Integrated Water Resources Management

Dry Sanitation Technology: The Solution

Tuvalu's Integrated Water Resource Management Project: Water conservation and wastewater management

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Abstract

Tuvalu has little access to groundwater, what is available is brackish and polluted; as such Tuvalu is reliant on household rainwater harvesting. During dry periods, communities often experience water shortages resulting in problems with health, hygiene and sanitation. On the capital island of Funafuti, water storage has been increased by 10,000 litres per household, and a desalination plant introduced. Despite these measures, water shortages are still prevalent.

In addition to groundwater being polluted; poorly constructed septic tanks contribute to pollution in the lagoons and coastal areas. This pollution is dangerous to the health of the community and contributes to the deterioration of local marine ecosystems. This coral is particularly important as it is Tuvalu's natural defence against coastal erosion and sea level rise as well as being a source of naturally occurring sand.

From the 2005 IWP (International Waters Project), dry sanitation technology (composting toilets) was identified as a potential solution to both issues. Composting toilets require no water as opposed to popular flush toilets which typically consume 30% of household water, and possibly higher during drought periods. Further to this as the waste in composting toilets is contained until all harmful pathogens and bacteria have decomposed; impacts from sanitation on human health and groundwater pollution are likely to be virtually eliminated, as well as generating a valuable resource (rich compost) in a sandy atoll.

The GEF IWRM Tuvalu demonstration project is introducing compost toilets in Tuvalu with the view to changing a nation's sanitation. A minimum of forty will be placed in volunteer homes, supported by awareness campaigns, champions and targeted engagement strategies. The aim of this demonstration is an independent uptake of composting toilets by the community.

A challenge facing the introduction of composting toilets is the community's initial reluctance to accept the dry sanitation technology as clean and hygienic. Nevertheless, as a result of awareness raising activities, attitudes are changing; increased numbers of families are requesting composting toilets. A major step forward in positive awareness is the 91% of recent study participants who consider composting toilets "a good idea". The term "composting toilets" confused the community and fed negative misconceptions. To create a positive association, "Falevatie" is now the term used locally for toilets constructed by the IWRM initiative; this is an abbreviation of "*a toilet which saves water and is good for you and the environment*".

Composting toilets have a vast potential for replication in other Small Island Developing States. Not only are they financially sounded - both cost effective and efficient; the technology reduces water demand by 30% (in most households), increasing the communities and individuals water use efficiency, increasing sustainability and climate change resilience. Moreover, composting toilets are especially important on coral atolls where land quality and size is not sufficient to allow correct management of sewage and sludge.

Introduction

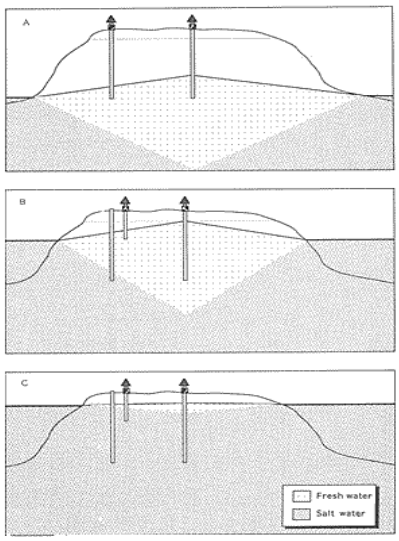
Tuvalu is on a social journey to adopt composting toilets (ecosan) to help adapt to water shortages, groundwater pollution and climate change. This paper outlines the need, the use and the future of composting toilets in Tuvalu, with a focus on the introduction and acceptance of dry sanitation technology into the community. The approaches used and refined to engage a sceptical community will be discussed, and the lessons learned presented. Topics include rainwater harvesting and the coast, dry sanitation technology (composting toilets), challenges and lessons, replication.

The Pacific nation of Tuvalu sits north of Fiji and is made of eight small coral islands, with a population of almost 12,000. The capital island of Funafuti has about 40% 0f the inhabitants with over 4,000 and is the main focus of this project.
Two major challenges confronting Funafuti are water shortages and wastewater pollution, ultimately impacting on the coral lagoon. Both of these issues can be effectively addressed by the adoption of composting toilets as the preferred form of human waste sanitation management.

Rainwater Harvesting and the Coast

Tuvalu has little access to groundwater and what is available is brackish and polluted (SOPAC 2007). A collection of factors contribute to this result, namely hydrogeology, salination of groundwater by king tides and septic tank pollution.

<u>Hydrogeology and Sea Level</u>



Funafuti has a small water-table; however, the hydrogeology of Funafuti means that there is no fresh groundwater source. The freshwater lens in atolls, including Funafuti, is formed by rainwater floating above the seawater; the amount of fresh water in the lens is a balance between what is added and what is withdrawn or lost through discharge or tidally driven vertical mixing (Falkland 1991). As a coral atoll there is a substructure of porous coral rock and sand, through which water readily moves and is exchanged. Additionally, land is narrow, at some points little more than a few meters, and the groundwater lens is as narrow as the land. The lens is only recharged by local rain and leakage/seepage from pipes and septics. During dry periods recharge decreases and the remaining fresh water mixes and becomes brackish.

Figure 1 (Titus 1990)

A further pressure on the fresh groundwater lens is the rising sea level, the effect being more pronounced in atolls than in larger, less porous islands (Titus 1990). The existing Funafuti groundwater is brackish, with limited current use; it is too saline for agriculture and or septics (where the salinity reduces their efficiency).

Funafuti has two small desalination plants; however, as well as being challenging to maintain, these cannot produce enough water to meet the needs of the island during periods of drought. Funafuti is therefore reliant on rainwater harvesting. During periods of water shortages, common practice dictates that the community defecate on the beach or in the limited island bush.

Septic Tank Pollution

Through the Millennium Development Goals (MDGs), UNICEF and WHO target "improved sanitation systems" such as sewage, septic tanks, pour flush latrines, and pit toilets as an essential step in combating issues in hygiene and human waste.

In line with this philosophy, the 2002 Government of Tuvalu census recorded 634 houses with improved sanitation systems and 212 homes with no human waste sanitation system. Incidentally compost toilets at that point in time would not have been considered or recorded as an improved sanitation system. However, these same pit-based systems are causing significant groundwater contamination on Funafuti, consistent with findings of the Pacific Islands Regional Millennium Development Goals Report of 2004, that *"small islands pit toilets can cause direct contamination of groundwater"* This is due to a range of causes aside from a high water basin.

Insufficient soil quality (organic and fines proportions), depth to groundwater and area for irrigation in Tuvalu mean that septic tanks cannot function as they are designed (Saloa 2005). There is insufficient area for adequate effluent distribution and runoff is not correctly treated before seeping to groundwater. A septic tank audit of Funafuti in 2001 (AusAID 2001) identified that 96% of septic tanks on the island were not suitably constructed. To further compound this issue, there are no septic tank pumps to desludge the septics, nor an operational sludge treatment plant on Funafuti. As such poorly treated wastewater is discharged to groundwater and excess sludge is simply removed to pits dug beside the septic tank. This practice is a major health and environmental hazard.

The resultant contaminated groundwater, causes significant health problems for the community. In 2006, the economic impacts of the untreated wastewater were estimated as between AUD$304,000 and $576,000. The highest component of this was identified as human health costs, at about 83% (Saloa 2005).

Groundwater pollution from septic systems is dangerous to the health of the community and contributes to the displacement of fish and coral in the coastal regions. The coastal areas of Funafuti are a major source of livelihood and also contain marine biodiversity of conservation value. These areas are under threat from poor solid and liquid waste management. Funafuti lagoon shoreline adjacent to settlements is degraded and showing signs of contamination (SOPAC. 2007). Increased pollution from leaking septic tanks affects productivity of the coastal waters (Kaly. 1998) through eutrophication of lagoons. Eutrophication supports the growth of algae in Funafuti lagoon, and the reef on the ocean side of the island is severely degraded. Destruction of marine habitat has been observed in the Conservation Area on the far side of the lagoon. The Conservation Area offers significant potential for eco-tourism and this is being threatened by the current lack of effective waste management (NWSC 2008). Coral is particularly important as it is Tuvalu's natural defence against coastal erosion and sea level rise as well as being a source of naturally occurring sand.

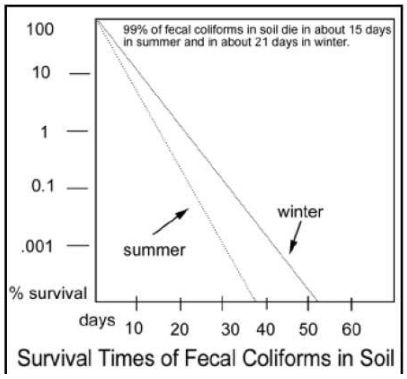
Research conducted under the IWRM project identified a significant change in perception of fishing over the past ten years (66%), with comments including "fish have moved away", "only able to catch small fish", "fish are poisonous" and "have to travel further to find fish". As a source of food, it can be assumed that for most families this extra effort puts a strain on everyday life.

Dry sanitation Technology

The Tuvalu International Waters Project (IWP) identified dry sanitation technology (composting toilets) as being of economic value (Saloa 2005). If all Funafuti residents were to convert to composting toilets (often referred to as ecosan toilets), Tuvalu could expect to save approximately AUD $2 million each year, offset against increased costs of approximately AUD $100,000 annually. At a household level it is estimated that construction cost of AU $900, and a minor economic benefit of about AUD $80 per household from the compost/soil that is generated. Additionally, since composting toilets do not need water, residents can expect to realise an economic savings in the shadow value of water that would have otherwise been used in toilet flushing. The choice of technology based purely on financial costs suggests compost toilet (new construction) as first in order of preference.

As a potential solution to both aforementioned issues of wastewater pollution and water shortages, composting toilets come out on top. Compost toilets require no water as opposed to current popular flush toilets which typically consume 30% of household water (according to research conducted by the Government of Tuvalu Water Sector). Further to this as the waste in composting toilets is contained until harmful pathogens have decomposed; impacts from sanitation on human health and groundwater pollution are likely to be virtually eliminated, as well as generating a valuable resource (rich compost) in a sandy atoll nation.

Figure 2 (Sopper and Kardos 1973)



For the use of this discussion, a brief overview of how compost toilets function is provided. Compost toilets do not use water for flushing. Instead, waste is disposed of into an aerated container with natural pulp such as coconut husks, leaves and woodchips. The bacteria naturally found within this environment aerobically breakdown the waste, as it decomposes heat is produced, which accelerates pathogen destruction (Figure 2). The end product is a safe compost (free of harmful pathogens) (Jenkins, 2005) which can be used productively as a soil conditioner, even on food crops. For a compost toilet to be effective it is important for a correct balance of moisture, air and pulp to be considered. All compost toilets must have good ventilation, a pipe for excess moisture and an absorption trench (or effective evaporation process). Pulp must be added at every use to aid aerobic breakdown, ideally the waste should be periodically stirred for this same reason.

The time it takes for human waste compost to fully decompose and all harmful elements destroyed varies in relation to the temperature of the compost, and factors such as moisture, aeration etc. However, a minimum of 12 months is advisable as helminths may survive for this period in ambient temperatures (Schönning and Stenström, 2004). The composting end product continues to be safely used in agricultural production around the world.

The Tuvalu Project

The GEF IWRM Tuvalu demonstration project is introducing composting toilets in Tuvalu with the view to changing a nation's sanitation practices. This project will demonstrate how composting toilets are constructed, used and maintained and will provide necessary training and capacity building to enforce this introduction. It is proposed that once the community, stakeholders and government fully understand the process and realise its benefits to the environment, community and economically; composting toilets will be embraced. Whilst the motto of the IWRM Tuvalu project is "Build it and they will come", considerable intelligent awareness raising and training and a significant amount of work focussed on community engagement, are critical to facilitating the uptake of composting toilets. The long-term goal is that in the future dry sanitation technology, composting toilets, will become the preferred form of sanitation on Tuvalu.

The GEF IWRM demonstration project will install a minimum of forty compost toilets in volunteer homes. For the use of this discussion we will consider three suitable compost toilet designs; the Natre-loo, Rotaloo and twin chamber. Many other designs exist; however for Tuvalu, low tech cost efficiency is necessary to ensure success. The basic principal of composting toilets requires time, an escape for excess moisture and plenty of aeration.

Working on the need for aeration, the Nature-loo design includes a specially designed sealed bucket beneath the pedicle which catches waste through the cute; this bucket is well aerated with aeration pipes to assist the composting process. When full the bucket is exchanged. The Rotaloo design is created with ease of use in mind; this design involves a plastic circular box containing six segments. As each segment is filled the segments are rotated so that a new (empty) container is under the toilet waste chute. In the time it takes for the original segment to return to the starting point the waste has decomposed to compost. This segment is then removed, emptied and replaced. As previously stated, the twin chamber is devised of two static chambers and unlike the Nature-loo and Rotaloo it is the toilet pedicle which is moved not the chambers.

Through interviews conducted with owners of various composting toilets here in Tuvalu, the Nature-loo was eliminated as a suitable option in Tuvalu for the following reasons. Although the compost produced was good and everyday use was satisfactory and free from smell and mess, it is clear that the structure for the toilet was very high and so steep steps lead to the toilet, additionally it was noted that replacing the nature-loo bucket was a disadvantage, being a difficult and time-consuming job, the lining up of the shaft and ventilation pipe complicates the task, the smell and mess made it unpleasant.

The Rotaloo is advantageous over the Nature-loo as it compact and so does not take up as much space, its segments are manageable and easy to lift and move. It is visually pleasing with good ventilation. Like the Nature-loo it is pre-constructed and so easier to install. However, the containers (segments) are considered too small for daily use by the average Tuvaluan family, there are larger containers available but these are high giving the same problem of steep steps found with the Nature-loo. Other issues considered include; changing and emptying of segments, misuse of containers, difficulty in rotation movement of segments when full and unpleasantness of touching the containers. It is also noteworthy that when working well the Rotamould is very good, however should difficulties arise it would be very awkward, messy and difficult to fix.

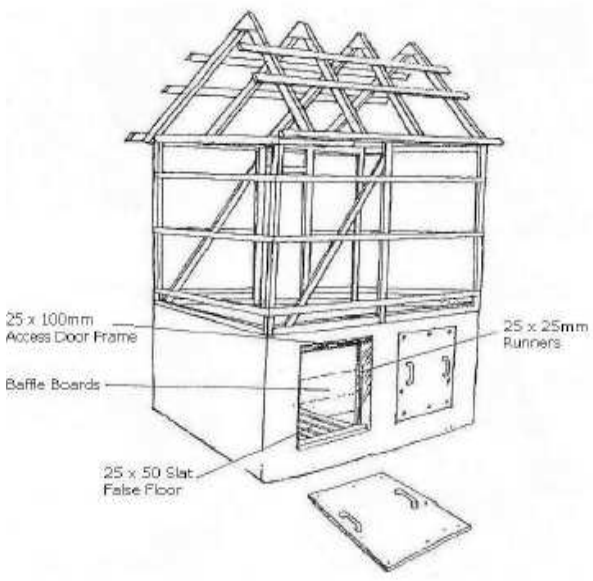
As a final note, unlike the twin chamber, both the Nature-loo and Rotamould are premade and thus expensive. The twin chamber is recommended by the IWRM Tuvalu project as the simplest and most effective design. The design is such that there is no off putting smell or visual aspects and it is not necessary to touch any waste material or buckets prior to the six months decomposition period. It is cost effective and sustainable, once built it should not incur further costs for ten years. Its large capacity, cleanliness and simplicity make it the ideal composting toilet for small island developing states.

A Design Committee of local architects, builders, and water quality officers worked to under the IWRM project to design a system suitable for Tuvalu. The design, taking into consideration ease of access, use and replication, local geology, available materials, local

lifestyle and social perceptions and preferences; has three differing variations of the design to suite different home structures.

The design selected is a “twin chamber” (Figure 3) [Designs for Nature-loo and Rotaloo can be found in Appendix 1]. Here, there are two separate chambers under the toilet-room for collecting waste, both with large enough capacity to last a family of ten a minimum of twelve months. Each chamber has a waste chute (toilet pedicle), excess liquid outlet pipe and absorption trench as well as a ventilation pipe. Once the first chamber is filled the waste chute is covered and the next chamber used. This is done by either moving a toilet pedicle from one chute to the other or using two toilet pedicles. Once the waste is decomposed to compost, the chamber is emptied with a shovel before being used again. What is emptied is safe usable compost.

Figure 3 (Crennan 2004)



The pilot toilet construction will be supported by awareness campaigns, local champions and targeted engagement strategies. Most importantly, throughout the project, construction and design techniques and skills will be shared with relevant builders, the community and other stakeholders. The aim of this demonstration is an independent uptake of composting toilets by the community. As such all parties involved with construction must be familiar with the correct process, in Tuvalu many people construct their homes themselves and so it is not only builders who must be trained on the correct process but all interested parties and future homeowners.

Challenges and lessons

A major challenge facing the introduction of composting toilets into Tuvalu is the community’s initial reluctance to accept dry sanitation technology as clean and hygienic. In addition to many misconceptions, due to lack of awareness, there is a difficulty in approaching the subject under a local taboo in discussing matters such as human waste disposal. A large hindrance can also be attributed to recent promotions of water seal toilets. In Tuvalu, the move from drop pit toilets (which are unhygienic and cause problems with pollution and sanitation) to flush toilets and septic tanks is recent. This move was initiated by

the Tuvalu Department of Health and placed strong emphasis for the need for water for toilets to be hygienic. As such, many consider compost toilets as drop pit toilets and so unhygienic and a step backwards.

Two surveys were carried out by the IWRM Tuvalu project in identifying initial issues and concerns within the community. The first, a survey of attitudes and perceptions, worked on research currently in place and identifies forms of communication within the community and popular misconceptions and gaps in awareness. A second, more in-depth survey, discovered the current status of toilets on the island and further discovered the communities understanding of wastewater disposal.

The first step taken by the IWRM Project was to dispel the confusion concerning compost and drop pit toilets. Whilst working with the community, informing them of the process necessary in composting toilets, it became evident that the term "composting toilets" confused the community and fed negative misconceptions. To create a positive association, "Falevatie" is now the term used locally for toilets constructed by the IWRM initiative; this is a Tuvaluan abbreviation of "a toilet which saves water and is good for you and the environment". The introduction of a new Tuvaluan word helps with an affiliation of progress and advancements in technology with the compost toilet, it is also synonymous with the design of the IWRM constructed and recommended toilets (twin chamber). Further to this, the world being a new Tuvaluan word means that the community feels a sense of ownership, that this is something belonging to Tuvalu, not simply another idea forced upon the community by outsiders. The use of quarterly and newsletters have assisted this as well as an information sheet taken to all homes within the community.

Awareness campaigning to date have been strong and taken on a range of forms. Much planning of promotion and engagement with the community developed as a result of surveys conducted. The project has been conscious on not preaching to the community but creating opportunities where members of the community can express concerns and ask questions.

Radio broadcasts have been used continuously to update the community on IWRM activities and composting toilets. IWRM survey results show that the strongest communication tool available is the use of radio to successfully communicate with the larger audiences. This is especially important when creating awareness within communities on the outer islands who cannot attend events on Funafuti. As such, events such as "Primary Challenge" have been broadcasted nationally.

Posters are useful tools to educate and bring awareness to the issues involved; strategically placed they can reach a range of audiences. To further engage the community, two poster competitions were held, one with youth groups (ages 16 – 30) another with primary school

children. Before the competitions were run sessions were held educating participants. Posters were displayed prominently at a government building during the King Tide Festival.

Tuvalu's King Tide Festival is a national environment awareness event which attracts a broad section of the community as well as international media. Working with festival coordinators and Alofa Tuvalu, the IWRM project participated in adult Environment Awareness Program and children's "Our Planet Under Water" events. All events were open to the public and in an interactive, relaxed and engaging atmosphere allowed the project to highlighted the dangers of septic tanks and the need for composting toilets in Tuvalu.

World Water Day (March 2010) saw the IWRM join forces with the Pacific Adaption to Climate Change project (PACC) and Ministry of Health to educate children of water related issues and composting toilets. The weeklong event included a nationally broadcasted quiz, in school sessions and interactive workbooks were produced.

Most notably effective has however been the Compost Toilet RoadShow. During the RoadShow, a pilot toilet was showcased by being displayed on a float and taken to different communities on the island. This gave members of the community an opportunity to inspect the toilet for themselves and discuss concerns they have with experts on hand. The new Tuvaluan phrase for composting toilets "Falevatie" emphasised ownership, games and entertainment ensured interest from the younger population (see pic below). This two day event resulted in over sixty volunteers coming forward to request composting toilets within their homes, a massive achievement when considering initial resilience to the idea of composting toilets.

As a result of such awareness raising activities, attitudes are changing; in a recent survey, when asked *"what is a compost toilet?"* 72% of participants had a positive response. Of these, 91% of participants thought composting toilets are a good idea. Furthermore, a recent Community Leaders workshop (end of session) questionnaire showed that of the attendants, 100% wanted composting toilets in their community whilst 93% wanted composting toilets within their home.

Additional research in the form of a household survey was conducted throughout 624 houses in Funafuti and accompanied a newsletter informing the public of the IWRM project, its aims and giving an overview of composting toilets. During this survey, 530 households replied "*yes*" to the question *"Do you want a compost toilet?"*

Replication

Composting toilets have a vast potential for replication in other Small Island Developing States (SIDS). Not only are they financially sound - both cost effective and efficient; the technology typically reduces water demand by 30% in most households, increasing the community and household water use efficiency and increasing sustainability and climate change resilience. Moreover, composting toilets offer significant advantages over other sanitation systems on coral atolls, where land quality and size is often not sufficient to allow appropriate management of sewage and sludge.

Cost efficiency and simplicity are the key to this potential. Composting toilets come in a range of designs and structures. However the basic principal is the same: generally, the simpler designs are kept, the easier they are to build and the more cost effective and useable they are in the long-term.

Many of the lessons learned in Tuvalu are likely to be directly or indirectly applicable to other SIDS and possibly other developing countries or small islands. Key success factors in the Tuvalu experience were: (1) considering constraints and opportunities presented by local conditions; (2) optimising use of locally available materials and (3) carefully considering and managing local perception. All were key considerations of the Tuvalu Design Committee.

(1) Local condition constraints and opportunities

The design constraints (and opportunities) associated with local conditions were identified by the Tuvalu Design Committee, including weather conditions, shallow groundwater, shallow rock and flooding from king high tides.

All materials used were suitable to withstand typical storms and cyclones and the climate (heat and humidity). In hot dry countries, composting toilets designs often include urine separating devices, others in cooler climate use electrical heaters to speed up the process. In Tuvalu, it is hot (25°C minimum to 30°C maximum), but not dry enough to warrant collection of urine as a resource, particularly as the moisture in the urine aids maintaining optimal moisture content during composting. The heat and moisture aid the decomposition process; so additives, design features or tools to aid composting (such as extra aeration pipes, periodic stirring of waste or glass panels) are not necessary for the successful use of composting toilets. High evaporation rates [1730 mm/year (Falkland 1999)] mean that it is also not necessary to be incorporate advanced drainage tools. Weather conditions also extended to human comfort in the instance of louvers for ventilation. The combination of shallow rock (typically less than 0.5m deep), shallow groundwater (also typically less than 0.5m deep) and tidal conditions, which see parts of Funafuti inundated annually, restricted designs to above-ground solutions.

(2) Optimising use of local materials

In Tuvalu, accessibility to many materials is also limited; however, for the design to be easily replicated by local builders beyond the project end, all materials had to be accessible and affordable. This concern was taken into consideration from the beginning of the design process and was ultimately one of the main influences in the design selected (twin chamber), as it can be easily created from available materials and does not impose the high additional costs of importation, prefabrication or moulding.

(3) Considering and managing local perception

In identifying key community concerns, local perceptions were considered in six ways:

i. Incorporating lessons learned from existing composting toilets, both successful and unsuccessful
ii. Asking the community's opinions and listening to the answers
iii. Engaging community members and leaders through targeted workshops
iv. Ensuring that community and other stakeholders were genuinely represented in the Design Committee
v. Increasing community ownership of the toilet through targeted strategies
vi. Increasing the project and support team capacity in technical aspects and community engagement

Initially the design committee visited composting toilets currently in use on Funafuti and assessed their appearance, design, structure and use. Interviews were conducted with the owners of successful composting toilets, and it was noted that the toilets were regularly used by large families, well maintained and free from smell. Comments concerning maintenance and problems arising with the toilets were noted and considered further during the design process.

Unsuccessful composting toilets were also visited. Constructed under aid funded projects, these toilets were built as public toilets and were not given to the care of one family. Due to vandalism their use and appearance could not be assessed, their design and structure were. It could be noted that these disused toilet contribute strongly towards the negative perspectives within the community that composting toilets are dirty and unhygienic. From this experience, it was clear that all toilets constructed needed to be properly maintained and, if given under aid, to be put under the care of individuals will to accept the responsibility for their upkeep. This is key in maintaining a positive image of the product.

Following the initial assessments, workshops were held with members of the community and community leaders. Through discussions, many misconceptions and attitudes were highlighted, likes and dislikes of designs (such as compost toilets as outhouses) were also noted. And finally, as part of an attitudes and perception assessment, a survey of 123 participants noted their dislikes and perceptions of composting toilets.

Throughout the project, strategies to address community concerns and increase ownership have been in place. This includes the creation of a new Tuvaluan word "Falevatie" and an emphasis on increasing understanding during all awareness raising activities. For a new system to be established, both the benefits of the new system and the problems with the current system need to be widely understood. The need to protect Tuvalu's natural resources (clean water and marine livestock), increasing sustainability and decreasing dependency has

to be brought to focus so that members of the community stop asking “Why should I care? How will it impact on my life?” and instead ask “How can I protect what is ours?”

All of the aforementioned information collected were considered during Design Committee meetings. Additionally, as locals, the members of the design team themselves understood many issues that the community may have with composting toilets especially when considering day to day use and maintenance. An example of consideration of local sensitivities was the dismissal of a model used in Samoa with tinted glass to accelerate decomposition - in Tuvalu it was considered this would offend sensibilities.

Outcomes of this process were the selection of the cleanest design in consideration of people’s sensibilities; considering family sizes the capacity of the chambers were increased and due to average available funds, a widely affordable model (the least expensive) was chosen. All of these additional considerations increased the suitability of the toilets.
In changing attitudes and perceptions of the community, commitment and belief was as important as a good understanding of issues and technologies involved. Training of all project staff from project management team to research assistants emphasised the national implications of continuing with current sanitation systems. Additionally, other specialists and project managers of similar projects gained understanding and helped transfer information to the community.

One such event, the Compost Toilet RoadShow, involved specialists and project coordinators assisting by giving information and encouraging the community. The RoadShow showcased a pilot composting toilet designed by the Design Committee to all communities. Through the event, not only were there community able to assess the toilet, their (the community) reactions were also assessed. As a result of the RoadShow, the design was further reviewed and more refinements made.

Conclusion

Composting toilets are vital in Tuvalu to conserve water due to a lack of reliable water sources in a country entirely dependent on rain as the primary water source. They mitigate the health risks associated with failing septic systems, lacking infrastructure, and resolve the other major water challenge in Tuvalu, the contamination of groundwater by septics, ultimately resulting in degraded coastal systems.

General community reluctance to embrace what was seen as a backward step in sanitation is being overcome through a combination of sound design strategies and innovative targeted engagement strategies. A composting toilet suited to Tuvalu was developed by a design team supported by expert review. The engagement strategies targeted raising awareness and understanding of the issues and the proposed solution and fostering ownership of the solution

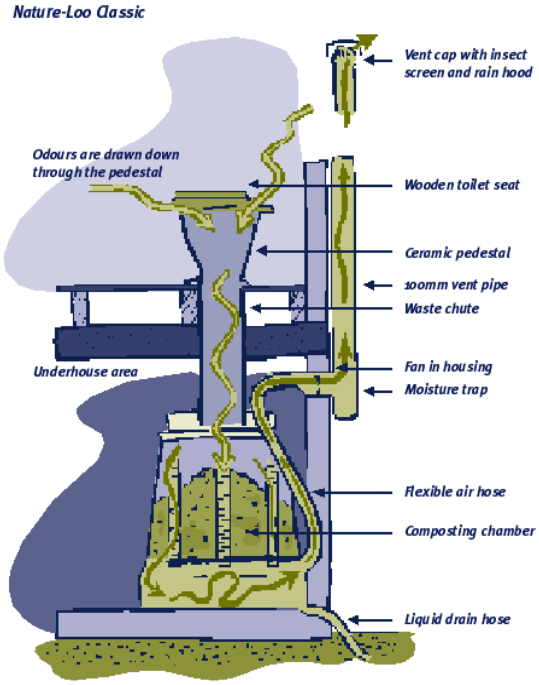
(through development of a new Tuvaluan word to name the toilet the “Falevatie”. The success in this integrated approach is evidenced by the massive oversubscription of the pilot scheme.

Composting toilets can be easily replicated in other small island nations. They fill an important niche in sanitation management, particularly on atolls keen to conserve water and reduce wastewater pollution. Learnings from the Tuvalu project will hopefully aid other countries in their efforts to improve island sanitation.

Appendix 1

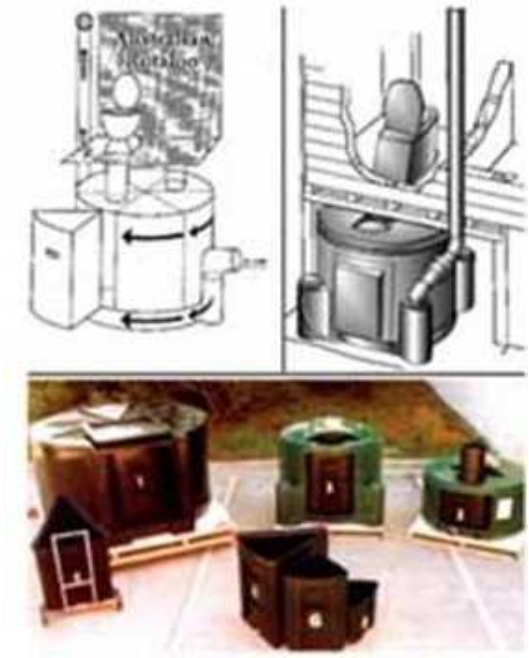
Compost Toilet designs

The Nature-loo



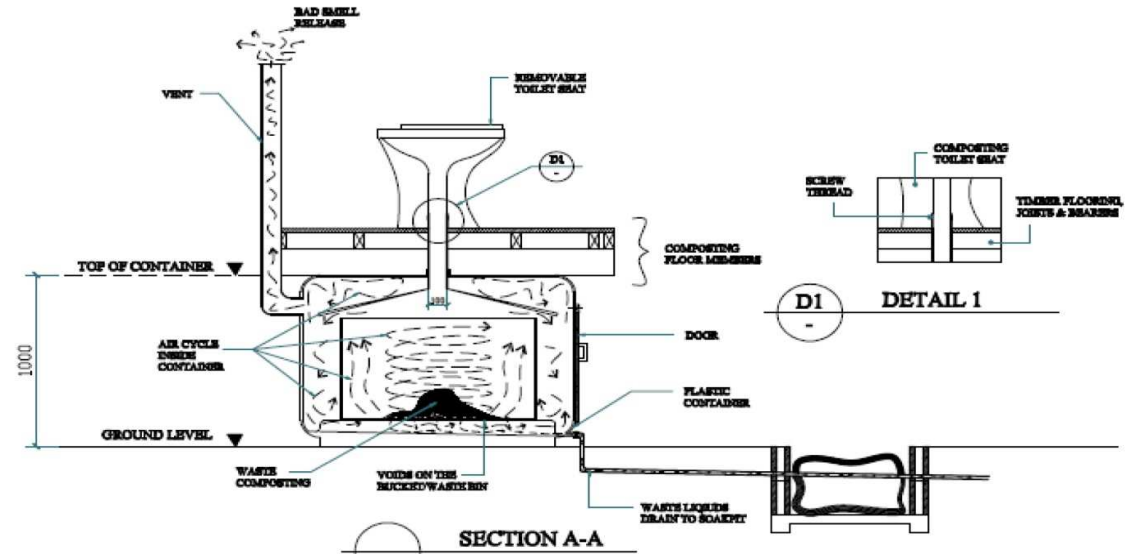
www.nature-loo.com.au

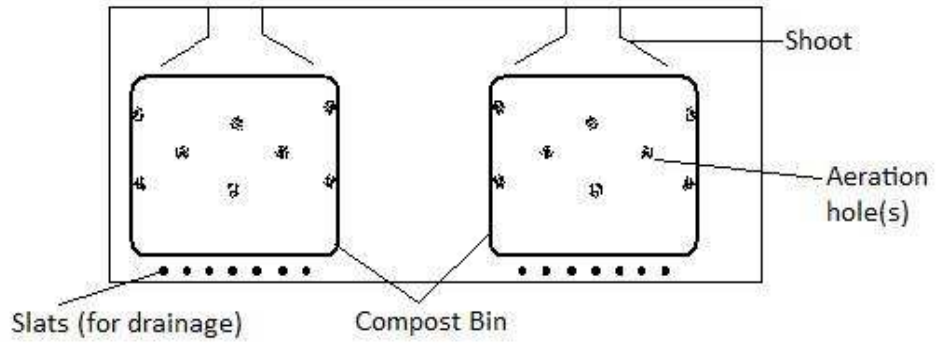
The Rotaloo

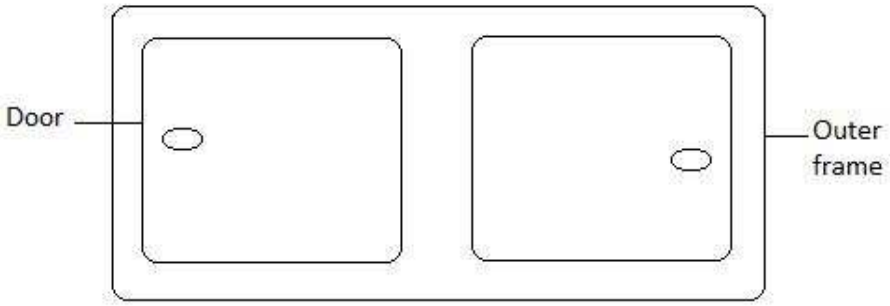


www.waterspecialist.com.au/Rotaloo

Twin Chamber







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