear agreements and trust that everyone would to stick to the rules that they made. If only one person reneged, or tried to take more water than their allocation, or left their tap open, it would mean that none of the other participants would get water. This would quickly escalate into major conflict among the participants. Thus, was important to commit entirely to the process at the beginning.

The following rules were subsequently agreed to:

- The header tank needs to be left to fill up. Then the tap will be opened and the 200 L drums for each household will fill up.
- Once the top household's 200 L drum is full, the tap for the header tank is again closed – so that it can fill up again.
- No-one can use water while their drum or tank is filling up. You need to wait until it is full, and the main tap is closed.
- Each person can receive 2 x 200 L in one day – so, for example, at 8 am in the morning and again eight hours later at 4 pm.
- The header tank will be left to fill up and remain full overnight, so as not to draw too much water from the spring.
- Phumelele Hlongwane will have access to 3 x 200 L drums – more water than the other participants. (This agreement was made because she is responsible for checking the header tank and opening and closing the main tap twice a day. She also provided a greater initial financial contribution).

1.1.4. Phase 2: Laying pipes and installing drums for each participating household

Thereafter, a discussion was held about where the ditches would go for the pipes to peoples' households. It was agreed that the main feeder pipe would be dug along the small road to Phumelele's house, that people would take their pipes off this line, and that the pipes would go through a few of the participants' fields. It was agreed that Landiwe's main homestead, but not the second, could be included in the system, and that no more participants would be included – those who had not yet paid would be removed from the list.

GPS coordinates were taken for each participating household using "Maveric" (a free cell phone App) and then plotted on a map using Google Earth. From this map, heights and distances could be determined and thereby who could receive gravity-fed water from the header tank and how much piping would be required.

Figure 20: Creating a Google Earth map from GPS coordinates using cell phones is not very accurate, so a correction was made. The blue line indicates the main feeder pipe to participants' homesteads running along the small road to Phumelele Hlongwane's homestead.

1.1.5. The header tank and reticulation to the households

The learning group constructed a level plinth for the header tank after it collapsed in a storm due to the initial, less secure arrangement of cement bricks and a pallet. This was an important lesson for the group where an attempt to save money and effort led to this unfortunate event. The group shouldered the setback well and collaborated to construct the more secure plinth.

Figure 21 (Right): Plinth for the 2 200 L header tank

They then dug the ditches for the pipes leading to their households according to the discussion and map provided for them and with assistance from MDF field staff. Each household procured the 200 L drum required. This was done within a week, after which the agricultural engineer assisted in laying the procured piping and installing the necessary connections and float valves in the drums.

Figure 22: Left to right: Laying the piping along the edges of the fields. Pipe branches towards the different homesteads. Fitting the inlet pipes to the 200 L drums. Installation of a float valve in each drum.

The group also agreed not to have taps installed in the drums, but to take water from the top of the drums. The system began operating after a few false starts when participants tried to take water before the drums were full and the tap at the header tank had been shut off. Participants eventually came to understand that none of their drums would fill up unless everyone waited until they were all full and the main tap had been closed. This is a requirement due to the low flow of the spring and the gravity-feed system.

1.1.6. In conclusion

Five months after installation, the project was still functioning well and all nine households were receiving their allocations of water. Some maintenance had been done to leaking connections and float valves. All members were very happy with easier access to water for household and gardening purposes and felt that this scheme would really come into its own in the winter of 2020. Phumelele Hlongwane found that managing the header tank was not too problematic or time-consuming and was very relieved that the process was running so well.

Figure 23: Left: The Gumede family's drum with water five months into the scheme's management. Centre: Mr Nkabinde's drum. Right: Phumelele's three drums.

This has been an extremely valuable process for building social agency in the learning group as well as for systemic and systematic learning for all the group members. They had to grapple with both the

understanding of the technical aspects as well as the social process that they had to put in place and adhere to.

The whole group was involved throughout, and learning took place through discussions, provision of information, working with the mapping and layout aspects, and practical work. A lot of the learning happened through trial and error, as participants started changing their perceptions and understanding.

Some of the technical aspects that participants needed to experience before fully appreciating them were:

- That increasing the size of the small dam for the spring would not increase the amount of available water – which was primarily dependent on the strength of the spring.
- That the underground water flow into the slotted pipe was just as strong or stronger than water flowing in a ditch above the ground.
- That the main pipe taking water from the spring to the header tank needed to be on an even gradient even though the header tank was situated well below the level of the spring. The initial ditch that was dug by participants did not adhere to this principle and water did not reach the header tank. This had to do with the broken terrain, the formation of air bubbles in the pipes and the weak flow of the spring itself.
- That households above the header tank were unable to receive water from this gravity-fed system and that estimating the level of the household compared to the tank did not work well – this is something that needs to be measured, and was done with GPS coordinates and Google Earth maps in a participatory fashion.
- That the header tank must be on a secure and level plinth due to the weight of the water in the tank.
- That a gravity-fed system fills up the drums from the bottom of the slope first.
- That the filling of the household drums was dependent on everyone not using water until all the drums were full and the main tap on the header tank had been closed.

In terms of the social aspects, participants initially believed it would be easy for them to manage the water use, but they very quickly realised that it was very important to have upfront and strict rules to ensure that everyone received the same allocation of water. This was a deeply empowering process for learning group participants.

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