Super Siphon

Installation & Design Manual

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The Vortech Super Siphon

Following 13 years of continued development, Vortech is proud to introduce the latest in Siphon Dosing Technology, offering a totally unique solution to Passive Irrigation.

The Super Siphon has no moving parts, requires no additional power input and its unique design offers direct benefits for the environment as well as savings on the installation, operating and maintenance costs, for life.

The Super Siphon has been designed to offer a superior performance never before achieved with absolute reliability and performance and is made partly with recycled material.

The Super Siphon offers a broader performance envelope, enabling a wider scope for its implementation and application.
**What is a Dosing Siphon and why use one in a septic system?**

A dosing siphon is a cyclic valve; it utilizes an air trap to form a dam or to hold back a slow flowing volume of water until a specified volume is reached. At this point the air pocket is purged and the volume of liquid is released or dosed.

Historically, the outflow from septic tanks was a continuous trickle to a disposal field. Because it was continuous, effluent would flow through the field until it found the lowest point in the field where it would over saturate the area and cause a creeping failure of the field. Modern septic design codes including AS/NZS 1546.1:1998 and TP58(4th Edition) recognize this failing and have prohibited trickle loading of disposal fields in favor of dose loading which provides uniform distribution of effluent over the entire field with resting periods between doses.

While pumps with timers or float switches can be used to dose fields, the **Super Siphon** offers a simpler solution. As long as the disposal field is physically below the septic tank, the **Super Siphon** can repeatedly and reliably dose indefinitely without any moving parts or additional power input other than gravity at a lower cost than any other solution.

There have been many examples of dosing siphons through the years, originally with valves, flaps or floats, some made of cast iron and concrete and in more recent times stainless steel and now PVC and polyethylene.

Until now, without exception all dosing siphons have had one or more limiting factors in their design and or function such as requiring minimum flow rates to maintain operation without stalling, substantial discharge head requirements to maintain draw-down action, difficulty to prime, inconsistent operation and the list goes on.

Vortech Ltd is proud to present to you the ultimate in passive dosing technology the **Super Siphon**
Advantages of using the Super Siphon:

- No power required for operation - only gravity
- No moving parts or on-going maintenance
- Will not stall
- Adjustable drawdown in the field
- High efficiency - low frictional losses through the system
- Quality design and manufacture of corrosion resistant materials
- Low cost - benefits for the installer and client
- Made locally in New Zealand of partially recycled materials - good for the environment
- Internal, external and sequential tank mounting options
- Easy to retro-fit to existing structures
- Versatility in its operation and application

Applications for the Super Siphon:

- Controlled dispersal of Domestic and Industrial Effluent
- Horticulture irrigation/dose feeding system
- Dam Storage for on-site micro-hydro systems
- Measuring/fluid volumes, food, photographic industries, etc.
- Storm-water retention control
- Dairy Effluent management and treatment
- Ornamental fountains/pond irrigation/aeration
- Wetland treatment systems
How the Vortech Super Siphon works

One of the most significant improvements of the Super Siphon over other designs on the market is the range of flow rates over which it will operate. Many siphons have minimum and maximum flow rates and if operated outside this range will cause the siphon to stall and allow continuous trickling flow without the owner/operator being aware it is no longer working. With the Super Siphon, flow rates can be reduced and even completely stopped (by placing your hand over the outlet for example) without affecting the siphons operation i.e., it will not stall, and will continue the cyclic dosing process when the restriction (or your hand) is removed.

The Super Siphon is simple in its operation with no moving parts, making it efficient and reliable for a lifetime of service. It works by utilizing a formed air-lock to obstruct the outflow of the water with the energy of the rising water outside of the siphon is used to displace the air-lock at a pre-set interval.
A typical dosing cycle is as follows:

When the rising body of water or fluid outside of the siphon covers the mouth of the balance tube (see figure 1) the operation has commenced, at this point an air lock has been formed within the bell.

As the external water level rises, the air pocket (within the bell) is subject to an ever increasing pressure as the external head rises. This pressure drives the water level down within both traps, 1: the main riser trap and 2: the air relief trap.

When the driving water column has reached the invert of the air relief trap (this is at the point of relief), the trapped air is then able to quickly rush out through the exhaust vent, at the same time of this exhaust operation the rising water column within the bell has reached the weir at the top of the riser tube (within the bell). As the air quickly escapes the water column within the bell (now under a hydraulic head) also rises quickly and drives all of the trapped air through the exhaust to atmosphere. This in effect creates a vacuum (under a head of water) within the siphon, drawing the water from one side of the siphon pick-up, through to the siphon outlet.

When all the external water has been drawn down to the bottom of the inlet tube or hole drilled into the side of the inlet-tube, air is sucked into the bell and the siphon/vacuum is broken, the balance tube now with both ends exposed to atmosphere equalizes the inside and outside pressure and the siphon is ready for another cycle.

**Operation & Performance Characteristics of the Vortech Super Siphon**

The **Super Siphon** comes standard with an operating drawdown of 400mm (+/-10mm) and can be easily field adjusted to any drawdown between 190-400mm (a Product Information brochure is included with each siphon with modification instructions). The unit can be special ordered for any drawdown distance between 400mm and 10 metres. Contact the distributor for special order details.

The **Super Siphon** will not stall, facilitating an intermittent function if required. The **Super Siphon** has flow rates ranging from 0-1000 litres/min (approx) within a 4mtr head.

This technology now allows the dosing to fields/receiving areas under 1mtr head, as well as many other applications such as; flood dosing to raised beds, and the ability to passively dose to RAAM distribution/irrigation networks (with suitable driving head).
Super Siphon Flow Rates

<table>
<thead>
<tr>
<th>Delivery Head (metres)</th>
<th>Flow Velocity (m/sec)</th>
<th>Flow Rate (ltrs/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>At Siphon Outlet</td>
<td>1.5</td>
<td>170</td>
</tr>
<tr>
<td>0.5</td>
<td>3.1</td>
<td>370</td>
</tr>
<tr>
<td>1.0</td>
<td>4.4</td>
<td>520</td>
</tr>
<tr>
<td>1.5</td>
<td>5.4</td>
<td>640</td>
</tr>
<tr>
<td>2.0</td>
<td>6.3</td>
<td>740</td>
</tr>
<tr>
<td>2.5</td>
<td>7.0</td>
<td>825</td>
</tr>
<tr>
<td>3.0</td>
<td>7.7</td>
<td>905</td>
</tr>
<tr>
<td>3.5</td>
<td>8.3</td>
<td>975</td>
</tr>
<tr>
<td>4.0</td>
<td>8.9</td>
<td>1040</td>
</tr>
</tbody>
</table>

Super Siphon Specifications

| Supplied drawdown distance:    | 400mm, +/-10mm |
| Minimum drawdown distance:    | 190mm          |
| Inlet pipe size:              | 65mm diameter  |
| Outlet pipe size:             | 2” BSP outlet port, 50mm nominal |
| Flow rate minimum:            | 0 litres/min (flow can be restricted or completely stopped during dosing without stall) |
| Flow rate maximum:            | ~1000 litres/min (for 4 metre head) |
| Head loss:                    | Drawdown distance + 150mm (inlet invert to outlet invert with clearances) |
| Minimum bottom water level above siphon outlet invert: | 100mm |
| Overall height:               | 620mm          |
| Siphon base to outlet invert: | 220mm          |
| Maximum width across bell:    | 350mm          |
| Top water level over bell:    | 150mm          |
| Weight:                       | <3 kg          |
| Siphon materials:             | PE & PVC       |
**Installation of the Super Siphon**

The super siphon is easy to install or retrofit and can be installed internally or externally to a tank. A typical installation is internally to a two chamber septic tank as shown below.

The Super Siphon is supplied as a one piece unit and is easy to install. Using 50mm DWV PVC pipe and fittings, glue the siphon true and plumb using a short length of 50mm DWV PVC pipe to a suitably secure outlet through the reservoir wall. A secure mounting is required; as the bell holds the air-lock and is under a hydraulic head; therefore it wants to float during its operation.

For ease of removal and maintenance a MAC union can be placed between the siphon and tank outlet pipe.
**Venting**

For most cases the siphon will operate reliably with a standard 50mm diameter outlet pipe however it is important not to obstruct the **Super Siphon** outlet.

When dosing to a non-vented or smaller diameter discharge line, install at least 250mm of 50mm diameter pipe on a falling gradient as shown above.

When dosing directly into an air-locked discharge tube of a small volume at close proximity to the siphon an external vent is required. This air locked tube could restrict the initial purge, therefore hindering the initial vacuum-formation within the bell and subsequence performance. A simple 50mm “Tee” mounted vertically at the head of the discharge line (as shown in fig. 3 below) is used with a rising vent. This is required when the receiving point is less than 0.5 metres from the outlet.

![Fig. 3](image)

**Index**
1. External Vent
2. Reservoir wall
3. Siphon outlet
4. Discharge outlet

**Note:** It is important not to raise the outlet invert level of the siphon by using smaller bore pipe fittings as a direct and level connection from the siphon. The smaller diameter bore would raise the main trap level, altering the pre-set conditions. A smaller bore supply line can be use so long as it is adapted below the invert level and complies to the standard conditions.

Also when installing through a larger pipe/coupling or tube through the reservoir wall, it is important to ensure that no air is trapped within the offset piping, ie; the outlet from the water side of the reservoir needs to be the highest vertical point of the coupling. This is achieved with a DWV Level Invert.
Priming Sequence for the Super Siphon

The **Super Siphon**’s main body must be filled with water (primed) prior to first use. The priming procedure is as follows:

1. Insure the water level in the tank is below the inlet of the siphon. The inlet must be open to air.
2. Fill the main body with water. This will require at least 2.5 litres. This can be achieved by pouring water into the open top of the vertical Exhaust tube (15mm pipe end) when siphon is mounted in place.

Once primed, allow the tank to fill with water covering the **Super Siphon**. The **Super Siphon** will start when the water level reaches approximately 160mm over the top of the bell. The **Super Siphon** will run (dose) until the water level reaches the bottom of the inlet.

This completes the priming process and the **Super Siphon** will now continue to dose automatically.

A Product Information brochure is included with each siphon with these priming instructions.
Modifying Super Siphon for drawdown distances between 190mm & 400mm

The Super Siphon comes standard with a 400mm drawdown distance (+/- 10mm). That drawdown can be reduced to as little as 190mm by modifying the siphon in the field using the following procedure.

As supplied the Super Siphon has a 400mm drawdown. This 400mm is measured from the bottom of the inlet tube below the bell.

To shorten the drawdown stroke, subtract the desired drawdown distance + 5mm from 400 and drill a 10mm diameter hole in the side of the inlet tube or bell the calculated distance up from the bottom of the inlet.

As an example, if you want a 350mm drawdown...

350mm + 5mm = 355mm
400mm - 355mm = 45mm

Measure up from the bottom of the inlet tube 45mm and drill a 10mm diameter hole.

When the hole is uncovered as the water level falls during dosing the siphon suction will be broken and the flow will stop at this point re-setting the siphon for the next dose.
Trouble Shooting

The Super Siphon is designed and factory tested to give years of trouble free use with no maintenance.

If your Super Siphon is not performing as expected, it maybe due to several reasons;

1. The dosing chamber was drained recently and the Super Siphon was not re-primed
2. The Super Siphon was not primed correctly initially.
3. There is an obstruction or blockage in the delivery lines.
4. The siphon has not been installed correctly.
5. The siphon has been damaged or modified in some way.

1. In all cases re-prime the Super Siphon
   Always Start by re-priming the siphon as detailed in the instructions to prime the system. This may solve the problem. If it does not then...

2. Determine the problem
   a. Drain the siphon chamber to below the siphon inlet pick-up/hole.
   b. Open the discharge line/s downstream of the siphon and evaluate for obstructions, i.e. flush the mainline, delivery lines and laterals with fresh water.
   c. Check that all flows are free and unobstructed, look for and remove any obvious signs of blockage and or damage.

3. Drainage flow
   With all peripheral port ends open in all the lateral lines, allow the dosing chamber to fill and watch for the siphon to dose.

4. Damage or unauthorized modification to siphon
   For the siphon to operate correctly all the connections between the components of the siphon body must be air tight. The exhaust tube and balance tube must be the correct length. Has the siphon been dropped, damaged or modified in some non-standard way? Are there any cracks or signs of air leakage anywhere on the unit? As the water rises around the siphon do you see bubbles form on or rise from the unit? If you find leaks, contact your distributor.

If the Super Siphon fails to dose correctly then there is either damage to the unit, or one or more of the tolerances within the system has altered. Contact your distributor.
Worldwide distributor contact details

AUTOFLOW Ltd
Anthony Garton
Phone: 09-408-6080
Fax: 09-408-6081
autoflowltd@xtra.co.nz
The Super Siphon LPED Design

The Super Siphon has been developed as part of the Low Pressure Effluent Distribution (LPED) disposal system as outlined in TP58 Section 9 and numerous systems have been installed with the Super Siphon and its predecessors the AFS series of siphons. A review of TP58 section 9 is advisable prior to designing with the Super Siphon LPED system. The system components are listed below and are designed and sized using a proprietary spreadsheet.

Design spreadsheet [Excel software]
A well designed Low Pressure Effluent Distribution (LPED) system is one in which the layout of the field and sizing of the components are all specifically designed. Some of these design requirements are as follows:

- The dosing volume from the tank has to be greater than the volume of the disposal field to entirely fill the field for even distribution.
- The disposal field lateral lines need to have sufficient pressure to squirt and clear blockages or root intrusions but not so much pressure that the system is prone to leaks.
- The entire system has to be sized to allow for frequent doses with rest periods in between.
- The system needs to be balanced to ensure even distribution throughout the network no matter what size or how long the individual distribution lines are or what elevation they are laid at.
- The system needs to be designed to ensure that the bottom lateral line does not become overloaded by effluent within the network draining to the lowest point.

All of these requirements are defined by the physical layout of the tank and field including the relative levels from the tank to the lateral lines, the levels of the lateral lines to each other, the distances involved between components, the size of the individual components selected and the frictional losses each component contributes for a given flow rate. The Vortech design spreadsheet allows the user to input all these values and then vary components to achieve the best design possible. While the spreadsheet has been designed to be as foolproof as possible, it should only be used by someone familiar with on-site waste design and the hydraulic principles involved.

Two chamber, typically concrete septic tank (see diagram page 9)
This tank can be obtained from a range of vendors but should meet the requirement of AS/NZS 1546.1:1998. The primary chamber receives and treats the solids while the liquids pass through a filter into the dosing chamber. The secondary chamber in the septic tank is a settling and dosing chamber with the Super Siphon mounted within it. In normal operation, as the dosing chamber fills the effluent rises above the siphon bell and when the siphon doses the effluent flows through the siphon and out to the disposal field.

A biological filter between the first and second chamber
The filter helps retain solids and the microbial mass in the primary tank to assist in primary treatment. Typically a filtration mesh size of 2mm is utilised in the primary chamber, this helps keep the lateral “squirt” lines from clogging as the filtration size is smaller than the typically used 3mm diameter squirt holes. Other squirt holes normally between 2.5-5mm diameter may be selected. For more on squirt hole size selection see Table 2 in this document.
A Super Siphon gravity dosing siphon

The Super Siphon controls the dosing of the treated effluent to the disposal field. Once primed for the first time it should operate indefinitely with no adjustment or cleaning necessary. Not all siphons are created equal... other siphons on the market can stall (stop working and allow continuous trickling) if the flow rates are too low or too high. The Super Siphon has been designed to prevent this and can be completely stopped mid dose without stalling. The calculation spreadsheet has been specifically designed for the Super Siphon flow characteristics and should not be used with any other siphon.

Mainline to Disposal Field

The effluent travels down the mainline from the siphon to the manifold at the top of the disposal field. The size of the mainline is dependent on the flow rate, slope, and length. On sites with shallow slopes a large mainline will reduce frictional losses and preserve head for field distribution and “squirt”. On steep slopes a smaller diameter mainline can be used to “choke” the flow and bleed off excess head prior to the effluent entering the field. Where the mainline is to be reduced from the 50mm diameter outlet, at least 250mm of 50mm diameter pipe should be placed at the outlet of the siphon to allow for unimpeded flow from the siphon at startup.

Manifold

The manifold is placed just above the top line of the disposal field and divides the effluent evenly between the laterals of the field. At the top of the manifold is a shutoff to stop the flow in the mainline and then a threaded “T” with plug is placed so that fresh water can be pressure fed if necessary into the manifold to flush the manifold and laterals. The manifold should be fabricated specifically for each job with the number of outlets to match the number of laterals. It is very important when plumbing the manifold that the lowest outlet of the manifold feed the highest line in the field. This prevents drain back at the end of the dose favoring the lower field lines and over wetting or flooding the bottom of the field. The bottom of the manifold is capped.
Two different types of manifolds are used regularly. The first uses a series of 50mm PVC “Y”s and fittings with Hansen fittings to connect to the delivery lines. It is expensive in fittings but can be easily constructed to suit by a competent drainlayer on site. See photo below.

The second type of manifold regularly used is manufactured by Autoflow and uses a heat modified and deformed section of 110mm diameter PVC pipe which has flattened side walls. These flat surfaces can easily be drilled on site to accept Hansen fittings as required.

**Delivery Lines**

The non-perforated delivery lines run from the manifold to each of the laterals. The further downhill the lateral, the longer the delivery line, the more head loss in the delivery line which helps compensate for the head gain of the lateral at the lower elevation. Hence the delivery lines do assist in balancing the field. Delivery lines are typically the same diameter as the laterals or squirt lines. They can be of
smaller diameter to throttle back head if needed to a particular line. The downside is that delivery lines of differing diameters are more complicated and easy for the drainlayer to overlook during installation. A clay dam should be constructed around the delivery lines to insure that effluent from one lateral trench isn’t able to flow through the delivery line trenches to another trench, short circuiting the design.

**Laterals or “Squirt” lines**

The laterals consist of selected diameter Low Density PolyEthelene Pipe (LDPE) pipe, with squirt holes at calculated centres, laid within perforated drain coil and laid dead level to the contour of the land. The diameter of the lateral line may range from 15 to 50mm diameter, however, it will be found that smaller pipes have higher head losses and the larger pipes contain too much volume to fill after each dose unless the squirt holes are fitted with irrigation whisker risers so that the pipe remains full after dosing. The length of the lateral required should not permit a drop in squirt volume from the first to the last hole of more than 5% to ensure even distribution and preferably the last squirt height should not be less than 1.4 metres. Within these constraints the length of the lateral is a function of the head at the first hole, the diameter of the lateral, the number, size and spacing of the holes. A spreadsheet analysis is required to accurately determine the maximum length of the lateral line. However, as a general rule 25mm diameter lines up to 30 metres long will be about optimum. As the squirt line discharges the effluent will pool in the perforated coil and drain into the surrounding soil. These laterals can be laid in 200x200mm trenches, backfilled with drainage metal or bark and overlapped with soil or can be pinned to the ground surface and covered with leaf detritus, bark or mulch. The ends of the lines should have a plug or valve that can be opened to allow the laterals to be flushed. The flushing valves shall be placed in such a way (i.e. in a PVC “mushroom” or box) that they can be easily located. The squirt line has a specific number of holes drilled at a defined spacing based on the results of the calculation spreadsheet. The holes should be drilled carefully to remove all swarf from the hole that may impede the flow of effluent. It is important that the disposal field be fenced from stock to prevent damage and in the case of surface laid systems that children and pets are kept out as well.
**Super Siphon LPED Design Methodology**

When presented with a new job a typical design methodology is as follows:

**Can an LPED system be used?** Use the Super Siphon spreadsheet.

Decide on the Design Occupancy and Flow Allowances based on the TP58 tables shown on the first part of the spreadsheet and then input the section size in square metres. Is the lot size to discharge ratio (m$^2$/litre/day) greater than 3? This is the ARC minimum requirement for primary systems.

**Can a Super Siphon system be used?**

Decide on tank and field locations. Is there a vertical fall of at least 0.5 metres between tank and field? If so it may be possible in the absence of aggressive root growth plants and with special care and design to use a **Super Siphon**. Generally however a difference in head of 3 metres between the top of the tank and the first lateral is desired to ensure that a self cleaning squirt height of 1.5 metres can be achieved using a 3mm diameter squirt hole size. If not, the site may be appropriate for a pump dosed LPED system.

**Specific Design of the System**

What is location, shape, use of field? Look at boundary/flow path offsets, orchard or landscaping etc. Check soil and water table depth in area of the field and categorize.

Calculate length of field required
Design lateral lines… 30m lateral runs in one direction maximum if possible
If greater than 30m does field have to be split (see the discussion of split fields below)
Size mainline and time of dose in spreadsheet
Adjust squirt hole sizes if needed to keep maximum squirt hole spacing around 3 metres.
Cell Description of the Super Siphon Design Spreadsheet

Note: When using the spreadsheet-
Blue cells– user input
Yellow cells– Calculated result by the spreadsheet

Design Occupancy

Input the design occupancy in number of people based on the number of bedrooms, or potential bedrooms as shown in TP58 Table 6.1

Design Flow Allowance

This is the design flow allowances per person per day based on the type of facility and fixtures installed. It is based on TP58 Table 6.3.2

Total daily design flow- This value is the design occupancy multiplied times the design flow allowance.

Minimum Primary Chamber Size

This is the calculated minimum primary tank chamber size which is the total load plus 2000 litres to allow for sludge and sediment buildup between cleanouts.

Quick Check on Lot Size

This is the allowable gross lot area to discharge volume ratio as defined in the Auckland Regional Council TP-58 and not all local councils have this requirement. For ARC TP-58 the allowable ratios are as follows:
Primary systems- 3.0 m²/litre/day (ARC-ALWP Rule 5.5.23)
Secondary systems– 1.5 m²/litre/day (ARC-ALWP Rule 5.5.20)

Section Size

This is the size of the lot in square metres used to calculate the ratio

Maximum Allowable Waste Water Volume on Section

This is the calculated maximum daily volume based on the gross lot area to discharge volume input.

Field Design

Loading Rate

This is the design loading rate of the system to the soil based on an evaluation of the soils in the area of the disposal field. The soil should be evaluated with respect to the factors described in section 5.2.2 of TP58 and the soil categorized per table 5.1 and as shown on the spreadsheet to
the right of the cell. Loading rates are also a function of the type of treatment selected and specific recommendations can be found in TP58 section 9.

Field size
This value is calculated by dividing the total load from section one above with the loading rate.

Areal width
TP58 defines the areal width for design as 1.0 metres. In practice the layout of the field should be wider but this conservative value is used for the design criteria.

Field length
This calculated value defines the total length of 1.0 metre wide disposal field required.

Number of lateral lines
This input value is the number of laterals that have been selected for the design. Note that if a seven lateral field is to be split (or centre fed), the value to be input in this field is still 7, not 14.

Average Length of Soak Lines
This calculated value is the average length of soakage required.

Average Length of Lateral Pipeline Required
This shows the actual length of pipeline required. It is assumed that soakage extends one metre beyond the end of the pipes so the actual length of each lateral line is two metres less than the design value.
Field Physical Characteristics

Field Layout- side or centre fed (split field)-

The total field length will be divided up in to a given number of LPED lateral lines based on the physical constraints of the field. Typical fields can be side feed to a single set of lines or centre feed (split) with lines coming off the manifold at each side as shown below. Side feed is simpler and less expensive to construct but because maximum lateral line length should preferably not exceed 30m, larger fields can be constructed using a centre fed (split) system as shown which allows 2x 30m per lateral.

For a side feed field this value should be 1. If the field is centre fed (split), enter a 2 in this cell.
Lateral squirt line diameter-
Unless there are specific reasons, select 25mm diameter pipe not more than 30 metres long per lateral. The difference in squirt volume along a lateral from first hole to last hole should not be greater than 5%. This is a function of head at first hole, lateral diameter, number of holes preceding the last hole and the length of lateral. Lateral pipe diameter and maximum length can be varied if necessary by use of a spreadsheet analysis.

As a guide, with 1.5 metre head at the first hole and using 3 mm diameter squirt holes at 3 metre centres for the following pipe diameters, the maximum length of the lateral is as follows:

**Table 1** - Guidelines for lateral length sizing

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Maximum Length of Lateral</th>
</tr>
</thead>
<tbody>
<tr>
<td>15mm</td>
<td>10m</td>
</tr>
<tr>
<td>17mm</td>
<td>15m</td>
</tr>
<tr>
<td>20mm</td>
<td>20m</td>
</tr>
<tr>
<td>25mm*</td>
<td>30m*</td>
</tr>
<tr>
<td>32mm</td>
<td>45m</td>
</tr>
<tr>
<td>40mm</td>
<td>70m</td>
</tr>
</tbody>
</table>

* normally recommended

Field Layout Table
This table of lengths and relative elevations will allow fields of up to 12 lateral lines (or 24 lines with a split system). Any time the field is designed with fewer than 12 laterals the unused cells should be left blank or zeros placed in those cells.

Design Length before Splitting
These are the design lengths of each lateral in metres. For a simple rectangular field the program automatically divides the field length required by the number of lateral lines chosen and inputs that length for each lateral line. For non-rectangular shapes the length of each individual line can be input however by overwriting the formula in the cell, the spreadsheet will no longer calculated lengths automatically. Note that for split fields, this design length is the full length of the lateral, not the half length of the split line.

Lateral Length
This is a calculated field which subtracts one metre off each end (or two metres total) assuming the end soakage discussed above. Where the field is split, this will show the length of half the lateral only, less the two metres.

Distance from Manifold
These fields represent the length of the feed lines between the manifold and lateral lines. Typically, the first line from the bottom of manifold to top line of field is about 1.5 metres and then with 1.5 lateral spacing these lengths increase by 1.5m for each feed line. The program defaults to these lengths. The length of each individual feed line can be manually input for non-standard cases by overwriting the formula in the cell, however the spreadsheet will no longer calculate lengths automatically.
Contour Relative Elevation
These elevations represent relative elevations between the tank and lateral lines in metres. The top cell represents the top of tank (i.e. R.L. 100.00m can be assumed unless another datum is available) and each lateral line cell should be filled in with its relative level. It is assumed that lateral line 1 is at the top of field. As noted earlier... for optimum operation the minimum distance between top of tank the first lateral should be three metres (i.e. lateral Line 1 R.L. is 97.00).

Main Delivery Line- Header
This is the diameter and length of the first section of main delivery line. Where the mainline diameter is to be reduced from the 50mm diameter outlet, at least 250mm of 50mm diameter pipe should be placed at the outlet of the siphon to allow for unimpeded flow from the siphon. These values can be input here.

Main Delivery Line- Mainline
This is the diameter and length of the second section of main delivery line. Where the mainline is changed from the 50mm diameter outlet, the changed diameter and length would be input here.

Total System Volume
This is the calculated total volume of the main delivery lines, manifold, delivery lines and laterals of the system.

Total Dose Volume
This is the calculated total dose volume based on the dosing tank cross sectional area and siphon drawdown. The dose volume must be greater than the total system volume or the field will not entirely fill and it will not be evenly distributed. This cell will turn red if the system volume exceeds the dose volume.

**Tank/Siphon Physical Characteristics**

Cross Sectional Area of Dosing Chamber
This is the cross sectional area of the dosing chamber. For a dual chamber 4500 litre concrete tank a typical cross sectional area of the dosing chamber is 0.83m$^2$. This value multiplied by the stroke length gives the dose in m$^3$.

Siphon Draw Down/Stroke Length
This is the change in liquid level for one dose of the siphon. A standard **Super Siphon** AS400 has a drawdown of 390mm or 0.39 metres. It can be modified on site for a stroke length of between 190mm and 390mm as required and the **Super Siphon** can be special ordered for draw-downs greater than 390mm.

Volume Per Dose in litres
This calculated field is based on the stroke length and area of the dosing chamber.

Bottom Water Level to Top of Tank
This number is the distance from the water level at the end of dose to the top of the tank in metres. It is used in calculating head to the field lines.
Pump head at proposed flow rate
This field is not used for Super Siphon design.

Estimated minutes of flow
This is the design minutes of flow of the system. A typical dosing cycle has the field filling at the beginning of the dose, building to full squirt as the field floods completely and squirting for approximately two minutes at full strength before the end of dose and dropping of pressure throughout the field as the last of the fluid runs down to the field. Short flows may not allow complete and even field distribution (and significantly increases flow rate and correspondingly the internal frictions) and long flows require either low pressure or small hole size which can lead to clogging. A practical minutes of flow range is between 2 and 3.5 minutes.

Actual minutes of flow
This calculated field shows the actual minutes of flow of the system based on the actual flow velocities, frictions and squirt hole selection. This value should be close to the estimated minutes of flow above.

Estimated flow rate
This calculated field is the volume per dose divided by the estimated minutes of flow from above.

Actual flow rate
This calculated field shows the actual flow rate of the system based on the actual flow velocities, frictions and squirt hole selection. This value should be close to the estimated flow rate above.

Header and mainline frictional losses
These calculated fields use the Hazen Williams formula to calculate the frictional losses in the header and mainline based on physical characteristics of the components and the flow velocities.

Field Calculations

Manifold and deliver line losses
These fields calculate and sum the frictional losses in the manifold and delivery lines.

Total head at laterals
These sum the frictional losses throughout the system to find the total head available at the laterals.

Head Available at First Hole (metres)
This is a calculated cell showing the head available at the first hole of each lateral line taking into account elevation differences and line losses in the mainline and delivery lines. A minimum head of 1.5 metres should be available to allow the holes to self clean and help prevent root intrusion. These cells will turn red if the head is less than 1.5 metres.

Squirt flow volume at first hole in lateral (litres/min)
This is the calculated flow rate available at the first hole in each lateral.
**Actual Flows**

**Number of holes along each lateral**
This is the calculated total number of squirt holes drilled along each lateral line. The number of holes is calculated based on the flow rate, hole diameter and lateral length to insure that an even flow per metre lateral is achieved for even field distribution.

**Hole spacing along lateral**
This is the calculated distance in metres between the squirt holes of each lateral. While the hole spacing can be any length, as the spacing gets larger than three metres it is less likely to result in even distribution along the LPED trenches. These cells will turn red if the spacing is greater than 3.0 metres. Typically the spacing can be adjusted by changing the squirt hole diameter in the next set of fields.

**Squirt hole diameter in lateral**
This is the diameter of the squirt holes for each lateral in mm. This hole diameter should be larger than the screening size of the biological filter in the primary tank so that any solids passing through the filter can easily pass through the squirt hole without clogging. Also the field installer should be reminded to remove all drill swarf from the hole to insure they are clear and free flowing.

A diameter of 3mm is the usual size for squirt holes however the spreadsheet will cater for various hole sizes typically from 2.5mm to 5mm. When the head available is larger a smaller hole size will be better.

**Table 2- Guidelines for Lateral Squirt Hole Sizing**

<table>
<thead>
<tr>
<th>Head at first hole of lateral (metres)</th>
<th>Squirt hole diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>5.0</td>
</tr>
<tr>
<td>1.5*</td>
<td>3.0*</td>
</tr>
<tr>
<td>3.0</td>
<td>2.5</td>
</tr>
</tbody>
</table>

* normally recommended

**Volume flow rate per meter lateral (litres/min)**
This field calculates flow rates of each lateral on a per metre basis. These values should all be approximately the same which indicates even field distribution.

**Total flow volume flow rate of field and Minutes of flow at this rate**
This is the sum of the individual flow rates from above and should be approximately the same as the estimated flow rate above.
Other Installation Configurations

Most siphons are installed internally within a tank; however, they can be installed in other configurations as well depending on their intended purpose. These include:

External-
As well as being installed internally. The dosing siphon can be installed externally to the tank or dosing chamber.

Alternating-

The Super Siphon has been designed such that two or more siphons can be joined in parallel to allow alternate or sequential dosing. Using multiple siphons, each siphon will dose sequentially sending fluid to different fields or destinations. This sequential dosing is preferable with multiple fields or where longer resting periods are required between doses. Previously this could only be done with hydro-sequencing valves that required significant driving head and were prone to failure.

Very Low Head Applications-

For very flat sites where head loss is a concern a low profile siphon can be special ordered where the main riser and adjacent pipes are shortened to lower the overall height of the siphon. This shorter siphon minimizes the head loss through the siphon to an absolute minimum. For flat sites, squirt holes larger than 3mm diameter in the LPED lines will be required and caution is needed where aggressive root growth plants, such as Kikuyu are present as the design squirt height will less than 1.5 metres which is the self cleaning velocity used to keep orifices clear or root ingress.
FILTER SUPER SIPHON STORMWATER CUT OFF SWALE DRAIN TO INTERCEPT OVERLAND FLOW

25mm DIA LDPE PIPE TYPICAL LATERAL LENGTHS AS SHOWN

DELIVERY PLAN ELEVATION

25mm DIA DELIVERY LINES

S.W SWALE DRAIN IF REQUIRED

50mm DIA PVC MAIN LINE MANIFOLD

MINIMUM COMPACTED CLAY BACK FILL TO SEAL THIS AREA OF TRENCH

DETAIL 'B'

1.5

1.5

1.5

1.5

1.5

PLAN

ELEVATION

50mm DIA PVC MAIN LINE IF REQUIRED

SEPTIC TANK MANIFOLD CUT-OFF DRAIN IF REQUIRED

SEPTIC TANK
50mm Ø MAINLINE STARTER LENGTH 250mm.

NOTE: HOLE SIZE 3mm
32/50 mm REDUCER

50 mm RISER

45° BEND

32 mm SCREW CAP ON TOP

50 mm BALL VALVE

50 mm x 45° JUNCTION

50 mm x 50 mm REDUCER

32/50 mm REDUCER

50 mm PVC PIPE END CAP

25 mm Ø HARDITUBE PIPE

SHORT 50 mm Ø PVC PIPE JOINER

END CAP

50 mm Ø HARDITUBE PIPE

(Sectional View)

WITH 25 mm Ø HOLE IN TOP.

25 mm Ø HANSEN 'HMS 25' MALE STRAIGHT SOCKET

25 mm Ø NYLON WASHER

50 mm Ø PVC PIPE END CAP

(2 SIDED)

TOP LINE L.H.S.

SECOND LINE R.H.S.

ELEVATION OF FLUSHING DETAIL

TOP LINE R.H.S.

TOP LINE L.H.S.

PLAN VIEW

32/50 mm REDUCER

50 mm PVC PIPE END CAP

25 mm Ø HARDITUBE PIPE

SHORT 50 mm Ø PVC PIPE JOINER

END CAP

50 mm Ø HARDITUBE PIPE

HANSEN 'HMS 25'

MALE STRAIGHT SOCKET

25 mm Ø NYLON WASHER

50 mm Ø PVC PIPE END CAP

(Short Length)

TYPICAL ASSEMBLY FOR ALL MANIFOLD TAKE-OFF CONNECTIONS

NOTE:
TOP FIELD LINE CONNECTED TO LOWEST CONNECTION ON MANIFOLD
BOTTOM FIELD LINE CONNECTED TO HIGHEST CONNECTION ON MANIFOLD ETC.

TYPICAL ASSEMBLY FOR ALL MANIFOLD TAKE-OFF CONNECTIONS

3 OUTLET MANIFOLD (SINGLE SIDED)

(4 OUTLET SINGLE SIDE SIMILAR)

ELEVATION OF FLUSHING DETAIL

TOP LINE L.H.S.

BOTTOM LINE R.H.S.

TOP LINE R.H.S.

TOP LINE L.H.S.

TYPICAL ASSEMBLY FOR ALL MANIFOLD TAKE-OFF CONNECTIONS

25 mm Ø HARDITUBE PIPE

HANSEN 'HMS 25'

MALE STRAIGHT SOCKET

25 mm Ø NYLON WASHER

50 mm Ø PVC PIPE END CAP

(Sectional View)

WITH 25 mm Ø HOLE IN TOP.

TYPICAL ASSEMBLY FOR ALL MANIFOLD TAKE-OFF CONNECTIONS

3 OUTLET MANIFOLD (SINGLE SIDED)

(4 OUTLET SINGLE SIDE SIMILAR)

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TYPICAL ASSEMBLY FOR ALL MANIFOLD TAKE-OFF CONNECTIONS

3 OUTLET MANIFOLD (SINGLE SIDED)

(4 OUTLET SINGLE SIDE SIMILAR)

NOTE:
TOP FIELD LINE CONNECTED TO LOWEST CONNECTION ON MANIFOLD
BOTTOM FIELD LINE CONNECTED TO HIGHEST CONNECTION ON MANIFOLD ETC.
ALTERNATIVE LAYOUT THRU NATIVE BUSH ETC. AWAY FROM PEDESTRIAN AREAS

TYPICAL CROSS SECTION UNDER GRASS

EXPOSED VIEW OF PVC REDUCER FITTINGS - DETAIL 'A'

CROSS SECTION IRRIGATION PIPE - DETAIL 'C'