Guidelines for the Design and Construction of Shallow Sub-Surface and Surface Irrigation

A properly maintained Aerated Wastewater Treatment System (AWTS) can provide a valuable water resource for your garden. However, these systems can pose a significant public and environmental health risk if they are not designed, installed and maintained appropriately.

The following design guidelines provide the minimum requirements for the design and construction of surface and shallow sub-surface irrigation systems designed to dispose of treated wastewater from an AWTS in a domestic environment.

Surface or Sub-Surface – What's the Difference?

Sub-Surface Irrigation

Shallow sub-surface drip irrigation is when domestic wastewater is disposed from flow emitters evenly spaced along a flexible low density polyethylene drip line. The drip line is buried between 150-200mm below the ground and effluent is distributed slowly and uniformly over a large surface area. Good quality topsoil is spread over the area to assist in the absorption of the effluent and the growth of lawn is encouraged to assist in the transpiration of effluent.

Surface Irrigation

Surface irrigation is when wastewater is disposed from drippers evenly spaced along a flexible low density polyethylene drip line similar to sub-surface irrigation. However, the drip line is generally buried at a depth of 100mm and riser pipes dispose of the effluent to the ground surface via a dripper. Good quality topsoil and mulch are spread over the area to assist in the absorption of the effluent whilst shallow rooted plants and grasses are planted at each dripper to assist in the transpiration of effluent.

Design and Construction – Sub-Surface Irrigation

- The installed pump must be adequately sized to service all irrigation fields. Most irrigation products will require at least a 10m head pressure to ensure the emitters will open. Head pressure directly relates to the power of the pump in the septic tank. Therefore, a 10m head will pump wastewater 10m high.

- A disc or mesh filter must be installed on the pump discharge line to protect pipework from any solids found in the wastewater which could potentially clog emitters. The mesh/disc filter must be 155-200 mesh/micron in size and must be installed in a box or above ground before the sub-surface irrigation area begins.

- The natural ground where the irrigation is to be installed must be cultivated (rotary hoed) to a minimum depth of 200mm.

- All distribution pipes (from the outlet of the septic tank system to the sub-surface irrigation field) must be buried to a minimum depth of 100mm from the natural ground surface. All irrigation pipes must be buried to a minimum depth of 100mm from the surface of the imported soil.

- The sub-surface irrigation system must be installed to ensure the wastewater is applied and dispersed uniformly over the entire area. The drip line must be installed in a grid format with one end intersecting a header manifold, and the other intersecting a footer manifold. (Refer to the diagram on next page).

- All drip line must be spaced a minimum of 1 metre apart and installed along the contours of the land.

- The manufacturer of the irrigation product should be consulted to determine the most appropriate emitter outlow rates which should be designed taking into consideration irrigation area design, soil permeability and water uptake of the receiving plants. Typically, emitters are usually spaced at 600mm apart to ensure uniform pressure throughout the system.

- Where more than one same sized irrigation field/area is constructed, a suitable automatic rotation system should be installed (e.g. auto-rotator or solenoids).

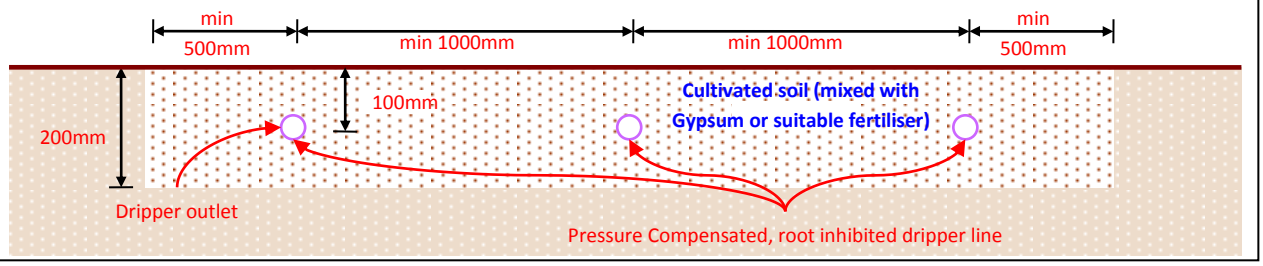
- Vacuum breakers/air release valves with suitable protection shall be provided to prevent ingress of soil into the irrigation lines under the effects of negative pipework pressure. Vacuum breakers/air release valves must be installed at the highest point in all sub-surface irrigation fields.

- Scour (flushing) valves in surface boxes shall be provided to allow for periodic cleaning of the system. Where flush water cannot be returned into the septic tank all flush water from each separate sub-surface irrigation field must be drained into a sump or trench. The trench/sump must be constructed in accordance with CA 1.2/03 and be 1m wide, 350mm deep and 1m long using clean uniform 20-40mm aggregate.

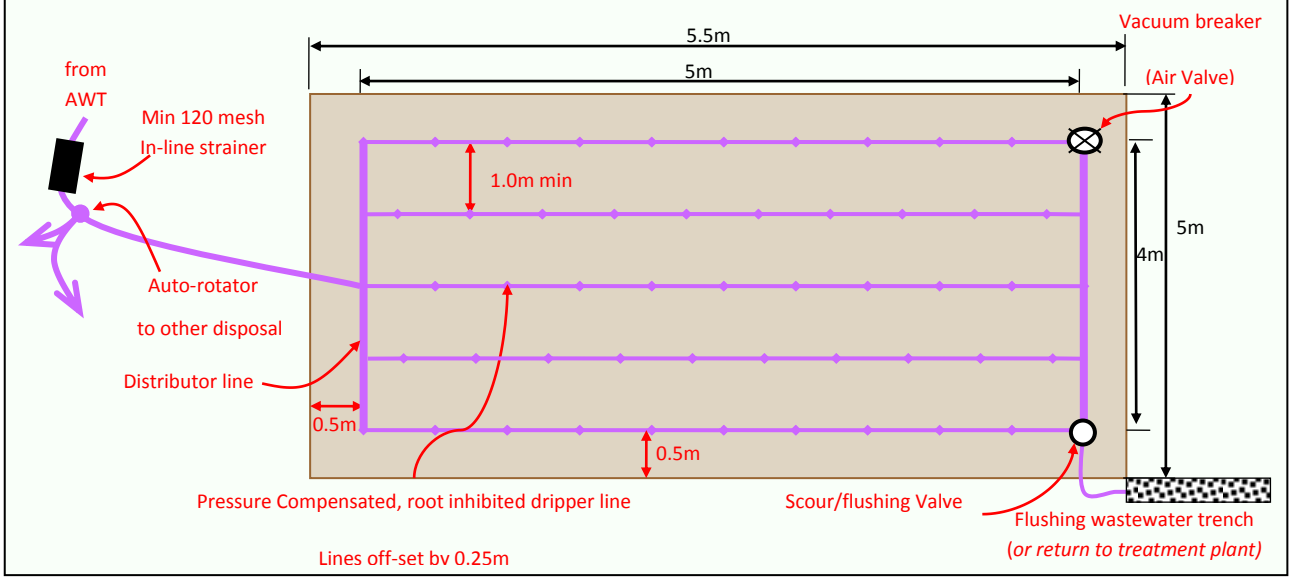
- Good, loamy topsoil must be brought in to cover the entire surface irrigation area to a minimum height of 100mm above natural ground level.

- The sub-surface irrigation area must be adequately planted out with lawn or suitable water tolerant plants. Where a chlorinator is installed, salt tolerant plants must be used (at least one plant for every 2 linear metres of drip line over the entire irrigation area). The lawn or plants must be maintained over the life of the system.

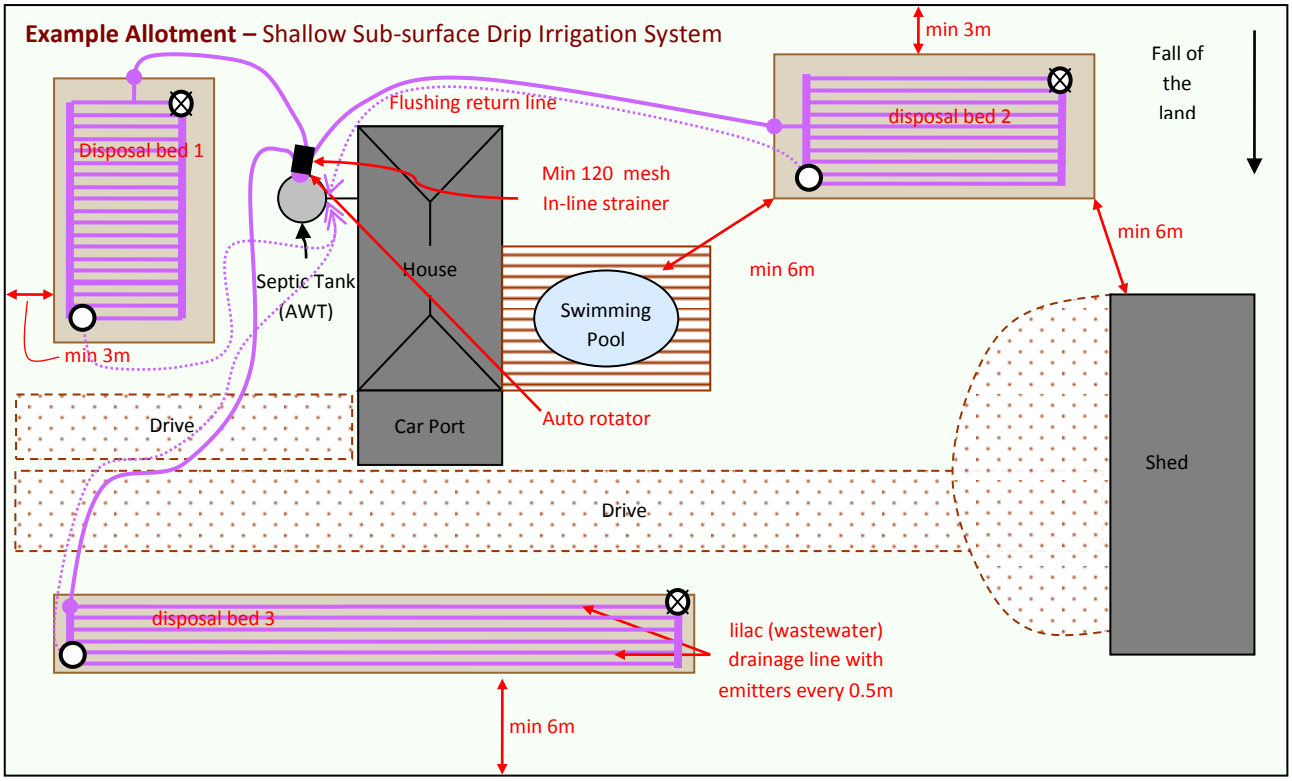
Layout – Shallow Sub-surface Drip Irrigation System (Clay Soils)



Example Disposal Field Layout – Shallow Sub-surface Drip Irrigation System



Example Allotment – Shallow Sub-surface Drip Irrigation System



Design and Construction – Surface Irrigation

- A disc or mesh filter must be installed on the pump discharge line to protect pipework from any solids found in the wastewater which could potentially clog drippers. The mesh/disc filter must be 155-200 mesh/micron in size and must be installed in a box or above ground before the surface irrigation area begins.

- The natural ground where the irrigation is to be installed must be cultivated (rotary hoed) to a minimum depth of 200mm.

- All pipework including distribution pipes and irrigation pipes must be buried to a minimum depth of 100mm.

- All drip line must be spaced a minimum of 1.4 metres apart and installed along the contours of the land.

- Wastewater must be discharged to a minimum of three (3) separate surface irrigation fields or areas. The pipework in each surface irrigation field or area must be situated at a minimum of 3.4m from the outer most pipework from any other irrigation area or field.

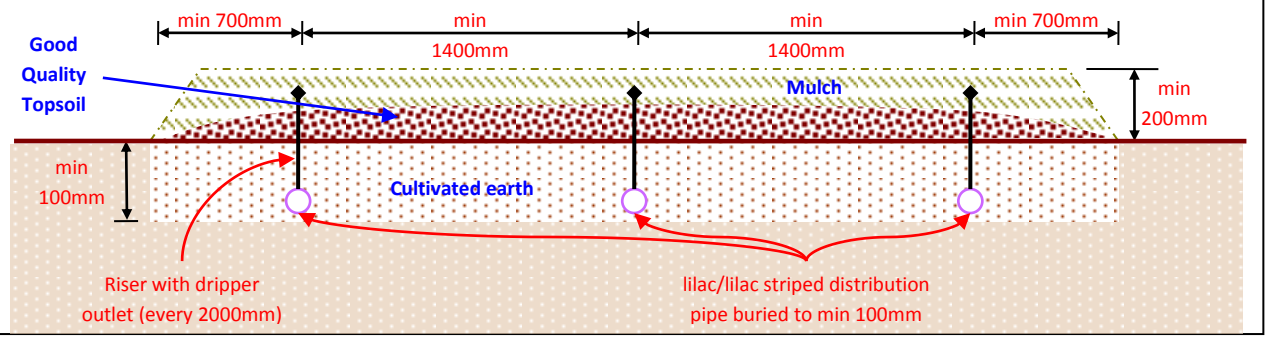
- Where flush water cannot be returned into the septic tank all flush water from each separate surface irrigation field must be drained into a sump or trench. The trench/sump must be constructed in accordance with CA 1.2/03 and be 1m wide, 350mm deep and 1m long using clean uniform 20-40mm aggregate.

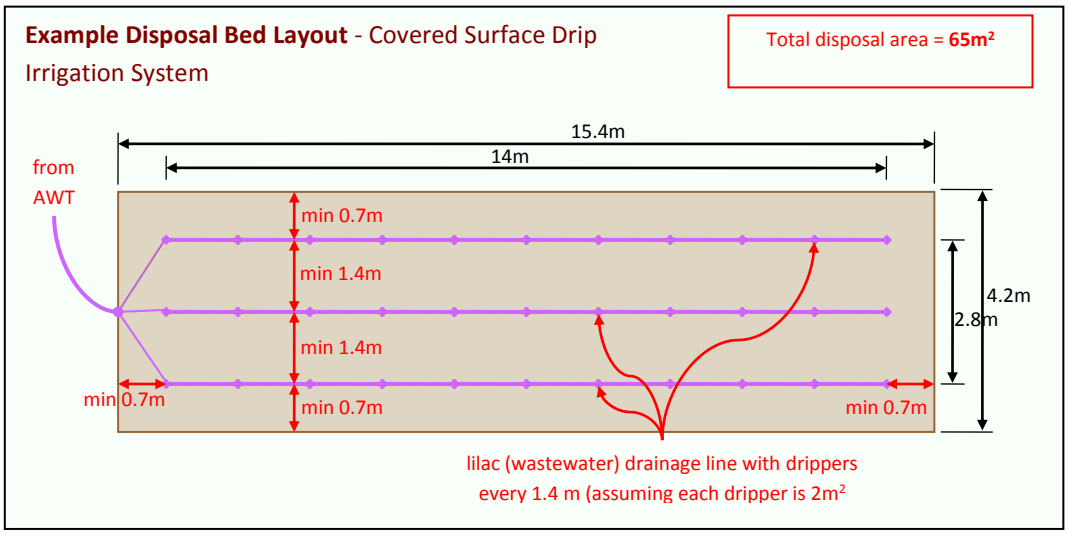
- Good, loamy topsoil must be brought in to cover the entire surface irrigation area to a minimum height of 100mm above natural ground level.

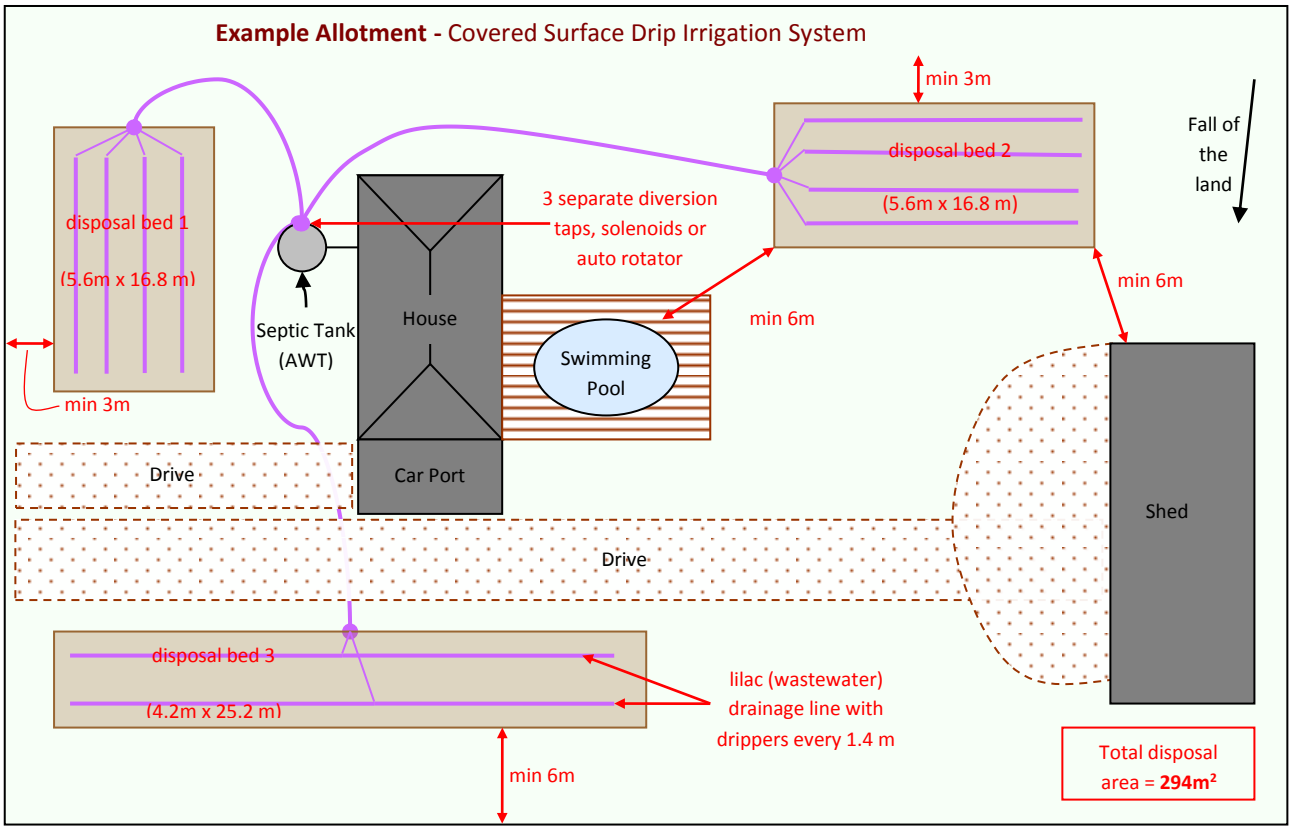
- A minimum height of 100mm of heavy mulch must be brought in to cover an area of at least 700mm in either direction of each dripper.

- Suitable water and salt tolerant plants must be used to plant the entire surface irrigation area. There must a minimum of one plant per dripper installed before final approval. The plants and landscaping must be maintained over the life of the septic tank system.

Layout - Covered Surface Drip Irrigation System (Clay Soils)




Example Disposal Bed Layout - Covered Surface Drip Irrigation System
Total disposal area = 65m²
15.4m
14m
from AWT
min 0.7m
min 1.4m
min 1.4m
min 0.7m
min 0.7m
min 0.7m
4.2m
2.8m
lilac (wastewater) drainage line with drippers every 1.4 m (assuming each dripper is 2m²


Example Allotment - Covered Surface Drip Irrigation System
min 3m
disposal bed 2
(5.6m x 16.8 m)
Fall of the land
disposal bed 1
(5.6m x 16.8 m)
3 separate diversion taps, solenoids or auto rotator
Septic Tank (AWT)
House
Swimming Pool
min 6m
min 6m
min 3m
Drive
Car Port
Shed
Drive
disposal bed 3
(4.2m x 25.2 m)
lilac (wastewater) drainage line with drippers every 1.4 m
min 6m
Total disposal area = 294m²

Determining Irrigation Area Sizing

Irrigation Area in m²

To assist in the design of the surface or shallow sub-surface irrigation area, the following tables recommend minimum wastewater disposal field sizing. In the absence of additional information and recommendations provided in the form of a Land Capability Assessment and specific soil analysis, the figures in the tables are the minimum area required based on permeability rates for the poorest quality soils in the area to ensure a conservative approach.

Number of Bedrooms	Minimum Disposal Area Required (m²)
1 bedroom dwelling	90
2 bedroom dwelling	130
3 bedroom dwelling	170
4 bedroom dwelling	210
5 bedroom dwelling	250
6 bedroom dwelling	290
7 bedroom dwelling	330

NOTE: These are minimum disposal area requirements in the absence of soil analysis information, the disposal area may be required to be larger depending on the water usage of a dwelling or other structure.

Surface Irrigation Area in m

Most surface irrigation pipe work is designed with dripper spacing's every 1.4m. The following calculations should be used to convert the square metre irrigation required (as discussed above) to the required number of drippers and then to calculate the total lineal metre measurement.

Drippers Required	Lineal Meters
Divide the required m² (each dripper irrigates 2m²) by 2 to determine the total number of drippers required. Example – 290m² ÷ 2 = 145 Drippers	Multiply the number of drippers required by 1.4m spacing to determine the lineal meters required. Example – 145 Drippers x 1.4m = 203m

Sub-Surface Irrigation Area in m

Sub-surface irrigation manufacturers will generally recommended an emitter spacing between 300mm to 1000mm. Typically, the recommended spacing between emitters is 600mm for soils in the Swan Hill region. The following calculations should be used to determine the required number of emitters based on the square meter irrigation areas discussed above.

Emitters Required
Divide the required m² by the emitter spacing (600mm) to determine the number of emitters. Example – 290m² ÷ 0.6 (600mm) =

Further Information

For further information please contact Swan Hill Rural City Council's Public Health Services on 5036 2591.