



KOROSAN

On-site Household Sanitation Guidelines for Fiji

#6 WATERLESS ecoVIP2 TOILET

1 PURPOSE

A safe, sustainable, effective and affordable sanitation system is an essential service for the health and wellbeing of all people. This guideline is aimed at rural dwellings that are not serviced by a reticulated sewer service, and where water-flushed toilets and associated wastewater management systems are not viable, appropriate, affordable, or desired. Such circumstances include: limited and/or unreliable water supply for flush or pour flush toilets, soil and site conditions that make liquid effluent management difficult or pose significant health risks, or where the costs involved in providing a fully functional water-based sanitation service are beyond the resources of the household or wider community. The available sanitation options then become pour flush or dry toilets. The two most common types of dry toilets are composting toilets or pit toilets. This guideline provides information for the design and construction of a special type of improved ventilated pit toilet called the ecoVIP2 toilet.

Guidance on choosing an appropriate toilet system are provided in KoroSan #1 and for assessing soils and site conditions in KoroSan #2. Other dry toilet options are outlined in the *Clean Communities, practical guide to building and maintaining toilets in the Pacific*, Live and Learn (2011).

2 UNIMPROVED PIT TOILETS

Pit toilets have been used in Fijian villages for many years. They are preferable to open defecation because they provide users privacy and security during toileting, and can reduce health risks by containing faecal wastes below the ground where the risk of contact by humans or animals is low. However, to avoid contamination of the environment they must be sited well away from waterways, areas with shallow groundwater, or where drainage and/or surface-water may enter the pit. They also need to be properly managed, including regular cleaning, maintaining a cover on the toilet pedestal (or squat pan) between uses to exclude flies, and emptying the pit or covering and moving to another pit before it over-fills.

In practice, many village pit toilets are poorly sited, constructed and/or managed, generating potential health risks via insect vectors (flies) and ground- or surface-water contamination. They often smell bad and are unpleasant to use.

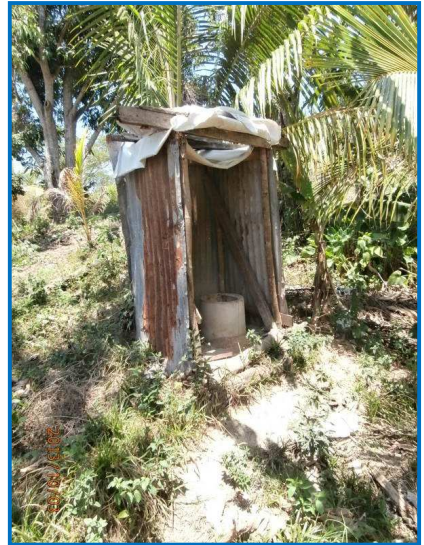


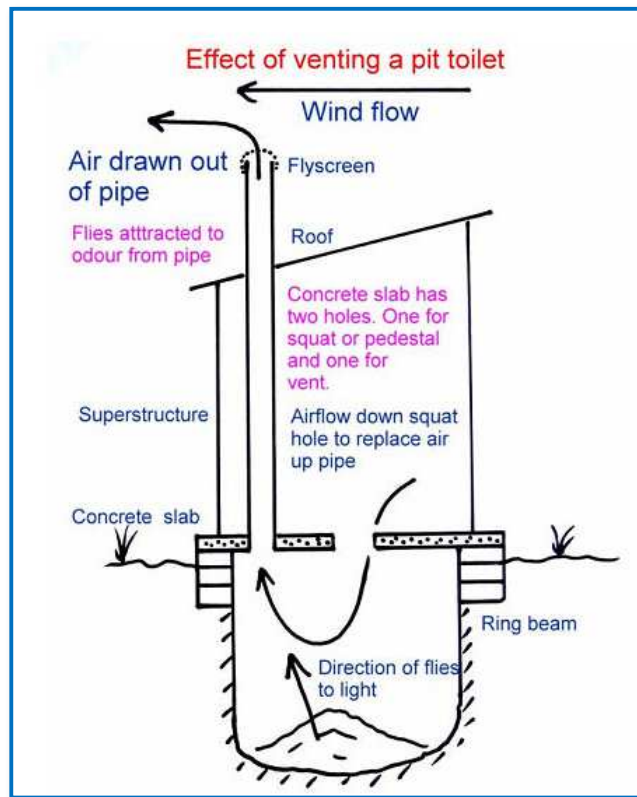
Figure 1. A sub-standard pit toilet.

3 VENTILATED IMPROVED PIT (VIP) TOILETS

3.1 STANDARD VIP TOILET

The VIP latrine was developed by Dyson Blair and Peter Morgan in the 1970s to improve the squat pit toilet commonly used in African villages. VIP toilets and their variants are now widely used in developing countries around the world as a simple and effective low-cost toilet option. The key features of the Blair/Morgan VIP toilet (Figure 2) are ventilation of the pit to remove odours, structurally sound pit and building design, insect screening and reduced light entry so that any flies entering the pit are attracted up the vent towards the light. Further information on building standard VIP pit toilets (and other alternatives) is provided in *Clean Communities, practical guide to building and maintaining toilets in the Pacific*, Live and Learn (2011).

Figure 2. Key features of the standard Blair/Morgan VIP toilet.



3.2 THE ecoVIP2 TOILET

The ecoVIP2 toilet is an adaption of the VIP toilet with particular relevance for Fijian villages. Its main feature is the provision of twin pits that can be used in sequence – with one rested while the other is filling. This means the toilet pedestal (or squat pan) can be readily moved from one pit to the other without having to re-site the building. The other key difference is the addition of small quantities of organic mulch (dry leaves and plant litter) and topsoil to promote an active humus ecology that supports biological decomposition by beneficial microbes, worms and insects. The leaves provide additional carbon and structure to help keep the pile aerated. The occasional addition of the ash helps with moderating the pile acidity.

A significant advantage of the ecoVIP2 is that, with appropriate siting, design, construction, loading and management, accumulated faecal wastes within the pit will break-down during the resting period, recovering a high proportion of the pit capacity. This can enable re-use of the pits over extended periods without the need for removal of the decomposed wastes or shifting of the toilet building. Trials in two Fijian villages over 2 years by the WASH Koro Project have shown effective decomposition of the pit contents, and very low or no odour, making them a pleasant, easy to manage, safe and healthy dry toilet option.

Figure 3: Two different ecoVIP2 toilet building designs. Note provision of hand washing facilities outside the toilet on the left, with drainage directed well away from the pit.



4 ecoVIP2 TOILET DESIGN AND CONSTRUCTION

The key features of the ecoVIP2 are:

- Dual pits
- Managed pit ecology to encourage active decomposition (Refer to Section 3)
- Attractive easy to clean building and fittings
- Hand-washing facilities to encourage good hygiene
- Durable, hurricane resistant building and materials.

Refer to Figure 4.

Figures 5, 6, 7 and 8 provide drawings of the ecoVIP2 toilet with details of the recommended dimensions. It is very important to find a suitable location for the ecoVIP2 - See Section 5.

The critical design and construction features for an ecoVIP2 toilet are:

- Two pits with dimensions as in Figures 5, 6, and 7.
- Pit walls to be retained by concrete walls to avoid cave-in or collapse.
- Base of each pit exposed to in-situ soil and must be level
- Dimensions of the toilet cubicle as in Figures 5 and 6.
- Concrete floor slab for the cubicle; 100mm thick with mesh reinforcing and dimensions as in Figure 8.
- Toilet cubicle to be structurally sound and resistant to high wind forces.

- Two 150mm vents as in Figure 5. It is recommended that the vent pipe (normally PVC) is painted black to encourage convective ventilation as the pipe heats up during the day.
- The toilet cubicle to be sealed and screened to prevent insect access
- The toilet floor should ideally be tiled to enhance visual appeal and aid cleanliness.
- Where possible a high-quality pedestal (or squat plate) should be used, that is visually appealing, and easily cleaned. The toilet pedestal (or squat plate) needs to be stable and to fit securely over the riser pipe, but also to be easily moved to the adjacent pit when required. A tight-fitting cap should be used to cover the toilet riser pipe not in use.
- Make provision for hand washing facilities that are readily accessible and easily cleaned, and provide soap. Direct water draining from the sink well away from the pits. Excess water in the pit can make the pile too wet, inhibiting aeration and reducing decomposition rates. It can also cause leaching of contaminants from the faecal matter into groundwater.

Figure 4. ecoVIP2 toilet features

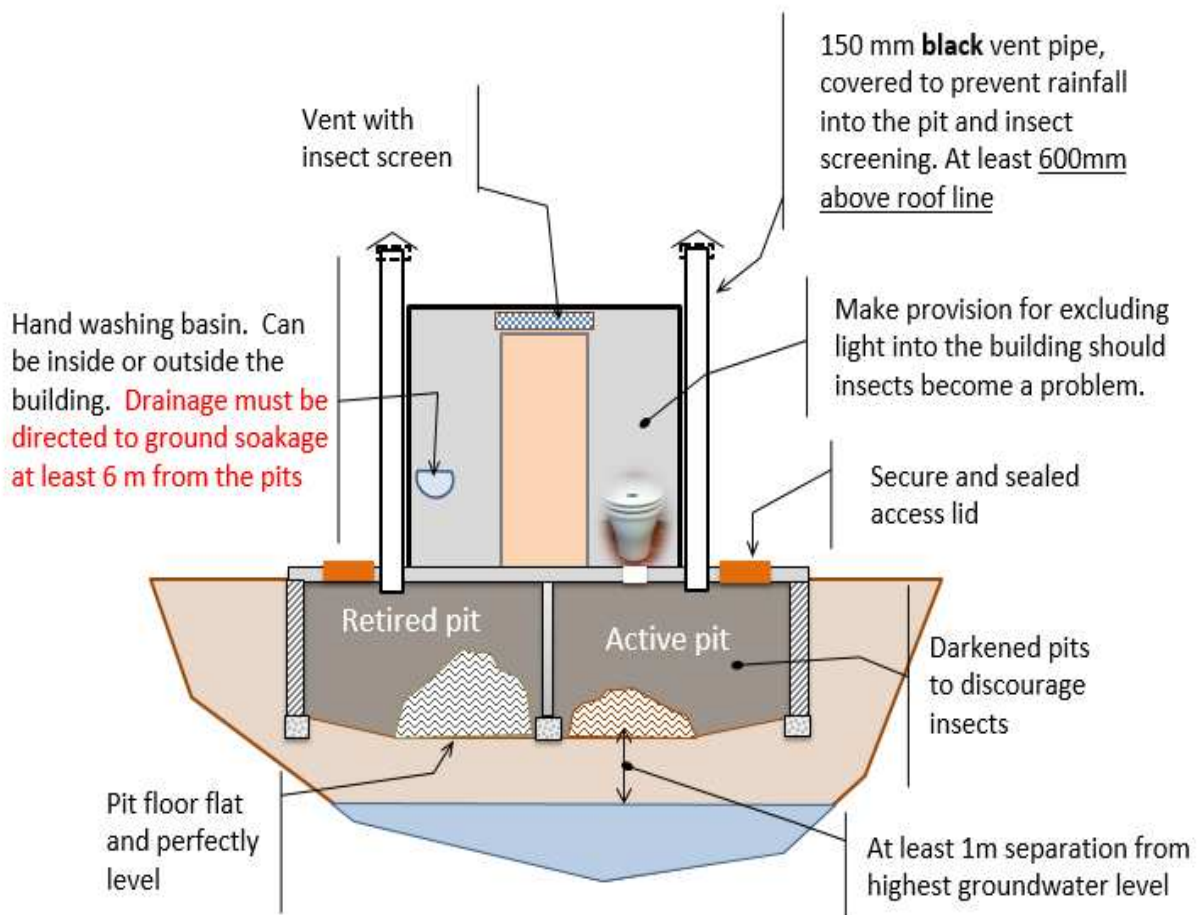


Figure 5. ecoVIP2 toilet front elevation.

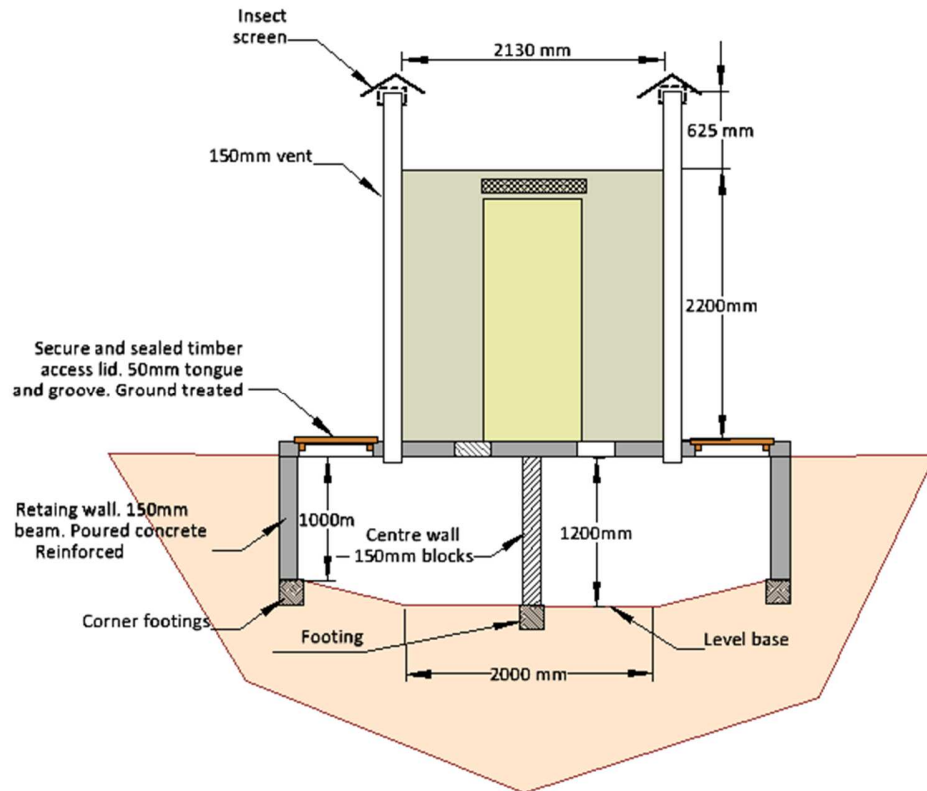


Figure 6. ecoVIP2 toilet side elevation. See Figure 7 for pit dimensions.

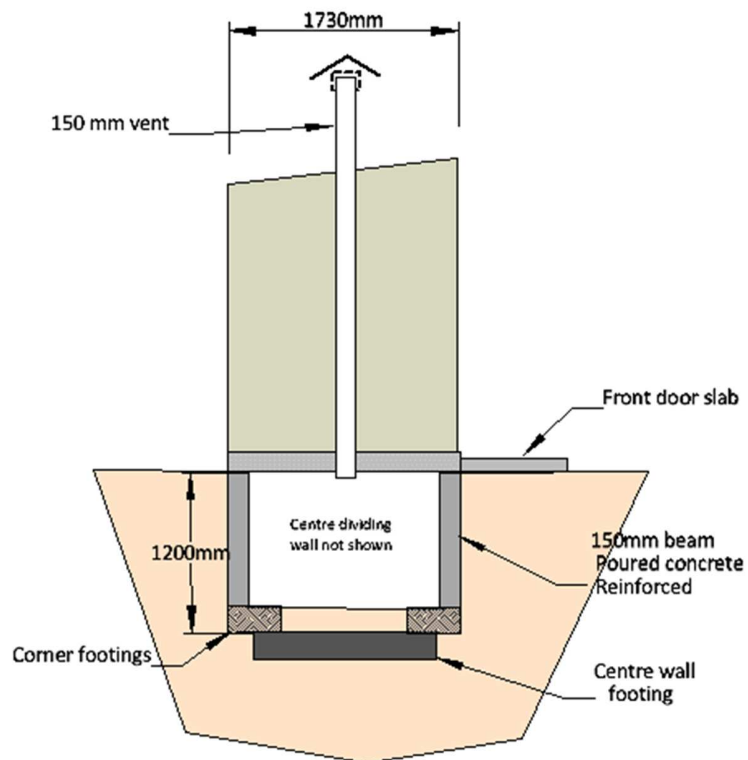


Figure 7. Plan view of pit foundations and cubical

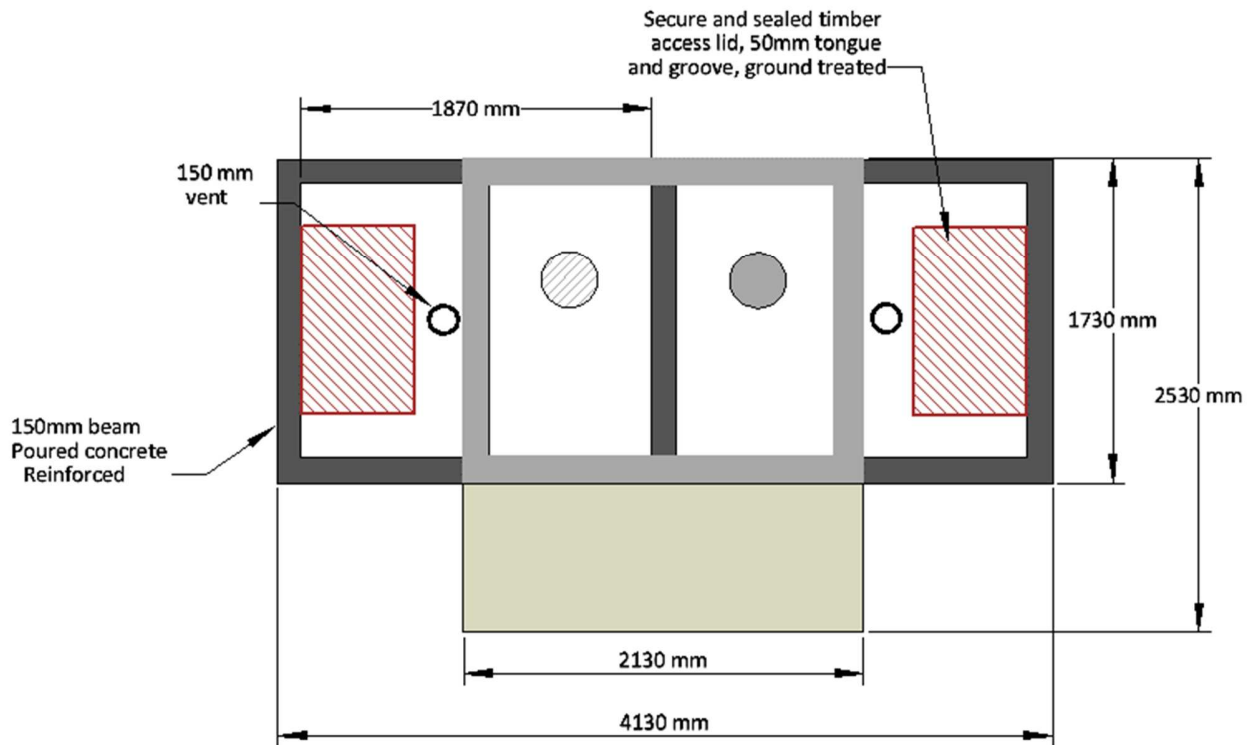
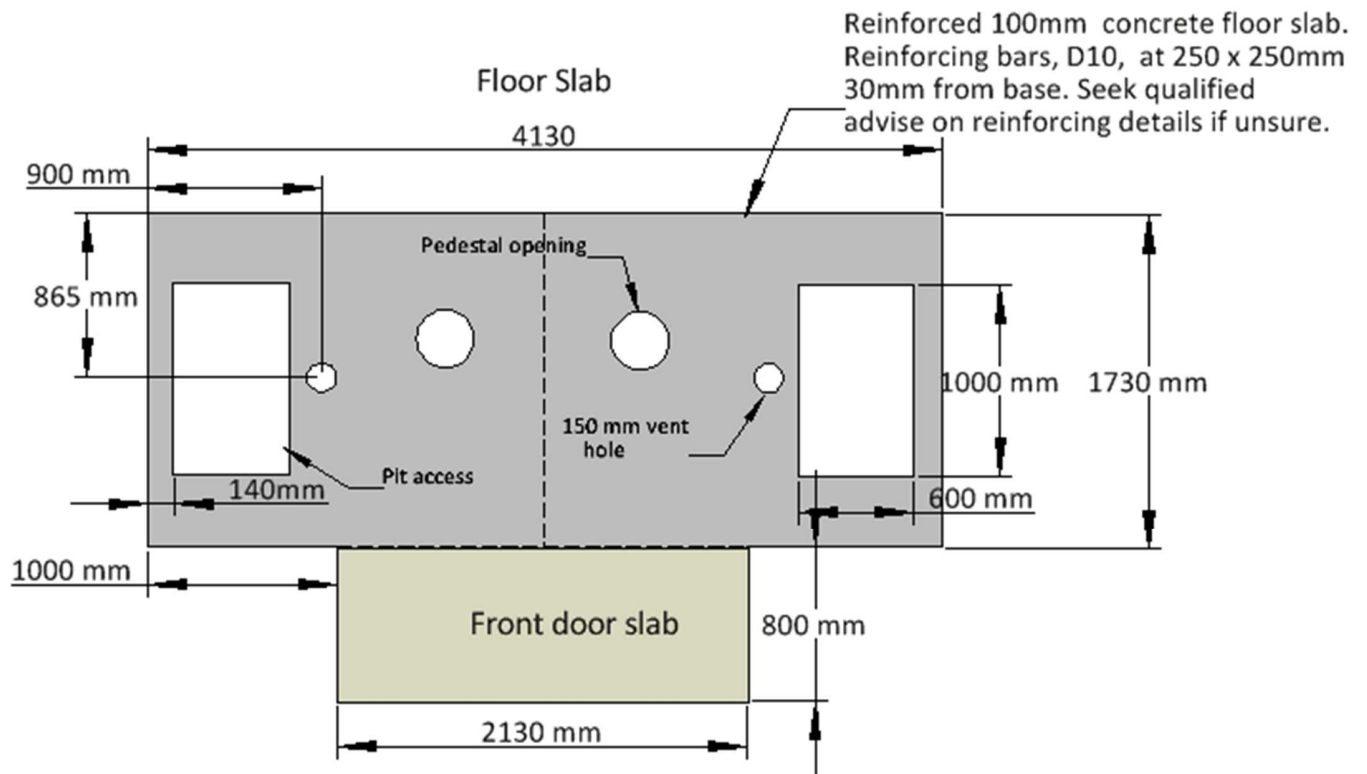


Figure 8. EcoVIP2 toilet floor plan.



4.1 WORKMANSHIP

The construction of the ecoVIP2 toilet pit and building must be carried out by or under the supervision of a suitably qualified and experienced tradesperson.

5 WHERE SHOULD I SITE AN ecoVIP2?

Careful consideration must be given to where the ecoVIP2 toilet is installed.

Key considerations as to where NOT to site an ecoVIP2 are:

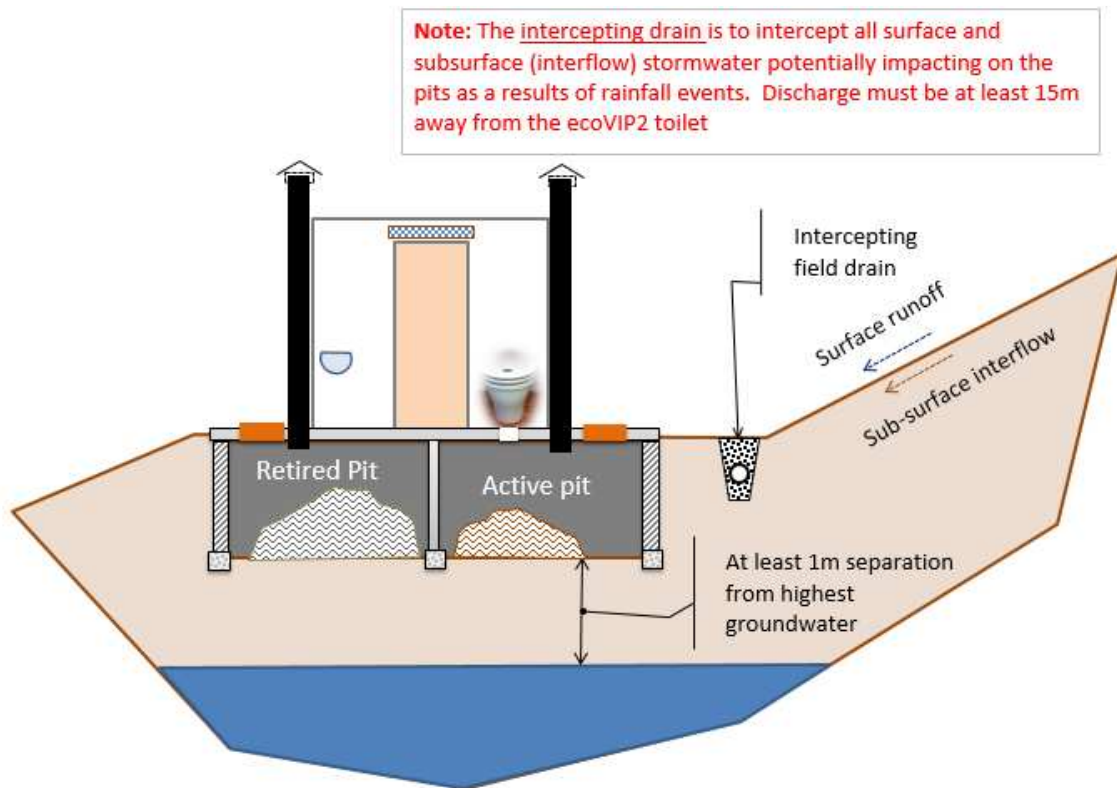
- In areas where there are buried services such as water supply pipelines, stormwater pipes, power and telecommunication cables.
- Close to areas used for growing, processing or storing food.
- Public areas where villagers and children gather, play and recreate.
- Areas subject to flooding and tidal surges and surface flooding after heavy rainfall.
- Areas where ground water (that is not used as a drinking water supply) is less than 1m below the base of the pits at any time throughout the year.
- Areas where water ponds, soils become wet and saturated at any time or are wetlands.
- Within 50m of a well or bore used for a village water supply, where the abstracted groundwater is more than 15m below ground level.
- Within 100m of a well or bore used for a village water supply, where the abstracted groundwater is less than 15m below ground level.
- Within 10m of a drain, stream or river.
- Within 100m of a surface water body used as a village water supply or bathing/swimming area.
- In soils that are loose and unstable. Soap stone can become unstable when wet and should be avoided.
- On land that slopes more than 15° (25%).
- Land with many large tree roots (It may be appropriate to remove trees and their root system).

Otherwise, locate the ecoVIP2 toilet within easy access of the dwelling and provide a pathway to it that is safe, particularly for elderly and those who may have physical disabilities. The grade must be easy and free of obstacles.

5.1 SURFACE DRAINAGE

A critical consideration when locating and then constructing the ecoVIP2 toilet is to take all measures to ensure no water enters the pit particularly after heavy rainfall. This is critical. Visual assessment of drainage patterns in consultation with landowners and occupiers who have observed surface water drainage patterns following heavy rainfall, is important. It may be necessary, in some situations, to install intercepting field drains to divert surface water away from the ecoVIP2 toilet pit. This is particularly important on sloping sites - refer to Figure 9.

Figure 9. Interceptor field drain on sloping sites.



6 COMMISSIONING THE ecoVIP2

On completion of the ecoVIP2 two toilet, the following commissioning process are recommended:

- Appoint a member of the household responsible for management and servicing of the ecoVIP2 toilet.
- Explain why regular management and servicing of the ecoVIP2 is critical, particularly in terms of mitigating health risks, odours, and pests such as insects.
- Full instructions should be provided to the users in terms of how the ecoVIP2 toilet works and how it should be used, and in particular, the regular addition of top soil, dry leaves and ash. Refer to the next section (Section 7) for details.
- Collect a supply of suitable leaf mulch and soil with the person responsible so they know what is required.
- Before using the toilet, add at least two buckets of topsoil and two buckets of leaves or dried fibre.
- Leaf litter from established bush or forest is ideal.
- Ensure that hand washing facilities are functional, and not able to find their way into the pit
- Ensure that the pit is fully sealed and secure and insect screens are in place.

7 OPERATION AND MAINTENANCE OF THE ecoVIP2 TOILET

7.1 INSTRUCTIONS TO MANAGERS OF THE ecoVIP2

- Place Posters 1 and 2 (appended) on the wall in the ecoVIP2 to inform users about how to use and maintain the toilet. It may be necessary to translate the posters to Fijian or another appropriate language.
- Instruct all users how the ecoVIP2 toilet operates and why it is important to take care with what is put into the pit.
- Collect and store, in a weatherproof container, topsoil, dry leaves, mulch, or chopped up fibre.
- Collect and store ash in a weatherproof container.
- Either:
 - Every week, add 5 L (about half a bucket) of topsoil, 5 L of dry leaves or chopped up fibre to the pit toilet and sprinkle with 2 cups of ash, OR
 - After each use, get users to add a small handful of topsoil and dry leaves or mulch, and once a week sprinkle with 2 cups of ash
- Ensure that the hand washing facilities are operational, and that soap is available.
- Provide a small rubbish bin to dispose of non-degradable things that should not go down the toilet (see posters).

WHEN TO RETIRE THE ACTIVE PIT AND MOVE THE PEDESTAL TO THE ADJACENT PIT

- If the ecoVIP2 is being managed correctly it should be possible to get at least two years or more of life out of one pit before having to shift to the adjacent pit. When the height of the pit pile is within about half a metre of the bottom of the pedestal, the pedestal should be moved to the adjacent pit.
- Before retiring the pit (i.e., covering the pedestal hole in the cubicle), about 15L of topsoil should be placed on top of the retired pit along with a similar volume of dried leaves. If available, seed the retired pile with composting worms. Close off the pit and seal it.
- When the second pit is near full, inspect the retired pit and measure the depth of the pile. If there has been a healthy ecology in the pit the pile depth is likely to be minimal and it should be possible, without having to remove any solids from the pit, to transfer the pedestal back to this retired pit. If it is considered necessary to remove some of the mature pit pile this should be done with a special auger, gaining access from the outside through the pit lids. The mature pit solids are to be buried in a non-public area and covered with at least 300mm of soil. The mature pit solids should be considered a health risk and handled with care and good hygiene measures adopted (Refer to Health Warning note below).
- Alternate the toilet pedestal (or squat pan) between the two pits as appropriate.

Figure 10. View of ecoVIP2 toilet with high quality pedestal and tiled floor providing a pleasant and easy to clean facility. Note user instructions on the wall, and readily available mulch and soil materials to add to toilet contents to encourage an active decomposer ecology.

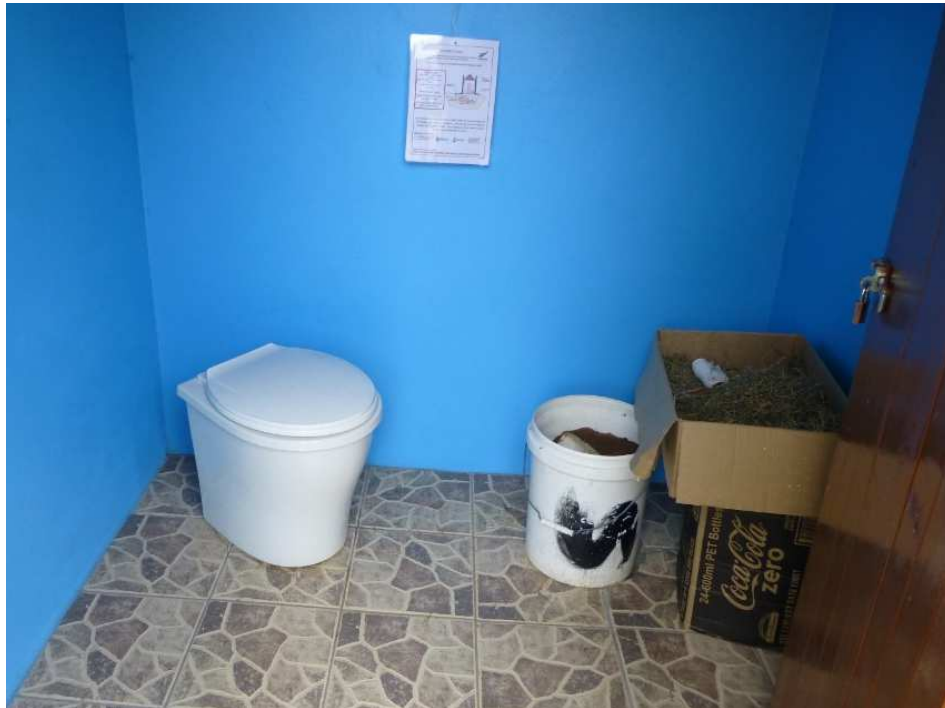


Figure 11: A small amount of topsoil, dry leaves or organic mulch and ash added once a week is beneficial for the biological degradation of the solids.

Topsoil



Dry leaves or straw



Ash



7.2 INSTRUCTIONS TO USERS OF THE ecoVIP2 TOILET

Refer to Poster 1 attached in terms of what should and should not be disposed into the ecoVIP2.

Refer to Poster 2 for general questions about the ecoVIP2 toilet.

Report any issues of concern to the manager of the ecoVIP2.

8 RISKS

ODOURS

It is possible that the ecoVIP2 pit could give rise to nuisance odours. Possible causes of this nuisance are:

- Failure or blockage of the vent pipes.
- Excess moisture has entered the pits.
- Insufficient leaf mulch and topsoil added to the pits.

The cause of the nuisance odours should be identified and remedial action taken.

INSECT INFESTATION

The ecoVIP2 has been designed to minimise the risk of insect infestation. If insects do become a nuisance, then it may be necessary to spray with a suitable insecticide. If this occurs insect screens should be checked.

STORMWATER ENTERING THE PIT.

Every effort is to be made to ensure that there is no risk of water, especially after rainfall, entering the pits. If a flood event occurs and flooding of the pits results, it will be necessary to abandon the ecoVIP2 toilet. It may be possible to have the pit pumped out by an approved septic tank pump out contractor.

9 REFERENCES

Morgan, P. (2009) Ecological Toilets. Start simple and upgrade from Aberloo to VIP. Stockholm Environment Institution EcoSanRes Programme. http://www.ecosanres.org/pdf_files/EcologicalToilets-PeterMorgan-Mar2009.pdf

Live and Learn (2011) *Clean Communities, A practical guide to building and maintaining toilets in the Pacific*. <http://www.livelearn.org/resources/>

Health Warning

The pile of decomposing faecal matter in the active pit will contain organisms that are a significant health risk to humans and animals. Protective clothing and gloves should be worn if handling this material. If at any point in time anyone comes into contact with this material, they must wash thoroughly with soap and water.

Children, in particular, and domestic and feral animals (e.g., dogs, pigs, chickens, rats) must be kept well away from this material.

The pile in the retired pit may contain microorganisms that present a health risk for up to 12 months or more and should be handled with care if it is necessary to remove it. After 2 years, well decomposed humus removed from the ecoVIP2 should be safe to spread around the base of trees or ornamental plants. As a precaution, direct use in vegetable gardens etc., used for human consumption is not recommended.

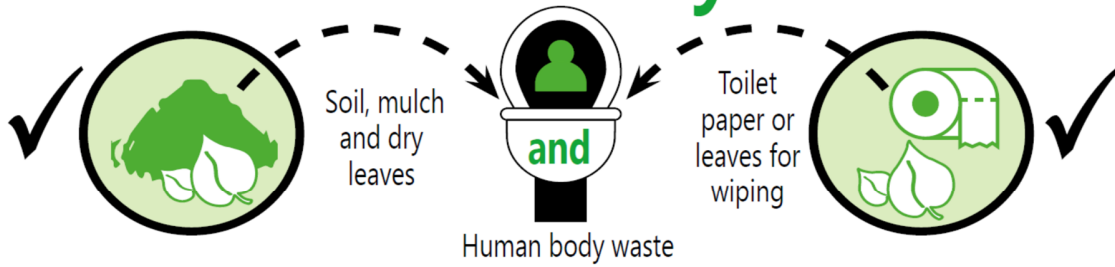
There should be no reason for direct contact with the pile in either the active or the retired pits, unless emptying the pit.

Figure 12: An unsuitable site for a pit toilet. Good views, but a high chance of contaminating the lagoon and being damaged during storms.



ecoVIP2 Toilet

Add only



Never add !



These are not biodegradable and will prevent the ecoVIP2 toilet from working properly.



ecoVIP2 toilet

Frequently asked questions

What is the ecoVIP2 toilet?	The ecological ventilated improved pit (ecoVIP2) toilet is an improved dual-pit version of the VIP dry toilet. It has been designed for natural and safe decomposition of body wastes
Why add the soil and leave mulch after each use?	Adding this material (soil and leaves) is critical to the successful operation of this toilet. It seeds it with microbes, worms and insects that live in the soil, so that the waste breaks down quickly to a humus that won't smell and is a low health risk to others. Also the leaves add carbon and bulk up the pile to promote air access.
Can I put sanitary pads down the toilet?	No – they contain plastic that will not break down.
Can I put tampons down the toilet?	Yes – but NOT the plastic wrapper or the applicator.
Why can't I chuck down baby wet wipes?	Wet wipes don't break down like toilet paper. Even if they say they are flushable, they contain synthetic fibres which do not decompose and the chemicals in them kill the beneficial bacteria.
Can I put nappies down the toilet?	No because they contain plastic and inorganic material and will not break down.
Can I put condoms down the toilet?	No – they are not biodegradable.
Why can't I put food-scrapings down the toilet?	Because they attract vermin (e.g., rats).
Isn't the humus that collects in the pit dangerous and full of pathogens?	Yes, it can be when fresh or immature. Care in handling it is important. Once the human waste has continued decomposing in the retired pit for 2 years and broken down into a friable material it is safe to dig out, however good hygienic practice is strongly advised. Well decomposed humus should be safe to spread around the base of trees or ornamental plants. As a precaution, direct use in vegetable gardens etc., used for human consumption is not recommended.

This guideline was produced in consultation with the Fiji Department of Water and Sewage and the Ministry of Health as part of the WASH Koro Project led by the National Institute of Water and Atmospheric Research (NIWA). The project was supported by the New Zealand Aid Programme through the Partnerships for International Development Fund of the Ministry of Foreign Affairs and Trade. Care has been taken to make sure the information provided is correct and fit-for-purpose, but we accept no liability for any errors or omissions, or the consequences of their use or misuse. The views expressed in these guidelines do not necessarily reflect those of the New Zealand or Fiji Governments.

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The Department of Water and Sewage.

The Ministry of Health, or your local

Provincial Council

KoroSan Guidelines

The WASH w project has produced the following series of technical and participatory guidelines to help mobilise villages and settlements to improve their water supply, sanitation and hygiene. These guidelines may be freely disseminated provided the source is acknowledged.

KoroSan #	Title
1	Choosing a village wastewater management service
2	Site, soil and wastewater flow assessment
3	Septic tank construction using concrete blocks.
4	Land application systems
5	Maintaining your septic tank and land application system
6	Water-less ecoVIP2 toilet
7	Greywater management
8	Village participation in water and sanitation actions

KoroSan - for healthy villages

