

The Madagascar Water Project

Phase III Program Report



September – October 2016

Introduction

PESM, now known as the Madagascar Water Project, has been drilling water wells in eastern Madagascar since February 2015. The Phase III Program of the Madagascar Water Project was conducted in September – October 2016. The focus area of the field work is along the east coast of Madagascar and a total of eight wells were drilled, six of which were successful. Significant progress was made in technical developments that will help expand the scope of future operations, and organizational and social development that will ensure the sustainability of the Program.

The Phase III Program accomplishments include the following:

- Perform routine maintenance and repairs on the 16 existing wells in the Andovoranto, Vatomandry, and Mahanoro areas;
- Continue to work with local communities to build a sustainable development infrastructure to capitalize on the water resource each well provides;
- Drill additional wells in the Commune of Tsivangiana in collaboration with the local Peace Corp Volunteer and at the request of local communities;
- Expand the drilling program in the Commune of Andovoranto to smaller outlying villages;
- Test the geologic and mechanical limits of the technology used and experiment with new technologies that have the potential to expand the capabilities of the program.

The original plan also called for the geologic evaluation and drilling of new wells in Mananara-Nord, in cooperation with the NGO Echoes of Madagascar, and to place pumps in villages along the NW coast, most notably Ampasimpitily. Since logistics required a minimum of a week to visit each place and time was running short, these programs were deferred.

People

The Director General, Frederick Rittelmeyer, and the Field Services Coordinator, Solo Andrianavalona provided the pre-planning, procurement and logistic functions. Hilaire Razanadrafely and Larry Rabenorosa joined the field team as the Community Relations & Development Coordinator and Geologist respectively. Their contributions will bring the Project much closer to sustainability. The Andovoranto Drilling Team traveled to Vatomandry and Mahanoro for the first time and two additional Drillers, Lahiaby and Lefeno were hired locally in Tsivangiana. Their work will help bring the Project closer to a sustainable operation in the area.



Andovoranto Drill Team, from left: Dimanche, Fred, Solofo, Sedera, Desire, Solo

Mission Statement

To provide safe, sustainable and accessible water sources to rural communities in Madagascar;

To build an enabling environment within communities to manage and operate their water resources and to use them to improve community-based sanitation and hygiene.

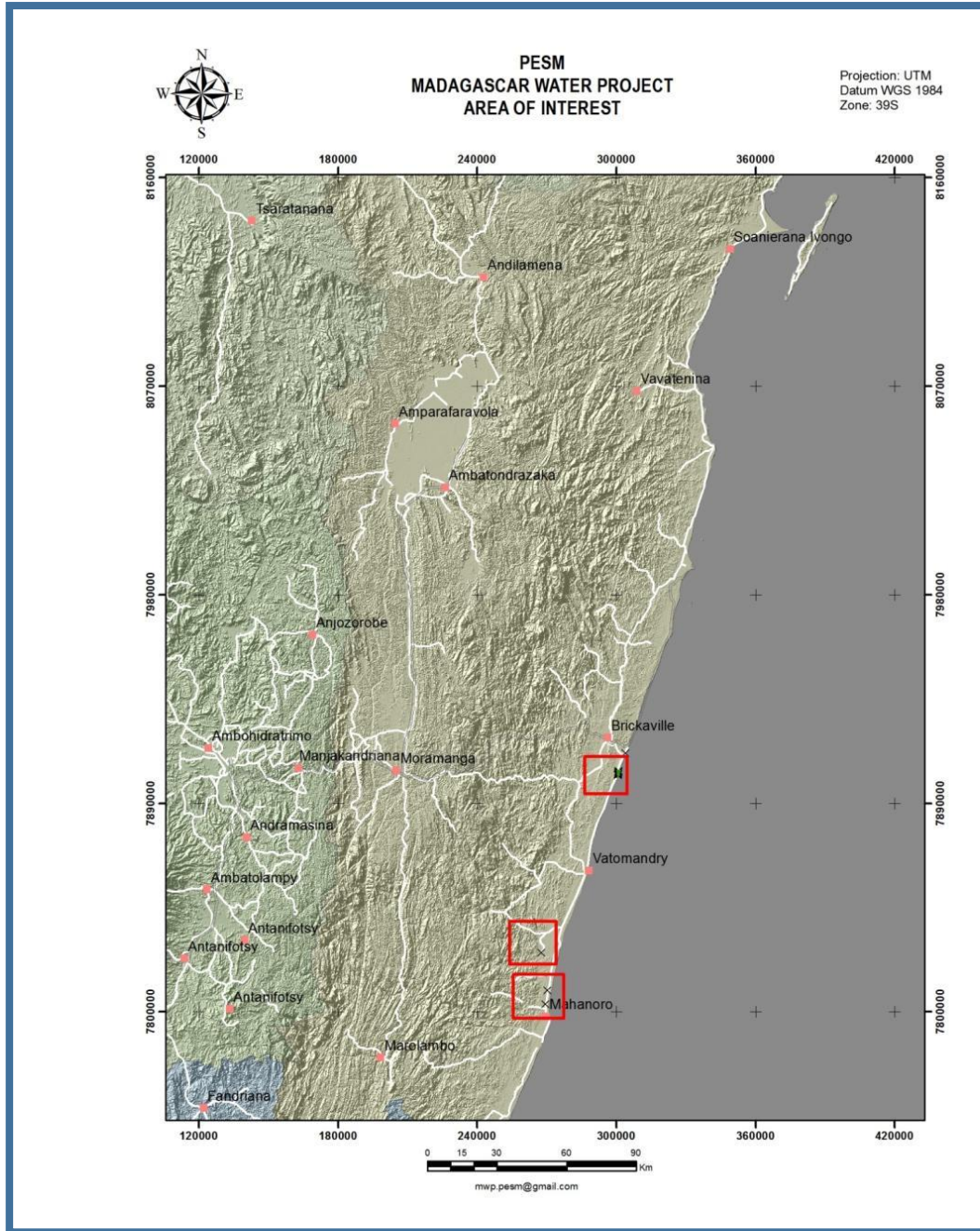


Tsivangiana: Lahiaby and Lefeno



Larry and Hilaire

Project Areas



The Madagascar Water Project has focused (N to S above) on the Communes of Andovoranto (14 wells), Tsivangiana (4 wells) and Mahanoro (3 wells). The Project has been successful in all three areas, although Tsivangiana has presented the greatest challenges.

When we arrive in a village we typically find wells that have failed due to lack of maintenance, open bucket wells that are under-utilized due to contamination concerns, and water sourced from nearby or distant rivers or the Pangalane Channel, which can be brackish at times.

The local communities readily accept responsibility for well management and welcome guidance to use their newly-acquired water resource to build a better quality of life for the village. The Madagascar Water Project provides the well at no cost to the village and a formal handover process is in place to ensure community ownership of the well is well-understood by all.

The Madagascar Water Project works to achieve sustainability by using locally acquired parts, local labor, repetitive training, periodic maintenance visits, remote technical support when needed, replacement parts and the organization and empowerment of Well Management Committees.

Moving forward, Solo is developing the skills to manage the Project, and with the participation of Larry as the Geologist and Hilaire as the Permit Man, the Madagascar Water Project can be entirely Malagasy. Sustainable progress of the Project mission will, however, depend on its' ability to get funding.

Drilling Program: Commune of Tsivangiana

The Madagascar Water Project came to the Commune of Tsivangiana at the request of the local Peace Corp Volunteer, Jennifer Nguyen. Geologically it is a difficult area to work because the quality of the underlying aquifer is poor. From a humanitarian standpoint, the needs are great with many of the villages having no clean water of any kind. Many get their water from rivers 100s of meters away.

The villagers are exceedingly appreciative of our efforts whether they end up with a successful well or not. The work in this area is exceptionally challenging and exceptionally rewarding.

Ambodivaro

Ambodivaro is a farming village of 250 people located on the road to Tsivangiana. The village has two bucket wells, one with a water depth of ~5 meters and the other temporarily dry during the dry season. They are not universally used due to the muddy nature of the water and the difficulty of getting water. Seeing the success of the water well drilled in Tsivangiana, the Chef of the Fokotany requested a well for the village.

One stratigraphic test hole was drilled to confirm the lithology in August 2016. The geology appears to be similar to the geology of Tsivangiana, which has very marginal aquifer quality. Since the Tsivangiana well produces moderately well, the decision was made to attempt a water well in the middle of the village.

The Madagascar Water Project worked with local officials to get land clearance and to form the Well Management Committee. The effort was successful and members of the Committee were well-engaged with the construction and management of the well. The Project hired two Drillers from the village, Lahiaby and Lefeno.



Drilling Operations in Ambodivaro

The Ambodivaro well was drilled to a depth of 8 meters. The top of the water table was found at a depth of 5.2 meters. The lithology within in the water zone consisted of brown clay-rich siltstone, with no sand or weathered basement red beds. Although there was free-standing water in the well, an attempt to flow the well was unsuccessful. The well was enlarged to a diameter of 6 inches and then completed with screens and a sand pack from 5 – 8 meters. The well flowed and the pump was installed. The well flows at a variable rate of 20 – 25 liters / minute and has maintained this rate for over two months.

The Ambodivaro well confirms water production is possible in relatively poor quality rock and will greatly expand the area we can expect to be able to make successful water wells.

Tsivangiana School Yard

Local officials and the School Master requested a well for the school yard. Since the school is some distance from the other wells in Tsivangiana and is located between the successful wells in Tsivangiana and Ambodivaro, the Project agreed to attempt to make a water well.



Tsivangiana School Handover / Dedication Ceremony

The preliminary Well Management Committee consisted of the School Master, the Chef of the Fokotany and a worker living next to the school. Several locations were evaluated prior to the selection of the well location.

The well was drilled to a depth of 8 meters and the top of the water table was found at a depth of 5 meters. The lithology within in the water zone consisted entirely of weathered basement red beds. In the past this has not been considered suitable aquifer quality, but free standing water was present in the well. With the success of the Ambodivaro well, the well was enlarged to a diameter of 6 inches and then completed with screens and a sand pack from 5 – 8 meters. The well flowed and the pump was installed. The well flows at a variable rate of 10 – 15 liters / minute and has maintained this rate for over two months.

This well shows water can be produced in the weathered basement red beds, although one could question whether the rate is sufficient. Given the well is located in a school yard and is not subject to high volume use, the pump was left in place. It continues to flow but is on watch to measure well performance.

These two wells have helped determine the line between a successful well and an unsuccessful well. The Ambodivaro well likely represents the lower limit of rock quality required to make a successful water well and the school yard well likely represents the best rock quality to be found in a marginal or unsuccessful well. Both locations provide an ideal setting to test new technologies to improve water production in poor quality aquifers. If the Project can make a successful well in red beds, the ability to provide clean water in very needy villages goes up substantially. The prospects would be limitless.

Ambodiramy

Ambodiramy is a large farming village of approximately 350 people. They rely entirely on one bucket well with water at a depth of seven meters. The village is not accessible to vehicles so a 15-minute walk is required to reach the village.



Larry, Hilaire and Peace Corp Volunteer, Jennifer Nguyen entering Ambodiramy

Local officials, through the Peace Corp Volunteer, made a request for a well. Although similar efforts to drill a well there have failed in the past, the Project agreed to drill a well because of the high humanitarian need and proximity to water in the bucket well.

The preliminary Well Management Committee consisted of the Chef of the Fokotany and other social leaders (elders) in the village. Several locations were evaluated prior to the selection of the well location and proper clearances and written permissions were obtained.

The well was drilled to a depth of 9 meters. The upper portion of the hole was sandy, but the lithology changed to a light brown clays-rich siltstone at 4 meters. The top of the water table was encountered at 6 meters. Since there was free-standing water in the hole, a screen was run and a pump was installed. After several hours of pumping over a period of two days, sustainable flow rates could not be achieved. The well was abandoned.

The need for clean water in Ambodiramy is quite extreme. The Madagascar Water Project will continue to work to develop a way to get water to this village and others with similar needs. A water pump with deeper production capabilities was used on the next well in Ambandrika.



Drilling the well in Ambodiramy was different than most and unfortunately unsuccessful.

Ambandrika

Ambandrika is located on a bluff at an elevation of 12m, with a stream running along the south side of the village a few 100 meters away. It is a farming village of approximately 60 homes for 300 people and they rely entirely on the river for their water. The need for clean drinking water and a water source closer to the village is very high. The village is not accessible to vehicles so a 20-minute walk is required to reach the village.



Village of Ambandrika

A core hole drilled to 9 meters in August 2016 encountered good quality sand at 6m but the top of the water table was not reached. For that reason, a deep production system developed by BushProof was selected for this location. A hole was drilled to 9 meters. Good rock quality and water were found at a depth of 6.8 meters, which is the depth limit of the pumps we normally use.

The BushProof pipe and pump system were run several times but the well failed to flow. The problem likely lies in the tight tolerances of the pumping system rather than the geology. Since BushProof cut the pump kit for a 9 meter hole and the casing became stuck off-bottom at 8 meters, we were not able to get the proper valve spacing required to produce water. This system or something similar has great potential to expand into areas with deeper water.



This well was completed using the BushProof Pumping System. Although unsuccessful in the Ambandrika well, it has the potential to expand projects into many new areas where the top of the water table is deeper than seven meters.

District of Mahanoro: Ambilabe

Ambilabe is a farming and fishing village located near the Pangalane Channel. They have one well drilled by UNICEF several years ago, and one drilled by the Madagascar Water Project in February 2016. The Well Management Committee requested two more wells be drilled in the village and the Project agreed to drill one additional well at this time.

The geology is perfectly suited for our drilling methods. The lithology is predominantly sand and the water table is well above the seven meter limits of the hand pumps. The well was drilled to the top of the water table at 3.3 meters and a stainless-steel sand screen was hammered to a total depth of 5.2 m. The well easily flowed 30 liters / minute.



Productive well in Ambilabe

Ambilabe is quite poor, even by local standards. Shallow water wells can be built quickly and at a very reasonable cost. They are a very cost-effective way to provide the community with a stair-step to improve their condition.

Commune of Andovoranto

Andovoranto is a core area of development for the Madagascar Water Project. Eleven wells were drilled prior to the Phase III Project. The Project has developed a good relationship with the Mayor and other local officials. They suggested our work move to one of several out-lying villages in the Commune.

The figure on the next page is a GoogleEarth view of the village of Andovoranto showing the nine MWP wells located there. Two Well Management Committees were organized and the wells are maintained by the Committees with some assistance from the Madagascar Water Project Andovoranto Drilling Team.



PESM MADAGASCAR WATER PROJECT ANDOVORANTO PARCEL SUBDIVISION

Projection: UTM
Datum WGS 1984
Zone: 39S



- ▲ Wells_PESM
- Parcel I
- Parcel II
- Parcel IV
- Parcel V
- Parcel III



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Kalomalala

After discussion with local officials, the village of Kalomalala was nominated for two wells. It is located about 6 km south of Andovoranto along the Pangalane Channel, on what is now the old, now abandoned, road to Vatomandry. It is a fishing village of approximately 400 people and relies on water from one open bucket well and the Pangalane Channel.



Route to Kalomalala, located on the left

Several meetings were called by the Mayor, Chef of the Fokotany and village elders. A Well Management Committee was assembled, well locations were selected and written permissions were obtained.

Two wells were drilled at each end of the village. The top of the water table was found at 4 meters and stainless steel screens (aka well points) were hammered to 6 meters. The wells flowed on test and a field test for water salinity indicated the water was fresh.



Members of the Well Committee undergoing training to maintain and repair the well pumps. The tool and spare parts required for the work are provided by the Project.

Flow tests for each of the Kalomalala wells were excellent, exceeding 30 liters / minute:

Well 1



Well 2



Andavakimena

Andavakimena is located at the ferry crossing on the road from Brickaville to Andovoranto. It is a fishing village of about 50 homes with 250 residents and the ferry is also a significant part of the village's economy. The village is divided into two parts on each side of the Pangalane Channel.

The village has two bucket wells that are under-utilized due to concerns of contamination and water salinity. The Madagascar Water Project drilled a well there in February 2015 and the village has efficiently managed and maintained the well. Both sides of the village were using the well and they requested a second well for the other side of the village. The Project agreed to drill the well.

The Project had a meeting with local officials and village elders and a site on public land was selected. The well was drilled to the top of the water table at 3.5 meters and a stainless-steel screen was hammered to a depth of 5.5 meters. The well flowed at a rate of 30 liters / minute and the table was built. A dedication / hand-over ceremony was held and two members of the Well Management Committee were trained to maintain and repair the pump.



Preliminary well testing of the Andavakimena well

Summary

The Phase III Program of the Madagascar Water Project was conducted in September – October 2016. Eight wells in six villages were drilled and six wells were water productive. When technical and social development is considered, all were very successful. Clean water supplies were provided to an additional 1000 people in three new communities. Technical advancements were made that will impact and expand the Project's ability to move into more communities. The Project's development into a more sustainable organization also advanced considerably.

The Madagascar Water Project drilled wells in core areas and expanded its' reach into several new villages. The target communities are those that have little or no access to clean water and have underground water resources that can be developed with the technology employed by the Project. Some of the villages live in relative comfort and others live in indescribable poverty. More than half the beneficiaries are children.

The chart below lists the wells drilled in the Phase III Program and their impact:

Commune	Village	Well No.	Status	No of New Beneficiaries
Andovoranto	Andavakimena	2	30 liters/min	100
Andovoranto	Kalomalala	1	30 liters/min	200
Andovoranto	Kalomalala	2	30 liters/min	200
Tsivangiana	Ambodivaro	1	25 liters/min	250
Tsivangiana	School Yard	1	15 liters/min	100
Tsivangiana	Ambandrika	1	Temp Plug	0
Tsivangiana	Ambodiramy	1	<10 l /min	0
Mahanoro	Ambilabe	2	30 liters/min	150
Total				1000

The Madagascar Water Project is expanding into needier areas with water resources that are more difficult to develop. Technical developments with pumping systems that can produce from deeper depths have been tested and are now better-understood. Our knowledge of the geology and reservoir quality has matured, and methods that can be used to produce water from lower quality aquifers have been developed and used successfully. The line between success and unsuccessful has been better defined and on-going work is done to lower the bar.

The Madagascar Water Project has made large steps towards sustainability. A Community Relations Coordinator, Hilaire, was employed and he has made great progress in the development of community participation and ownership, and the formation and empowerment of the Well Management Committees. The Field Operations Coordinator, Solo, now has the knowledge and experience to plan and execute drilling, well maintenance and field training programs. The Geologist, Larry, contributes his knowledge to perform well feasibility studies and refine well locations. For the first time

outside funding was obtained through a GoFundMe campaign that succeeded in collecting 30% of the funds required for the Phase III Program. Fred is currently working on proposals to pursue funding through government and corporate resources.

The Madagascar Water Project has no competition. Very few organizations are working in the area and many of those that have placed wells in the villages do not support them after the initial installation. The Madagascar Water Project aims to be an important part of the area for years to come.