

COMPOST TOILETS

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1. INTRODUCTION

Compost toilets are perceived by many as an environmental alternative to the flush toilet in managing human waste matter in a domestic situation. They were originally developed in Scandinavian countries during the 1940s for intermittent use associated with holiday area dwellings. This application subsequently expanded into servicing for permanently occupied dwellings in which human waste matter was handled by the compost toilet and all sullage (greywater) outputs from kitchen, bathroom and laundry were handled by a greywater treatment unit and soakage trench disposal system.

Compost toilet use and development has since expanded into many countries with a considerable range of commercial systems now available, and many "do-it-yourself" guidelines published in the literature. The original waterless compost toilet systems were seen as reducing water use and wastewater output from household activities while at the same time producing a useful by-product in converting human waste into nutrient rich humus. Subsequently, compost toilet alternatives incorporating low-flush pedestals and liquid separation systems have enabled the convenience of a conventional flush toilet while minimising water use and providing a mature compost output.

However, the perceived advantages of this method of handling human waste in a domestic situation is offset by the level of commitment required by the homeowner and/or occupier in supervising and maintaining the composting operation and ensuring that potential environmental and public health effects are minimised while managing a decomposing excreta pile within the confines of a dwelling. These effects relate to odour and vector control, and management of the compost end product in a hygienic and risk free manner. In addition, the value of the humus output as a soil conditioner and nutrient is limited by the low annual volume of end product from a typical family, and the fact that health authorities recommend a minimum of 12 months storage or burial prior to use for this purpose.

2. COMPOST TOILET BASICS

2.1 Principles for Effective Composting

2.1.1 The Composting Process

The organic nature of human faecal matter lends itself to bacterial and fungal decomposition by combined aerobic and anaerobic processes leading to production of a stabilised humus material. Well ventilated and mixed composting enables aerobic processes to predominate, controlling odours and moisture levels, and limiting the survival of pathogenic organisms. The potentially offensive nature of faecal matter is thus converted into an inoffensive nutrient rich by-product readily assimilated into the soil environment.

To maintain aerobic conditions and prevent dominance of anaerobic conditions resulting from high moisture content, good ventilation must be provided, and an appropriate quantity of 'bulking' material in the form of dry vegetable or other suitable organic matter must be added regularly to mix with the accumulating faecal matter. Peat moss, leaf litter, sawdust, wood shavings, hay, straw or mature compost will enable air pathways through the compost pile as well as soaking up urine. The carbon content of the bulking material offsets the high nitrogen level from the ammonia in urine thus maintaining healthy aerobic decomposition processing. Any accumulation of excess moisture in the composting operation can lead to a dominance of anaerobic conditions with resulting nuisance odours and a reduction in the rate of waste stabilisation.

Under conditions in which inadequate ventilation or build-up of excessive moisture leads to the dominance of anaerobic conditions, it may be necessary to embark on a major maintenance and recovery operation.

This might include applying and mixing bulking material in volume together with draining off excess liquid in order to restore aerobic conditions, or emptying the composting chamber of the partially decomposed content and restarting the process.

2.1.2 Temperature

During conventional composting processes the temperature within the compost pile increases in proportion to the overall level of aerobic bacterial activity. This is determined by the of nature of the organic matter, the rate of microbial growth, moisture content, aeration (supplying oxygen for bacterial action via air movement through the pile) and the mass of the compost pile (in retaining the heat generated). Optimum temperatures of 55°C to 70°C will maximise decomposition rates and neutralisation of pathogens.

Composting toilets will not achieve such temperature levels due to their small pile volume and the variable nature of their loading pattern. At best they might achieve 25°C to 35°C with adequate decomposition and pathogen die-off being a function of the time spent at such low temperatures. Even at low ambient temperatures adequate composting action will proceed (albeit slowly) if there is a correct balance of bulking agent and moisture control.

The most significant impact on temperature level is heat loss involved in evaporation of excess moisture. Even in well insulated compost chambers under low ambient winter temperature conditions, heat loss from evaporative conditions (often exacerbated by over ventilation) will be more significant than heat loss through the walls of the unit.

2.1.3 Moisture Control

The optimum moisture content in the composting mass should be between 40 to 50%, requiring a ventilation process that provides sufficient warm air to evaporate excess liquid contributed by urine. Decomposition can be inhibited if over aeration is applied and the compost begins to dry out. Ideally a combination of controls such as urine separation, fan ventilation, warm air heating, provision for liquid recycling (to correct for drying-out) and moisture content monitoring will enable optimum operational performance. However, such control measures may be beyond the scope of individual household systems.

2.1.4 Aeration

To maintain aerobic conditions the composting mass must maintain a void space of some 20 to 30% uniformly throughout to ensure good air supply to all areas of the pile. The air flow rate must be just sufficient to provide the oxygen needed for microbial stabilisation as well as evaporation of excess moisture without inhibiting decomposition processes by cooling the compost mass. Passive ventilation via natural air flow reduces the operational cost but is not as reliable as active ventilation via a fan.

2.2 User Commitment

A conventional waterborne on-site wastewater system comprising a single flow path servicing solution typically involves conveyance of combined flush toilet (blackwater) and sullage (greywater) flows through a septic tank or alternative treatment unit to a land application area for uptake and further treatment of the effluent. On the other hand, use of a composting toilet results in two separate flow paths, one for human waste and one for greywater. The human waste compost pile is a living biological entity that for optimum performance depends on regular and active control of both solid (faecal matter and bulking material) and liquid (urine and condensation) inputs. This requires consistent supervision of the decomposition process, active management of bulking material addition and venting performance, and routine attention to compost removal and subsequent further treatment.

The 'flush-and-forget' approach of waterborne servicing no longer applies, and the owner/user of a compost toilet thus requires a level of dedication and time commitment to maintaining an effective and trouble free service that does not exist with the conventional waterborne system. Regular inspection of the composting process is an imperative to ensure that daily addition of bulking material is being properly carried out.

2.3 Health Risk Implications

Human waste matter potentially contains pathogenic (disease causing) micro-organisms. The risk of disease being transmitted from use of a composting toilet depends upon the level of microbial and viral infections within the user group (that is the particular household) and the likely contact with raw or incompletely composted and matured output from the toilet. This risk can be negligible in a single household where the owner/occupier is maintaining and servicing the unit in a controlled manner in accordance with the operational requirements and instructions laid down for that specific unit. For a well motivated owner/occupier supported by appropriate maintenance and servicing guidelines, then user and handling risks can be eliminated. For toilet users who do not wish to undertake the required maintenance and handling duties, then a conservative approach to managing compost outputs could involve the use of an external contractor.

3. TYPES OF COMPOSTING SYSTEM

3.1 General

Six types of composting system are provided in these guidelines. These are

- waterless toilets (continuous; batch; rotating drum);
- mini-flush systems;
- low flush (worm based) systems
- do-it-yourself (DIY) systems;
- portable toilet units; and
- low flush (worm based) hybrid systems.

Appendix A sets out a list of systems in the above categories available in NZ at the present time as determined from web-site information at the time of publication of these guidelines. To assess the availability of other systems that may have been introduced to NZ since publication, consult the Yellow Pages listings or web-search "composting toilets New Zealand".

3.2 Waterless Toilets

3.2.1 Low Capacity Continuous

These units consist of a compost chamber and toilet seat sized to fit in a normal toilet compartment in a dwelling. They were initially developed for intermittent use in recreational dwellings (such a baches and cribs in the NZ context) where weekend or short term holiday use gave the contents time to decompose and mature between occupancy periods. Addition of mixing and fan ventilation technology has enabled their permanent use for low level occupancy. Typical systems available in NZ include the Biolet/Ecolet range. Relatively frequent servicing for removal of the end product is tailored to occupancy level and duration of use.

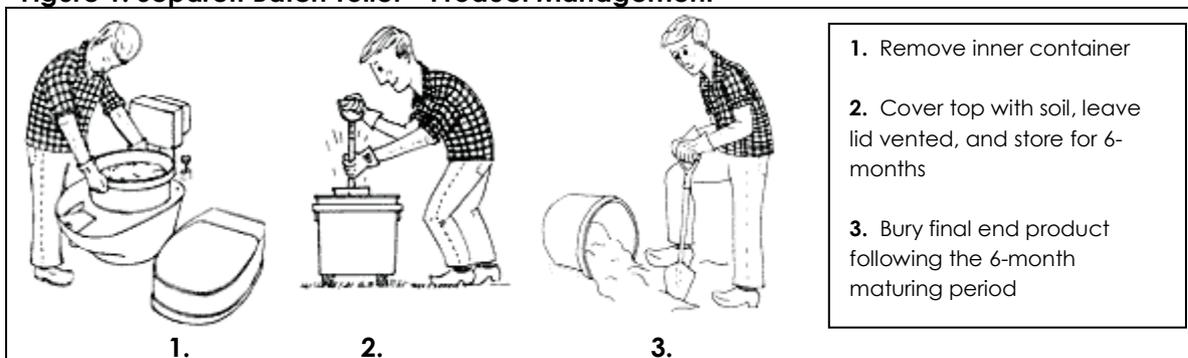
3.2.2 High Capacity Continuous

These units consist of an inclined compost chamber installed below floor level in a basement or outdoor chamber with the toilet seat and pedestal fitted within the normal toilet compartment in a dwelling. They are suitable for permanent use for both low and high level occupancy, with annual removal of the compost end product required. These systems may be naturally ventilated or provided with fan assisted ventilation. Typical systems available in NZ include, Clivus Multrum, Toatrone and Biolo.

3.2.3 Low Capacity Batch

These units consist of a human waste container and toilet seat sized to fit within a normal toilet compartment. When the waste container is full it is replaced with an empty container and removed to a secure location to allow the contents to decompose and mature over several months. Typical systems available in NZ include Ecolet NE (non-electric), Separett (cottage toilet) Kiwi Bog and Separett (household toilet). The Separett is a fan vented system, and is shown being serviced in (Figure 1).

Figure 1: Separett Batch Toilet – Product Management



3.2.4 High Capacity Batch

These units consist of either a large capacity human waste replaceable container within the toilet compartment in a dwelling, or alternatively with the replaceable container or containers located in a basement or outdoor area under the floor below a toilet seat and pedestal located within the normal toilet compartment. One system uses multiple container units rotated sequentially on a turntable (carousel) with eventual emptying to a compost maturing container or to soil burial. These systems are usually fan ventilated. Typical systems available in NZ are the Rota-Loo and Separett Classic household systems and the Rota-Loo commercial and public use system.

3.2.5 Rotating Drum Composters

These units are installed within a larger than normal toilet compartment due to the size of the rotating drum mechanism. Human waste is received into the horizontal drum which is vented to assist moisture evaporation, and turned regularly (at 4 to 6 revolutions every 3 days or so) by a handle mechanism to enable mixing of bulking agent and solid waste matter. Typical systems available in NZ include Sun-Mar and Kakapo, the latter being a local development which combines drum collection with batch processing.

3.2.6 Bin Maturing

Batch and drum units provide less mature compost output than continuous composters thus requiring further processing via maturing bins or subsoil burial prior to being used as a soil conditioner supplement. Hence the need to provide an area for container storage over 6-months or more, or to provide a separate compost storage and maturing bin. Some batch units use a degradable liner bag in the toilet container to enable clean transfer of waste material direct to the compost bin. Degradable liner bags can last up to 3 months before beginning to deteriorate.

3.2.7 Optional Extras

These include:

- urine separation as a means of reducing moisture content – the urine is either transferred to treatment in the greywater system or separately conveyed to a subsoil soakage system;
- fan ventilation options in either 12 volt or 240 volt; and
- solar assist ventilation systems.

3.3 Mini-flush Systems

A low flush toilet unit is sited above a separator unit which uses centrifugal force to spin out the urine and flushing water to a holding tank, or to the greywater treatment unit. Faecal solids drop direct into the composting chamber. The system available in NZ is the Aquatron Flush Composting unit which can be attached to a low capacity batch/continuous system or a high capacity continuous system.

3.4 Low-flush (Worm Based) Systems

Conventional dual flush toilet units transfer all urine and faecal solids into a decomposition chamber in which worms assist the biological decomposition and processing of the waste. In one system a dual chamber provides alternating load and maturing cycles. The liquid drainage passes to the greywater treatment unit or to a separate treatment and subsoil soakage or evaporator disposal system. Two NZ units are available – the Worminator (dual alternating chamber) and the Worminator & Evaporator.

3.5 DIY Systems

Numerous references within the environmental literature provide details for DIY units. These include variations on batch toilet systems and continuous high capacity units. Appendix D provides dimensions and construction details for an inclined continuous composter (Clivus Minimus) for a single dwelling application [Ref. 2]. BRANZ does not recommend self-designed composting toilets for use in NZ due to the considerable range of manufactured systems available in this country.

3.6 Portable Toilet Units

In situations where a short term or temporary use is required portable and/or prefabricated compost toilet systems may be preferred to portable chemical toilet units. Pacto and Green Loos are two such units available in NZ.

3.7 Low-flush (Worm Based) Hybrid Systems

These units are referred to as “vermicomposter” units. They utilise a single tank with an organic material base filter layer for receiving and treating flush toilet and kitchen wastewater flows. Whereas other waterless and mini-flush compost toilet systems considered above require separate treatment of greywater comprising kitchen, bathroom and laundry flows [greywater-regular], the hybrid system accepts the kitchen flow leaving greywater comprising bathroom and laundry flows [greywater-lite] for separate treatment. The two hybrid vermicomposter systems available in NZ are Autoflow and Envirosystems.

4. APPLICATION OF COMPOSTING SYSTEMS

4.1 Urban Residential

Overseas case studies show that where used and supervised by an enthusiastic and dedicated owner/occupier, compost toilet systems can provide for successful human waste management in an urban environment. The key to this success is the level of commitment to operational supervision and maintenance by the user. Normally a special waiver in respect of building regulations is required as in NZ alternative toilet systems are not permitted under the Building Code if a mains sewerage system is available. Approval may be more successful where a second toilet system is required below the grade line of the sewer servicing the main flush toilet unit.

4.2 Rural Residential

Rural residential dwellings serviced by on-site wastewater systems are generally the main applications for composting toilet use. Only committed and enthusiastic owner/occupiers seek to utilise a compost toilet and accompanying greywater system for their property.

In subdivisions there is a risk that if the property and dwelling become locked into a compost toilet as the sole permanent servicing option, then resale options become limited to potential owners who are likewise committed and enthusiastic users of such systems. Hence, it is clearly desirable that the property be future-proofed at the development stage as suitable for a conventional fully water-borne servicing solution.

Clearly with larger properties such as lifestyle blocks and farmlets such future-proofing is automatically assured by the size of the property and the ready availability of land area for some type of waterborne system.

For holiday area locations there are environmental advantages in adopting compost toilets for dwellings in lakeshore and estuarine ribbon developments where nitrogen limitations on wastewater effluent discharges are in place. Management of urine nitrogen outputs becomes important with either separate off property management able to handle the small volumes involved or alternatively evaporative management of urine and excess liquid. Low capacity continuous and batch compost systems are able to handle the intermittent occupancy of holiday use, with larger capacity continuous systems able to handle dwellings when upgraded for retirement and general permanent occupation.

4.3 Rural Commercial Facilities

Although compost toilets may be suitable for employee use in commercial facilities such as shopping centres and factories, and for accommodation facilities such as camping grounds and lodges, the key challenge in such multi-use situations is the lack of personal commitment to user requirements which are vital to system operational performance. Casual users are likely to neglect or ignore operational use instructions due to unfamiliarity or disinterest, thus placing considerable onus on a dedicated owner to organise or maintain rigorous supervision and management of the system. Joint use systems thus require special oversight in ensuring reliable and trouble free operation.

4.4 Public Use Facilities

Situations such as community halls, picnic areas, parks, roadside rest areas, recreational and sports field locations are generally multi-use systems where the system performance is most vulnerable to user neglect and indifference to operational needs. Usually servicing is in the hands of employees or contractors whose commitment to the objectives inherent in compost toilet use are lukewarm, and who inevitably have to deal with the distasteful aspects of system misuse. Hence maintaining high quality service conditions can be quite a challenge. Compost toilets in such situations work most effectively when subject to competent and informed supervision and servicing.

4.5 Temporary Use Facilities

For construction sites, special events, mobile camps (in support of military, scouting or other short-term use situations) portable or collapsible kit-set batch toilet units can be more acceptable than long-drops or chemical toilet systems. They offer advantages in water savings and end product can be buried locally.

4.6 System Selection

Appendix B below summarises the several types of composting toilets, indicates the potential applications appropriate to system types, and outlines the operational commitment and issues to be considered relevant to their use.

Appendix C matches system type against potential applications.

5. REGULATION

5.1 Building Code Requirements

The NZ Building Code Compliance Document for Clause G1 indicates that composting toilets (which come within the definition of a "privy") are to be located at least 3 metres from a dwelling (see Acceptable Solution G1/AS1, section 5.02). In addition, for dwellings in urban areas serviced by mains sewerage, the Building Code requires the toilet system to be connected to the sewerage system (Clause G13.3.3).

However the Building Act 2004 (Part 2, section 67) enables the building consent authority to grant a waiver or modification of the building code subject to appropriate conditions. Most modern commercial composting toilet systems, when used and operated within these guidelines, can readily achieve the personal hygiene requirements envisaged under Clause G1, and hence can be consented for installation and use within a dwelling.

5.2 AS/NZS 1546.2 Requirements

Waterless composting toilets are covered by the joint Australian/New Zealand Standard AS/NZS 1546.2:2008 [Ref. 1]. The Standard contains provisions dealing with the following matters:

- performance requirements;
- design factors (public health, 3.3; construction, 3.4; composting requirements 3.5);
- end product quality (App'x A);
- sampling end product (App'x C);
- procedure for monitoring (App'x G);
- operation & maintenance (App'x H); and
- safe handling of solid/liquid end products (App'x K).

5.3 Gisborne District Council Requirements

Council will currently consider consent applications which address the following issues:

- The property site area must be suitable to accommodate an alternative waterborne on-site wastewater management system in the event that the compost toilet malfunctions or that future owner preferences require replacement of the system with a flush toilet.
- Any proposed commercial toilet system must meet the performance requirements of clauses in the Building Code in respect of durability (B2), personal hygiene (G1), ventilation (G4) and foul water (G14).
- The application should be accompanied by a BRANZ (or equivalent assessment agency) statement in respect of meeting the Building Code requirements as supplied by the manufacturer/supplier.
- In the absence of a BRANZ Appraisal or equivalent agency statement the application should be accompanied by evidence regarding meeting the Building Code requirements prepared by persons recognised as having authority in such matters.
- For on-site built units, certification is required by an independent assessor as to design and construction methods being satisfactory, and that the system meets the Building Code performance requirements.

Council also sets out requirements for managing the composted end product (see section 8 below).

Council does not require that all locally installed commercial compost toilet systems be certified as complying with the requirements of AS/NZS 1546.2:2008. However, all consent applications should include a statement regarding the extent to which the proposed system meets the compliance requirements of the Standard. This shall be compiled by a person recognised as having authority in such matters.

5.4 Issues

5.4.1 Greywater Management

All dwellings equipped with a compost toilet as the main human waste servicing system will require a greywater management system for handling kitchen/laundry tub/bath/shower/washing machine or bath/shower/washing machine wastewater flows. These systems should be designed, installed, maintained and monitored in accordance with Council guidelines for greywater systems.

Note: For the purpose of these guidelines, greywater types will be differentiated as:

- greywater-regular [all greywaters, including kitchen, bath/shower, laundry tub and washing machine];
- greywater-heavy [kitchen, laundry tub] and
- greywater-lite [bath/shower and washing machine].

5.4.2 Sale of Property

If the property with a fully functioning compost toilet and greywater system is sold, with the new owner intending to continue with use of the system, then prior to settlement or handover of the property to the new owners, the compost toilet system should be decommissioned and set up for re-commissioning for the new occupiers. At the same time a WOF (warrant of fitness) check should be undertaken on the greywater system, and any maintenance or upgrade work required completed to the satisfaction of the new owner.

If the new owner intends to abandon the compost toilet and convert to a waterborne flush toilet system, then both decommissioning and WOF checking should likewise be carried out as above. Documentation relating to the original site investigation proving the property is suitable for full on-site wastewater servicing should be made available to prospective purchasers if requested, and/or to the new owner.

6 DESIGN CONSIDERATIONS

6.1 Overview

When selecting a compost toilet a range of design considerations should be taken into account. These include:

- capacity to handle the number of persons and frequency of use intended (this should also take into account potential "high load" situations such as guests at entertainment events or holiday periods);
- access to and room within the dwelling for installing the compost toilet unit, for servicing it within the toilet compartment, and for removing both liquid and compost end product;
- ready access to an adequate supply of suitable bulking material;
- provision for storage of bulking material, both within the user compartment, and for bulk storage away from the user compartment;
- venting arrangements including air inlet to the toilet compartment and the compost chamber, as well as arrangement for the exhaust outlet;
- provision of power supply to operate heater (where fitted) and fan ventilation system;
- ensuring that opportunities for attracting vermin and insects are minimised;
- allowing for variability in climatic factors to be taken into account in the design and/or selection process;
- ensuring that the system is easy to clean, and that the toilet compartment pedestal in basement located units is suitably tapered to minimise fouling;
- checking the adequacy of the manufacturer/supplier's operating and maintenance guidelines; and
- meeting the requirements of Council in supplying information in support of the consent application (section 5.3 above).

Appendices A and C provide information on the types of toilet systems available and their potential application for a range of use situations.

6.2 Humus Starter

Some manufacturer/suppliers provide an organic rich humus “starter” mix to line the base of the compost chamber prior to commissioning. This may or may not include so-called “starter micro-organisms”. In some cases the starter mix is also the same material as the bulking agent added by each user to lightly cover excreted material following defecation.

6.3 Bulking Material

Bulking material is an organic rich additive required to assist in maintaining an open structure within the compost pile to facilitate aeration and thus odour free aerobic microbial decomposition. It has to be added regularly to enable separation of individual faecal excretions and soak up urine. Ideally addition of bulking material should be undertaken by individual users at time of use – a daily check should be carried out by the dwelling occupier each evening to confirm the day's offerings have been covered and bulking material added as necessary. The bulking material also provides a carbon source for those micro-organisms needed to process the nitrogen content of both the urine and faecal organic matter.

In situations where the manufacturer/supplier does not provide a proprietary bulking material then alternative material(s) will be required. This may be sawdust (from untreated timber), mulch (medium grading), leaf litter, wood shavings, straw or other types of organic or humus materials that will assist in 'bulking' up the composting mass and facilitating air movement into and through the mass.

Selection and use of suitable bulking material is particularly important for larger continuous composters which have long period processing capacity. If for any reason the composting process breaks down through inadequate management, the emptying and restarting of the compost process will be a significant undertaking, both in removing the accumulated and partially matured material, and finding a suitable location for its further treatment and disposal.

Smaller continuous composters and rotating drum composters have devices/arrangements to enable regular turnover and mixing of contents, thus more effectively achieving a good faecal matter/bulking agent combination. For batch toilets with potentially a much shorter period between emptying events than continuous composters under the same usage pattern, over-use of bulking material will shorten servicing time.

6.4 Climate Effects

Cold weather conditions will impact adversely on the composting process if over-aeration with cold air occurs. In such situations consideration may be given to providing a heating system for either the toilet compartment or the air inlet or both. Alternatively, a larger unit may be adopted for cold weather applications to enable more capacity to cope with the slower decomposition rates.

6.5 Urine separation

All compost toilet systems will accumulate liquid from both urine addition and from water as a by-product of bacterial decomposition or as condensation. This liquid can become odorous (from ammonia evaporation) if it accumulates to any extent. Evaporation through venting can assist in controlling liquid levels, but over-venting to achieve suitable evaporation levels can cool the compost and decrease decomposition rates. It is thus necessary to achieve a suitable balance between compost moisture level, evaporation rate and liquid accumulation build-up. Diverting urine can be the most effective means of achieving this balance.

However, drying out the compost pile by overcompensating on liquid management is also detrimental to decomposition and provision for adding moisture (via water spray) may therefore need to be made.

Many proprietary systems provide for urine separation with a specially configured toilet seat and pedestal – this requires male users to be seated for urination. The urine is diverted to either separate storage tanks for subsequent disposal, or directed to the greywater system for treatment and land application.

Where pedestal loaded systems are not provided with urine separation and it is decided necessary to retrofit such a facility, then urine separation pedestal conversion kits are available (Appendix A).

6.6 Venting

Venting arrangements will be recommended by the manufacturer/supplier of a proprietary system. Fan venting of the toilet unit is by far the preferred approach. The inlet and outlet pipework may be lagged to prevent heat loss during inflow and limit condensation feedback into the toilet unit during outflow. Inlets and outlet should be secured against entry of insects (and vermin).

In addition to ventilation provision for the compost pile, attention should be given to appropriate ventilation of the toilet compartment so that minimal impacts are imposed on users during compartment occupancy. The best approach is a fan ventilation system which draws fresh air into the compartment, creating a positive pressure so as to direct air down through the toilet pedestal to exit through the compost venting outlet.

7 MANAGING LIQUID DISCHARGE

7.1 Urine Management

In the absence of a urine diverter, urine will accumulate in the base of a toilet from natural soakage through the compost pile. A drainage outlet should be provided to enable ready transfer to a urine management system. This may consist of a storage tank (requiring regular emptying and separate disposal) or a drain line to the on-site greywater management system for the property.

Alternatively urine may be diverted away from the compost pile by a separator pedestal and seat (see section 6.5 above). This may be to storage (and separate disposal) or to the greywater system.

Some manufacturer/suppliers recommend use of the stored urine as a fertiliser by diluting 1 to 8 with water and applying via watering can to plants on the property. Council does not accept this method of urine management.

7.2 Liquid Drainage Disposal

As well as direct urine accumulation and/or diversion the compost pile will produce decomposition liquid as well as condensation liquid from daily and seasonal temperature and humidity changes. This liquid can be detrimental to the effectiveness of the combined aerobic/anaerobic decomposition processes, and if allowed to build up in the base of the pile will generate odours.

Thus all compost toilet systems should be provided with a liquid drainage and management system.

For low use toilet applications (such as cottages or holiday home use) a simple subsoil soakage pit or trench may be adequate to treat and dispose of the discharge. For permanent use and larger capacity systems the treatment and disposal of the liquid should be via incorporation into the greywater management system. The daily quantity of such liquid discharge is low (a few litres only) and will not impact on the design capacity of the greywater system.

For systems with mini-flush or low flush pedestals the resulting flush liquid will require either a separate treatment and land application system, or collection for incorporation into the greywater management system. Design capacity of that system should be increased accordingly.

7.3 Evaporation

For non-urine separation batch or continuous composting toilets fan ventilation may be used to control moisture content and liquid evaporation. Heating units may be used for evaporation assist. Some larger continuous composters incorporate evaporation trays supported by fan or passive solar ventilation. Such trays will accumulate salt deposits which need to be cleared under routine maintenance procedures.

8 MANAGING COMPOST END PRODUCT

8.1 Product Quality

AS/NZS 1546.2:2008 recommends that compost end product achieves the following quality characteristics prior to removal and disposal (Table A1 in the Standard):

- monitoring samples should contain no recognisable faecal material;
- moisture should not exceed 75% by weight;
- *E-coli* level should not exceed 200 MPN/gram dry weight; and
- salmonella organisms should not be detectable in 4 gram dry weight.

The Standard sets out a sampling regime relating to monitoring end product and performance assessment against the above quality requirements. This sampling regime and quality characteristics apply to systems being tested under the performance evaluation process set out in Appendix D in the Standard for those systems undergoing certification. The monitoring and testing procedures are not field testing requirements, but may be used to assess field performance.

Low capacity continuous and rotating drum composters utilise mixing processes to enable ready assimilation of fresh faecal material with maturing material, with end product transfer to collection trays where sampling of product is able to be carried out. Large capacity continuous composters have a final product compartment from which samples can be taken. Care has to be used to ensure that fresh material has not slipped down into the final compost compartment.

For batch composters the individual containers do not provide a final end product – final product is the result of the 6 month storage process following container replacement and removal of the full container to storage (see Figure 1 above).

8.2 Removal of Compost

End product removal will be driven by toilet usage and accumulation rates. This process requires a common sense approach to handling the material so that personal contact with product is avoided by the use of gloves and appropriate tools and containers. Manufacturer's instructions will advise best practice handling for their specific unit. AS/NZS 1546.2:2008 recommends the use of face masks, goggles and protective clothing (including gloves) when handling compost.

For properties which do not have room for disposal of final product then removal by waste management contractor can be adopted.

8.3 Burying Final Product

Final product should be buried at least 100mm below ground level and covered with topsoil. This includes material direct from continuous composters, and mature contents of batch containers following 6 months storage. Recovery of fully mature compost from burial areas may be used by persons wishing to make use of the nutrient value of the matured product for garden application. A 12 month burial period is recommended before recovery and use of the matured material. Table 1 below sets out Council's current requirements for managing end product.

Table 1: Council Requirements for Managing Compost End Products [Ref. 3]

Method	Requirement	Notes
Collection for off-site management	Registered Contractor	Signed contract required
Safe Burial on the Site	Define the area for compost disposal including the size of the area	Must be adequate for the proposed disposal frequency per annum
	Distance to the dwelling, other buildings, and boundaries	Minimum distances 1.5m to building foundations and boundaries.
	Other uses of area	Disposal site must be a reasonable distance from food crops (burial around fruit trees is OK.)
	Soil structure	To determine suitability of the disposal site (information can be obtained during the site assessment for the greywater system)
	Distance to waterways	Minimum of 30m to a bore or waterway.
	Distance to groundwater	Base of disposal area to be 600mm minimum above seasonally high groundwater
	Slope and contour of disposal area	Recommended slope not greater than 20 degrees (or 1 in 3)
	Depth of soil cover	Recommended minimum cover over compost end product of 100mm of good quality topsoil.

9 INSTALLATION/CONSTRUCTION

9.1 Proprietary Systems

Manufacturer/suppliers will provide a full set of installation instructions and advise on the room required to site their system within the dwelling toilet compartment, and in the basement area where systems include an under-floor composting chamber.

9.2 DIY Systems

Appendix D sets out construction details for an inclined continuous composter. The basic compost/worm toilet referred to in Appendix A is only recommended for remote area facilities and not for general household use.

9.3 User Compartment Ventilation

Good ventilation is critical in achieving a user-friendly environment in the toilet compartment. Fan ventilation provides a more reliable air flow through the compartment than passive ventilation. Passive solar ventilation using an outdoor vent pipe enclosed in a black painted sheet metal tube can provide effective airflow through a controlled inlet into the toilet compartment. This approach is most effective if the vent pipe and warm air tube are exposed on the sunny side of the building [Ref. 2].

10 OPERATION AND MAINTENANCE

10.1 User Guidelines

For proprietary systems the manufacturer/supplier will provide a set of user guidelines as well as a laminated summary sheet for posting in the toilet compartment. The summary sheet should indicate that the composting toilet comprises a living biological process that has to be protected by careful use. The requirements for adding bulking material following each use should be clearly indicated on both the user guideline summary sheet and the bulking material storage bin/box or dispenser.

The basic rule for compost toilet use is that only human waste matter, toilet paper and approved/recommended bulking material should be added to the compost chamber. The summary sheet (in large type readable from a sitting position while the toilet is in use) should emphasise the importance of keeping non-faecal material out of the composting chamber.

For DIY units the same restrictions apply. The designer/builder should provide similar user guidelines and summary sheet for posting within the toilet compartment.

10.2 Additives to Assist Composting Action

Additives claimed to promote and maintain effective composting action are available on the market (Appendix A), and may be recommended or supplied by some manufacturer/suppliers. Such materials/compounds are not essential to maintaining good composting action, and certainly will not assist in recovering systems which have failed due to overload or mis-management. Regular use may impose significant operating costs on the system without showing real cost benefit.

10.3 Operation and Maintenance

The manufacturer/supplier for a proprietary system will supply a set of operating and maintenance (O&M) instructions. The owner/occupier of the dwelling will be responsible for O&M, and where the property is rented, it will be important that the owner ensures the occupier is fully aware of their responsibilities for complying with the user instructions, and for undertaking such routine maintenance as is required by the O&M instructions.

Key maintenance elements will include details re frequency of service checks as well as:

- information on appropriate cleaning methods for the toilet pedestal (including use of cleaning fluids);
- checking bulking material supply and storage capacity top-up;
- procedures to check compost condition and progress with maturing;
- removal of batch containers and replacement of container units and/or liner bags;
- storing batch containers and pre-treatment (by adding soil cover) to assist decomposition process during the storage period;
- removing compost from continuous composters;
- checking the health and activity of worms in vermiculture systems;
- dealing with excess moisture levels (including use of bulking materials and checking that drainage outlets are clear);
- removing 'salt' accumulations from evaporation trays;
- dealing with cold weather conditions;
- requirements for placing system on stand-by prior to periods of non-use; and
- measures for start-up following periods of non-use.

11 GREYWATER OPTIONS

Measures for dealing with greywater discharges from dwellings serviced by composting toilets are outlined within Council Guidelines for Greywater Management. However several manufacturer/suppliers of composting toilets offer a total servicing solution including greywater treatment hardware and disposal system advice along with supply of the toilet system.

These are detailed in Table 2 below, which splits the systems into those dealing with greywater-regular (including greywater-heavy), and those dealing with greywater-lite. Council may, subject to conditions, give a waiver to allow installation of a proprietary greywater system outside the guidelines.

Table 2: Proprietary Greywater Systems

Manufacturer Supplier	Compost Toilet Unit	Greywater-Regular Treatment and Disposal Unit	Notes
Clivus Multrum	Clivus Multrum	No proprietary system	<ul style="list-style-type: none"> Recommend approaching local council for treatment and disposal requirements Can advise on various methods available Can supply a greywater Pre-filter
Eco Toilets	<ul style="list-style-type: none"> Aquatron Toatrone 	Two-stage (series) settling tanks (2,000L total capacity) with outlet lint filter	<ul style="list-style-type: none"> Recommend approaching local council for disposal requirements Recommended trench system details provided
Rota-Loo	Rota-Loo	<ul style="list-style-type: none"> 3,000L sullage settling tank and alternating trench system (Niimi System) 3,000L sullage settling tank and rock plant filter plus mini-leach field 	Niimi system approved in Victoria, Australia by EPA Vic
Bio Systems	Biolo	1,800L greywater treatment tank plus soakage (leach field) trenches	
Natural Flow Systems	Wormorator	<ul style="list-style-type: none"> Greywater settling tank Effluent outlet filter ETS (evapotranspiration) beds 	Supply and installation service
Simple Waste Water Solutions	Wormorator & Evaporator (plant filters and evaporator)	<ul style="list-style-type: none"> Greywater treatment unit Plant filters Sand filter LPED land application system 	
Manufacturer Supplier	Vermicomposter Unit	Greywater-lite Treatment and Disposal Unit	Notes
Autoflow	Autoflow Vermi Composter (flush toilet plus kitchen wastewater)	<ul style="list-style-type: none"> 1,500L greywater-lite treatment tank Batch reactor (media filter second stage treatment) Siphon dosed LPED land application trenches 	Land application area is planted out with evapo-transpiration vegetation

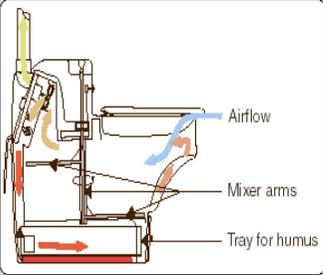
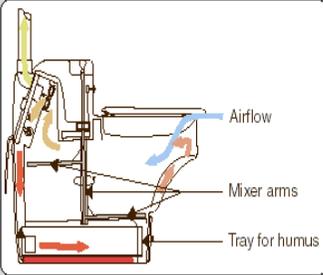
[Continued]

Manufacturer Supplier	Vermicomposter Unit	Greywater-lite Treatment and Disposal Unit	Notes
Envirosystems	Envirosystems Vermicomposter (flush toilet plus kitchen wastewater)	<ul style="list-style-type: none"> • Greywater-lite treatment within separate chamber in combined vermiculture tank • Alternatively greywater-lite treated via Grey Water Filter unit (bark chip and gravel) • SDC (siphon dosing chamber) and LPED soakage trenches 	

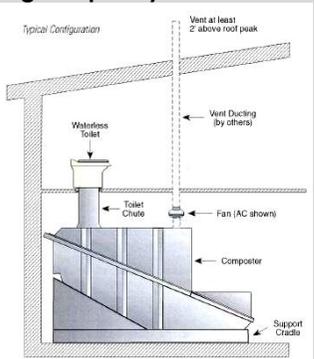
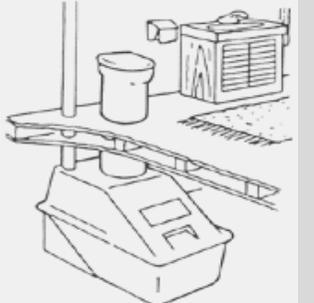
12 REFERENCES

1. AS/NZS 1546.2:2008 On-site domestic wastewater treatment units – Part 2: Waterless composting toilets
2. Department of Conservation, NZ (1995) Wastewater Servicing for Remote Area Recreational facilities – A New Zealand Concept and Design Manual
3. Gisborne District Council, Customer Service Unit – Installation of Composting Toilets

APPENDIX A: NEW ZEALAND AGENTS, SUPPLIERS and MANUFACTURERS of COMPOST TOILETS

System Type	Available System and Models	Country of Origin and Website Details	NZ Agent, Supplier, Manufacturer	Notes
<p>Low capacity continuous</p>  	<p>Bioilet</p> <ul style="list-style-type: none"> Bioilet 10 Standard [3 person; manual mixer; liquid control] Bioilet 20 Deluxe [3 person; automatic mixer; liquid control] Bioilet 30 NE [non-electric 3 person; 12 volt 4 person; exchangeable bin maturation; external liquid disposal] Bioilet 20 [3 person; automatic mixer; liquid control] Bioilet 60 XL [4 person; automatic mixer; liquid control] <p>Ecolet</p> <ul style="list-style-type: none"> Ecolet Manual (2 persons semi automatic) Ecolet Automatic XL (3 persons fully automatic) 	<p>USA www.bioilet.com/products www.rotaloo.com</p> <p>Swedish www.clivusmultrum.co.nz</p>	<p>Warren Moore Alternative Sewerage Systems (NZ) Ltd 52 Aorangi Road Bryndwr Christchurch 8035 New Zealand mailto:pete@compostingtonz.co.nz Ph: (03) 351 6496 Email: warrenm@freelance.gen.nz</p> <p>Waterless Composting Systems NZ Ltd, 1/160 Parker Road, Oratia, Waitakere City 0604 Ph: (09) 818 8215</p>	<p>Boilet/Ecolet subject to Beal Appraisal C250, June 2006 www.bqi.org.nz/pdf_img/Appraisal.pdf</p> <p>Agent for Clivus Multrum Australia [Boilet/Ecolet subject to Beal Appraisal C250, June 2006 www.bqi.org.nz/pdf_img/Appraisal.pdf]</p>

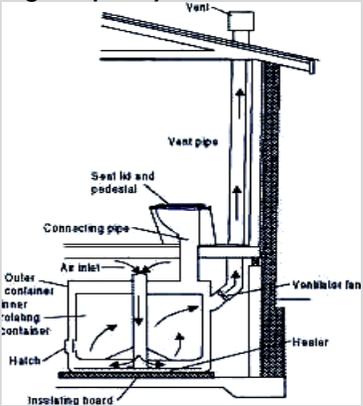
Appendix A: New Zealand Agents, Suppliers And Manufacturers Of Compost Toilets (c'td)

System Type	Available System and Models	Country of Origin and Website Details	NZ Agent, Supplier, Manufacturer	Notes
<p>High capacity continuous</p>   	<p>Clivus Multrum</p> <ul style="list-style-type: none"> • CM8 - 8,000 uses/yr [small homes] • CM10 - 10,000 uses/yr [family homes] • CM14 - 14,000 uses/yr [large family homes] • CM20 - 20,000 uses/yr [larger homes with plus 2 toilets] • CM40 - 40,000 uses/yr [commercial and public facilities] • CM60 - 60,000 uses/yr [high public use (e.g. rest areas)] 	<p>Swedish www.clivusmultrum.co.nz</p>	<p>Waterless Composting Systems NZ Ltd, 1/160 Parker Road, Oratia, Waitakere City 0604 Ph: (09) 818 8215</p>	<p>Agent for Clivus Multrum Australia</p>
	<p>Toatrone</p>	<p>NZ version of Swedish Clivus Multrum www.ecotoilets.co.nz</p>	<p>Eco Toilets PO Box 14 028 Enderley Hamilton Phone: (07) 828 8474. Fax: (07) 828 8212 E-mail: info@ecotoilets.co.nz.</p>	<p>Separation of urine provided for</p>
	<p>Bioloo (dry pedestal)</p> <ul style="list-style-type: none"> • Domestic size units (5 person) • Commercial size units <p>[Design to order units]</p>	<p>New Zealand www.biolooc.co.nz www.biolooc.co.nz/SMALL%20LOO.htm www.biolooc.co.nz/greywater.htm</p>	<p>BioSystems Ltd PO Box 7012, Te Ngae, Rotorua 3042 Ph: 0800 BILOOO 027 490 5160 vanb@wave.co.nz</p>	<ul style="list-style-type: none"> • Systems manufactured by Plastic Systems Ltd, Rotorua • Provide design and installation service • Provide greywater systems

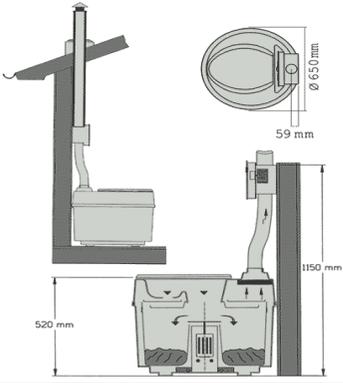
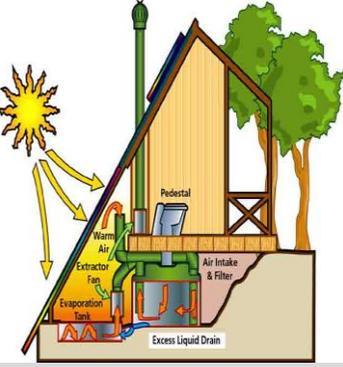
Appendix A: New Zealand Agents, Suppliers And Manufacturers Of Compost Toilets (c'td)

System Type	Available System and Models	Country of Origin and Website Details	NZ Agent, Supplier, Manufacturer	Notes
<p>Low capacity batch</p>    <p>http://www.kiwibog.com/images/bog_strait_up.jpg</p>	<p>Ecolet Ecolet NE (2 persons full time, 4 persons part time; batch composte; non-electric)</p>	<p>Swedish www.clivusmultrum.co.nz</p>	<p>Waterless Composting Systems NZ Ltd, 1/160 Parker Road, Oratia, Waitakere City 0604 Ph: (09) 818 8215</p>	<p>Agent for Clivus Multrum Australia</p>
	<p>Separett – Torp-Isak Cottage Toilet</p>	<p>Sweden www.separett.eu www.lewisgray.com</p>	<p>Lewis Gray Ltd PO Box 30 2060 North Harbour Auckland 0751 Free Phone: 0800 17 18 17 Ph: (09) 415 3348 Fax: (09) 415 3396 E-mail: sales@lewisgray.com</p>	<ul style="list-style-type: none"> • Urine separation separate management (soakaway or greywater system) required • Mains power or battery power fan operation • Container removal and storage of waste material for 6 months prior to further composting or burial • Compostable liner provided
	<p>Kiwi Bog</p>	<p>New Zealand www.kiwibog.com</p>	<p>Kiwi Bog Company Ltd 63 Robinson Road The Brook Nelson 7010 Ph: (03) 546 9769 Mobile: 027 449 1699 and 027 204 2733 E-mail: info@kiwibog.com</p>	<ul style="list-style-type: none"> • Urine separation toilet • Bag collection of faecal matter (storage in external container for 6 months prior to burial) • Biodegradable bags available • Fan ventilated (12v electric)

Appendix A: New Zealand Agents, Suppliers And Manufacturers Of Compost Toilets (c'td)

System Type	Available System and Models	Country of Origin and Website Details	NZ Agent, Supplier, Manufacturer	Notes
<p>Low capacity batch (c't'd)</p> 	<p>Separett</p> <ul style="list-style-type: none"> Villa 9000 Villa 9010 12v Villa 9200 110v; <p>[All systems 4 persons over 3 to 6 weeks; unlimited numbers require emptying]</p>	<p>Sweden</p> <p>www.separett.eu</p> <p>www.lewisgray.com</p>	<p>Lewis Gray Ltd PO Box 30 2060 North Harbour Auckland 0751 Free Phone: 0800 17 18 17 Ph: (09) 415 3348 Fax: (09) 415 3396 E-mail: sales@lewisgray.com</p>	<ul style="list-style-type: none"> Urine separation separate management (soakaway or greywater system) required Mains power or battery power fan operation Container removal and storage of waste material for 6 months prior to further composting or burial Three containers and two lids provided with each unit
<p>High capacity batch</p> 	<p>Rota-Loo (Dwellings)</p> <ul style="list-style-type: none"> Rota-Loo 650 (4 persons) Rota-Loo 950 (8 persons) 	<p>Australia</p> <p>www.rotaloo.com</p>	<p>Warren Moore Alternative Sewerage Systems (NZ) Ltd 52 Aorangi Road Bryndwr Christchurch 8035 New Zealand mailto:pete@compostingtonz.co.nz Ph: (03) 351 6496 Email: warrenm@freelance.gen.nz</p>	<ul style="list-style-type: none"> Collection (batch) containers on inner rotating carousel Standard or urine separating pedestal available

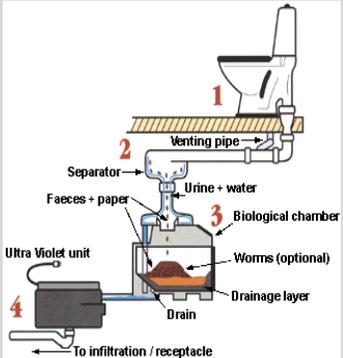
Appendix A: New Zealand Agents, Suppliers And Manufacturers Of Compost Toilets (c'td)

System Type	Available System and Models	Country of Origin and Website Details	NZ Agent, Supplier, Manufacturer	Notes
<p>High capacity batch (c'td)</p> 	<p>Separett Classic 3000 (evaporating and dehydrating toilet)</p>	<p>Sweden www.separett.eu www.lewisgray.com</p>	<p>Lewis Gray Ltd PO Box 30 2060 North Harbour Auckland 0751 Free Phone: 0800 17 18 17 Ph: (09) 415 3348 Fax: (09) 415 3396 E-mail: sales@lewisgray.com</p>	<ul style="list-style-type: none"> Fan plus heating element 2 solid waste/compost containers with double urine discs and 1 lid, Carbon filter venting cassette.
	<p>Rota-Loo (Commercial and public facilities)</p> <ul style="list-style-type: none"> Maxi Rota-Loo (with Soltran Building) 	<p>Australia www.rotaloo.com</p>	<p>Warren Moore Alternative Sewerage Systems (NZ) Ltd 52 Aorangi Road Bryndwr Christchurch 8035 New Zealand mailto:pete@composti toilets.co.nz Ph: (03) 351 6496 Email: warrenm@freelance.gen.nz</p>	<ul style="list-style-type: none"> Solar assist liquid evaporation

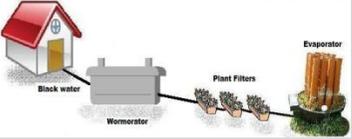
Appendix A: New Zealand Agents, Suppliers And Manufacturers Of Compost Toilets (c'td)

System Type	Available System and Models	Country of Origin and Website Details	NZ Agent, Supplier, Manufacturer	Notes
<p>Rotating drum</p>	<p>Sun-Mar</p> <ul style="list-style-type: none"> • Excel (220v) [3 to 4 person dwelling; 6 to 8 person holiday home] • Excel NE (Non-electric) [2 to 3 person dwelling; 5 to 7 person holiday home] • Compact [1 person dwelling; 3 to 4 person weekend] 	<p>North American (based on original Swedish development)</p> <p>www.sun-mar.com</p> <p>www.ecotech.co.nz</p>	<p>EcoTech Ltd - Composting Toilets</p> <p>488 West Coast Road RD 1 Awanui Far North Northland 0486</p> <p>Ph: (09) 4067546 Fax: (09) 4067546 Mobile: (027) 279 3127 E-mail: sales@ecotech.co.nz</p>	<ul style="list-style-type: none"> • Excel (220v) provides evaporation of liquid • Excel NE requires a 25mm drain line for liquid
	<p>Kakapo</p> <p>Single dwelling unit (rotating drum)</p>	<p>New Zealand</p> <p>www.kakapos.net</p>	<p>Kakapo Composting Toilets</p> <p>Advanced Epoxy Flooring 124A Bedford Street St Clair Dunedin 9012</p> <p>Ph: (03) 455 7192 Mobile: 021 374 826 Email: advfibre@ihug.co.nz</p>	<ul style="list-style-type: none"> • End product requires further maturing in separate compost bin • Liquid tray diversion to outlet drainage system

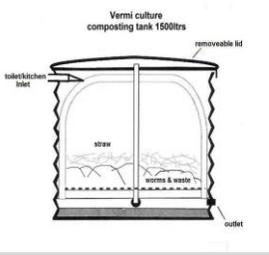
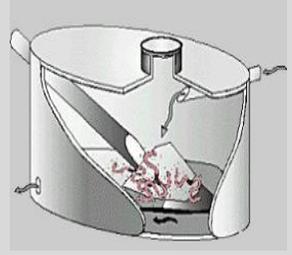
Appendix A: New Zealand Agents, Suppliers And Manufacturers Of Compost Toilets (c'td)

System Type	Available System and Models	Country of Origin and Website Details	NZ Agent, Supplier, Manufacturer	Notes
Mini-flush 	Aquatron Model 4x100 (1-2 person dwelling; 5 person holiday home) Model 4x200 (5 person dwelling) Model 4x300 (8 toilet commercial system)	Swedish www.aquatron.se www.ecotoilets.co.nz	Eco Toilets PO Box 14 028 Enderley Hamilton Phone: (07) 828 8474. Fax: (07) 828 8212 E-mail: info@ecotoilets.co.nz .	Separation and treatment of urine and flush waters
	Bioloos (ceramic flush pedestal) <ul style="list-style-type: none"> • Domestic size units (5 person) • Commercial size units 	New Zealand www.bioloos.co.nz www.bioloos.co.nz/SMALL%20LOO.htm www.bioloos.co.nz/greywater.htm	BioSystems Ltd PO Box 7012, Te Ngae, Rotorua 3042 Ph: 0800 BIOLOO 027 490 5160 vanb@wave.co.nz	<ul style="list-style-type: none"> • Systems manufactured by Plastic Systems Ltd, Rotorua • Provide design and installation service • Provide greywater systems
Low-flush (worm based) 	Worminator	New Zealand Natural Flow Systems www.naturalflow.co.nz	<ul style="list-style-type: none"> • Natural Flow Northland Fax: (09) 404 0648 Mobile: 027 274 8262 E-mail: gssdave@xtra.co.nz • Natural Flow Systems Auckland Ltd Ph: (09) 424 4669 Mobile: 037 486 6451 E-mail: naturalflow@orcon.net.nz 	Provide complete blackwater (Worminator) and greywater system

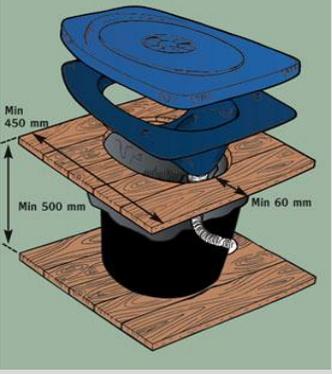
Appendix A: New Zealand Agents, Suppliers And Manufacturers Of Compost Toilets (c'td)

System Type	Available System and Models	Country of Origin and Website Details	NZ Agent, Supplier, Manufacturer	Notes
Low-flush (worm based) (c'td) 	Wormerator/Evaporator	New Zealand www.simplewastewatersolutions.co.nz	Simple Waste Water Solutions Ph: (09) 422 7817 Fax: (09) 422 7812 E-mail: info@simplewastewatersolutions.co.nz	<ul style="list-style-type: none"> • Wormerator • Plant filters • Evaporator (zero discharge system)
DIY Units	Clivus Minimus (continuous composter; standard household)	USA	Carol Stoner (1977) "Goodbye to the Flush Toilet", Rodale Press [cited in DoC Concept and Design Manual, 1995]	Refer Appendix D for details
	Basic Compost/Worm Toilet (4 person household)	New Zealand www4.wave.co.nz/~earthel/text/compost.doc	Mr Harry Franks	DIY unit comprising: <ul style="list-style-type: none"> • compost container (replaced when full) • free draining liquid outlet
Portable toilet units 	Pacto Mobile and field toilet (unit foldable for transportation)	Sweden www.danfo.com www.lewisgray.com	Lewis Gray Ltd PO Box 30 2060 North Harbour Auckland 0751 Free Phone: 0800 17 18 17 Ph: (09) 415 3348 Fax: (09) 415 3396 E-mail: sales@lewisgray.com	<ul style="list-style-type: none"> • Waste encapsulated in durable foil bag • Biodegradable foil for composting or burial; polythene foil for incineration
	Green Loos (portable composting toilet)	New Zealand	brad@greenloos.com	Winner of SPARK entrepreneurial challenge, Auckland, 2009

Appendix A: New Zealand Agents, Suppliers And Manufacturers Of Compost Toilets (c'td)

System Type	Available System and Models	Country of Origin and Website Details	NZ Agent, Supplier, Manufacturer	Notes
Low-flush (worm based) hybrid  	Autoflow Natural Wastewater Treatment Systems	New Zealand www.autoflow.net.nz	Autoflow Ltd 18 North Rd, Kaitaia, Far North 0410 Phone: 09 408 6080 Fax: 09 408 6081 Email: autoflowltd@xtra.co.nz	<ul style="list-style-type: none"> Both toilet waste and kitchen waste treated in vermicomposter chamber Separate greywater (bathroom and laundry) treatment
	EnviroSystems	New Zealand www.trident.co.nz	Email: envirosystems@trident.co.nz	<ul style="list-style-type: none"> Both toilet waste and kitchen waste treated in vermicomposter chamber Separate greywater (bathroom and laundry) treatment
Optional Extras 	Additives Compost-Zing	New Zealand www.bokashi.co.nz	Bokashi NZ PO Box 11 Pleasant Point South Canterbury 7947 Ph: (03) 614 8150 Fax: (03) 614 8160 E-mail: info@bokashi.co.nz	Plant by-products inoculated and fermented with EM (Effective Micro-organisms) used in odour control and improving efficiency for compost toilets

Appendix A: New Zealand Agents, Suppliers And Manufacturers Of Compost Toilets (c'td)

System Type	Available System and Models	Country of Origin and Website Details	NZ Agent, Supplier, Manufacturer	Notes
	<p>Urine Diverter Kit</p>	<p>Sweden www.separett.eu www.lewisgray.com</p>	<p>Lewis Gray Ltd PO Box 30 2060 North Harbour Auckland 0751 Free Phone: 0800 17 18 17 Ph: (09) 415 3348 Fax: (09) 415 3396 E-mail: sales@lewisgray.com</p>	

Note: The named toilet models above represent those confirmed as available at the time of publication of these Guidelines.

APPENDIX B: Selection of a Compost Toilet System

System	Application	Benefits	Operational Commitment	Issues
All Systems	All applications	<ul style="list-style-type: none"> Provides an alternative to the flush toilet Reduces household water use Reduces loading on the on-site wastewater management system Provides an end product which can be further composted on-site or readily assimilated within the soil by burial 	<ul style="list-style-type: none"> Dedicated and informed commitment is required by owner/occupier to regular operational inspection and maintenance to ensure optimum system performance and service delivery Manufacturers' user instructions need to be located in prominent location within user area 	<ul style="list-style-type: none"> Must provide separate greywater systems for kitchen, bathroom and laundry wastewater flows Handling of end product requires care and diligence to avoid potential health risk Any failure of system due to misuse or inadequate operational supervision and maintenance will create odours and may require emptying and restarting the process/system
Low capacity continuous	<ul style="list-style-type: none"> Low occupancy rural residential dwellings Intermittent occupancy holiday homes 	<ul style="list-style-type: none"> As above for All Systems 	<ul style="list-style-type: none"> As above for All Systems Casual users (holiday residents) need to be schooled in proper use of the system. 	<ul style="list-style-type: none"> As above for All Systems Casual users (holiday residents) need to be provided with contact details of owner in event of any user/operational problems
	<ul style="list-style-type: none"> Urban residential second toilet 	<ul style="list-style-type: none"> Provides an alternative to the flush toilet where location is below sewer grade line Reduces load on sewerage system End product can be disposed with household refuse collection 	<ul style="list-style-type: none"> As above for All Systems House guests need to be schooled in proper use of the system. 	<ul style="list-style-type: none"> Building Act waiver required from local council Hand wash facility requires sump and pump to greywater system upstairs Relevant other matters from all systems above
High capacity continuous	<ul style="list-style-type: none"> Permanent occupancy rural residential dwellings Rural commercial facilities (employee use) Rural and holiday area accommodation facilities (lodges; camping grounds) Public use (toilet facilities) 	<ul style="list-style-type: none"> As above for All Systems 	<ul style="list-style-type: none"> As above for All Systems Commercial and public use facilities require trained and dedicated staff to service units 	<ul style="list-style-type: none"> As above for All Systems

APPENDIX B: Selection of a Compost Toilet System (c'td)

System	Application	Benefits	Operational Commitment	Issues
Low capacity batch	<ul style="list-style-type: none"> • Low occupancy rural residential dwellings • Intermittent occupancy holiday homes 	<ul style="list-style-type: none"> • As above for All Systems 	<ul style="list-style-type: none"> • As above for All Systems • Casual users (holiday residents) need to be schooled in proper use of the system. 	<ul style="list-style-type: none"> • As above for All Systems • Handling and storage of end product containers requires care and diligence to avoid potential health risk • Process of final composting or burial of container contents after 6 months storage requires care and diligence to avoid potential health risk
High capacity batch	<ul style="list-style-type: none"> • Permanent occupancy rural residential dwellings • Rural commercial facilities (employee use) • Rural and holiday area accommodation facilities • Public use (toilet facilities) 	<ul style="list-style-type: none"> • As above for All Systems 	<ul style="list-style-type: none"> • As above for All Systems • Commercial and public use facilities require trained and dedicated staff to service units 	<ul style="list-style-type: none"> • As above for All Systems • Handling and storage of end product containers requires care and diligence to avoid potential health risk • Process of final composting or burial of container contents after 6 months storage requires care and diligence to avoid potential health risk
Rotating drum	<ul style="list-style-type: none"> • Low occupancy rural residential dwellings • Intermittent occupancy holiday homes • Permanent occupancy rural residential dwellings 	<ul style="list-style-type: none"> • As above for All Systems 	<ul style="list-style-type: none"> • As above for All Systems • Casual users (holiday residents) need to be schooled in proper use of the system. 	<ul style="list-style-type: none"> • As above for All Systems
Mini-flush	<ul style="list-style-type: none"> • Low occupancy rural residential dwellings • Intermittent occupancy holiday homes • Permanent occupancy rural residential dwellings 	<ul style="list-style-type: none"> • As above for All Systems • Provides convenience of flush toilet 	<ul style="list-style-type: none"> • As above for All Systems • Casual users (holiday residents) need to be schooled in proper use of the system. • Need to ensure users are aware this is not a conventional flush toilet system 	<ul style="list-style-type: none"> • As above for All Systems

APPENDIX B: Selection of a Compost Toilet System (c'td)

System	Application	Benefits	Operational Commitment	Issues
Low-flush (worm based system)	<ul style="list-style-type: none"> • Low occupancy rural residential dwellings • Intermittent occupancy holiday homes • Permanent occupancy rural residential dwellings • Public use (community halls) 	<ul style="list-style-type: none"> • As above for All Systems • Provides convenience of flush toilet 	<ul style="list-style-type: none"> • As above for All Systems • Casual users (holiday residents) need to be schooled in proper use of the system. • Need to ensure users are aware this is not a conventional flush toilet system • In addition users need to understand its performance is dependent on the health of worm based decomposition processes • Commercial and public use facilities require trained and dedicated staff to service units 	<ul style="list-style-type: none"> • As above for All Systems
DIY	<ul style="list-style-type: none"> • Low occupancy rural residential dwellings • Intermittent occupancy holiday homes • Permanent occupancy rural residential dwellings 	<ul style="list-style-type: none"> • As above for All Systems • Provides opportunity for low cost sanitation servicing 	<ul style="list-style-type: none"> • As above for All Systems • Casual users (holiday residents) need to be schooled in proper use of the system. 	<ul style="list-style-type: none"> • As above for All Systems • Need to ensure quality workmanship is achieved • Council building consent and construction/installation inspections will be required
Portable toilet systems units	<ul style="list-style-type: none"> • Construction sites • Social events (sports; exhibitions) • Military operations • Camping gatherings such as Scouts and other groups 	<ul style="list-style-type: none"> • As above for All Systems 	<ul style="list-style-type: none"> • As above for All Systems • Casual users (workers, visitors, staff) need to be provided with clearly readable and visible user instructions 	<ul style="list-style-type: none"> • As above for All Systems

APPENDIX B: Selection of a Compost Toilet System (c'td)

System	Application	Benefits	Operational Commitment	Issues
<p>Low-flush (worm based system) hybrid system</p>	<ul style="list-style-type: none"> • Low occupancy rural residential dwellings • Intermittent occupancy holiday homes • Permanent occupancy rural residential dwellings • Public use (community halls) 	<ul style="list-style-type: none"> • As above for All Systems • Provides convenience of flush toilet • Accepts kitchen waste flows • Household produces greywater-life which is more acceptable for treatment and recycle for garden use and toilet flushing 	<ul style="list-style-type: none"> • As above for All Systems • Casual users (holiday residents) need to be schooled in proper use of the system. • Need to ensure users are aware this is not a conventional flush toilet system • In addition users need to understand its performance is dependent on the health of worm based decomposition processes • Commercial and public use facilities require trained and dedicated staff to service units 	<p>As above for All Systems except that only treatment and land application for greywater-life is required.</p>

Appendix C: Matching System Type with Potential Applications

System Type	Potential Application							
	Urban residential second toilet	Intermittent occupancy holiday homes	Low occupancy rural residential dwellings	Permanent occupancy rural residential dwellings	Rural commercial facilities	Rural accommodation facilities	Public use facilities [recreation areas; community halls]	Temporary Use Facilities
Low capacity continuous	Biolet Ecolet	Biolet Ecolet	Biolet Ecolet					
High capacity continuous				Clivus Multrum Toatrone Biolo	Clivus Multrum Toatrone Biolo	Clivus Multrum Toatrone Biolo	Clivus Multrum Toatrone Biolo	
Low capacity batch		Ecolet NE Torp Isak Kiwi Bog	Ecolet NE Separett Kiwi Bog	Separett Kiwi Bog				
High capacity batch				Rota-Loo Separett (Classic)	Rota Loo (Soltran)	Rota-Loo (Soltran)	Rota-Loo (Soltran)	
Rotating drum		Sun-Mar Kakapo	Sun-Mar Kakapo	Sun-Mar Kakapo				
Mini-flush		Aquatron Biolo	Aquatron Biolo	Aquatron Biolo				
Low-flush (worm based) system			Wormorator Wormorator & Evaporator	Wormorator Wormorator & Evaporator			Wormorator & Evaporator	
DIY		Clivus Minimus Basic Compost (Worm Toilet)	Clivus Minimus Basic Compost (Worm Toilet)	Clivus Minimus Basic Compost (Worm Toilet)				
Portable toilet units								Pacto Green Loo
Low flush (worm based) hybrid system			Autoflow EnviroSystems	Autoflow EnviroSystems				

Note: The named toilet models above represent those confirmed as available at the time of publication of these Guidelines [Refer Appendix AA]

