

Information for Designers and Installers of AES systems

ET has a free online training course for designers, installers, consenting officers, building inspectors and interested persons, available on our website www.et.nz and <https://www.et.nz/aes-online-course/>

An AES Wastewater designer (WWD) is a person who meets the requirements of a local consenting authority, and who has completed ET's online course.

An AES installer is a Licensed drainlayer who has completed ET's online course and has a current PGDB number. Installers are required to have shown they are familiar with the principles and installation requirements of AES treatment systems by completing the training course.

The ET design and review process

The design of most AES systems is specific to each individual site. A site investigation by an AES accredited WWD is required and the resulting AES design must take the results of this investigation into account. These thoughtful designers who have your long term cost interests at heart, are all over NZ. While this may require a little more thought by the designer the lasting benefit to the owner is no maintenance, nothing to break down and among the highest quality of On-Site wastewater treatment tested in NZ. That will continue in that manner for at least 3 decades with only the septic tank to empty of sludge every 5 years or so. This is the documented experience of the AES process in the USA.

An **AES Design Calculator** is available under Resources on our website at <https://www.et.nz/resources/design-aids/>. Designers use this to record their information when sizing an AES system for a specific site. The AES design calculator accompanies each design submitted to ET for review. This review process covers the sizing and layout of the AES system and when this meets design requirements ET approves the design and digitally signs a pdf of the AES design calculator and the construction drawings. This document you will require for application for Council Building consent approval in similar fashion to any wastewater treatment solution

Construction Drawings

The digitally signed pdf includes construction drawings which have been checked to ensure they incorporate sufficient detailed information to enable the intended correct form of installation possibly by a relatively inexperienced AES installer. There is nothing complicated in an AES install – it is simple pipe laying for any trades person however thought must be applied to how the system is to get its air supply. NZ Councils are conditioned to only accept such signed annotation for submission for Consent approval. This review by Et does not cover the site and soil assessment by the WW designer

Refer to signed design calculator example appended which would normally be attached to the construction drawings.

AES system design

A site and soil assessment, average and peak daily flow volumes and a method of disposal to land are ascertained by each designer as with any wastewater design and are covered in the 'Wastewater Design Report' to which the ET digitally-signed AES design calculator and installation plans will be attached.

The AES bed is where advanced secondary treatment takes place and is often also the method of disposal to ground of the treated effluent. In its simplest form AES is a completely passive system, with discharge to land occurring through the base of the AES bed. If owner preference, site constraints or council rules so require the AES bed can be installed within an impermeable lined underground bed incorporating a treated effluent underdrain for collection to a pump or siphon chamber for remote discharge through pressure compensated drippers or another disposal method. Installations in this form can also include for effluent treatment process recirculation for additional nutrient reduction and for UV sterilisation.

The Consent Process

This signed AES Design Calculator is used by councils when processing consent applications as evidence that it has been peer reviewed by Et and then again by us for the supply of AES components when they are subsequently ordered by the installer. The complete Wastewater Design report from your wastewater system designer will also include the results of your site and soil investigation etc.

AES Design Construction Plans, showing all the necessary information along with the AES Design Calculator and any special construction specifications should be available as a separate file to be printed on the minimum number of pages. This will then be available to the installer(s - if pricing is required) to have with them on site. The inclusion of the AES Design Calculator provides detail on how the system was sized and the estimated sand quantity necessary for construction.

This separate 'Construction' file can then be attached to the complete wastewater design report for council consent processing. As a minimum, this concise design and construction information can be identified in an index in the documentation for Council submission for consent, as **consecutive** pages for printing however this is not our preference and a separately printable 'Construction' file should be available.

These are the key points that need to be addressed in your AES design:

1. AES Calculator

- For the Design Loading Rate (DLR) use the secondary treated effluent rate per AS/NZS 1547:2012 or Auckland TP58 or GD06. Note that as the OSET test results were an order of magnitude better than that for Advanced Secondary Treatment the secondary treatment DLR's will be very conservative.
- If the AES system proposed collects the effluent from a lined AES bed for dispersal via pump, use DLR 50mm/d in the AES calculator and a DIR for dispersal appropriate to the soil type at the site.
- Gradient of the base of the AES bed is expressed as a percentage but this is only relevant if you do not intend to install the AES bed flat within the slope.
- Installer details can be left blank if not known at time of design.

In the design document for review, the following needs to be shown or stated:

2. Septic tank

Location of septic tank in relation to house, boundaries and AES bed. Provide level information if the AES bed is to be constrained by elevated ground water.

Outlet filters are not required but if they are desired by either the designer or the council, attention must be paid to the consequences of them becoming blocked if they are not maintained. This is only an issue when venting of the system is to exhaust at the terminal vent on the building. We do not recommend this method of venting as the possibility exists of smell from the terminal vent. This is not a consequence of the AES treatment process rather it's a consequence of air passing over untreated effluent on the way to the AES bed. If you wish to install an outlet filter in these circumstances there must be an alternative air path around the septic tank. This is a better option anyway whether a filter is fitted or not.

3. Site plan

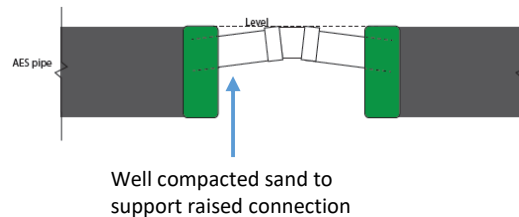
- The dimensioned position of septic tank relative to building and AES bed.
- Position of the AES bed.
- Position of high and low vents with diameters noted on the plan.
- Relative levels of the pipework connecting the various components especially if ground water or relatively impermeable layers within the proposed bed are identified.

4. Plan of AES bed – available from the Et website – must show:

- The number of rows. Note the maximum length of a single serial AES row is 60 metres
- The number of pipes per row

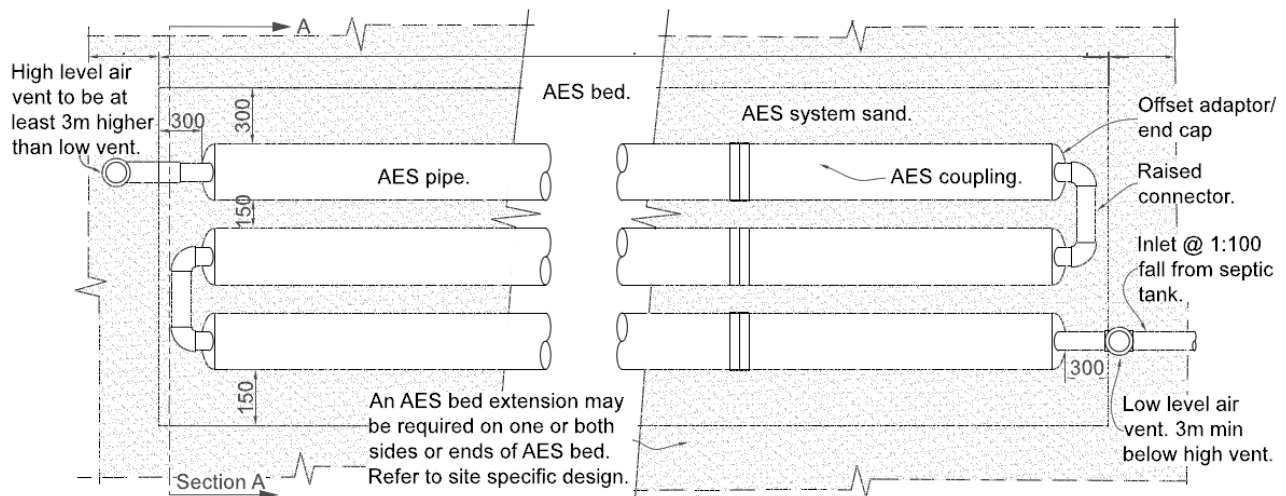
- The separation between rows of 150mm minimum and 300mm to the outside rows to the walls of the excavation.
- AES bed extension if that is required.
- A note that AES specification sand is required
- The planned serial nature of the inter-connection of the AES pipe rows. If the system installation is a minimum of one row that one row must be at least two separate sections of AES pipe interconnected with with offset adaptors. The minimum two interconnected sections of a single row would be in one line. Such a small system would usually be designed for installation to follow the contour on a slope or if other site constraints suit a long, thin bed area.

Example of a straight raised connection:



- The following Plan shows a 3 row serial system divided into 3 sections thus exceeding the minimum of 2 sections requirement.
- Topsoil coverage showing a minimum of 150mm to existing surface levels and maximum topsoil coverage can be dictated by the practicality of installation. Topsoil from the site is generally appropriate.
- The plan should show crowning of the topsoil cover to shed rainfall water to past the limits of the covered bed and any cutoff drains to divert other flowing surface water away from the bed.
- Show the intended surface finish. Grass cover to the bed is ideal as the close root structure will assist to shed rain water

Example of a plan view:

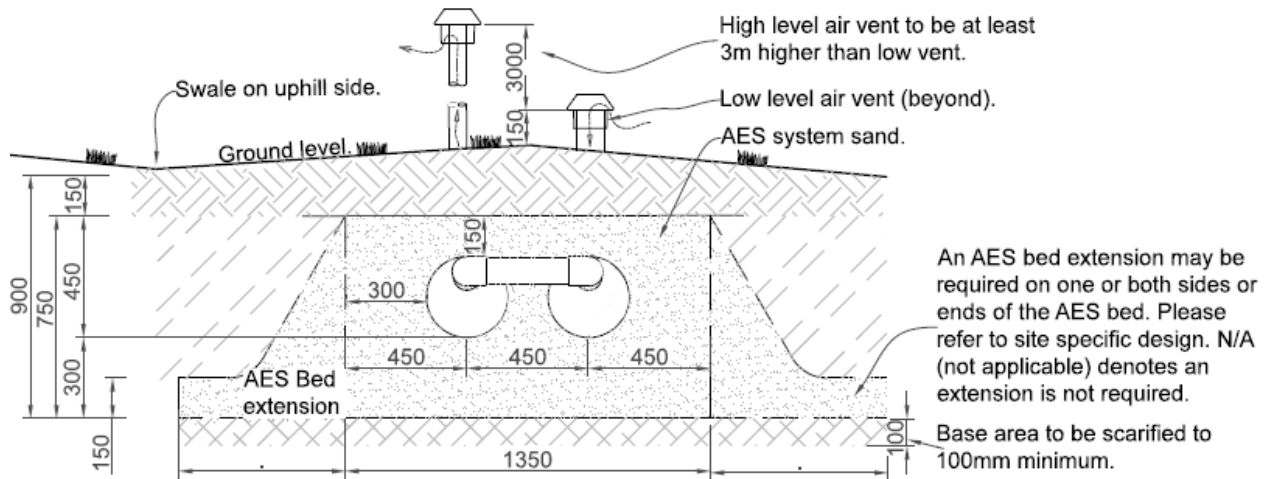


5. Cross Section of AES bed

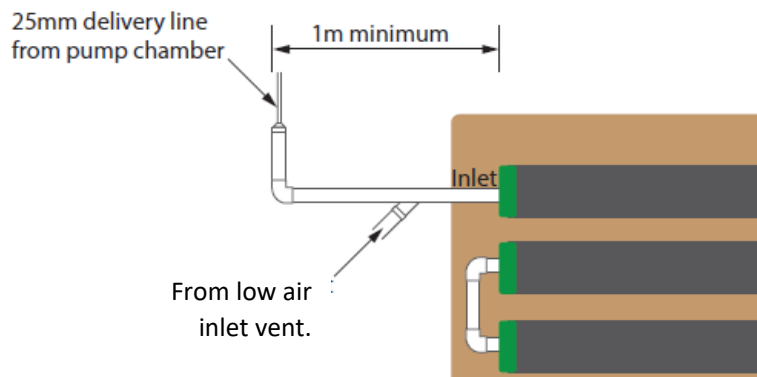
- For 3-4 Category soils the base area of the bed needs to be scarified to 100mm with a toothed bucket or small ripper.
- For category 5-6 soils the base area needs to be further scarified / ripped to an added depth of 200mm
- If a sand bed extension is required please include the dimensions of this on both the plan and cross-section views. Templates are available on our website <http://www.et.nz/resources/technical-drawings/>
- If there is the potential for flowing surface water this must be diverted from the application area either by a swale, cut-off trench and/or mounding of the bed top surface.
- Ensure sand coverage minimums are included, either in section or plan views or separately.
- If effluent is pumped into the AES bed, a velocity reducer must be installed to reduce turbulence inside the

AES pipes – include a diagram of this reducer. See the example following below.

Example of cross section:



Velocity reducer:



6. Venting of the AES bed

- You must ensure the system has a high air outlet vent and a low air entry vent shown in the design.
- The Low vent should preferably be connected at the inflow end of AES system and be dimensioned to be a minimum of 150mm above ground in a protected position away from mowers or vehicles and above snowfall level if that is an issue.
- The High Vent must be a minimum of 3 meters vertically above the level of the low vent and as above be connected preferably at the terminal end of the AES pipe system. If an even number of AES rows / sections are designed this connection will be at the same end of the bed as the inlet and the pipework can be installed in the same trench as influent line from the septic tank if this appropriate.
- 100mm DWV pipework is appropriate underground. High level air exhaust venting above ground can be a minimum of 2 x 50mm diameter vents if installed in internal framing or 1 x 65mm minimum diameter external vent. For large systems or if aesthetics are of no issue, vertical 80mm and 100mm vents can be used.
- Vents with preferably their own separate pipework can be located any distance from their connection to the AES system. However all connecting venting pipework **must** fall back to the AES bed and be noted on the plan in this manner so that no water trap can form through condensation that can block air flow through the system.
- Note all vents to be kept free of vegetation.

For use by consenting authorities - a signed calculator is a PS-2; proof of design review by ET.
For use by wastewater system designers for sizing of AES wastewater treatment systems receiving residential strength wastewater. Supplied to ET with design/ drawings and then signed by ET

When ordering AES materials - installers please supply to ET a Design Calculator signed by ET and council consented plans.

Site Address	14 The Back of Beyond Road, Erewhon		
Client Name	Buggy Rabbit		
Designed By	WWD Ltd	Designer Phone #	Designer AES Cert. #
Installer	To be Advised	Installer Phone #	Installer AES Cert. #
Council Area	Canterbury	Drainlayer Licence #	Date

Receiving soil category, surface water, water tables & all other site constraints to be addressed by designer.

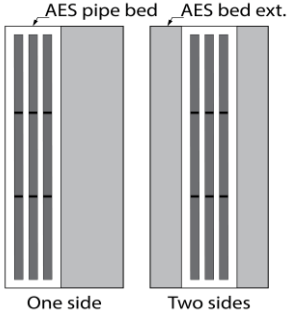
System designer's site and soil data. Enter data in light blue fields.		NOTES
Number of bedrooms	3	>> Enter "NA" if this design is for a campground, office, cafe etc without bedrooms.
Number of people	5	
Daily wastewater design flow allowance per person (l/p/d)	165	
Loading rate for AES pipes (L/m AES pipe/d)	38.0	>> Standard rate is 38 L/m AES pipe/d, averaged over a week. This is the NZ certified loading rate.
Do you want to use cut AES pipes - eg, 3.5 AES pipes per row? Y or N	N	
AES bed - No. of rows to suit site - max. AES pipe row length 30m/ 10x3m lgth	2	>> Longer AES beds increase contact area with surrounding soil.
Soil Category (per AS/NZS 1547) from site & soil evaluation	4	>> Contact ET for information regarding customising AES bed layouts to clay soils and sloping sites.
Design Loading Rate (DLR) based on soil category (mm/day)	30	>> Soil conditioning may be necessary. Ref AS/NZS 1547/ TP58/ GD06 & Notes below.
Sand depth beneath AES pipes - standard 300mm tested 3.5 FC Log reduction	300	>> Standard 300mm achieves 3.5Log reduction for FC**; increase sand depth to reduce FC further. Total expected FC Log reduction through AES system in this design: 3.5Log.
Is there a pump between the septic tank and the AES bed? Y or N	N	>> Ensure there is 50mm min. fall between septic tank and AES pipes, and pipework laid at 1:100 min.
Is this property sloping? Y or N	N	>> Crown top of bed to shed rainfall.
Is this design vented to the building terminal vent (TV)? Y or N	N	
Diameter of high vent (mm)	65	>> 65mm, 80mm or 100mm.
Is sampling of the treated effluent required? Y or N	N	
Distribution Box required Y or N	N	Number of ports required, including inlet port, and port for air vent if so designed.

NOTES: Increasing the pipe loading rate reduces the buffer capacity/ total volume of the pipes. The total volume of the AES pipes is 20,352L, which still allows room peak flows to be discharged over a relatively short time.

- Scarification of receiving surface is required in clay soil structures in Cat 4,5,6. In addition refer to AS/NZS 1547:2012, TP58 and GD06 (draft)
Always excavate and scarify parallel to the site slope and the rows of AES pipe.

- Drainlayers are reminded to practice good construction techniques as per AS/NZS 1547 and as provided on AES installation instructions supplied with components.

Plan view: AES bed extensions



AES Bed Design Calculator Outcomes		AES Bed dimensions	
Daily design flow (Q)	825.00 L/d	AES Pipe Bed	AES Bed Extension
Min. length of AES pipe rows	10.86 m	Length (m)	12.60
No. of 3m AES pipes per row	4.00 lths	Width (m)	1.35
Total volume of AES pipes	1696.00 L	Sand Depth	0.75
		Area m2	17.01
			10.49
For 'Surrounding' extension or to increase bed length/ decrease width enter "Y" - otherwise leave blank:		If 'Y' enter custom width (m) of AES bed - otherwise leave blank:	
	Length (m)	Width (m)	Minimum AES footprint required 27.5m2
The dimensions of this AES bed with side extension/s are:	12.6	x 2.18	= 27.5 m2 total

AES Bed Schedule of Materials	ET Signature box - ET Use Only
AES 3m length pipes required	Producer Statement PS-2 Design Review - approved by ET. (Does not cover site and soil assessment by designer.) Reviewed by: DL 27/11/2018 9:32 Data entry by: SJ Open PDF in Adobe Acrobat; hover over signature Follow link below to download Signature Verification macro www.securedsigning.com/products/signature-verification-service Click on signature in PDF to view signature validation
AES couplings required	
AES offset adaptors	
100mm vent cap with mesh	
Vent cowl for high vent	
TV inspection not required	
Sample port not required	
Distribution box not required	
Total AES System Sand required (guide only)	
8 lths	
6 ea	
4 ea	
1 ea	
1 ea - 65mm diam.	
13.9 m3	

To be used as a guide only; this AES Design Calculator is a design aid to assist calculating of the AES components and configuration. Site and Soil conditions as specified in NZS1547:2012 are calculated and designed by a **Qualified Designer**. Environment Technology has no responsibility for the soil evaluation, loading calculations or the DLR entered by the designer for this calculator.

*Residential Effluent is classed as having less than 300mg/L BOD5 and 350mg/L TSS prior to entry into the septic tank, and does not contain wastewater from industrial processes.
AES pipes can be cut to length on site. AES pipes are supplied in 3 metre lengths only.

** AES-38 single pass system achieved 3.5 log reduction for FC in OSET-NTP Trial 12, 2016-17 benchmarking period.

***Microbial removal rates through medium sand - Pang (2009). *Microbial Removal Rates in Subsurface Media Estimated From Published Studies of Field Experiments and Large Intact Soil Cores*

To have a design reviewed and signed off by ET - Designers please email your AES Design Calculator and drawings to design@et.nz
To order AES components - installers please email your signed AES Design Calculator and council consented plans to info@et.nz