Final Report, Dennis Bouva Foundation (DBF)

August 2011 Evaluation, Pumps 1-15

Marofarihy Commune, Southeast Madagascar

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Objectives:

- Evaluate maintenance of all water pumps
- Determine technical status of all water pumps
- Analyze access issues surrounding all water points
- Identify suitable locations for (3) new pumps
- Assess potential of implementing JIRAMORA concept in collaboration with BushProof and with aim to long-term sustainability of the project (e.g. willing to pay [WtP] for water and electricity)

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Executive Summary: Following the August 2011 evaluation of pumps 1-15, generally speaking, it was found that 11 pumps are in good working order and widely used while 4 pumps have various problems (broken, too heavy or turbidity issues). There is a high level of motivation among pump users, and we encountered very few (if any) problems related to the pump committees. Women see the pump as a place of social gathering and *fihavanana* (social bonds) and all users noted a significant drop in stomach maladies and diarrhea. Some users walk up to 3 kilometres per day to fetch water from the pumps, thus underlining the widespread appreciation of access to potable water. Children often fetch water on their way to school. Migrants/extra-locals often rely exclusively on the pumps during the dry season when other water sources (wells, canals, rice fields) dry up completely. While there was one instance of social disjuncture in relation to extra-local pump use, all other respondents expressed great tolerance in this practice and had no problems sharing the pumps. Some of these migrants for instance assisted in the initial construction of the pumps, even if they live several kilometers away.

MadaTeam identified the following problems with the DBF pumps in Marofarihy commune. Officially, the pump at the hospital and in Mideboka are both broken. The latter broke down during the evaluation study (August 2011) though the cause of malfunction was unknown. At the time, the village technician in Mideboka was in the process of diagnosing and repairing the pump with the assistance of Joeline and the Marofarihy technician (Ambantelo). The pump at the primary school in Marofarihy has a problem with water quality; the water is brown/turbid and heavily deters people from using the pump (See pump descriptions below for more detail). The pump next to the road in Marofarihy smells and tastes of petrol, though the level of petrol/petrol smell and taste appears to shift over time (perhaps depending on rainfall). The water there is also brown, though it is unclear whether this is due to limited use or a deeper problem. Former users of this pump now rely on an open well nearby for water and some asked if there was an immediate way in which to purify the well water while the petrol problem persists. The pump in Ambotaka is incredibly heavy, which deters people from using it; there are only an estimated 20 people who use the pump and most are students or teachers at the school. Importantly, we discovered that the main source of potable water in Ambotaka, a UNICEF-built hand pump, had broken down; in the village, as a result, most people now drink from the canals and rice fields.

Accordingly, in addition to Ambotaka, where there appears an urgent need for a pump, the MadaTeam proposes the installation of new pumps in Betela and Belambo. In Betela, there is a semi-closed well already in use that locals purify with dwindling supply of *sur eau* (a water purification solution) provided by USAID. Moreover, the well is completely dry for a large part of the dry season. In Belambo, people collect water from *lavaka* – hand dug holes in the ground.

In terms of pump maintenance, and perhaps the most important finding of this evaluation, it was found that local people are not only willing to pay for water; they are *already* paying for water. Every village and pump committee has a system of *cotisation* in which all pump users participate (between 100-200Ariary/household/month). The funds are collected to pay for any repairs needed on the pumps. Thus villagers appear to have an efficient system of maintenance already in place, revolving around the use of a community appointed (as opposed to BushProof-appointed) technician referred to as Ambantelo. The technician, based in Marofarihy, claims to have repaired pumps in Ambotaka, Lac Amisy, Marais Ambony, Pump de Genie, Mideboka, Andranofotsy Nord, and the Marofarihy hospital. There is a great level of public confidence in his ability to repair the pumps. The system of cotisation was previously based on the monthly collection of funds; however, as villagers realized that monthly payments would be too expensive - and in light of the expense and accumulation of money this involved (for committee treasurers), nearly all cotisation systems

are now based on incidence only (i.e. only when a pump is broken). Every village has its own arrangement, though nearly everyone participates in this system of payment.

The system of cotisation appears to be connected with the Malagasy notion of *adidy*, or moral obligations to the community. The *adidy* is a system wherein families give a portion of their harvest (manioc, rice or sweet potatoes), *lambas* (traditional cloth) and sometimes even *zebu* to kin networks or the larger community. For example, when there is a death in the village, the *adidy* is invoked and everyone contributes to the obligation to share wealth; essentially it is a form of moral reciprocity within the community. Villagers related the system of *adidy* with the obligation to maintain and repair the pumps; this relates to the fact that the pump is a source of social cohesion and *fihavanana* (social bonds). Thus the cotisation system does not necessarily reflect a "willingness to pay" (in the economic sense), but a moral *obligation* (*adidy*) to upkeep and maintain the pumps as they are considered communal resources. It also explains the success of the cotisation and willingness of most (if not all) community members to participate.

Access to the pumps is often shaped according to socio-economic factors and particularly poverty. In this sense, vulnerable groups appear to include the poor (most evident in Marofarihy centre), the elderly, children, and men/children/women who go to work in the rice fields and have no means of carrying potable water with them.

One vulnerable group is the elderly and/or physically weak people. In Ambotaka, the elderly are excluded from using the pump because it is far too heavy. The weight of the pump and distance between Ambotaka centre and the pump (near the school) also deters other people from using it as well. In Marofarihy, there are elderly people who cannot fetch water for themselves and often rely on paying others (100A/bucket) to collect pump water for them.

The above point relates to the fact that children, who would otherwise carry out the role of fetching water (especially within kin groups), are restricted – to some degree – from accessing the pumps due to the perception that children risk breaking the pumps. Many respondents suggests that the (grand)parents of children could be held financially responsible if the pump malfunctions (this is not the case with all pumps, as in many villages children's "proper" use of the pumps was highlighted). Because of the tension surrounding children's use of the pumps, it should be analyzed further whether this poses an actually threat to access (for children themselves). Children play an important role in collecting water, though we observed, on many occasions, their use of wells instead of pumps (particularly near the primary school). This might also have to do with the fact that discoloured water (red or brown, in the case of the primary school) is seen as "dirty" whereas transparent water is seen as "clean" and thus potable (even if it comes from the well).

Another vulnerable group includes the poorest of the poor. In Marofarihy for example, we were told that a very poor family opted not to use the pump purportedly due to the inability to participate in the cotisation, though upon interviewing the head of the household, we were corrected that they did indeed use the pump though with great caution (for fear of breaking it). Consequently, the head of household's children, including one young mother reputed to have some mental problems, were restricted from collecting pump water themselves as they were seen as incapable of operating the pump correctly (and thus too much of a risk). Conversely, one MadaTeam member said that even if people do not use the pump, they say that they use the pump. More research needs to be carried out on how the committees themselves deal with extremely poor families. In many villages, there is a great deal of flexibility and poor households who cannot pay the cotisation are not obliged to.

Other groups who do not have access include migrants (particularly the elderly) who live too far away from the pumps to fetch water. These people, especially in the very rural areas, drink water from the canals and rice fields. Importantly, in terms of labour, farmers (including women and children) who leave the village early in the morning to go work in the

rice fields – and who have no means of transporting potable water – are obliged to drink water from the canals/rizeres throughout the day. Thus the transportation of potable water for both migrants and farmers appears to be a problem.

The second half of this evaluation aimed to analyze the feasibility of implementing JIRAMORA, a BushProof (BP) proposed long-term finance scheme based on the *transfer de gestion* (management transfer) of the pumps to local communities and BP. It is premised on the idea that local people are not willing to pay for water, but are willing to pay for electricity. BP proposes the rental of solar powered lamps (herein referred to as "ToughStuff (TS)"[1] in local terminology) through the use of a social village entrepreneur (SVE) in each village. The lamps would cost 200A/day, though there would be an added, monthly cost for water. It was unclear from the proposed maintenance contract what the total cost of water/electricity would then be for local people. Were a maintenance contract with BP to be signed, all maintenance and capacity building for the pumps would then be the responsibility of BP.

There appear to be four problems related to the JIRAMORA scheme. The first is that local people already have a system of cotisation in place (they are already paying) that does not follow a monthly schedule. The current system of payment takes into account the fact that people's incomes are much lower during the dry season (no harvest). It can be thus established that local incomes are not uniform throughout the year.[2] Second, in Marofarihy, TS lamps have been long-established and are rented out by the microfinance institution, TIAVO. Many respondents expressed dissatisfaction over the lamps and suggested they were ultimately more expensive and less efficient than petrol lamps or batteries. Another grievance related to the fact that the lamps do not charge well during overcast/cloudy weather conditions and would not work properly during the rainy season. Some people said that the lamps were not bright enough for children to study by. Third, villages in outlying, rural areas would not be able to profit from the rental system in Marofarihy due to distance (lamps must be returned each following day to be re-charged). In BP's scheme, such villages would rely heavily on the presence of one SVE per village; each SVE would have to have the financial capital required to purchase the panels in addition to the lamps. Fourth, in terms of maintenance, if pumps break down villagers would have to rely on assistance from and communication with Tana which could potentially cause delays; it is unclear how communication would improve with BP as part of the maintenance contract.

In short, as locals are already maintaining the pumps themselves (via the local technician, Ambantelo), JIRAMORA runs the risk of being too expensive for local people; it also runs the risk of forcing people to pay twice (for water). Also, there is some doubt as to the efficacy of TS lamps, particularly since many people (especially in Marofarihy) wish to use electricity for more than just night light (e.g. charging cell phones, access to computers or televisions/cinema social centres). While all villagers expressed deep enthusiasm over the idea of having electricity, it should be analyzed further whether TS solar lamps would indeed fulfill the needs and expectations of projected users. Each village appeared to have different needs in terms of electricity.

The role of BP in maintaining the pumps is unclear to all stakeholders involved (local communities, MadaTeam, DBF, and BP). There is a notable gap in communication between the local (Marofarihy), national (Tana) and international (Amsterdam) level with regard to both BP's responsibilities in terms of maintenance and local realities of pump use. BP maintains that it is not responsible for repairs/pump maintenance. Many MadaTeam members expressed discontent over BP's performance and professionalism. In short, and certainly due

[1] It should be noted that ToughStuff solar lamps are already being renting out at a cost of 200 Ariary/day by TIAVO, a micro-finance company, in Marofarihy.

[2] During a meeting with TIAVO (micro-finance), it was found that many farmers in particular had trouble paying back their debts.

to these miscommunications about BP's pre-existing role in maintenance, the morale among MadaTeam with regard to BP was somewhat low at the end of the evaluation. The author strongly suggests that better communication and transparency be achieved and mobilized between the local (Marofarihy commune), national (BP) and international levels (DBF in Holland). During a meeting with BP in Tana (end of evaluation), BP staff (Luke Barrett) made clear that BP is a company rather than an NGO and that no maintenance contract had been signed with DBF. MadaTeam members however see it as the duty of BP to ensure well-functioning wells after installation; it was also expected that the location of the pumps should have been better approved/implemented by BP. It was found that BP never conducted an analysis of water quality or turbidity on the pumps. In addition, water quality was not tested prior to installing the pumps, nor was it tested during routine visits. From what was gathered during the final meeting with BP in Tana, BP does not see a prior evaluation of geology or water quality as part of their contract with DBF. The issue of pump location was unclear. It was stated by BP that technicians are not responsible for scrutinizing the location of the pump and that, in general, they follow the advice of the MadaTeam and/or local communities who choose a particular place. This was contrary to the expectations of the MadaTeam, who assumed that BP would alert all stakeholders involved if the proposed pump location was poorly placed (due to geology, topography, water level, or height). There appears to be a lack of documentation and poor communication between the BP technicians who install the pumps and the heads of BP office in Antananarivo.

Suggestions: In light of these results, it is entirely up to DBF to decide how to move forward. The researcher suggests that better communication is key to ensuring fewer misunderstandings, particularly between the MadaTeam and DBF.

If local capacities to manage and maintain the pumps were strengthened, team members brainstormed a variety of options. They proposed that materials be sent via taxi-brousse from Tana, for instance, with outside finance. Water quality tests could potentially be carried out in Fianarantsoa, though the samples may no longer be viable by the time they reach the laboratory (BP mentioned that water samples must be tested within 6 hours) if they were sent by taxi-brousse). Another option is locating water testing facilities in Manakara. BP also mentioned that there is a mobile water testing kit available at a cost that would enable MadaTeam members to test the water while in the field. It was unclear whether this kit could be acquired from BP or if it had to be purchased elsewhere. Luke Barrett expressed willingness to revise the maintenance contract and JIRAMORA concept based on the findings of this study, particularly in light of local people's system of maintaining the wells and cotisation. Were a compromise to be reached, DBF and BP may wish to focus on how to strengthen local capacity for well maintenance.

Other questions/suggestions include the following:

- For the elderly, could there be a volunteer system instigated by the commune to ensure water access?
- Could DBF meaningfully address the issue of economic disadvantage and extreme poverty as a deterrent to pump use with committee members (in light of cotisastion system)?
- What materials were provided by BP to villages to build capacity to maintain the pumps locally (e.g. les tiges, PVC, etc)? How much do these materials cost? Has BP liaised with the Marofarihy technician?
- Is it possible to think of a short-term alternative for pumps that suddenly break down, such as using *sur eau* (water purification solution) or a filtration system? Are there any

alternatives available to locals for emergency situations when pumps break down and there are no remaining sources of potable water (e.g. pump with petrol, Ambotaka)?

- Can DBF look into acquiring *jerrycans* (plastic containers) for farmers and children who work in the rice fields? These actors are often forced to drink from the canals which are potentially contaminated (*zebu*).
- Regarding ToughStuff lamps, would it be possible to organize a one-month trial period (perhaps in collaboration with BP) in which villagers may use the lamps though at *no cost*? Following such a trial period, could surveys be carried out asking villagers if they would be willing to continue paying for the lamps? This scheme would have to be communicated extremely carefully to local people to avoid confusion.[3] The main purpose being to analyze user responses to the efficacy and costs/benefits of the solar lamps.
- Can BP and DBF estimate the costs and benefits of covering open wells with canzee pumps so as render well-water potable? How much would this cost?

[3] It should be noted that, at present, only Marofarihy centre is capable of facilitating such an initiative due to the presence of TIAVO. Outlying villages do not have access to the solar panels and thus would not be able to charge the lamps for a feasibility study. DBF (or BP) would have to acquire or rent solar panels to be based in the rural villages.

Pump Evaluation

Meeting with Marofarihy comité – The committee is in charge of pumps 3, 13, 7, and 11. With the assistance of TIAVO (who acts as both a "bank" as well as microcredit organization), a system of *cotisation* (payment) was put into place to pay for repairs. Previously the money collected from users was kept by the committee treasurer; however, the treasurer and committee members found this problematic as it would (potentially) lead to social problems. To promote neutrality, TIAVO keeps all money collected, acting as a bank, and re-distributes funds in case of repairs. If there is a need for repairs, the committee recruits the technician (Ambantelo); committee members come to a joint decision about the cost of the repair.

There are sometimes water shortages due to the large number of users. The pump at Andranofotsy Sud is too heavy, and the water level drops after short-term use; thus users must wait 15 minutes for the water to return.

Requests: Can something be done about the heavy pump? Can DBF move the pump with gasoline?

Interview with Ambantelo:
In an interview with him, we found that most the pumps have problems with the PVC pipes; they break frequently. Ambantelo fixes the pipes and changes the valves. Many pumps have broken down since installation: the pump at the hospital, Ambotaka, Lac Amisy, Marais Ambony, Pump de Genie, Mideboka, Andranofotsy Nord. He has fixed them all one or more times. Ambantelo claims to have repaired the pump at the hospital three times, though now it does not function as the PVC is broken in two and lodged in the pump. One problem he cites is that the length of the pump and the length of the PVC pipe are the same (24m); when he cuts the PVC, the pump begins to work again.

Meeting with 30-40 Marofarihy pump users (pumps 3, 13, 7, 11) -

The pumps significantly reduce the efforts of women; both women and *zaza* (children) fetch water from the pumps. Women claim to be in charge of managing and using the pumps. This is considered acceptable by both genders. Parents often ask children to fetch water at the pumps. In terms of fady, people are aware of keeping animals (*zebu* etc) away from the pumps as they risk contamination. Water (from pumps) is was for drinking and cooking only; the open wells or other water points (rivers, canals, etc) are used for washing (clothes and bathing).

In terms of exclusion, when asked if there are villagers who do not use the pumps, one woman replied, "Yes, because they do not participate in fixing the pumps [paying the 200A fee]." One man noted that drinking from the wells leads to diarrhea and stomach illnesses. While villagers noted that some people cannot use the pumps for economic reasons, one women injected: "Some people just don't want to! Maybe they want to be sick to the stomach." There are reportedly three types of cases involving people who choose not to use water from the pumps. The first concerns the economically underprivileged. The committee however insists that they understand this barrier and often do not force them to pay (though the details remain unclear as to how this works in practice). There still may be deterrents such as the poor assuming they would have to pay and avoiding use (see case of extremely impoverished family in Marofarihy). The second group avoids use due to behavior. These tend to be affluent people (merchants, shop owners, etc.). The third group includes the restaurants/restaurant

owners, who need large amounts of water and thus choose to take it from the well instead of the pump.

Exclusion is primarily based on socio-economic factors and poverty. In Marofarihy, *piavy* (migrants, those of non-Antemoro descent) – particularly those new to the region – tend to be worse off economically and more vulnerable. (The chef de commune maintains that "everyone" is *piavy*.)

There was one some of a family recognized as *piavy* who purportedly never used water from the pump. The head of the household, a man in his 30s or 40s, lived with his family in a type of 'communal' house as he didn't have the money for a house of his own. He was hired by the restaurant for a period of time, and they asked him to fetch water from the well (as they needed large quantities).

Eventually we discovered who the man was and where he lived. We went to interview him in his home; he lives in an extremely impoverished household and his father is very ill. He explained that he and his wife do use the pump (de génie) for cooking and drinking, though he has problems paying for repairs. He mentioned that sometimes he is afraid that he cannot pay for repairs and this makes him hesitate using the pump. He does not allow his children to use the pump because he insists they do not know how.

One significant [economic] change for pump users is shift from spending additional income on medicine to food due to the drop in stomach illness/diarrhea. Children are no longer sick[4], allowing mothers more time to do other things – such as work. One woman related this social change through an anecdote; while in the past, when the children were sick due to water from the well, food would be left to burn – now it is not the case: she feels more control over life.

During the dry season, the pumps become much heavier, more difficult to use and produce less water. The only exception is the pump de genie (no 3) which improves during the dry season. During the wet season, there are no problems.

General remarks from villagers: One man was pleased with the pumps but suggested they did not produce enough water (particularly during the dry season). He asked if DBF could build more pumps near him. One woman, who lives close to the primary school, asked if the pump could be moved as the water is brown. One man who lives between Marofarihy and Mideboka asked if DBF could build a pump between the two villages. One man, who lives near the pump contaminated with petrol, says that when pumps break down people immediately use the wells; he asks if there is some alternative option – for example purification methods for decontaminating well water (or a filter)?

In terms of numbers of use, villagers suggest that 170 households use the pump de genie (no 3), though this number increases to 205 households on Thursdays (during the market, when *piava* [extra-locals] come to sell goods in Marofarihy). Over 100 households use the pump at Andranofotsy Nord (no 7).

Villagers expressed a very strong desire in having electricity. Families spend on average 100-200A/day on petro and candles. The average price of petrol is 2.500A/litre; people use about 50ml/day of petrol. Merchants spend 500A/day on electricity (un *groupe* or generator). People suggested they were willing to pay 200A/day for electricity (about the same as current expenditures). However, one man (man who lives close to pump with petrol) noted that – while electricity is a great idea, for having a radio, better light for studying (children) and eating, etc – not everyone would be able to pay that much. How would we help the poor people in Marofarihy pay for electricity?

[4] Ultimately we were unable to obtain data on child illness rates/time in Marofarihy due to the perpetual absence of the communal doctor. The hospital was closed up each time we went there (five times in total). Therefore we rely here on testimonies of local people rather than hard data.

Pump no 13 (Andranofotsy Sud, Marofarihy) – Constructed last year, main problem being the pump is very heavy. Many people drink from the pump, particularly people from the market, though others still use an old well nearby (mostly for washing clothes, bathing).

Pump no 7 (Andranofotsy Nord, Marofarihy) – Pump has had five repairs since installation and is widely used. Three repairs related to dirty/brown water; two repairs had to do with the *tuyau* which was broken. Noting the frequency of repairs, the villagers came together to build a fence with door that can be locked. Villagers are permitted to fetch water during certain times of the day so the pump can replenish itself. The "opening" hours are between 6h-10h and between 14h-18h. Adults primarily fetch water, not children.

Pump no 11 (next to main road, Marofarihy) – Main problem is that it tastes and smells of petrol. We tasted the water to confirm; it tastes strongly of petrol. The pump was normal at the beginning of installation (22/09/10) and exhibited no signs of contamination. After one month, users began to notice a difference. We were informed that the level, odour and taste of petrol changes; also, when people take water from the pump and cook it, the taste of the petrol is much stronger.

Most people now use a nearby well as their primary source of water. The man with whom we spoke asked if there was an immediate solution, such as a filter or means of decontaminating well water.

One week later, we return to the pump and it tastes/smells markedly *less* of petrol. It had rained heavily during the week, though we do not know if these made a difference in terms of the taste/smell. Again, informants say that the level of petrol changes periodically. There are some rumours that the petrol in the pump may have been an act of sabotage, as the pump is located on the land of the ex-L'Adjoint de Commune.

Pump no 13 (Marofarihy) – Many children using this pump though the adults don't seem bothered. The pump works very well. Previously the pump was repaired by the local technician, Ambantelo (here we have interview with him, see separate section on maintenance).

Pump no 3 "de génie" (Marofarihy) - near office of the Commune. The pump works though has been repaired three times in the past.

One incident in which the pump broke was probably an act of sabotage. It involved a social dispute between a member of the committee, a villager and an older woman somewhat marginalized from the community. During the installation of the pump, the committee informed villagers that everyone who wished to use the pump had to participate in transporting the sand and rocks. One woman did not want to participate, continuing to take water from the well. The woman was under the assumption that DBF gave Joeline large amounts of money to pay people to install the pump and that she had kept it for herself; thus she accused those who did help of being ignorant.

After it was constructed, however, she went to the pump once during the dry season, when the well dried up. At this point, the committee had enforced hours of use (between 05h00 and 18h00); the woman arrived before 05h00 and the door was looked. She woke up a committee member and demanded the key; the member got up to look for the key and the woman left the scene, leaving her bucket by the pump fence. In the meantime, another villager (young woman) arrived at the fence as it was nearing 05h00. The committee member went to the pump and unlocked the door for the young woman. The other woman came back and demanded to use the pump first as her bucket had been there before the other villager

arrived. The young woman told her that she should be able to take water first because she helped participate in pump installation. Then the woman threatened her by saying, "If I don't break this pump tonight, consider my father a dog!" Comparing a family member with a dog is considered a very serious fady (taboo) among the Antemoro. The woman stormed off, and the next morning at 05h00, the tige was completely bent in two.

The committee came together to decide what to do, as there was no proof that the woman had done it. While many members thought she should pay, the Mayor eventually intervened and together they decided that the villagers (including the woman) would pay for the repair equally. Ambantelo bent the the tige back into shape, and BP replaced the tige in June 2009.

Marofarihy users (both schools plus hospital) - With regard to both [school] pumps, villagers say that management is very bad. Many people do not take responsibility for their role in maintaining the pumps; several do not participate. An example of this is that the fence around the primary school pump was never finished. The community uses the pumps but leaves the management responsibilities with the schools because they are closer to the pumps. Consequently, the money for repairing the pumps comes from the families who live close to the pumps and the families of students. For both pumps, the committee enforced discipline regarding the hours – mainly for children who use the pump(s) often.

Pump no 8 (Marofarihy, next to secondary school) – The pump has a good flow and is not too heavy. During the dry season, the water flow is okay. Villagers from other areas come to take water from the pump. The pump has broken down twice (once due to the tige). Has many more users compared to pump 15.

Pump no 15 (next to primary school) – The pump is heavy and situated on the side of a hill (Naina mentioned that the pump was poorly placed). One man says that the pump is hard to use as it is very heavy, particularly for old women; it hurts their backs. The water is brown; villagers state that, since the initial installation of the pump, the water has always been brown.

Several days earlier, we had gone with Ambantelo to clean the pipes – which were covered in mud – as villagers complained of the water being brown. Apparently the water became clear again though only temporarily. One man said that, at first, the water comes out clear, but after four buckets, it turns brown/yellowish; the same problem exists despite the repair by DBF and Ambantelo. After four buckets, it is necessary to leave the pump for a period of 20 minutes. Many people do not want to wait that long so look for water from other sources. A woman agrees with him, adding that when the pump is used heavily, the water turns brown – and in the wet season, it turns red. Many people nevertheless appreciate that the pump is there and often leave the water in the buckets so as to let the mud settle to the bottom. There are also people from outside the area who take water from the pump.

Many users (especially children) choose to take water from the well, located at the bottom of the hill, just seconds away from the pump, instead of the pump because – as one girl stated, the water used to be clear but now it is brown. Thus there is a clear aversion to drinking and using discoloured water.

During the cyclone season, more people tend to use the pump as the well is inundated with water. The pump also becomes easier to use during this time (as opposed to the dry season) and has less of a brown colour (more red, however).

One woman said that there is too much of a distance between pumps 8 and 11 (next to road in Marofarihy). She wishes there were a pump closer to her.

BushProof did not leave a telephone number in case of emergencies.

Villagers spend between 100-400A/day/household on petrol. They have heard of TS and TIAVO though many said it was "*tsy tsara*! (not good!)" Villagers say that TS does not provide enough of a charge for radios, phones. Many people use the salle de video to charge this equipment. Some tried renting the TS lamps for 200A/day, and say that TS does not give enough light (pas de "*veilleuse*" [night light]). The light goes down quickly. All users combined use with petrol. Nevertheless, they are interested in having electricity/energy source. But TS is deemed insufficient as it cannot power electrical equipment.

Pump no 2 (Marofarihy hospital) – The pump is still broken. It functioned in 2008 when it was built, though in 2009 (when Naina and Baba when back) the pump had red water. In 2010 and 2011 BushProof came to look at the pump and explained to villagers that perhaps there was not sufficient dévéloppment when it was first installed; BP suggested that the pump be moved. Water from the primary school pump is used instead.

The story and history of the hospital pump is extremely complicated. Apparently, from its initial installation in 2008, the pump flowed with red (ferrous) water. This deterred people from using the pump. In 2009, purportedly with Bart present, team members returned to find that the pump did not work at all. BP repaired the pump in June[5] 2009. In October 2009, during an evaluation carried out by Naina and Baba, the pump worked but the water was still red; villagers noted that once they started using the pump again, the water began to flow red. In June 2010, the pump was broken again and produced no water at all. BP repaired the pump, paying two villagers to pump out 400 litres of water (le dévéloppment); however the water was still red. Baba and Naina noted during this trip that the doctor had advised people not to drink from the pump because of the red water. In September 2010, Carole and the rest of MadaTeam observed that the pump was again broken. Someone (we do not know who) lodged a piece of wood into the PVC pipe. There are several speculations as to why this person may have done this (as discussed with MadaTeam): 1) the individual had no technical experience and perhaps tried to repair the pump him/herself; 2) it was an act of good conscience, so as to prohibit villagers from drinking red (contaminated) water; 3) it was an act of sabotage.

Interview with old woman (70s +?) –

We were told that an elderly woman living across the street from Joeline did not take water from the pump. Dina and I went to interview her in her home, where four or five children were playing and running in and out. The woman claimed that she drank cooked with the water from the pump, and used well-water for bathing and washing clothes and dishes.

However, she mentioned it was very difficult for her to fetch water herself; she is older and not strong enough to carry the buckets. Her grandchildren are not old enough to get water from the pumps themselves; she also mentioned that they risked damaging the pump and she doesn't want to pay for repairs. She thus pays people to fetch pump water for her (100/bucket). On average, she spends 200-300A/day on buckets of water from the pump. Sometimes she doesn't have enough money to pay for people to fetch water for her, in which case she limits consumption. This is especially the case during the dry season (Oct and Nov in particular), when there is very little money at all. During this period she gets the water herself but only one bucket per day (and she limits consumption). The woman explained that people might think she doesn't use the pumps because she never attends the reunions (village meetings); she says that she always sends representatives on her behalf. Moreover, she participates in the system of cotisation (100A-200A). She thinks that potable water is important as it reduces the

[5] It is unclear whether BushProof was present during Bart's trip in 2009 (verify).

risk of diarrhea, stomach problems, etc. Before, children were getting sick from the wells, particularly during the dry period (Oct-Dec). Even with the pump, people must get water very early in the morning otherwise the pump risks running dry.

Pump no 1 (in Alakamisy; combined with data from a réunion with a large group of people from Alakamisy in Marofarihy a few days later) – The pump apparently works very well and has a good taste; there is a roof and fence around the perimeter. The pump was built in 2008 and has had only one repair since then (and it was the handle of the pump). The pump was repaired by Ambantelo (they call him when there is a problem). Children do not use the pump; it is only used by women. People use the lake to bathe and wash clothes. For washing dishes, drinking and cooking, the pump is used. Since the onset of the pump, villagers have noticed better health and fewer stomach problems. People no longer drink or cook with the water from the lake. The pump is also a meeting place for women; it is considered a place of *fihavanana*. Women don't feel that they are saving time necessarily as the distance between the pump and the lake are the same. Contrary to other pumps (e.g. Marofarihy), the pump functions well in both the dry and wet seasons.

Sometimes migrants from other villages come to take water from the pump, though this has created no social problems. They come mostly during the dry season. While this is not currently a problem, the *chef fokotany* mentioned that it would be better for the migrants if a pump was built closer to them (in Betela, Belambo).

In terms of maintenance, the village participates in a system of cotisation. Previously, a collection was made every month; these monthly payments were used to build the roof and the fence. However it became clear that, particularly during the dry season, it was difficult for the poor families to pay. During the dry season, there is little production of rice (*vary*) and poverty levels rise. The pump committee made a joint decision to halt the cotisation during these months (Oct-Dec roughly). In the wet season, they collect money (about 100A/family/month, or 100A/family only when there is a problem). The committee wants to use any left-over money to repair the roof over the pump. All villagers participate in cleaning and pulling weeds around the pump.

During the production period, rice, manioc and sweet potatoes. People mostly eat what they cultivate, though some is set aside to sell for school fees, soap, batteries, and petrol. Some also goes towards the *adidy* (moral obligations/responsibilities) in the village. The *adidy* is a system wherein families give a portion of their harvest, lambas (traditional cloth) and sometimes *zebu* to the community or within kin networks. For example, when there is a death in the village, the *adidy* is involved on a higher level; it is essentially a form of moral reciprocity within the community. Villagers related the system of adidy with the obligation to maintain and repair the pumps; this relates to the fact that the pump is a source of social cohesion. this in some sense relates to the success of the cotisation system, wherein water pump users fulfill their obligations to maintain the pumps through *adidy*.

Approximately 60 households use the pump from Alakamisy; however, 100 households in total use the pump including those on the periphery (neighbouring villages).

Villagers spend on average between 100-200A/day on petrol. They economise; if the petrol lamp gives off a good amount of light, some women shorten the wick (*meche*) and it lasts much longer (though does not produce as much light). Sometimes there is no petrol available in the local boutique and people must travel by foot to Marofarihy. People in the village have heard about TS and the solar panels. The president of the fokotany bought a solar panel and lamp in Marofarihy to try it out; the total package cost 90,000A. He uses it if the sun gives off enough light; if he puts the lamp setting on the highest emittance mode, it only

lasts until about 2am. Otherwise, at a very low setting, it can last until the morning – though it is not strong enough to read by or for the children's studies. He says that he must supplement the used of TS with petrol. Another local authority tried TS and encountered the same problem. Another issue is that the solar panels must be displaced throughout the day as the sun moves; this is time consuming and is often a small job outsourced to children. The president sometimes asks his [adolescent] children to move the panels. During the wet season, there is heavy cloud cover and there is not enough sunlight to charge the panels.

There has been no contact with BushProof since the installation.

Pump no (several km away from Marofarihy; bad road; went on foot) – The pump works very well; it was installed in June 2010 though since then there have been no problems. The *chef du village* immediately pointed out how children are very well-educated about the pump in terms of how to use it; he insisted that children learn to fetch water from the pump at the age of two. People here are generally very pleased with the pump. The pump is used for drinking and cooking though also washing clothes – as the water is considered *midio* (clean). Approximately 45 families, in addition to 32 families in neighbouring villages, use the pump, totally 77 households.

The people with whom we spoke lived both in the village itself and neighbouring villages, several kilometres away. For example, a women who lives 1km away from the pump sends her children to fetch water before they go to school. A man in his thirties who lives 3km away participated in the construction of the pump (transported sand, etc) and comes every two days to fetch water. He conserves the water in a *jerrycan* (plastic container). He drinks water from the pump though cooks with water from the rice fields and canals (as the distance is too far). However, while before he had to walk 6km to get clean water, he now only has to walk 3km. He sometimes comes with friends who, not having *jerrycans* of their own, offer to help him carry the water back to the village in exchange for sharing some of the water in his *jerrycans*.

In contrast, there are some people who choose not to use the pump simply because it is too far away. While the extra-local use of the pump has never caused social conflicts, one woman said that it would be preferable to have closer access.

People have observed much better health since the installation of the pump, and are conscious of the importance of clean water. In terms of conflict, the major grievance is the distance between the villages that use the pump and the pump itself; many people take water from the canals and rice fields because it is more convenient.

In terms of maintenance, the village was not aware of who to contact in case of a need for repair. Joeline told them to contact her if there was ever a problem (she would call Ambantelo). The villagers responded that they would repair it themselves if they knew how to do it. If there is a problem, there is a system of cotisation ('*system de gestion*'); people do not pay every month, though everyone is willing to pay for repairs. Villagers confirmed that BushProof had not left a phone number or contact information in case of a problem.

The committee itself reportedly works well. After the pump was installed, the committee took it upon themselves to educate (faire *sénsibilisation*) in neighbouring villages about the importance of clean water and use of the pump.

During the rainy season, and because the village is situated in a low-lying area, much of the village is inundated with water. The pump is also inundated, and to avoid contamination the villagers cover the pump. Many people are forced to move closer to the main road, where there is no access to water. During this time people tend to fetch water from the canals for all uses.

Villagers spend about 300A/day/household on petrol, candles or batteries. No one in the village had heard of TS. People claimed to be ready to pay 200A/day for electricity.

Pump no 6 (Ambohinandraso) – The pump works very well; there have never been any technical problems. People are very motivated to fetch water from the pump. There is an old well in the pump's vicinity (< or > 20m?) though it has been completely abandoned and is unusable. There are 450 regular water users in the village. The pump is a site of social ambience and cohesion; every week the villagers come together to clean the pump and meet each other. They have seen an improvement in health (particularly stomach problems which are very rare now). Women no longer have to cook the water before drinking it. While the committee advises children not to fetch water, parents tell their children to fetch water; however, there do not appear to be any serious conflicts related to this.

The pump functions during all seasons. During the cyclone season, there is an inundation of water and many people have to live in the school as their houses are flooded. During the dry season, migrants come to use the pump as other water sources (rice fields, canals and wells) dry up. This is tolerated with some hesitation by villagers, who are reluctant to share the use of the pump primarily due to a fear that extra-locals will break it and not pay for repairs. Migrants are allowed to take water but only under tight supervision – especially of children.

The chef fokotany pointed out that there are 1,300 inhabitants in the wider fokotany (a total of 170 households over three villages); the pump cannot accommodate the water needs of everyone.

The pump has never been broken, though if a problem arose the village has the phone number of a BushProof technician. BushProof also left some materials in the village (PVC pipes) just in case. However, BushProof has not been to the village to check on the pump since 2009. Joeline informed the chef fokotany about Ambantelo's services.

The villagers are very interested in the solar panels and TS, though no one has tried them. The problem is that the plaque and lamp combination costs 90,000A and is considered too expensive; conversely, 200A/day might be manageable.. The JIRAMORA concept is thus a possibility here.

Pump no 12 (Betany, or "Bevaona") – Since the installation of the pump in 2010, it has functioned very well; there have been no repairs. People in the village and in outlying areas are all very motivated to fetch water. About 100 people use the pump. Villagers have noticed a drop in stomach illnesses and diarrhea. Children often go to fetch water before going to school. Men, women and children use the pump. There is no roof though the village has built a fence around the pump.

If there is a problem with the pump, the village will have a meeting to decide how to proceed. Previously, there was a system of cotisation of 100A/family/month; however, this system was discontinued. Money that was saved from the older system is being kept aside in case of a need for repairs.

One man who lives 1.5km to the East of the village expressed a wish that the pump was closer. Another user, a woman who lives 1km to the South, underlined this wish. In short, there are many people who do not use the pump because of distance. These individuals use the canals for all water purposes. While the pump delivers water during the dry season, they do not travel the distance necessary to use the pump during this time; they either go directly to the river or dig a hole.[6] In the village, during the rainy season, some households are flooded and families have to move to higher ground; however, they still use the pump.

Since the creation of the pump, there has been no contact with BushProof. The villagers have never heard of or seen TS. If families economise, each household spends

[6] Where these individuals live was unclear; I heard the name "Mananano" mentioned though I don't know if this refers t the name of a village or something else. Perhaps ask Carole.

100A/day on petrol. For families who have children who go to school, the expenditure is more like 300A/day. Sometimes there is a problem with the availability of petrol.

Pump no 4 (Ambotaka) – The pump is situated on top of a steep hill next to the secondary school; it is extremely heavy and difficult to use, even for an adult. While the water seems to have good quality and flow, the pump is poorly maintained (no fence, liter surrounding it, etc). In the dry period, it is possible to fill four buckets of water, though villagers must then wait for the pump to replenish itself. In the wet season, there are no problems with water flow but the water turns red (sign of high iron content). Some people drink it anyway, though they cook it first. When the colour of the water is transparent, villagers drink the water immediately.

The pump was damaged and repaired three times by Ambantelo. All water users participate in paying for the repairs. The story follows that in June 2010 BushProof came to the village to diagnose the cause of damage; BushProof said they would return though reportedly they did not return to the area. BushProof purportedly gave the village a tige (for one repair), though Ambantelo actually repaired the pump. BushProof did not explain why it was so heavy. Other times the parents of the school children were the only ones charged with paying for the repairs as the students were seen as the primary users. Teachers give the older students buckets to go and fetch water for consumption during the school-day.

The main problem is that the pump is far too heavy. While villagers were enthusiastic about the pump in the early stages, they soon realized how heavy it was and determined that it made more sense to use other water sources (namely the canals and river). Villagers think that the primary reason why the pump breaks so often is because of the weight; perhaps the pump is being worked too hard. There are people who are excluded from using the pump because it is too heavy. These people take water from the rice fields because it is easier. Indeed, a large number of people in the village avoid use because it is too heavy, particularly the elderly, children and the physically weak. The pump has been extremely heavy since its initial installation. It is estimated that about 20 people use the pump (mostly school children and teachers).

It is important to note that, during the visit, we learned that a pump built by UNICEF in the main village of Ambotaka was broken. This leaves the entire village with only one potable source of water: the pump. However, as very few people use the bump because it is too heavy, this points to a serious threat to clean water access.

The pump has however been crucial to the school children who use it. There has been a notable drop in stomach problems. Other children who do not go to school, who work in the rice fields, drink water from the canals and rizieres (where there are *Zebu*). If a new pump were to be installed, villagers request that pump no 4 not be "displaced" but rather kept operational for the school. They request the new pump to be in an area where more people are present. The land issue[7] they argue could be negotiated within the village and overcome; in other words, despite the traditional structure of land ownership in the village, it was insisted that compromises on where to place the pump could be made.

Between 100-300A/household/day is spent on petrol. For the parents of school-children, more is spent. They have never heard of TS. `

Again, confusion about the role of BP. Baba mentioned that, when the pump at Ambotaka was broken, MadaTeam asked BP for a diagnosis of the problem. BP determined that both the *tige* had been cut and the handle was broken. BP told Baba that the MadaTeam had to buy materials to fix the pump, though Baba answered that they first had to consult with

[7] The pump is located on officially state-owned, communal land. It is common knowledge that pumps should ideally not be placed on privately owned (or traditionally owned) land; however, in the case of Ambotaka, villagers suggested that a compromise could easily be made between villagers and local authorities.

Sara and DBF. In the interim, BP sent for material in Tana to be sent to the area in order for the pump to be fixed. There was a miscommunication here over whose responsibility it was to pay for the materials (this reportedly occurred in Oct 2009).

Pump no 5 (Amkaboka) - We went by foot to this rural village and crossed several rice fields; along the route, we saw a few people drinking from the canals. The pump was constructed in 2009 and endured one repair (fixed by Ambantelo) in 2011. The pump is very easy to use though it sticks a little if the handle is pulled too far. Approximately 20 households use the pump regularly, though during the dry and wet season combined, up to 270 families use the pump. Still, there have been no conflicts with migrants. The villagers are very open to sharing the pump with outsiders because they helped in the construction of the pump. Similarly, the villagers said that – were DBF to build a pump for these outlying villages – they would also help transport sand, etc. in return. They hoped that pumps could be constructed in villages farther away. Some people transport water in jerrycans though many do not have them (especially farmers). The committee was active in educating other water users about the value of clean water.

Primarily women and children access the pump (but also men). Children get water on their way to school. Even old people use the pump because it is not heavy.

People here previously dug holes in the ground to find drinking water. Users are instructed to be careful using the pumps (especially children) and maintain it well. Before, there were stomach problems; after the pump, people are healthier.

During the dry season, the water level does not change. In the wet season, the pump still functions well and there is no discolouration; in fact the pump functions even better. In Oct/Nov, people who live far away come to take water from the pump because all other sources have dried up.

There is a system of cotisation here though not every month; only when there is a problem.

Bushproof left a telephone number in the village and made a village during the construction of other pumps.

People spend about 100A/day/household on petrol, and 200A/day during school months. They have heard of TS but never tried it. They heard it was not worth it given the amount of light it emits.

Pump no 10 (Marais Ambony) – The pump is located in a very rural area accessible only my foot. It was built in 2010 and is very easy to use. Up to 48 families use the pump; 28 participate in the cotisation. There were never any repairs or technical problems; however, they would call Ambantelo if there was a problem. Villagers say that when water is left in the bucket overnight it turns brown.

Many people drink from the pump (mostly women and children), but those who work in the rice fields (men, women and children) drink from the canals. This is people they have no way to access the pump water while working. They have no way to transport the water to the rice fields. Farmers and children would use jerrycans to transport pump water to the rice fields every day on their way to work. In fact, farmers from Marofarihy who have rice fields in the area do this; they fill their jerrycans in Marais and take them to the rice fields for the day.

However, these are the only people who take water from other sources and fail to use the pump consistently: those who work the land. People outside the village walk up to 500m

to use the pump, no more. When water in other sources is not available, the pump is used as an alternative – particularly for outsiders.

During the wet season, the flow is very good and water clear. There is no problem with brown water. In the dry season, there is some limitation in the availability of water; people must wait a bit while the pump replenishes itself.

The village has had no contact with BushProof since installation; BP did not leave a phone number.

Before, when people were forced to drink contaminated water, there were rashes and small bumps on the skin.

There is a system of cotisation in the case of repairs. Each family pays 200A per month, though it was unclear whether the money was collected by the committee every month or one every four months. While some can pay each time, others ask for a delay.

People spend 200A/day/household on petrol. They know about TS and the plaques solaires, but no one has used it. They know it is a system of renting and returning the lamps to TIAVO; they feel that they live too far away to participate in this (as they would have to go all the way to Marofarihy) and thus it is not a convenient option for them.

Pump no 9 (Mideboka) – The pump is broken; it broke just prior to our visit on the 15th of August. This is the fourth time the pump has broken since its installation. BushProof recruited a technician from the village to repair the pump; he collaborates to some degree with Ambantelo. BushProof has purportedly come on several occasions to train the technician, though he admits that he does not have the materials necessary to repair the pump (this time). Joeline mentioned that she would check in Marofarihy. There is also a widely used UNICEF hand pump in the village. The villagers say that the DBF and UNICEF pumps are used equally. The UNICEF pump broke down once and was repaired locally.

Villagers are very motivated about using water from the pump. Men, women and children who are old enough to carry a full bucket are permitted to use the pump.

The system of maintenance in Mideboka is very unique. As there was already a pump in the village prior to the DBF pump (built by UNICEF), there was already a system of management in place. There is a women's collective that manages all problems and issues related to the pump(s). The women began growing plants around the periphery of the pump when they realized that people were taking wood from the fence as fuel; they assumed that villagers would be less likely to steal plants. The cotisation system only comes into play when repairs are needed, and the amount depends on the repair. It is *only the women* on the committee who pay: not families; each woman pays 100A.

Before going into the rice fields, farmers take water from the pump to carry with them. No one drinks water regularly from other sources.

There are times when water is consumed from the Mananano river (which is considered sacred). These are during benedictions or ritual ceremonies. Here a distinction is made between the sacred power of the river water compared to that of the pump; the pump water was not created by the *zanahary* (Creator) and thus cannot be used for benedictions. There is a precise area from which to take water from the river, which is also referred to as the *ranodrazana* (ancestral water).

In the dry season, villagers can use the pump for four hrs. They must then wait for 30 minutes for the pump to recharge (this is not the case with the UNICEF pump). In the wet season, the water is very clean though the pump becomes very heavy.

There are 301 households, with 10 people per home. Villagers would like to have another pump in the village as there is not enough water available to satisfy the needs of the population.

100A-300A/day/household is spent on petrol. The light is enough to eat by. No one uses TS; they have heard of it, but are not interested. If DBF is planning on implementing electricity, the village would be thrilled. They would like to have access to electronic equipment in a 'social house' where the community can gather together (une maison collectif).

Proposed Locations New Pumps (3)

1. Betela – The main water point used by the villagers is a semi-open well (puit)[8] which was built in May 2003. About 20 households use the well. In the dry season, the well dries up completely and villagers often go to Alakamisy to fetch water from the pump or the lake. If water is fetched from the lake, some villagers drink it immediately while others wait to cook it. Water available in Betela often depends on the irrigation system adjacent to the well; the canal is fed by Lac Ivaokwana. When the canal goes dry, villagers know that only one month of well-water will still be available.

Contrary to other wells, there are no problems with stomach illnesses or diarrhea because villagers purify the well every three months with '*sur eau*' – a water purification solution. After the well was constructed by USAID,[9] *sur eau* was given to and therein available at the infirmary. However, the provision of *sur eau* to the infirmary by the *disponeur* (assuming it was USAID) stopped two or three years ago (also, the *résponsable* at the infirmary left the village). The villagers have been using a reserve of the product though it will only last a bit longer. The local authorities will have a meeting with the village to decide how to pay for *sur eau* in the future, after reserves are depleted.

2. Belambo – The village is in a very rural location located in the forest, on the other side of the lake. DBF came to the village last year to have a réunion with the people about the possibility of installing a pump, but no one came; the local authorities explained that there was a miscommunication and expressed their apologies, insisting that the village is deeply enthusiastic about the pump.

There are about 50 households, those the local authorities suggest that many more people from neighbouring areas would use the pump because the villages are so isolated. The villagers have already been educated (sénsibilisé) about the importance of clean water.

As there is no well in the area, the current water source is the *lavaka*: holes dug in the ground deep enough to penetrate the water table. There are several lavaka in the area – one every few houses. From October onwards, there is little water available in the holes. While the lake is also used for water access, it is heavily used during the dry season.

School children bring cooked water in gourds to school, but when empty, take water from the lavaka (ask an adult or older child to do it). Fever, stomach pain and diarrhea are all a big problem.

Adults (or young adults) are the only people permitted to take water from the lavaka because it is extremely dangerous. There is a risk of falling inside the holes for children.

Publically owned land is located opposite the village, and villagers have identified a suitable place for a pump (easily marked).

[8] The well had a smaller opening compared to most wells in the area (i.e. in Marofarihy, where the wells are completed open). This suggests the well was partially closed at during installation.

[9] This needs to be verified; I am almost certain it was USAID but I did not write it down (maybe check with Carole).

People spend 100-300A per day/household on petrol (it depends, as sometimes they economise) which provides light until the morning. They have heard of TS, but choose not to use it because of the perception that it is too expensive.

3. Ambotaka – (see description above; DBF pump not in use and UNICEF pump broken)

Meeting with Luke and Serge (end of trip, Tana) – There are no official maintenance contracts with DBF. Moreover, it is not clear how many times per year BP goes to visit the pumps. They cannot go to the area without charging DBF. BP went twice this year though not sure what is happening with the hospital; apparently they went down in February 2011 and thought that the borehole might not be functioning properly. Luke was not there; it was Antoine and Ingrid.

BP engages in two activities: 1) installation of pump, 2) selection of local technician and formation to train the technician.

The 120 Euros/pump/yr was only a proposal; it is not yet being paid by DBF.

Luke says that, in terms of maintenance, it is important first and foremost to know that BP is a company – not an NGO. There must be some source of revenue if DBF requires that pumps be repaired.

BP has been operational since 2005 though heads of office have changed several times (perhaps explaining the miscommunications about the pumps).

Water has not been tested once since the installation of the pumps.

It was conceded that mistakes had probably been made (particularly with regard to the hospital pump). Still, DBF cannot after three years demand that the pump be replaced/repaired at BP's own cost. Moreover, at the time of installation, no guarantees were made between DBF and BP. At present BP does sign contracts for new pumps.

Serge confirmed that BP gave DBF a 6 month guarantee on each pump.

If a maintenance contract were to be signed, DBF would receive support from Tana, money for the technicians, parts from Tana, and other practical support. Also the contract would include detailed follow-up of pumps and better documentation. It was unclear whether water quality tests would result from the contract.

BP knows nothing about the water quality of a proposed site until they commence drilling, so there is a risk involved. They can however carry out a sondage – drilling a borehole – for 1050 Euros/sondage. This would be able to test water quality before building the pump. What probably happened was that the water quality was bad but the pump was built anyway. There may have been some awareness made about this to the fokotany or MadaTeam, and compromises made, but he wasn't there so he doesn't know. Moreover the BP does not report back.

So to be clear, there were no water quality tests done prior to installation – only visual tests.

The pumps need to be used constantly in order to stay transparent (CS: however, at primary school when people start using heavily the water becomes even browner?).

BP will go down to repair the pumps but wants to see the report of Seagle first.

Luke says that every time (most times?) BP goes down to the area, it is by their own good will; they are not paid by DBF to check on the pumps. There appears to be no accounting system, and no reports are written following pump installation. If they are alerted to a problem with the pumps, BP sends a BP technician who happens to be in the region to check on the pumps.

Regarding the frequency of repairs, each pump is designed for a maximum use of 150 people. If more than 150, it puts extra stress on the pump and creates problems. The pump can also run dry. There are engineers here but no geologists – they are foremost a company. No samples were taken from the pump locations prior to drilling.

Necessary parts: the tige (material is not very good, breaks easily), handle, PVC (and special glue). The valve, which needs to be changed regularly, can be replaced with bicycle tires.

If a pump was installed on a faulty borehole (ie the hospital probably), it must be moved/replaced. Serge mentioned that, in terms of site location, BP simply drills the boreholes according to what Baba and the MadaTeam tell them. The drilling team does not consist of engineers; there is a possibility that there was no initial [technical] study of suitable pump locations. However, in practice there should be one engineer present to advise on pump location during each pump installation.

With regard to turbidity/brown or red water, BP says that it cannot be fixed after two yrs. It is a problem of the 'dévéloppment'. The idea is that the dévéloppment will be continued by users through using the pumps actively. Regarding the dirty (muddy) pipes, perhaps the decante/screen was damaged during pump installation.

If DBF decides to cover open wells, BP would cover them a canzee pump, thus rendering the wells still useable (and potable).

Water quality can be tested in Fianarantsoa, though the bacteria life-span is only 6 hrs so it would probably have to go by 4x4. There are kits available to test water quality, turbidity, bacteria, etc., but they cost 2000-4000 Euros. But then quality could be tested on the spot.

TIAVO/toughstuff –

TIAVO is a microcredit organisation that engages in two main activities: 1) the collection and redistribution of money (acting as a bank); 2) offering loans to members. One has to be a member in order to obtain a small loan. While this has worked well for some members of the communities, it has indebted others who cannot pay off their loans. Upon entering TIAVO's office, we saw a poster with the photographs of at least 10 individuals in the Marofarihy area who were "wanted" for not paying back their loans within the allotted amount of time. We were not permitted by TIAVO to take a picture of the poster.

TIAVO began renting out TS in 2010. The primary users are families who own a commercial enterprecise (merchants) who sell products at the market during the night. There are 10 households who use TS regularly. Some have bought both the solar panel and lamp for 90,000A. Half of the users are satisfied with TS, half are not; those who only want light appear to be happy with the product though those who want to charge telephones, radios, televisions, etc. and less satisfied. TS also depends on the climate; in the winter, there is not always enough sunlight to charge a lamp. Those who do rent a lamp for a day must return it the following day so it can recharge. The TIAVO staff has not heard of JIRAMORA nor BushProof. Similarly, there appears to be no contact between BushProof and TIAVO.

Joeline participated but was not satisfied; the light emitted is not as good as a normal watt lamp. For 1500A, one can buy 3 batteries (*pils*) which last 21 days with a normal light emittance; with toughstuff, one rents a lamp for 200A per day and it is not as luminescent. This works out to being 4,200A/21 days for toughstuff versus 1,500/21 days for normal batteries (though excluding the cost of the torch). Thus in Joeline's opinion, TS is more expensive and less efficient. In terms of local use of TS, people prefer to charge telephones at the hotel where there is a *groupe électrogène* (generator). The perception is that it is faster than the *plaques solaires* (solar panels), which take all day to charge.

TS has some sort of partnership with Conservation International (CI). During a publicity tour, where a CI/TS representative with a loudspeaker came to Marofarihy with two trucks full of both TS and CI employees, half of the sénsibilisation was dedicated to promoting TS (with partner TIAVO and FIANTSO) and half to environmental education (primarily targeting children).