Pesticide Handling Areas and Bioremediation Guidance Notes

Biofilter
(D & H Group)

Biofilter
(Wroot Water)

Biobed with outside filling area

ESSEX&SUFFOLK WATER living water

love every drop. anglianwater

Contents

Summary

Pesticides often originating from sprayer filling and handling areas have been regularly found in surface and groundwater by water companies and regulators. The levels of pesticides detected pose problems and costs for water companies and can harm aquatic life. Bioremediation using biobeds and biofilters is a low cost and effective way of treating spray waste, washings and run-off from sprayer filling areas. The liquid washings and wastes are collected from a bunded fill area where the sprayer is loaded and possibly washed, this liquid is then treated through a Biobed or Biofilter.

The bioremediation process involves slowly passing the waste liquid through a natural biomix, which is a mixture of straw, friable soil and compost, which is contained in a biofilter or biobed. Pesticides ingredients are locked onto the organic components in the biomix and subsequently the bacteria present in the mix gradually breakdown the active ingredients reducing the levels found in the washings by up to 100,000-fold. The liquor from the biobed/biofilter may then be irrigated to agricultural land.

Early systems adopted by farmers were mostly based on a the Biobed system where the water volumes that needed to be treated also included the rainwater collected by the outdoor sprayer filling area. However, in recent years farmers have recognised significant advantages of covering the sprayer filling area and installing a biofilter, thus creating a focused sprayer centre with the creation of an insulated building often including the pesticide store as well as winter storage for the sprayer.

The process of biofilter and biobed adoption is regulated in England and Wales by the Environment Agency within the application of the Waste (England and Wales) Regulations 2011. These regulations require an operator of bioremediation systems to obtain an exemption within the regulations.

The last version of the “Pesticide Handling Area and Biobed Manual”[1] guidelines was published in 2015. This updated document has been supported by Essex & Suffolk Water (part of the Northumbrian Water Group) and Anglian Water who wish to encourage the continued adoption of bioremediation and to update the original manual. This document updates and includes advice on the latest thinking and covers: Bioremediation, Biofilters, Biobeds and their mode of action, correctly sizing the systems, permissions needed, construction details, advice on their operation and maintenance, examples and costs as well as other options and references.

This guidance document has taken account of the rules and regulations at the time of writing. Always follow current best practice and seek local support to ensure you are utilising up to date information and processes in your decision making.

These guidance notes have been prepared by Bill Basford, FIAgrE with assistance from Patrick Goldsworthy of Goldsworthy Associates.

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[1] https://voluntaryinitiative.org.uk/media/xt2jctfc/design_manual_updated_922015.pdf

Introduction and basic concepts

Since the original bioremediation work in the early 2000's which took account of poor practice, limited rinsing techniques and randomly developed sprayer fill sites, significant changes have been noted:

- Operator training and qualification has developed markedly through the National Register of Sprayer Operators now administered by BASIS.
- Most crop sprayers on arable farms have an annual sprayer "MOT" through NSTS (National Sprayer Testing Scheme)
- Sprayer designs have improved on board washing and rinsing systems which reduce the volume of residual liquid held in the sprayer when it is empty.
- Sprayer control systems often link to precise GPS application systems which can ensure that spray volumes are accurately calculated and there is no left-over spray solution.
- Filling volumes are now monitored routinely, and safe systems limit the risk of overfilling.
- Integrated rinsing arrangements mean that sprayer washings from the inside of the sprayer tank and pipelines are applied to the crop.
- With ever larger and more environmentally aware farm businesses this is an incentive, along with higher work rates and safer practices has seen a growing number of farms establishing an integrated sprayer centre including sprayer storage, sprayer filling and cleaning and the pesticide store within one dedicated building.

FAQS ON THE BASICS

What is bioremediation?

A mixture (**Biomix**) of straw, friable soil and peat-free compost is used to lock up and gradually degrade dilute pesticides, sprayer washings and spray solution. Pesticides are locked on to the organic material, mainly the straw and then be broken down (remediation) by the soil bacteria. Biomix is contained within a biobed or biofilter, either of which receive liquid drained from the sprayer filling area.

Why do sprayer filling areas present a challenge?

Liquids (rainwater, splashes and spills, sprayer washings and surplus spray solution) draining from a sprayer filling area will contain pesticides which on reaching water can harm aquatic life and affect drinking water supplies. Water companies treat drinking water routinely but where pesticides are detected – even at minute levels - these present challenges to regulatory requirements for drinking water and can also challenge the treatment processes. If farmers and growers want to continue to have access to a range of pesticides, then biobeds and biofilters are an effective way of reducing the risks of pesticides reaching water.

How significant is the point source pollution from the filling area?
Case studies at farm level in some localities have shown that losses from pesticide handling areas can account for more than 80% of detections in a catchment. Nationally it is thought that 40% of pesticide detections in untreated water come from the handling activities with the remaining 60% coming from the field through run-off drain flow, drift and overspray, with drain flow being a major factor for some pesticides.
Improving the pesticide handling area and managing washings and wastes that come from pesticide handling is a relatively simple - one size fits all - measure that can be taken to help keep pesticides out of water.
Inadvertent splashes and spills of pesticide can occur during sprayer filling, as well as the larger quantities of liquid produced during sprayer cleaning can seriously harm water quality. Correct design and management of filling areas can virtually eliminate this problem.

What is a pesticide handling area?
The pesticide handling area is the site where the sprayer is filled and is often the site used for sprayer washing, nozzle calibration, sprayer testing, maintenance and storage. Its size is that which includes all the sprayer dimension (and some or all of the tractor) with an allowance for operator movement. It is normally a concrete or impervious base over which all sprayer filling occurs, but which excludes other yard waters, except rainfall over it, in some designs. The accepted design through bunding or levels management ensures that all the liquids draining from the area enter a direct drainage system to a biobed or biofilter.

The handling area may be external and thus subject to rainfall but increasingly many sites have included the facility either under a roof or within a dedicated building including all pesticide related activities.

What is a biofilter / biobed?

A **biofilter**, normally found internally, above ground, is filled with biomix and uses a series of impervious containers instead of a pit. These containers, normally 3, are mounted one above the other and the liquid flows by gravity from the top through each container to the next and then to a final reception tank. A biofilter is most suitable for a covered sprayer filling area.

A **biobed** is an external pit in the soil including an impervious liner, normally below ground level and covered with turf. A pumped drainage system within the biobed ensures water movement flows out of the biobed to avoid ponding which will affect biobed function.

A biobed is normally developed adjacent (or sometimes further away) to the filling area – thus it may be described as an **indirect biobed**. A biobed may also be created directly under the filling area – the weight of the vehicle being supported by a

framework and removable grid which allows all drips and spills to fall directly below the operation, this is a **direct biobed.**

Liquids enter the biomix within a biobed or biofilter from the bunded sprayer filling area either by gravity or pump, where they undergo bioremediation and are then drained or pumped from the biobed or biofilter. This liquid, with negligible pesticide residues, can be used for irrigation of a vegetative growth area of land or re-used e.g. for subsequent sprayer washing or possibly recycled to keep biomix moist in warm conditions. (see expected volumes in paragraph below)

What does a biobed/biofilter do?
As described earlier, it is the biomix in the biobed which degrades pesticides within the liquid to cling or lock onto organic matter, particularly onto the straw. Some chemicals do this very rapidly. The bacteria within the soil and within the biomix then slowly work to break down the pesticide residues, with the compost helping stabilise the moisture content within the mix. Most of the “bacterial work” occurs in the upper layers of the biobed/biofilter. There is little benefit in building a deeper biobed beyond 1.2 m max as it will not treat any more liquid. It is important to keep the biobed/biofilter topped up, probably annual to ensure correct function.

How do I make Biomix?
Biomix is prepared by adding the ingredients on a **volume basis**. The proven mix is 50% straw (unchopped was used in the trial work), 25% friable soil, 25% peat free compost. The straw must be loose, well shaken out when mixing and thoroughly mixed with the soil and compost. The mix should resemble a heap of dirty straw when prepared. Layering of the ingredients without mixing does not work and has led to total failures of the system.

A well-mixed heap of biomix prior to loading.

The biomix will need to be exchanged after 5 years, guidance on both storage and spreading of this material to land is covered later.

How much spray waste can a Biobed/Biofilter treat?
Most farm spraying operations will generate around 5-7000 litres of sprayer washings per year, the exception being larger vegetable farms where significantly more washings are needed between loads.

The waste exemptions (see reference 1) allow biobeds to treat up to 15,000l of spray waste (excluding rainwater) in a 12-month period. A biofilter can treat up to 15,000 litres including rainwater in the same period. Remember rainwater can be a significant component: e.g. 6m x 8m x 650mm rain = 31,200l.

System	Treatable volume sprayer washings	Rainwater
Biobed	15,000 litres	Plus additional rainwater on filling area and on biobed
Biofilter	15,000 litres	Includes rainfall so consider avoiding/limiting rain volume falling on the pesticide handling area and entering system. Best suited to a roofed area

What can a biobed or biofilter treat?

Biobeds and biofilters are only designed to treat dilute pesticide solutions such as washings from the sprayer filling area– including drips and small spills and internal and external sprayer washings (including sprayer cleaning agents). This would also apply to "washings" from granule and pellet applicators. However, biobeds and biofilters are **not a substitute for best practice** and every effort should be made to avoid spills or splashes of pesticide concentrates. For example, use a drip tray under the induction hopper. This may then be washed off into the induction hopper.

The system has only been accepted by regulators as a treatment for dilute spray wastes. It has **not been approved** by regulators for any other farm wastes such as sheep dip or fertiliser. Fertiliser washings may – by disrupting the carbon nitrogen ratio - affect the performance of the biomix.

Best practice also requires that in most cases:

1. Any leftover spray solution should be sprayed on to the target crop keeping below the maximum dose.
2. Where the sprayer system allows it, the first set of tank/boom washings should be sprayed onto the target crop again ensuring the maximum dose is not exceeded.

The regulatory aspects can be found in the Health and Safety Executive's *Code of Practice for Using Plant Protection Products, available as a* downloadable pdf.

Provided best practice is followed the performance of the biobed and biofilter technology has proved acceptable to the Environment Agency and Scottish Environmental Protection Agency.

NEVER dispose of concentrated pesticide through a biobed or a biofilter. If concentrated pesticide should enter the biobed, the resulting effluent is likely to be a hazardous waste and should be treated as such.

How much do biobeds and biofilters cost?

Costs vary depending on whether a new handling area is required, the final choice of system, and whether farm labour or specialist contractor is used. Thus, the range of costs indicated below is wide. The choice of new or second-hand materials also affects the cost and access to grants. Second hand equipment, particularly IBC's (**I**ntermediate **B**ulk **C**ontainers) for Biofilters need to be undamaged, robust and well-designed. Two companies are known to provide kits for biobed construction and biofilter systems. Further details are given in the reference section.

Biofilter System £4,250 - £6,250
Biobed System £6,000 - £22,500

Guidance on Grants

Nationally, dependant of local catchments there may be grants and support available administered through the Catchment Sensitive Farming programme. These grants may be linked to particular components or construction details of the civil and ground works involved, roofing, storage tanks, biofilters, biobed kits etc and rates are given on the web site https://www.gov.uk/search/all?keywords=biobeds and further detailed on page 36.

Additionally, grants may be offered by water companies where there are specific concerns within specific catchments. Rates of grants are reviewed frequently for either systems or components linked to local, regional or national programmes.

Do I need permission before I can go ahead and use a Biobed / Biofilter?

Yes, this is because sprayer washings are regarded as a waste and the remediation process is considered a treatment process to which The Waste (England and Wales,) Regulations 2011 apply. However, the arrangements are straightforward, on-line and currently free.
Two exemptions are required:

- the T32 Permit Exemption for the Biobed/Biofilter
- the U10 Exemption for spreading the spent biomix

Waste exemption T32 allows the treatment of non-hazardous pesticide washings in a biobed or a biofilter. Details of the T32 exemption are included at the end of this document or within paragraph 42 of the Waste Management Licensing (Scotland) Regulations 2011. Certain differences exist in Scotland.

The exemption has several conditions and limits. These are to ensure that any lined biobed or biofilter is built, run and looked after in a way that ensures the pesticide washings are correctly treated and that the treatment does not cause pollution or harm to groundwater and/or surface waters. This includes the requirements that:

- The biobed/biofilter is located in a secure area of the farm place and the waste cannot leak from the biofilter/biobed.
- The lining of the biobed is impermeable.
- The biobed/ biofilter is suitable for treating the waste.
- The biobed is covered with turf – not required within a biofilter.

- After the biomix use period there is secure storage of the biomix for 12 months prior to spreading to land in accordance with exemption U10 – Spreading waste on agricultural land to confer benefit.

As a part of the registration process you are expected to commit to comply with the limits and conditions of the exemption, that your biobed or biofilter will not pose any significant risk to the environment and that you have prepared appropriate plans and risk assessments. Registration of an exemption can be done **online** or by post and there is currently no charge.

Are there any other options?

A simple solution is to have an entirely field based system with all filling and handling and wash down taking place in the field, but this is not always practical or convenient. Other options include:

- Collecting washings and run-off from the handling area in a sump (1500 litres max) and paying for professional waste disposal.
- Spraying the washings out on an area with a groundwater permit, this is now called a Permitted Area[2] and can only be approved by discussion with the Environment Agency.
- Some research farms and horticultural producers have installed the Sentinel (carbon filtration system).

A mobile treatment unit

Do I need to get permission for these options?

As with a biobed or biofilter if you install a Sentinel or Phytobac (see later) you will need to obtain relevant waste exemptions from the local Environment Agency. Disposal of washings from a sump by spraying out to land requires an environmental permit.

Novel solutions – These are discussed at the end of this document.

[2] Thus an Environmental Permit (formally called a Groundwater Authorisation). Note: there is no such thing as an “Approved Soakaway”.

What are the options?

Option	Best For	Guide Cost	Environment Agency
Entirely Field Based System	Small farms and larger farms with a field bowser	Bowser & Staff Cost	No contact required but ensure filling and wash down areas are at least 10m away from any watercourse, borehole proximity must be observed (see distances later page 32) and do not take place on compacted soil or over field drains
Pesticide Handling Area draining to sump with **Professional Disposal**	Small to Medium sized farms	Annual disposal charge	No contact required; but ensure no more than 1500 litres is routinely stored at any one time and that there is no risk of liquids leaking from the sump
Pesticide Handling Area draining to sump with **disposal to an area with a Groundwater Permit (Permitted area)**	Small to Medium sized farms	Annual permit	Requires groundwater permit from environment agency, and ensure no more than 1500 litres is routinely stored at any one time and that there is no risk of liquids leaking from the sump
Pesticide Handling Area draining to sump for treatment in an **Offset/Indirect Biobed**	Medium to Large farms with an established concrete filling area	£ 6000 - £20000	Require appropriate waste exemption(s) from Environment Agency/SEPA but ensure no more than 1500 litres is routinely stored at any one time and that there is no risk of liquids leaking from the sump
Drive over Biobed	Medium to Large Farms needing a new or repositioned pesticide handling area	Few examples known but likely to be at the higher end of that quoted above	
Pesticide Handling Area draining to sump for treatment in a **Biofilter**	Glasshouse units, small or mixed farms	£6000 - £9000	
Covered Pesticide Handling Area draining to sump for treatment in a **Biofilter**	Medium to large farms with spare barn	£ see above – covered building area will be extra to figure dependent of scale in functions included.	
Pesticide Handling Area draining to sump for treatment in a **Sentinel**	Large farms Research establishments	To include necessary ground works and unit from £20,000	

Pesticide Handling Areas

In the past, many sprayer filling areas have been sited near to a convenient chemical store, water supply and electrical supply with little attention to potential pollution from the site. It is worth reviewing the location, design and construction to limit pollution potential from the area. You also need to consider how this area relates to the size of biobed/biofilter which may be needed. Initially, taking note of distances given for siting, it is worthwhile conducting an assessment on the current site to improve matters. For example:

- Is the filling area trafficked by other vehicles – residues spread by traffic?
- Do yard waters pass onto the filling area?
- Is the surface impervious or cracked?
- Is there discrete drainage which may be intercepted?
- Can the site be modified easily – or is a new start justified?
- Could an existing roofed area be used?

It is likely that the sprayer fill area may be improved by including a bund to contain drips, spills and washings and exclude as far as possible other waters. The area should have an internal drain with a silt trap which is directed to a tank or chamber. From this facility (maximum operational size 1500 litre) 3 options which are possible:

1. Disposal via a registered waste carrier to a suitably permitted disposal site.
2. Disposal to a Permitted Area approved by the Environment Agency on the farm.
3. Directing liquid to a biobed or biofilter for bioremediation.

The latter requires an assessment to be made to calculate water loadings into a biobed or biofilter. Where the filling area is not covered the rainfall amount should be assessed. Note that for every 1 mm falling on 1 square metre then 1 litre of water may be collected. This is important to be included in calculations (as on page 18 of these notes) to specify the size of a biobed or biofilter. However, the 15,000 litre T32 maximum spray washings allowance does not include allowance for rainwater; but the area of the biobed should include an allowance for rainfall under current guidance.

Table 1 Typical dimensions required for pesticide mixing / handling areas

Sprayer Type	Overall length (metres)	Overall width (metres)
Self-propelled sprayer	7	5
Trailed	7	5
Mounted	4	5

The size of the bunded handling area is a compromise between containment, minimising the volume of clean rainwater requiring treatment and maintaining the ability to work safely. Some trailed sprayers may require more room, indeed contamination may be found on the rear of the tractor. The areas suggested will not allow for full

boom unfolding. However, it is possible to modify the handling area for an indirect biobed to enable the boom to be fully extended. Note that the Code of Practice for using Plant Protection Products recommends that boom spray- out should normally be done in the field area previously sprayed.

The example later shows how to calculate the size of an indirect biobed system including the fill area contribution.

Constructional detail of sprayer filling area

1. Remove existing topsoil. Excavate site as necessary to allow the following construction:

2. The excavated site should be with approximately 150 mm of well compacted hardcore over which a sand blinding layer (approximately 25 mm) should be placed to protect a damp proof membrane (dpm) of 1200g weight. A 150 mm thick, reinforced concrete slab should then be laid to falls of not less than 1:100. A concrete bund (300 mm wide x 100 mm high) suits many sites and is constructed around the entire perimeter of the slab. This size has been shown to be practical within the biobed evaluation work. It may be possible to create an acceptable bund by other means so long as it is impervious and does not allow over topping of liquids.

3. The bunded concrete slab should have a drain installed, for example an ACO slotted cover type drain (100mm x 100mm), installed in accordance with manufacturer's instructions, which is connected to a silt trap, with removable cover and a nominal capacity of 250 l below inlet. Another option is to install concrete sloping 4 ways to the centre of the slab where a drain is situated. This is achieved without the need for joints which could lead to premature leaks and failures. A silt trap must be provided within this drain.

Sometimes it may be possible to modify an existing concrete area to form the bunded sealed area needed. You should make the following checks / modifications:

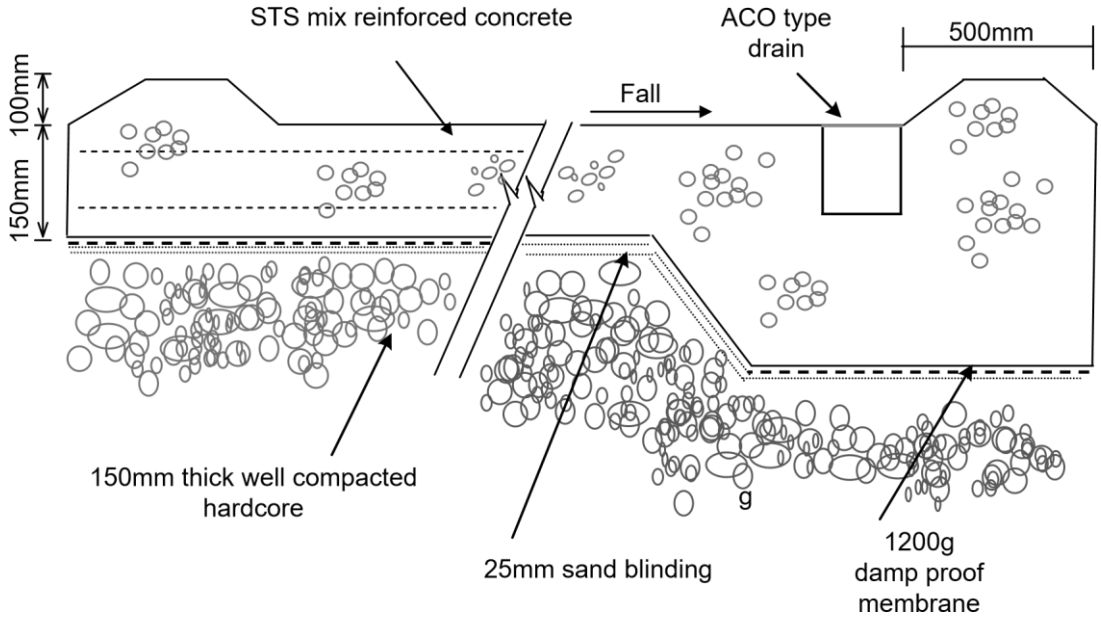
1. Check the concrete is in good condition, i.e. free from damage, pitting and cracks such that liquid cannot pass through. Also check that there is adequate fall (1:100) though this must be related to bund height ensuring that the bund prevents overflow of liquid from the fill area.

2. Is there a drain present that can be intercepted to only take runoff from the mixing handling area? If not, you need to install one, for example an ACO type drain. Cut the concrete along one edge of the handling area (suiting the fall) to accept a 100 mm x 100 mm ACO type drain, and install in accordance with the manufacturer's instructions. The drain should connect to a silt trap, with removable cover, with a nominal capacity of 250 l below inlet.

3. Construct bund edge of minimum 300 mm wide x 100mm high around the entire perimeter of the handling area. See notes above linked to construction of a new

area. The existing concrete surface may need to be roughened, including bonding agents or similar to accept the new concrete mix.

Pesticide Handling Area



Concrete pesticide handling area with bund and ACO type drainage system

Temporary liquid storage from pesticide handling area

All liquids falling on the pad (be they sprayer washings, spills or **even rainwater**) are to be considered as contaminated waste. As a result all should be collected and stored in the sump tank for professional collection or treatment through a bioremediation system. From the pesticide handling / wash down area all liquid **MUST** drain, via the silt trap, to a secure temporary storage, constructed of seamless polyethylene or similar. Do not use old single skin metal tanks. The pump switch levels must be set to ensure that no more than 1500 litres of waste is deliberately stored. You may also need to allow some surplus capacity in the tank for situations such as electricity or pump failure, or excessive wet periods when biobeds cannot be irrigated. If this is not addressed, either the biobed will be over-irrigated or damaged, or the handling and wash down areas may flood. With care it is possible to plan for any failure to allow liquid to feed back to the fill area thus indicating early maintenance required. It is good practice to ensure that the bunded volume of the fill area and tankage could hold the tank capacity of the sprayer.

Thus, in emergencies, liquids can be retained for action. However the regulatory operational limit of 1500l still applies. The overall tank size will be determined by these considerations. Under certain conditions the tank may need to be bunded. These will depend on the potential environmental risks associated with tank failure.

The Environment Agency exemption/registration process does not require the farmer to submit their risk assessment, it assumes that the farmer's own risk assessment is sufficient (i.e. if anything goes wrong the EA will look at the farmers risk assessment and risk management plans. Consider if holding tanks for spray wastes need to be bunded especially if located in 'high risk' areas (e.g. Groundwater Source Protection Zones, Sites close to surface water). The tank should be located near to the biobed /biofilter. Precise constructional details for the installation of this tank will vary with design. You should be guided by the manufacturer. You must ensure that the connection between the silt trap and storage tank is secure, such that **NO** leakage can occur.

Planning and Permissions

There are a number of basic steps that need to be considered before building a biobed or biofilter. These are:

1. Checking the Risks to Groundwater
2. Drawing up a site plan and local risk assessment
3. Deciding on the configuration type of biobed/biofilter you will install
4. Calculating the size of the biobed
5. Registering the relevant waste exemptions with the environment agency

1 Checking the Risks to Groundwater

It is vital that a biobed/biofilter poses no risks to groundwater and the Environment Agency Exemption only allows for biobed/biofilter to be installed in low-risk sites classed as Source Protection Zone 3 or in areas where there are no groundwater supplies. For the larger/most significant abstractions these zones are mapped (for small abstractions default distances apply) but all show the risk of contamination from any activities that might cause groundwater pollution in the area. The closer the activity is to the point of abstraction, the greater the risk. To assess the suitability of the proposed biobed/biofilter site in terms of risk to groundwater, you should follow this process using Magic Maps to find SPZs that have been mapped in your area:

Use this link to enter Defra's multi-agency map
https://magic.defra.gov.uk/MagicMap.html

Click on the **Map Layers** button

Being careful to click on the small arrow, now select layers and make viewable by ticking the following:
Designations
Land Based Designations
Non-statutory

Then select all the **Drinking Water Protected areas for England and Safeguard Zones**

The transparency of each layer, in order to better view the map behind the layers, can be changed. To do this, click on the button on the right of the **Designations** heading which will bring up a slider bar.

Enter your postcode or click on your location by zooming in, view any limiting coloured zones. Changing the scale of the map may help.

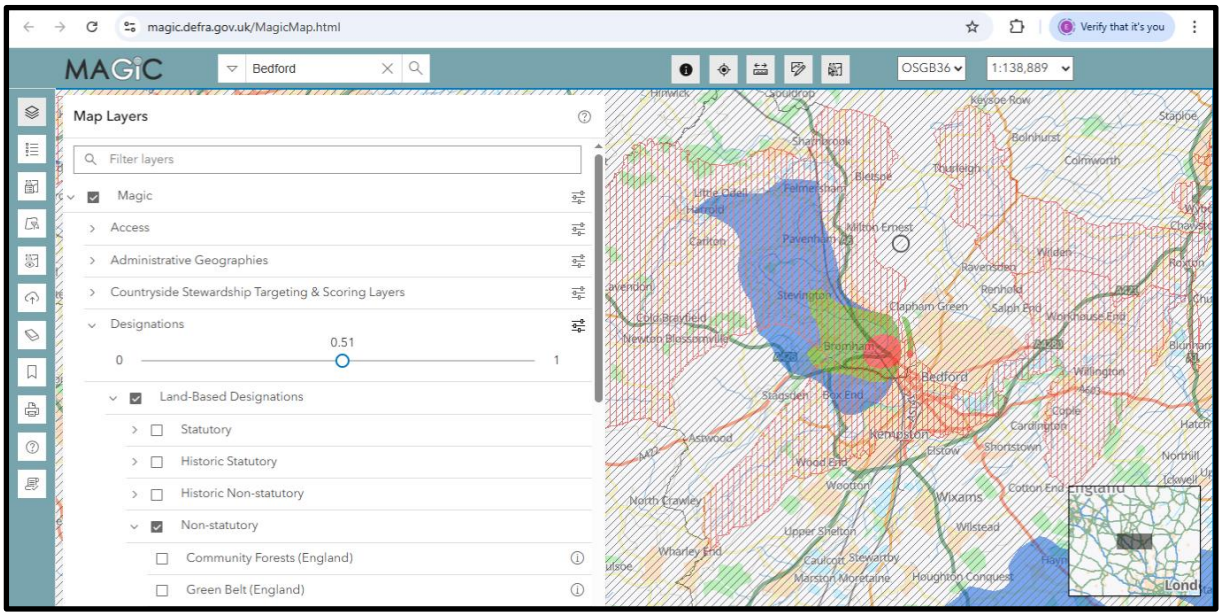
Zone 1 (Inner protection zone) RED
Closest to the source, and shows the most vulnerable groundwater.
Zone 2 (Outer protection zone) GREEN
The outer zone covers areas at risk from pollution by pollutants that do not break down quickly.
Zone 3 (Total catchment) BLUE the total area supplying water to the source.
Zone of special interest BROWN
Sometimes, a fourth zone is defined. This is usually where local conditions mean that industrial sites and other polluters could affect the groundwater source even though they are outside the normal catchment area.

A local site inspection by EA is needed if a biobed/biofilter is proposed to be located within a SPZ 1 or 2. If the proposed location of the biobed falls within an SPZ1 or 2 you should consider first if an alternate location that is outside the SPZ1 or 2 is an option. If not contact the Environment Agency Agriculture Waste Registration help line 0845 603 3113 to discuss the arrangements for a site inspection.

The location of all wells, springs and boreholes (e.g. private supply on neighbours' land) that have not had SPZs mapped, including those not used for human consumption also need to be considered. For this, you will need to make local enquires within at least 50m of you proposed biobed site.

Take a screenshot of your post code area confirming that it is not in an SPZ1 or 2 and keep a written record of your enquiries to show that you have taken account of groundwater risks.

In the example below farmers wishing to build a biobed in the red and green areas below will need to consult with the Environment Agency.



Screenshot showing Groundwater Source Protection Zones around Bedford, April 2025, the system for selecting the layers is shown on the left-hand side of the map. Clicking on the layers button will hide this.

Different arrangements for Groundwater Protection apply in Scotland for further advice consult with your local SEPA Office

2. Draw up a site plan and local risk assessment

Draw up a basic site plan including features such as the pesticide store, the location and size of the biobed/biofilter, associated sumps and pesticide handling area and the area that will be irrigated. Make sure the drawing shows any local ditches, ponds, farmyard drains, rainwater drains and any foul water sewage or septic tanks. Show any route where water can flow around your proposed site and also mark the direction of drainage and any slopes. It is good practice to ensure that the pesticide handling area is at least 10 m from any water course, but **it is an Environment Agency requirement that the biobed or biofilter is not located within 10m of any surface water body or clean water drain / watercourse**. This will include all yard drains and other drainage channels e.g. French drains. If the drainage from the biobed / biofilter or post treatment irrigation area (section) could meet any underground field drains, you should intercept and / or divert that drainage.

On the plan show any local environmentally sensitive area or protected habitat[3] this is important as there is a risk that biobeds/biofilters could produce harmful discharges. If either unit, or at a later date the spreading of biomix is likely to take place be within

[3] Examples of environmental sensitive areas or protected habitats include Sites of Special Scientific Interest (SSSI), Candidate Special Areas of Conservation (CSAC), Special Areas of Conservation (SAC), Special Protection Area (SPA), sites as defined under the RAMSAR convention, Areas of Outstanding Natural Beauty (AONB) and reservoirs You can get more information on environmentally designated areas and sensitive habitats including location at http://www.jncc.gov.uk/

250m of an environmentally sensitive area then you should produce an Environmental Impact Assessment (EIA)[4].

Finally, the site needs to be secure from public access so make sure the map shows any roads and foot paths as well as the main farm traffic routes.

3. Deciding on the configuration type of unit you will install

As you will see later there are three basic options,

- the offset/indirect biobed where the biobed itself may be some distance away from the planned or existing pesticide handling area,
- the drive over biobed which provides the function of a pesticide handling area as well as a biobed
- a biofilter. An important consideration is to ensure the site and handling area design minimises the quantity of rainwater entering the biofilter. Increasingly roofed sprayer fill areas are being installed, or an all-inclusive Sprayer Centre providing all aspects of supporting sprayer operation.

4. Calculating the size of the biobed/biofilter

A biobed is sized to provide sufficient biomix to degrade the expected chemical loading. The basic specification is based on one square metre surface area of biobed per 1000 litres of total liquid to be treated.

A simple example is given below:

Annual volume of pesticide waste and washings: 15,000 litres is used in this example as the maximum permitted within the exemption per biobed. The actual amount may be considerably less than this where limited tank washings[5] are involved; therefore, a careful assessment must be made of the annual production of washings/wash down etc to indicate biobed size. (see Appendix 2)

Annual rainfall: 650 mm Average rainfall data can be obtained from http://www.metoffice.gov.uk/climate/uk/.

Example: Required area of pesticide handling area: 7 x 5 metres = 35 square metres (Length of sprayer + 1.5 m x Width of sprayer + 2 m)

Taking the maximum volume of liquid requiring treatment per biobed: 15,000 litres of pesticide waste and washings plus 22,750 litres of rainwater (650 mm on 35

[4] The EIA should ensure that all possible risks around installing a biobed/biofilter are considered and that measures are put in place to manage the risks. The EIA should include a description of measures that you would be put in place to avoid, reduce and, if possible, remedy significant adverse effects. You should also consider alternative sites you may use and the reason for selection of the preferred site.

[5] A typical arable farm may only conduct a thorough tank and spray lines wash 5-7 times a year using c. 200-300 litres of water each time. Most frequently spray operations/sequences are organised so that either no washing is required or a “rinse through” in the field is sufficient. Especially with the most modern sprayers the major hassle is cleaning the outside of the sprayer, not so easy to do in the field. See table later of example washing volumes.

metres) equals 37,750 litres[6]. Based on a figure of 37,750 litres and the requirement for one square metre per 1000 litres, the biobed needs to be 1.0 m deep and have a surface area of 38 square metres. In practical terms, this would mean that the biobed as a minimum would be 6.0 m wide x 6.5 m long x 1 m deep.

The above calculation is only an example. The size of sprayer filling area will vary with the size of sprayer, while rainfall and the amount falling on the filling area will vary, e.g. whether roofed or not, annual rainfall.

Should the biobed be covered to exclude rainfall?

The biobed itself should **not be covered** as this will impact on the ability of the biobed to degrade the pesticides. However, there are benefits from limiting the volume of the clean rainwater entering the biobed. Purpose built buildings are becoming increasingly attractive to cover the fill area and to house the sprayer during non-spraying times as well. Any building which would allow the bunded handling area to be covered would mean the overall size of the biobed can be reduced significantly and a Biofilter could be a better more compact and lower cost option.

Biofilter Size

The basic design of Biofilter is based on the assumption that 3 x 1000 litre containers or IBCs linked in series have the maximum capacity of treating 15,000 litres per 12 month period. Unless alternate sized containers are used then a basic calculation to confirm that no more than 15,000 litres (including rainfall) will pass through the biofilter every 12 months. Some proprietary designs may use slightly smaller containers.

5 Keep it simple. Follow the guidelines. Stay legal. Register a biofilter/biobed

Farmers, being farmers, will come up with a range of ingenious and creative ways of making their own biobed. The problem is that the research showing biobeds work has been conducted on a standard design. EA and SEPA support and approval of biobeds is based on that standard design. Deviation from the standard design may be possible but you will need to discuss this with your local EA or SEPA office first.

Don't be surprised if they appear cautious, they want to be satisfied that your variation is as good as or better than the standard design in these notes and they may ask for research evidence. The long and the short of it is that it may well be less hassle to stick to the basic designs given here.

Once you have registered the waste exemption using the link below: you can proceed to build your biobed/biofilter

https://www.gov.uk/guidance/waste-exemption-t32-treatment-of-waste-in-a-biobed-or-biofilter

[6] It is not necessary to include the area of the biobed when calculating the volume of rainwater intercepted by the biobed. This has already been taken into consideration in the one square metre requirement for every 1000 litres of liquid. For direct biobeds the surface area is governed by the volume of spray waste and the physical dimensions of the sprayer

The Biofilter

This system provides similar chemical breakdown to a biobed and may suit operations where limited volumes of pesticide waste are produced, that is where little, or no rainwater enters the system (e.g. a covered filling area) or smaller systems.

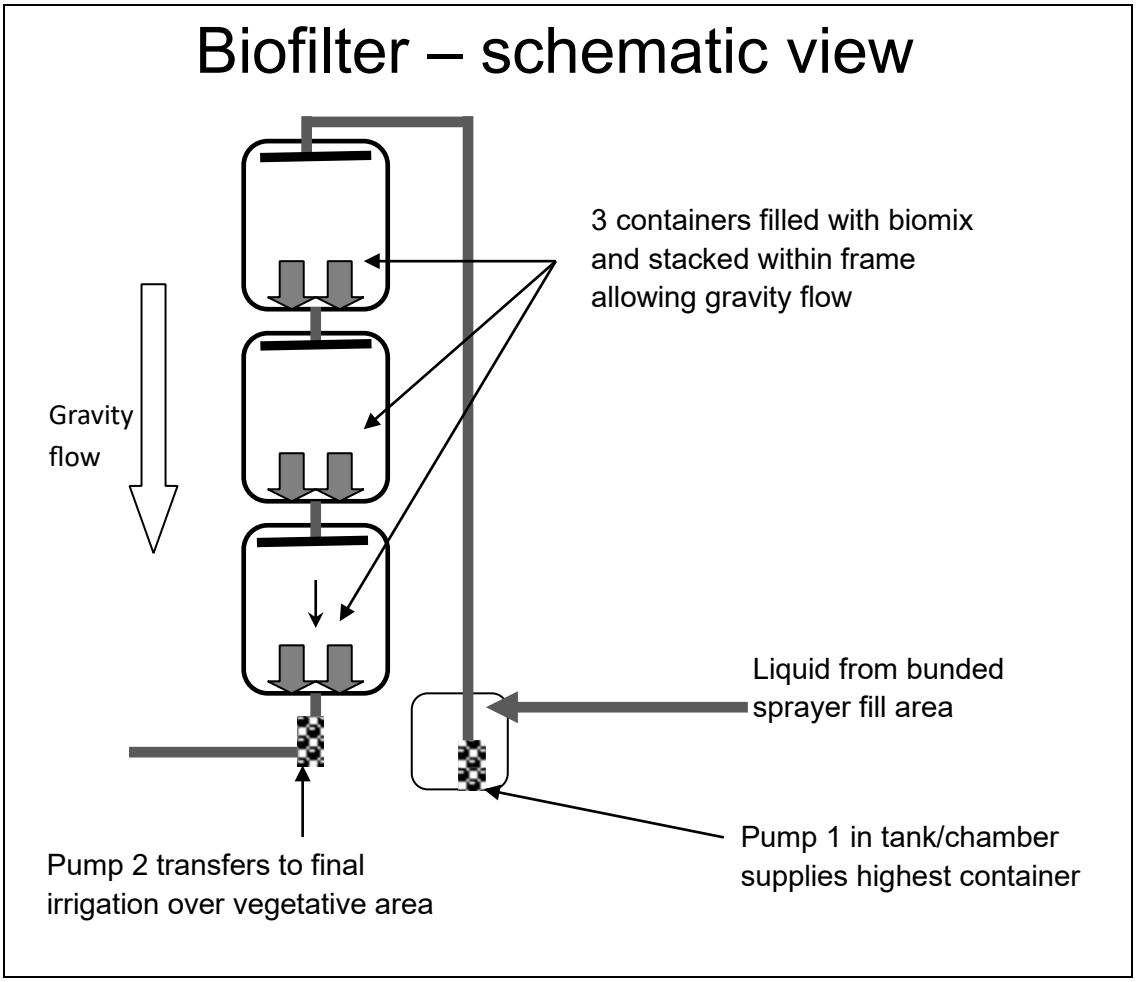
The same basic concept is followed: containment, liquid ratios to biomix, ingredient types, final use of water as with a biobed. UK Trials in 2008 confirmed that the biofilter gave as good as and in some cases better performance than a biobed. Thus, the biofilter is included by EA in the T32 and SEPA Paragraph 42 exemptions, subject to the same siting restrictions as a biobed.

The components of the biofilter system are:

- Tank/chamber to collect sprayer washings and pump to transfer liquid to the highest container
- 3 containers offering volume for appropriate biomix volume required
- Plumbing connections between containers
- Final liquid collection and pump transfer to re-use, irrigation or recirculation through biofilter system
- Irrigation area

Proprietary designs now include bespoke stacking containers normally offered in kit form. Original work was based on IBCs of a nominal 1000 litre capacity with their tops removed and linked plumbing allowing liquid distribution from the top container to the next underneath and so on through to the bottom container. See image below:

The top of the upper container should be covered to prevent rainfall entering the system, or the biofilter is located under a roof. It is important that the liquid spreads uniformly over the material surface within each container.



Constructional detail and comment:

- Follow the design advice for the pesticide handling area. The total area required may be much smaller if handheld or small sprayers are in use. Detail of the required fall and silt trap are as for biobeds.
- It is also sensible to install the biofilter itself within a bund to trap any possible leaks and avoid any risks to water. This could be within the main bunded pesticide area.
- The capacity of the biofilter bund should at least match the volume of liquid held in the biofilter and associated storage tanks.
- Ensure the biofilter is safe, the container stack should be placed on a level base and held within a secure frame to ensure the stack remains vertical. With proprietary designs a frame may not be required.

The liquid coming from the fill area is then stored within a tank or chamber subject to a routine operational 1500 litre limit. This facility will include a suitable pump, see construction notes below.

- A final (fifth) tank with a pump is also needed to collect the treated liquid prior to re-use, irrigation or recirculation through biofilter system. This will be affected by site and any distribution system. Distribution could be by drip irrigation as suggested for the biobed. As the amount of treated liquid is likely to be smaller than a biobed (evaporation is greater in an above ground system) the irrigation area may be reduced.

BIOFILTER CONSTRUCTION

1. Calculate biomix volume required and mix ingredients, leave to compost as for biobed.

2. Create a sprayer fill area with silt trap and discrete drain following guidelines set out for biobed use. It is likely that the bund size can be reduced where pedestrian operated, or hand sprayers are used. The bund should limit vehicular and other pedestrian access and contain calculated liquid amounts.

3. Develop a level impermeable base suiting the dimensions of the container stack, concrete is suitable.

4. Install appropriate power supply, protected by circuit breaker.

5. Install pre-biofilter container or designated IBC, routine operational volume of 1500 litre capacity following manufacturers' instructions, particularly where this is installed underground. A small pump is needed to lift the water from the pre biofilter tank to the top container and pressurise the distribution system. This has been provided by a submersible centrifugal pump with integral float switch. A 240v pump with circuit breaker protection delivering 50 l/min at 7 m head has been successful. It is possible that a low voltage system would also be suitable, perhaps with solar charging where no mains power is available.

6. This must allow a suitable pump to be inserted and allow clear operation of the pump level switch system.

7. Install the proprietary biofilter containers as per kit instructions. If DIY, then the following notes may be helpful. Select number of containers to be used (ensuring type is fit for purpose) and if a support frame is required. Remove top section of each at container shoulder. Ensure that the frame and container are not weakened unnecessarily; devise system to improve this if required. Retain one cover to cover the top container of the stack whilst in use to limit rainfall entry, unless the stack is under a roofed area. Insert wire mesh lining in each container base, cover with a permeable landscape membrane (Plantex ®) or similar. Install a layer (10cm) of washed quartzite pea gravel over this to ensure the drainage outlet to the container below is not blocked.

8. Load containers with biomix ensuring there is an even consolidated fill with no 'short circuit' routes for liquid.

- Create plumbing system from main pump in pre biofilter tank to lift to top container and through top cover to piped ring distribution system. Secure plumbing throughout system as below: 12mm push fit domestic plumbing can be used to produce uniform distribution in each IBC. Holes, 2 mm diameter drilled in the **upper surface** of the pipe at 100 mm intervals keeps pipework full and allows good distribution to biomix surface.

DIY Biofilter pipework

Proprietary Biofilter pipework

9. Devise a coupling system for container-to-container link and from bottom container to discharge or retention as planned.

10. Final assembly. Take care when working at height to develop the stack of containers and link container plumbing together. Secure containers within frame, connect electricity and test system – before filling with biomix -with water to check for leaks etc.

11. Consider insulation of exposed pipe work and vulnerable areas to minimise low temperature problems

Proprietary Biofilter –
D & H Group

Proprietary Biofilter –
Wroot Water

Indirect or Offset Biobed

Biobed Construction

The exact design of the biobed can be adapted to meet specific local requirements. For example, while most biobed systems will be based around an excavated hole in the ground, a sealed above ground tank could be used where the volume of liquid requiring treatment is low. An above ground tank-based system may also have a lower environmental risk, as it can be inspected. For this reason, it may represent an acceptable reduction of risk in vulnerable groundwater areas. However, the biobed **MUST** be sealed, be at least 1.0 m deep[7] and have a minimum surface area of 1 square metre for every 1000 litres of liquid requiring treatment.

The following detail describes a typical biobed system:

A pit should be excavated to contain the biomix. This can be a shape to suit any tank or lining system. Successful biobed construction has been achieved with soil side slopes of 30 to 35 degrees. These should be blinded with 25 mm sand, over which a geotextile membrane of 190 grams per square metre should be laid. The hole should then be lined with a material of a type suitable for a small reservoir. This liner should be 1.5 mm thick and be constructed from a synthetic material; it should be one piece and not contain any unsealed seams as this could allow seepage of pesticide solution. Two systems allowing water flow from the biobed have been used:

1. Liner with bonded outlet point
   A drain is inserted through the liner; this requires a bonded outlet point, able to accommodate a 100 mm outlet. The liner manufacturer should be consulted before ordering the bonded outlet as its construction will depend on the angle of the soil side slopes. The bonded outlet **MUST** be installed in accordance with the manufacturer's guidelines, as if it is not sealed correctly this could result in the biobed being unfit for use. The outlet should be installed at the lowest point of the excavation, compatible with the site layout. This outlet facilitates the rapid transport of the treated water for final distribution or re-use. A coil (approx. 5m) of 100mm perforated field-drainage pipe should then be laid into the base of the biobed (on-top of the liner) and connected to the drain intake to prevent the biomix material clogging the pipe.

2. Internal Sump - This has proved the more practical/useful option.
   A sump is created when excavating the biobed pit. The liner is then laid incorporating the sump area and the liner is not perforated. A central permeable vertical access tube is installed approx.0.5 metre diameter. This will allow water to flow into the sump base and a pump is installed within this

[7] There is no performance benefit – other than longevity - to building a deeper biobed. The bioremediation work of the turf and biomix takes place in the upper layers. Even with longevity there is a regulatory requirement replace the biomix every five years.

tube. A ring of perforated field-drainage pipe should then be laid into the base of the biobed (on-top of the liner) which assists liquid flow to the pump. The pump then operates on the float switch setting to pump the treated water to the final irrigation point. Ensure that any float switch can activate cleanly within the pipe diameter.

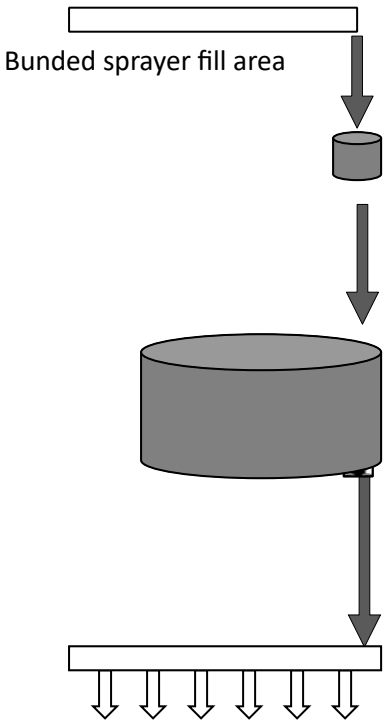
Turf cover

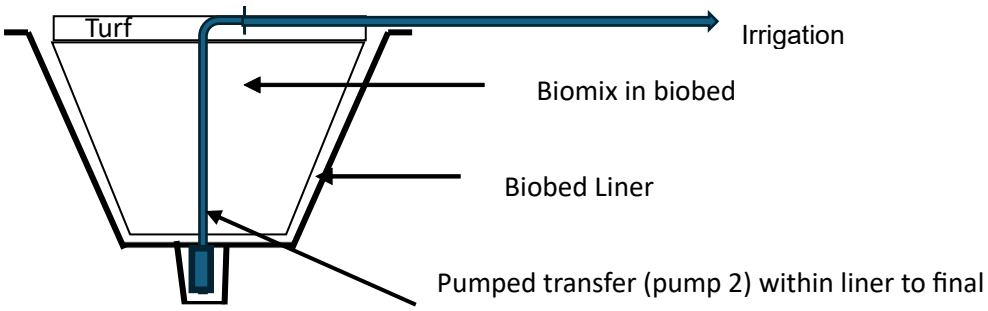
The lined biobed hole should then be filled with biomix and covered with coarse grass turf. Domestic grade turf is not recommended as this has little soil reserve and limits the development of the grass growth over the biomix. If the biobed is not to be used immediately, adding the turf layer should be delayed allowing for the addition of fresh biomix following an initial settlement period. The turf layer **MUST** be in place before pesticides are added to the biobed. The health of the turf is an important indicator of the health of the biobed.

The indirect biobed is a system where all pesticide mixing and handling takes place on an impermeable surface with a sealed drainage system. This directs run-off to the adjacent biobed.

Indirect (Offset) Lined Biobed

Schematic side View





Indirect biobed. *Sprayer is parked on impermeable handling area with runoff diverted onto an adjacent biobed*

Indirect biobed system under construction*. Bunded handling area in foreground, with a boom wash out section all draining to single collector. Background – liner within hole waiting to be filled with biomix and secure intercept tank awaiting installation.*

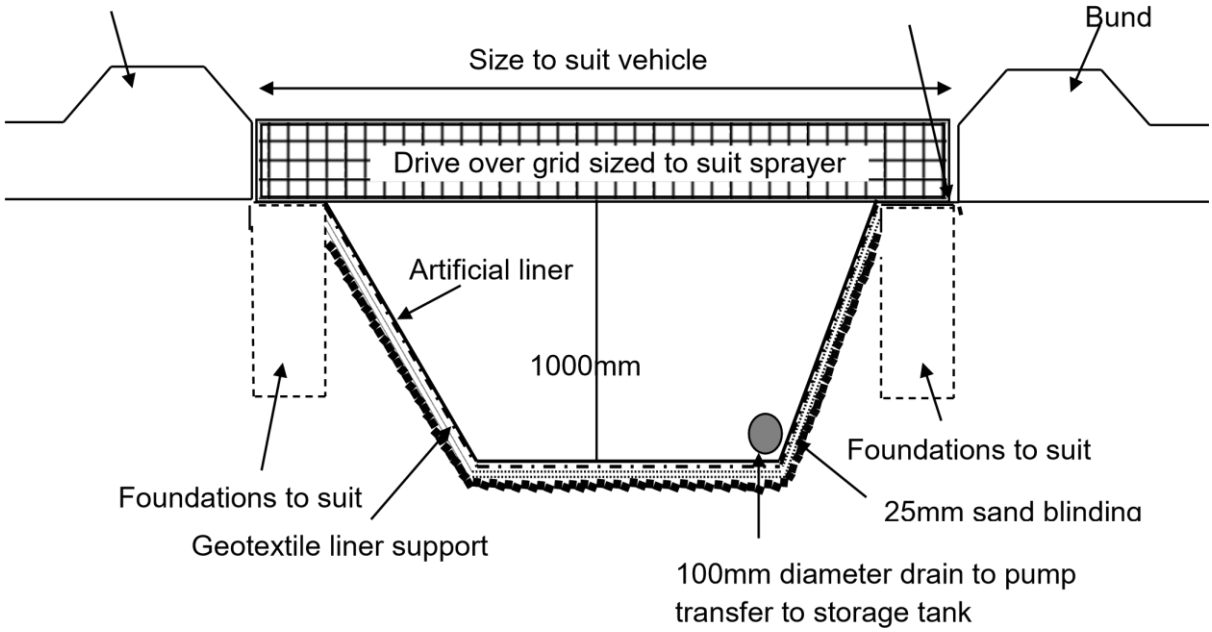
Liquid transfer to an indirect biobed

It is important to distribute the liquid held in temporary storage evenly over the biobed so as to utilise the full surface area, this has been successfully achieved using low-cost drip irrigation. These systems have a low-pressure demand (nominally 7m head) which can be supplied by a submersible pump, fitted with a float switch and installed into the base of the temporary storage tank. Pumps with a nominal capacity of up to 50 litres per minute @ 6.5m head (approx. 200 watt motor) would be suitable. Flow rates from the emitters on this type of irrigation are typically one to two litres per hour and should be spaced at 0.25 – 0.4m, with the dripper lines spaced at a similar distance. The system should be inspected regularly for signs of damage (e.g. mice) and loose joints.

Direct (Drive over) Biobed

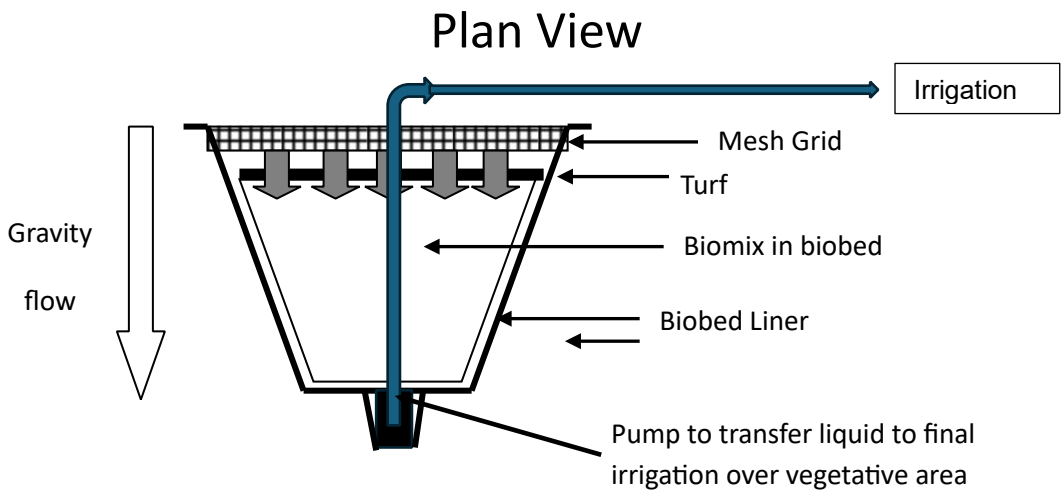
With a direct biobed system the sprayer is parked, washed and filled on a reinforced steel mesh grid over the biobed, thus intercepting directly any spill, drips and washings. Gravity causes movement of liquids within one area. However, unlike the indirect system, it is unlikely that any existing facility would be suitable for modification, so a new construction will be needed. This is likely to be challenging and expensive.

The biobed is constructed as outlined in the sketch below. Vehicle access to the biobed necessitates a robust grid over the biobed surface. This grid needs to comply with all health and safety requirements both in terms of an operator handling concentrated pesticides and the support of a fully loaded sprayer. A 40 mm x 100 mm steel mesh is recommended. All liquids as well as soil/mud from tyres should be able to pass vertically through the grid and onto the biobed. The grid will also require removable sections, to allow for maintenance of the biobed. The grid should be supported with end and side foundations. These will need a firm sub-base to lay the concrete over. It is recommended that you liaise with the grid supplier over the anchorage system for the grid. The direct biobed system should only receive liquids from the sprayer above. Therefore a bund, similar to that for the indirect biobed intercept area should be installed, with a raised edge of minimum 300mm x 100mm.



A schematic view of a direct biobed liquid flow is given below:

Direct (Drive over) Lined Biobed



Example of grid construction used to allow access to direct biobed systems

The Biobed and Biofilter Mix

As described earlier a biobed or biofilter is basically an organic filter system. This consists of a mixture of straw (wheat or barley), peat-free compost[8] and topsoil. The ingredients should be mixed **by volume** as one part compost (25%), one part topsoil (25%) and two parts straw (50%). Ideally the mix should be allowed to stand for between 30 and 90 days before being added to the biobed/biofilter. This allows the composting process to start to breakdown the straw, which makes it easier to create a homogenous mix. Note that it is more difficult to create a good mix when using very wet or heavy (clay) soils, therefore friable lighter soils offer the best potential in the mix. A fore loader or telehandler with a simple fork has been shown to be sufficient for mixing after alternately adding each ingredient.

Volumetric proportions of straw, peat-free compost and topsoil

[8] Use of peat in the biomix is discouraged given that it an unsustainable resource. A peat free substitute should be used if possible. Farmyard manure is not approved for use in the biobed. There is potential for waste peat based growing media to be used in the biobed as well as composted green waste. However, both do not currently have approval for use in the biomix. If growers feel there is a case for using these or similar materials, they should discuss this with their local EA office.

Handling Area Operation and Maintenance

The provision of a bunded filling area is not an excuse for poor practice. Every effort should be made to contain spills of pesticide concentrate by using an induction hopper and drip trays.

N.B. Concentrated pesticide must **NEVER** be disposed of to a biobed.

Where spillage of a concentrate occurs, this should be treated using a proprietary spill kit. If a large spillage of concentrate reaches the biobed then the entire biobed mix will need to be replaced with the biobed mix being removed by a professional waste disposal contractor

Maintenance should include:

- Regular clearance of sediment in the silt trap to ensure rapid transport of liquid to temporary storage and subsequently the biobed. Certain pesticides stick strongly to soil. Therefore, soil that accumulates on the handling area may be contaminated with pesticides.
- Vehicles other than the sprayer should not have routine access over the handling area as potentially contaminated soil may be transported off the site. You should regularly clean the handling area with any soil collected to be placed directly onto the surface of the biobed/biofilter.
- Inspection of the concrete surface looking for any developing faults/cracks etc. If found early repair will ensure pollution potential is reduced.

Irrigation of final discharge water

Drip irrigation is proposed to allow distribution of the treated water from a biofilter or biobed over a vegetative area. Soil type will determine the spacing of both emitters and pipes. Light soils will require closer spacing; progressively wider spacing on heavier soils to a probable maximum of 0.5m being likely. To control irrigation, a system should be to apply 2-4 mm at a time. Where spacing as 0.5 x 0.5m is possible with emitter flow as before, such an application would be possible within 30 minutes.

It is possible to bury the drip irrigation some 50 mm below the soil surface which would control surface evaporation and minimise any vermin problems.

This pump should be automatically controlled (e.g. float switch) but allow manual activation for checking purposes.

Other sprinkler types of irrigation may be used. Sprinkler systems are likely to require a higher-pressure system, and this could challenge pump selection to accommodate this.

Biobeds and Biofilters are classed as waste recovery systems. This means it is necessary to ‘reuse’ the treated water. Possible re-use options include irrigation (as described above), sprayer washing or use as the carrier for pre-crop total herbicide applications.

If the treated water is to be used for “irrigation”, this **MUST** be applied to a vegetated area:

- that is neither frozen nor waterlogged.
- is at least 10m away from any surface water.
- 50m from any spring, well or borehole not used for domestic or food production.
- and 250m away from a borehole used to supply domestic or food production.

Note: The distances above are similar to those cited in the Farming Rules for Water linked to diffuse pollution incidences.

You should fully consider and document the presence of any underground drainage systems. Irrigation must be applied at a rate such that there is no surface runoff generated. A drip irrigation system as described before would be suitable. It may be advantageous to collect the treated water post biobed and thus the biobed drain outlet should be connected to a second temporary storage tank. The tank should operationally offer less than 1500 litres capacity and of a type and installation as described earlier.

Operation and Maintenance - Biofilter

1. Arrange for the final discharge pump to deliver to chosen outlet, i.e. Re-use storage, irrigation or recirculation to pre-biofilter tank.

2. Considering the surface area of the containers the filling pump should be set to discharge at a maximum of approximately 150 - 200 litres of liquid at each operation. This equates to approximately 115 - 150 mm water max per session within container type. Pump flow at the pressure head will dictate running time. Three to five minutes should achieve a reasonable application rate, typically this running period may be required every one or two days, but this will depend on volume being treated.

3. The biofilter should never be flooded; it is necessary to check that moisture movement through the container is regular. Flooding and moisture status should be readily visible with translucent containers.

4. Check for leaks frequently initially, reduce checking frequency to one per week once system proved

5. Check for problems in cold weather, though most biofilters are now installed within a building.

6. Top up containers once per year or as necessary following inspection.

7. Keep basic records of when biofilter commissioned, overall use periods, faults, repairs etc.

8. Completely replace biomix every five years and follow storage and spreading requirements. As with biobed experience, it has shown that it may be prudent to leave a thin layer of biomix over the base pea gravel in each container to assist with ‘seeding’ the function of the biomix. Alternately use some of the spent biomix during the mixing/composting process. This enhances the biomix activity during future use.

Operation and Maintenance - Biobed

Biobeds are intended to be low-cost systems that require only minimal technical and management inputs. However, some maintenance is needed to make sure the system performs well. Keep a logbook to show that the biobed is being operated and maintained correctly. This should include construction details as well as routine maintenance records, for example when the biobed was topped up, silt traps cleaned, the biomix replaced, where it was stored and when it was spread to land.

Turf Condition

Monitor the turf for any poor growth, water if necessary, in prolonged dry periods of non-use.

Annual Top up

The biomix over time will decompose and compact. To keep the biobed performing well, an average minimum depth of 1.0 m should be maintained. To achieve this, the biobed may need to have fresh pre-composted biomix added every year. Wearing appropriate PPE, the turf layer can then be removed; this is normally easy as the turf does not root heavily into the biomix. The fresh biomix added and the turf replaced. Alternatively, the turf layer may be left in-situ, the fresh biomix added and then re-turfed.

Liquid depth in chambers and pump operation.

Experience will indicate normal operational water depths in any chambers or tanks. Checking these routinely will highlight any problems developing. Pump operation can be tested by checking the float switch operation.

Drip irrigation

Check for any damage/leaks etc within the irrigation system. Inspect the biobed vegetative growth. In periods or areas of high rainfall it may be necessary to manually manage the pumping intervals applying to both the biobed and disposal irrigation systems. This will suggest a storage tank post biobed. Experience will guide necessary action relative to soil types, capacities installed and system interaction.

Cold weather provision

Most systems will need to remain functional during cold weather to handle natural rainfall entering the system. Installations should limit all surface pipe runs as far as possible. Where they exist, they should be insulated to an effective level using proprietary waterproof pipe insulation.

Most systems will be vulnerable where drip irrigation is used over biobed surfaces. It is suggested that these be covered with a straw layer for insulation purposes.

Five yearly replacement of biomix

It is a regulatory requirement that the biomix **must** be replaced after five years[13]. Excavation to remove the used biomix must be done carefully to avoid damaging the liner. It may be prudent to leave a thin layer of biomix in the liner to avoid risk of damage, some evidence exists that the bacteria present within the soil attune themselves to the process and thus leaving a small amount of mix (or adding some to the new biomix) may assist in the function of the biomix. While the biobed is empty, use a shovel to gently disturb any remaining biomix so that the construction can be carefully examined and any defects repaired. Liner life should be longer than two fills and replacement may only be required if it is damaged during unloading.

[13] Data on the long-term performance of the different biobed systems operated under UK conditions is limited. However, the scientific literature suggests that the biomix should work effectively for five to eight years.

Storage and Use of Spent Biomix

The spent biomix must be stored so that there is no risk of it being a source of water pollution.

Storage requirements:

- On an impermeable surface.
- 10m away from any surface water or clean water drain.
- 250m from any spring, well or borehole.
- Store for a minimum of 12 months and no more than 36 months.
- No more than 50 cubic metres may be stored at any one time.
- Sheet over the heap to limit run off or store the biomix under cover to reduce rainwater run-off.
- If the spent biomix is stored **on concrete** (or other impermeable surface), any run-off should be collected and irrigated to vegetated land, that is neither frozen or water logged, subject to the distances given above.
- If the spent biomix is stored **in the field** ensure the storage is sited away from any field drains and that there are no risks to surface and ground water.
- Keep a plan and record of your storage arrangements.

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Spreading spent biomix to land – a U10 exemption must be obtained to permit this.

Used biomix may be spread to land[14], as long as this results in benefit to agriculture or ecological improvement[15] and subject to the following restrictions:

1. You must be entitled to carry out the activity on the land.
2. The land is at least 10m away from any surface water and 250m away from any spring, well or borehole.
3. Wherever practical, target spreading on areas of 'lower risk land'- as defined by the Codes of Good Agricultural Practice.
4. The land is not waterlogged, flooded or snow-covered, frozen or been frozen in the preceding 24 hours.
5. The application does not exceed 50 tonnes per hectare in any period of 12 months.

[14] Ensure that you have the U10 permits/exemptions for land spreading waste.

[15] Agriculture benefits include the provision of nutrients such as nitrogen and phosphorus, while the addition of organic matter can improve soil structure and water holding capacity. Ecological improvements could include the maintenance or improvements of habitats.

6. You make an allowance for the available nitrogen, total phosphate and total potash in the waste when working out fertiliser requirements.
7. The application follows any requirements that apply to Nitrate Vulnerable Zones.

Maintenance Costs

It is unlikely that large costs will be incurred with routine maintenance. Trial sites have not shown high costs and preventative maintenance routines will pay dividends.

OTHER OPTIONS - Further notes

Two systems may be worthy of examination for comparison with biobeds or biofilters.

1. **Heliosec:** This is an evaporation system developed in France to receive spray washings from the filling area. It comprises a galvanised steel frame supporting a special 'plastic' open topped bag. The frame incorporates a polycarbonate roof which prevents rainfall entering but is positioned to allow airflow between the roof and bag thus promoting evaporation. No discharge is created from this system. Several are known to be installed in UK. No exemption is needed in the UK but siting of such and bunding are recommended as per forementioned bioremediation systems. The bag must be recycled when dry, probably once per 12 months with an appropriate fee and waste transfer notice. This unit is likely to require a private import from France.

Heliosec installed in France - 2009

Heliosec installed in Essex. Approximately 10 years use, (photo 2024).

2. **Phytobac**: This is a bioremediation as well as an evaporation system, which receives the spray washings from a sprayer filling area, it also makes no discharge unlike biobeds/biofilters. It was developed in France. It uses a different biomix recipe – 70% soil and 30 % straw with a similar system for the waste spray liquid to be distributed over the biomix surface. The biomix is held within an impervious container, concrete panels or 'plastic' have been used. Sizing of the unit is via guidance which has been made available through Bayer CropScience in UK. https://cropscience.bayer.co.uk/mediafile/100474793/bcs-phytobac-manual-part-one.pdf

One Phytobac is known to be operating in UK. Siting rules and T32 and U10 exemptions apply.

Phytobac installed in Cambridgeshire, concrete panel container.
Detail of sliding roof and drip irrigation below.

References and Useful Contacts:

- https://www.gov.uk/government/organisations/environment-agency
- www.voluntaryinitiative.org.uk,
- https://www.gov.uk/guidance/catchment-sensitive-farming-reduce-agricultural-water-pollution
- T32 and U10 exemptions are available from Environment Agency website - https://www.gov.uk/government/collections/waste-exemption-guides

Biobed and Biofilter kits:

The two companies listed below offer comprehensive products and kits for biofilter / biobed installations.

D & H Group

https://www.dandhgroup.co.uk/bio-filters-bio-beds/

Wroot Water

https://wrootwater.com/index.php/water-treatment-2/bio-beds-bio-filters/

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Thanks are due to those farmers listed below who willingly shared their experiences and equipment images.

James and Debbie Nott – J.R & E.H Nott
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Peter and Richard Maddever – P.H. Maddever Farms
Andrey Ivanov – Wilkin & Sons Ltd.
Rob Stacey – P.J. Stacey & Son
Dan Wormell – P.R. Wormell Farms
Christy Willett – Parklands Farm

Commissioning Water companies

Essex & Suffolk Water (part of the Northumbrian Water Group).
Northumbrian Water Limited, Northumbria House, Abbey Road, Pity Me, Durham. DH1 5FJ
https://www.eswater.co.uk/

Anglian Water Plc,
Anglian Water, Lancaster House, Lancaster Way, Ermine Business Park, Huntingdon Cambridgeshire, PE29 6XU

https://www.anglianwater.co.uk/

Example Sprayer Washing Volumes

Sprayer Washing Scenarios (litres)													
		Arable Farm			**Vegetable Farm**			**Mixed Arable/Grass Farm**			**Grassland Farm**		
	Farm Profile	Sophisticated equipment used, makes most of labour-saving devices. Latest sprayer design. Good awareness of keeping sprayer clean and to avoid crop damage BUT will plan work to avoid unnecessary rinsing, may not always do end of day rinse			Sophisticated later equipment with labour saving devices; very risk averse and will not want to risk damage to crops, overdosing or residues so many full washes a year even if not always needed			Second hand smaller sprayer with few labour-saving devices but spraying frequency low and unlikely to be growing sensitive crops limited awareness of sprayer hygiene issues			Small older sprayer very basic, sprays 1-2 times year low awareness of sprayer hygiene… may not wash at all!		
Sprayer washing	Typical Process	Frequency/ year	Washing volumes for Median Tank Size 3000L	Volume of washings for biobed	Frequency/ year	Washing volumes for Median Tank Size 2000L	Volume of washings	Frequency /year	Washing volumes for Median Tank Size 1500L	Volume of washings	Frequency/ year	Washing volumes for Median Tank Size 1000L	Volume of washings
Full wash	Only happens when changing between sensitive crops or reactive products; process would involve 3 rinses each rinse using 10-20% sprayer capacity if internal rinse nozzles fitted; for grassland assumption made that internal rinse nozzles not available	5	3000	3000	20	2000	8000	2	1500	9000	2	3000	6000
End of day rinse	One quick rinse through 10% of sprayer capacity probably applied to arable crop or grass but not veg…for grassland assumption made that internal rinse nozzles not available therefore one full tank rinse	40	300	n/a	70	200	14000	4	1500	6000	0	0	
Exterior Washing	Either done in the field or with a good facilities draining to a biobed/filter	5-20	100	4000	70	100	7000	6	100	600	2	100	200
	Total Washings			**7000**			**29000**			**15600**			**6200**
	Volumes Exclude Rainwater from handling area												

FAQS:

- **What volume of spray washings can be treated in a biobed?**

The maximum volume of sprayer washings (excluding rainwater) that can be treated by a Biobed is 15,000litres. The surface area of a biobed needs to be big enough to handle all planned sprayer washings and any associated rainwater; work on 1 m^2 per 1000 litres of total liquid.

- **How often will I need to top up the biomix?**

Biobeds naturally sink by about 20-40 cm/year as the straw and peat free compost degrade. Using PPE, gloves particularly, peel back the drip lines and the turf layer and top up annually. Re-install the turf or cover with fresh supply, re-fit drip pipe.

- **How often do I need to empty a biobed?**

The EA exemption states that the material should be exchanged every 5 years. The old material must be store protected from rainfall and any subsequent leaching for 12 months. Then it can be spread to land under Exemption U10 at not more than 50 m^3 per hectare.

- **What is the biomix?**

All the UK trial work was based on that biomix used in Sweden. It is by VOLUME 50% any cereal straw, 25% friable soil and 25% peat free compost. Various composts are now available based on a variety of ingredients. The compost needs to be of a fairly fine nature to ensure good moisture migration throughout the mix. A lumpy mix may not be successful. Shredded wood-based composts are unlikely to be successful.

- **Should the biobed be covered?**

No, the biobed works best as a moist – not saturated - environment. Rainfall on the surface will support this, even dews will be helpful in dry times. A roofed environment may lead to the biobed drying out too much.

- **How do I maintain a biobed?**

Ensure that the liquid transfer system functions well, probably check at least weekly during non-spraying time. Observation during normal use will identify whether the drip irrigation is working well as well as any problems, leaks etc. Beyond this the biobed does not demand intense management. Yearly top up of the biomix may be necessary.

- **How do I operate a biofilter?**

Once installed, liquid flow from the fill area, normally covered, will transfer through the silt trap to the primary tank and pump. This delivers liquid to the top biofilter container and gravity then ensures liquid flow through the remaining containers. Dependant on design there may then be a final tank, fed by gravity which then allows discharge from the biofilter, or a second pump will deliver the treated liquid to the irrigated area.

- **What volume of pesticide washings can be treated in a biofilter?**

The EA exemption permits up to 15,000l of waste liquid to be treated by a biofilter per 12-month period. However, there is much less material in the majority of biofilters than would be found in a biobed. As most units will be linked to a covered fill area this may mean that only 3000 – 5000 l of contaminated liquid will be needing treatment.

- **How often do I need to empty a biofilter?**

As with a biobed the EA exemption states that the material should be exchanged every 5 years. The old material must be store protected from rainfall for 12 months. Then it can be spread to land under Exemption U10 at not more than 50m^3 per hectare.

- **Should the biofilter be covered?**

Yes, excessive rainfall entering the system is likely to be detrimental. Replacing the top cut off an IBC or using a proprietary lid on another container will be sufficient to limit rainfall entry.

- **Should the biofilter be irrigated?**

This should not be necessary. Where the unit is sited under cover it may be possible that in a dry warm season the contents could dry out. Recirculation of liquid leaving the biofilter may be helpful in maintaining the moisture status required.

- **How do I maintain a biofilter?**

Ensure that the liquid transfer system functions well observing liquid transfer and gravity movement of liquid through the biofilter containers also checking for leaks. Beyond this the biofilter does not demand intense management. Yearly top up of the biomix may be necessary.

- **What can I do with the treated washings?**

As with a biobed these washings can be irrigated to a vegetative area. Drip Irrigation suits this need well.

- **What happens after five years of operating a biofilter?**

This will coincide with the need to exchange the biomix, then to store that under cover for a further year before spreading the material to land under the U10 Exemption. It may be possible to exchange the material earlier than this by replenishing one container at a time. Storage of the material under cover is required as with the 5-year rule.

Examples of Bioremediation systems in use.

A sprayer centre building, insulated, including chemical storage and incorporating central drain to underground tank. Includes remote door operation for security.

All possible liquids drain to central tank, including on occasions washing machines kept for soiled clothing.

Recent improved technology – a closed transfer system, reducing the potential for contaminated discharges.

A covered sprayer washdown facility with boom spray out trough. Note removable covers to limit rain ingress to trough. Biofilter mounted on a substantial frame, top container includes roof.

Fully insulated building, including sprayer filling area is sloped 1:100 to far end, serving an internal biofilter, constructed 2012 providing rainwater harvesting, remote door operation and chemical storage.

Biofilter showing frame and coupling system including low tank to discharge to external irrigated area or recycle to top to maintain moisture in biomix.
Picture taken 29/11/2024 - shows longevity of biofilter system.

Horticultural fruit spraying operation. Small lean to onto existing sheds, constructed using farm labour incorporates central drain to biofilter.

Roll down windbreak to limit weather influence, simple answer to small scale equipment.

Biofilter in sprayer centre shed, extremely clean operation and flow meter fitted for interests' sake to discharge showing annual use.

Rainwater collection systems increasingly being fitted to sprayer centre developments.