Treatment of Waste Water

This guide is not intended to give full requirements or design criteria. It is provided to give path/facility developers information regarding potential solutions to sewage and greywater handling.

Note: Unless a disabled person is to be employed to operate and maintain these works the system need not be designed to meet accessibility criteria. However, siting operating controls at heights suitable for people with disabilities places them at convenient heights for maintenance workers.

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Treatment of Waste Water

1 Introduction

It is important that drainage systems are considered holistically and that each detention basin, retention pond and swale is recognised as part of a network of habitats and wildlife corridors.

- Where possible, locate new drainage features close to but not directly connected to existing wetland areas, so plants and animals can naturally colonise the new features and ponds.
- Create well vegetated shallow bays and establish areas of marsh.
- Avoid smoothly finished surfaces; although they give the impression of tidiness they provide less physical habitat diversity for plants and animals.
- If planting is essential ensure native plants of local origin are used.
- Create shallow water habitat, which is generally less affected by pollution than deeper water habitats: Shallow water supports a range of wildlife that is less vulnerable to the effects of pollutants, particularly emergent plants and air breathing animals. In contrast, submerged aquatic plants in deeper water and animals which live permanently under the water (such as mayfly larvae, dragonfly larvae and fish) are often badly affected by pollutants.
- There is no ideal amount of vegetation from a wildlife perspective, although more is usually better. Where it is necessary to harvest plants to remove pollutants it is probably best to accept the process.

Any discharge from a wastewater treatment system is likely to require a consent from the Environment Agency. Each authority may lay down specific measurable parameters which you will have to satisfy to enable you to discharge the treated sewage effluent from your premises into a watercourse, soakaway or sub irrigation system. In some areas ‘Consent to Discharge’ is not required. In most areas ‘Consent to Discharge’ is not required if you are replacing an existing system with similar.

1.1.1 Greywater

All waste produced in the home or from a facilities area, except toilet waste (urine and faeces) is called greywater. Greywater from washing dishes, showers, sinks and laundry comprise the major part of residential and facilities wastewater.

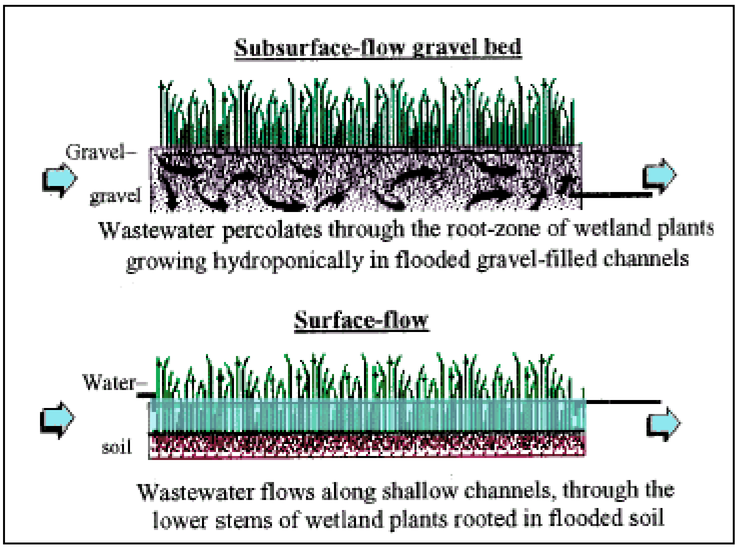
Greywater compared with mixed wastewater is generally harmless from an environmental and hygienic point of view. Problems connected with greywater are relatively small and local. On the other hand, if not managed properly, greywater will be a strong source for smell. A primary target should therefore be to remove the high levels of easily degradable compounds that are responsible for this. This must be done quickly since anaerobic conditions and odours will occur very soon (within hours if warm). It should be required that wherever greywater is freely exposed to people, it should first be treated to secure that BOD do not cause anaerobic conditions.

1.1.2 Sustainable urban drainage systems (SUDS)

Progressive urban development has resulted in rapid increases in run off to watercourses following storm events. Because rainfall can travel quickly to the watercourse via impermeable surfaces there is very little natural infiltration to ground or retention to reduce levels of pollutants such as silt, organic matter and petrol/oil derivatives. SUDS aim to detain run-off and release it slowly into watercourses or to ground. This reduces the likelihood of flash flooding and results in greatly improved water quality. SUDS schemes are often cheaper and easier to maintain than traditional engineered drainage solutions involving gully pots and petrol interceptors.

SUDS employ a whole suite of techniques to effectively manage drainage at source including porous paving, dry ditches (swales), detention/attenuation ponds, and integrated constructed wetlands.

1.1.3 Constructed Wetlands



Constructed Wetlands (CW) are man-made wetlands designed to mimic the biofiltration action of natural wetland systems. Shallow, permanently flooded or wet marshy ground populated with macroyphytic vascular plants (i.e. reeds) are known to trap and hold large amounts of solids, particulates and dissolved constituents of waters that pass through them.

In CW effluents/ polluted waters are channelled into a series of man-made ponds with an impermeable synthetic liner or clay base, filled with either the original soil from the site or with selected substrates (normally sands and gravels). These are planted with vascular hydrophytes, aquatic plants, which quickly develop extensive submerged root systems.

Within the submerged soil/root profile distinct zones of aerobic and anaerobic activity develop, where roots, soil, algae and microbiotic aquatic fauna trap, hold, absorb and transform pollutants from effluent waters. These changes are affected by many mechanisms, from simple accretion to soil particles and root systems, sedimentation, chemical precipitation, adsorption and the complex chemical pathways of algal and phyto-utilisation of nutrients for transformation to biomass and eventual carbon sequestration.

The table shows the percentage removal of several pollutants from secondary effluent in Natural Wetlands.

Pollutant	% Removal
BOD	70-96
Suspended solids (SS)	60-90
Nitrogen	40-90
Phosphorous	Seasonal

(United States EPA, 1988)

There is little published information available about discharge levels from CW. Managers should regularly monitor discharge balances.

Ideally, CW discharges would have

<= 1mg/l P (as phosphorous),

<=1mg/l N (as ammonium) and

<=5mg/l BOD (Biochemical Oxygen Demand)

A CW designed for sewage treatment can be expected to remain effective at peak for 10 years followed by declining effectiveness for up to 25 years.

Dealing with CW at the end of its working life could become problematical. After years of being loaded with nutrients and pollutants they may well be regarded as contaminated soils.

1.1.4 Integrated Constructed Wetlands

The integrated constructed wetlands (ICW) concept is a specific approach to the construction of wetlands, led by the Irish Department of the Environment, Heritage and Local Government, and the Centre for Research into Environment and Health at the University of Wales, Aberystwyth.

ICWs are distinct from other constructed wetland approaches as they are designed to facilitate the widest possible range of ecological conditions as are found in natural wetlands, including those of soil, water, plant and animal ecology. The approach strives to achieve 'landscape fit' and 'biodiversity' into the design.

The constructed wetlands require relatively low capital inputs compared to conventional pollution treatment technologies and have the potential to provide improved water quality, environmental improvements, biodiversity enrichment and sustainable economic development in a cost effective manner.

Waste water from farming activities, food processing activities and small settlements are an area of growing concern as the EU Water Framework Directive comes in to force.

1.1.5 Buffer zones

Buffer zones are being used increasingly in agricultural landscapes to reduce the impact of diffuse pollutants on water courses. Each buffer zone should be designed as a unique solution to an individual problem. Commonly buffer zones are located adjacent to water courses, but equally they can be sited with ditch networks or along breaks of slope. Understanding how polluted water reaches receiving watercourses is fundamental to ensuring that buffer zones achieve their goal of nutrient stripping, silt trapping and the attenuation of the impact of pesticides and herbicides.

2 Background

Non-professional Developers often lack knowledge of the different systems and combinations available. There are significant differences in the range of applications and a wide variety of types, makes and arrangements of most types. The following provides a description which should help clarify the situation.

2.1 Site Assessment

Assessment of the soils, water supply, hydrology and water quality will be necessary in order to determine:

a) The ease with which areas of wetland can be created on a site;

b) The nutrient levels likely to be found in a wetland;

c) Other characteristics, such as salinity, of the water.

This information will indicate what wildlife a wetland is likely to support and/or what measures might be required to make the water quality and regime suitable for a particular group of wildlife.

- Underlying geology and aquifers;
- Whether the ground is liable to flooding;
- Nature of the sub-soil and groundwater vulnerability;
- Implication of plot size;
- Proximity of underground services;
- Ground topography and local drainage patterns;
- Whether water is abstracted for drinking, used in food processing or dairy farms;

- **Implication for, and of, trees and other vegetation;**
- **Location of surface water systems and terrestrial ecosystems.**

The preliminary assessment may indicate that the ground is unsuitable for the installation of an infiltration system, in which case an alternative disposal method should be considered.

A trial hole should be dug to determine the position of the water table and soil conditions. This trial hole will enable the sub-soil type to be determined. The trial hole should be a minimum of 2 m deep, or a minimum of 1.5 m below the invert of the proposed distribution pipes. The trial hole should be left covered for a period of 48 hours before measuring any water table level.

For safe and effective dispersal of the wastewater, the groundwater and bedrock/impermeable layer should be at least 1 m below the bottom of the distribution pipes. It should also be noted that it is the seasonally highest level of the water table that should be determined for the infiltration area.

2.2 Location

Research has shown that there are no health issues that dictate a safe location of an infiltration field relative to a building. However damage to the foundations of a building is likely to occur where discharge is too close to the building.

Therefore, it makes sense to ensure that any water bearing strata directs any effluent outflow away from the building.

To prevent any structural damage, every part of an infiltration system serving a private wastewater treatment plant or septic tank should be located at least 5 m from a building. An infiltration system should also be located at least 5 m from a property boundary so that an adjoining plot is not potentially contaminated.

However the ground strata or permeability of the soil may influence this dimension and it may be reduced slightly where the strata directs any ground water away from the foundations or if the soil is free draining. To preserve the structural integrity of the building, it may be prudent to increase the dimension where ground conditions would allow wastewater to collect around the building's foundations.

a. **At least 50 m from any spring, well or borehole used as a drinking water supply; and**

b. **At least 10 m horizontally from any watercourse (including any inland or coastal waters), permeable drain, road or railway.**

Further assessment of the site should include the following features

a) **Is the local area of importance for a particular wetland community or species? If so, is it possible to accommodate this interest on the site and, therefore, strengthen that local value? The closer two** similar habitats are to one another, the greater the likelihood of species colonising from one to the other.

b) Are there adjoining habitats of particular conservation value? Is it possible to use the site to enhance this value? In general, the larger the area of a particular habitat, the more likely it is to support specialist species associated with that habitat, and the more viable the populations of a particular species are likely to be. It may therefore be appropriate to encourage the important habitat to spread, or to encourage habitats that are complementary to that habitat, including non-wetland habitats such as woodland or grassland.

c) Does the surrounding area offer habitats that complement those on or proposed for the site? Many largely aquatic animals are dependent upon, or at least influenced by, the adjacent terrestrial habitats: scrub provides perches and shelter from the wind for flying insects; newts feed in long grass and hibernate under soil or stones; Wigeon and Coot graze on areas of short grass adjacent to open water. If a site is surrounded by extensive undeveloped land it may be helpful to consider how this can be used in the design of any new wildlife features.

d) Is it possible to link areas of similar habitat together? Corridors along which animals and plants can migrate are extremely valuable. Streams and ditches offer suitable corridors for many species of wetland wildlife.

2.3 Disposal of Contaminated Waste

Local Authorities are strongly urged to provide suitable safe disposal of human contaminated items in public sanitary facilities. This provision will help prevent children and animals being hurt or infected by discarded items in play and travel areas.

The toilet and sewerage system is designed to deal with urine, faeces and toilet tissue. When other items are flushed down the toilet it can easily lead to blockages in the pipes and can cause flooding by contaminated water. This problem is especially true in local sewage wetlands etc. (see our guide Treatment of Waste Water) where design is minimal and intended for unsupervised working.

Similarly when the waste eventually gets to the sewage treatment plant it can block the plants' filter screens.

If there is heavy rainfall, this waste may escape from overflow pipes directly into the river and sea. This waste is known as Sanitary Related Debris (SRD).

Items which cause problems when pushed into WCs include

General waste

- any other items e.g. food, plastics, toilet roll tubes, tights etc

Contaminated waste

- Condoms and Femidoms
- Cotton buds
- Disposable nappies
- Facial and cleaning wipes
    - Incontinence pads
- Sanitary towels, panty liners and backing strips
- Tampons and tampon applicators

Clinical waste

- Colostomy bags (separately bagged before adding to disposal bin)
- Old bandages

High Hazard items (separate disposal)

A notice should instruct users on safe disposal.

- Razor blades ,Syringes and needles (special sharps disposal bins)
- Medicine including inhalers (return to pharmacist do not dispose of in the sewage system. E.g. antibiotics mixing with sewage etc can promote the growth of antibiotic resistant strains of disease causing germs)

Other waste which can cause a problem to the waste system and should not be disposed of down sewage systems - includes

- Engine oil
- Food waste (meat, fish, vegetable peelings)
- Gardening chemicals
- Grease
- Household chemicals
- Kitchen fat
- Paint
- Radiation products

Please do not place clinical waste and needles (e.g. incontinence pads, colostomy bags and dressings) in standard waste bins as this is both a health hazard and illegal. Clinical waste includes all items which may be contaminated by bodily fluids or blood products. These items must be handled by trained personnel with control procedures and disposed of by licensed contractors in UK. (see NHS guidance 'Example local clinical waste disposal procedure within a total waste

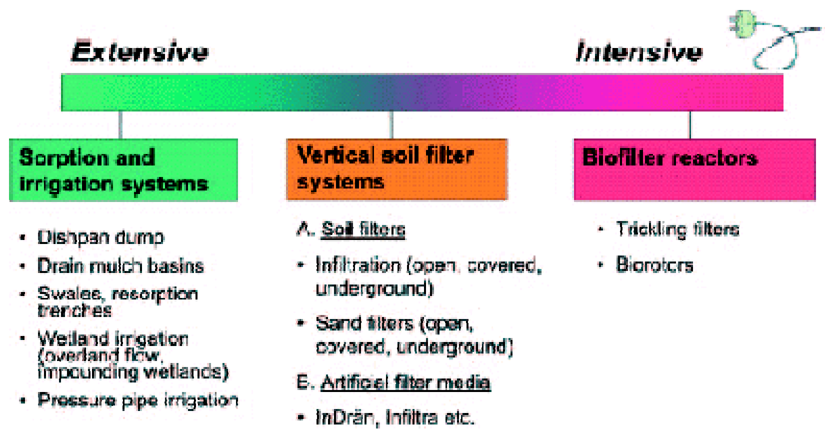
management regime' available to download from http://www.nhsestates.gov.uk/download/sustainable_development/Waste%20disposal%20procedure.pdf)

A notice should be attached to disposal bins requesting the user to empty colostomy bags and faces down the WC before disposing of the item in the appropriate bag.

The provision of separate disposal bins for various categories of waste could mean that additional space will be needed in both unisex and ambulant disabled peoples sanitary units. Authorities are also likely to have higher disposal bills due to collection and disposal of wastes in the higher categories.

3 Forms of Filtration

There are three common types of holding and/or treatment system in use these can be supplied by a number of companies in various alternates and combinations. Alternatively systems may have been



Examples of aerobic attached biofilm techniques ranged in a continuum from extensive to intensive applications. Energy used for running the treatment processes in the examples on the left side is provided by the sun and the carbohydrates within the water; instead of artificial energy they need large land areas. On the right side, intensive applications are found. These systems are compact but need electricity to work. Furthermore, sludge is produced that has to be handled. The systems in the middle need a minimum of artificial added energy and produce no or very little sludge. These systems use soil as filter media and are often found to be the most appropriate solutions for greywater treatment.

constructed on site using local materials.

3.1 Cesspits or Cesspools

These do not provide treatment; they are simply holding tanks which must be emptied by tanker on a regular basis. They are often large structures, unsuitable for single domicile domestic use due to operating costs and they are the least favoured option under present regulations. You may come across the term cesspit used to describe what is actually a septic tank. Emptying vehicles should have access to within 35 metres of the tank and should not be along a busy roadway.

Cesspool installations are particularly susceptible to buoyancy lifting. For this reason they are normally backfilled with concrete. In a dry, well drained site, however, the tank should be completely backfilled with pea shingle, on a level concrete base.

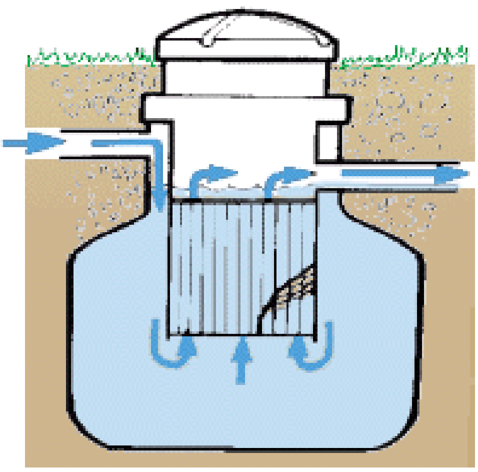
In a wet, poorly drained site, the tank should be bedded onto a carpet of pea shingle which itself is laid on a 150mm thick concrete base. It should then be backfilled with concrete filling the tank with water at the same time to prevent flotation. Ground water pumping may well be necessary.

3.2 Silage Effluent Tanks

Normally manufactured using special chemically resistant resins, these tanks are one piece factory sealed and tested units of the similar dimensions as cesspools. Delivered direct to the farm they can be off-loaded using ordinary farm handling equipment and usually installed within a day. Regulations relate the minimum capacity of the tank required to the solo capacity

3.3 Septic Tanks

Sceptic tanks provide minimum treatment and discharge to a soakaway. These are generally only used for smaller domestic and small countryside facility developments and are nowadays less acceptable to the planners in built up areas. They should be sited at least 7 metres from any building.



A septic tank for greywater pre-treatment should be constructed with one or several chambers. The first chamber should be the largest and constructed with storage volume at the top since much of the sludge is floating. An effluent filter applied in a vertical outlet tube, improves security for sludge flight

Septic Tank

The accumulated solids need to be pumped out occasionally by a licensed contractor. These must be inspected at east once every month.

3.4 Biological treatment plants i.e. Biodigesters

These systems provide a much higher level of treatment than septic tanks and may discharge directly to a water course, provided a Consent to Discharge is in place. Modern packaged plants are the officially preferred option at present.

Inspection and maintenance must be carried out in accordance with manufactures instructions.

3.5 Package Sewage Treatment Plants

Discharges to a water course may be direct or in-direct. Indirect refers to a soakaway ortertiary reed bed with an overflow to a watercourse. Systems such as this are now commonly used and are referred to as 'Partial' or 'Seasonal'. Maintenance and inspection requirements should be as per the manufactures guidelines.

3.5.1 Soakaways

Soakaways, distribution fields or sub-irrigation systems for dispersal into the ground. These are constructed in different ways according to location but the preferred method is now a system of interlinked trenches. Design of a new soakaway is subject to the results of porosity or percolation tests. These should be inspected at least once every two weeks.

3.5.2 Reed beds, constructed wetlands and mounds.

These are often used where the ground conditions and water table are unsuitable for traditional methods of effluent dispersal. They can take up large areas of ground. Cost of construction and maintenance vary widely dependent on the nature of the location and the quantity of sewage to be processed.

See also BRE Good Building Guide No 42.

3.5.3 Overland flow reedbeds

Water flows over the surface of the reed bed through plant stems and accumulated leaf litter. The simplest to construct, they offer the greatest potential for nature conservation. A coppice woodland can be used to fill the same function as a reed bed normally with an underground distribution system.

3.5.4 Rafted lagoon

These are useful where there is a variation in water flow or level. Plants are supported by floating rafts. Treatment is by microbes attached to their roots.

3.5.5 Ponds

Ponds and basins are widely used to achieve maximum attenuation of storm flows. Barrier planting and shallow reed planted margins reduce the potential safety problems of open water.

Dependent on the size of the pond, quantity of discharge and whether there is a flow through the pond. 'Consent to Discharge' may be required. Ponds will normally be more acceptable when used in combination with a constructed wet land.

3.5.6 Retention Ponds

Retention Ponds retain a certain volume of water at all times. This can avoid possibly unsightly exposure of banks of collected sediment and enhance performance in removing nutrients, trace metals, coliforms and organic matter. Allowance for a considerable variation in water level during storms should be incorporated in the design, so that a significant storage volume can still be provided.

3.5.7 Storm Water Infiltration Ponds

Shallow 'ponds' are constructed to receive peak storm water flows, these then 'soak out' the water over a period of time hence attenuating surges in flow to the rivers and watercourses. This has the effect of lowering peak water flow and hence decreasing the risk of flooding due to the impact of development, with its associated hard surface areas and fast 'water run-off'.

The ponds themselves also provide a habitat for many 'wetland' species, thus promoting 'bio-diversity', and form an attractive landscaping feature which enhances the overall site appearance.

3.5.8 Petrol/Oil Separators

These are units used to separate oil, petroleum products a comprehensive range available to suit most applications including garage forecourts. The design must conform to all regulatory standards. These may be used in combination with other cleansing methods.

3.5.9 Kitchen Grease traps

For kitchen wastewater from restaurants and in households where a lot of grease and oil is handled for food preparation, it can be necessary to install special grease traps to protect the pipe system from clogging.

3.5.10 Greywater Screens, seals and filters

Different pre-treatment techniques based on screens, seals and filters are available on the market. Such prefabricated techniques are useful in large wastewater systems and in special applications such as drop-irrigation systems. For the ordinary applications, they will seldom be found reliable enough or as cost efficient as septic tanks.

Home-made seals or Filters constructed of gravel may be appropriate in the very small scale. For example, in rural areas climates without prolonged freezing conditions an open gravel filter combined with soil infiltration is often a very good greywater solution.

Finely chopped kitchen waste when mixed with sewage enhances the treatment potentials of wetlands.

3.5.11 Cesspool Leakage

A cesspool etc. should be sited so that there is no risk of polluting water supplies and for preference as far as possible from any inhabited building. The tank can overflow or may leak which is an offence under the 1936 Public Health Act. In addition if it pollutes a watercourse, the Environment Agency may take legal proceedings under the Water Resources Act 1991 or issue an order requiring action within a given time scale.

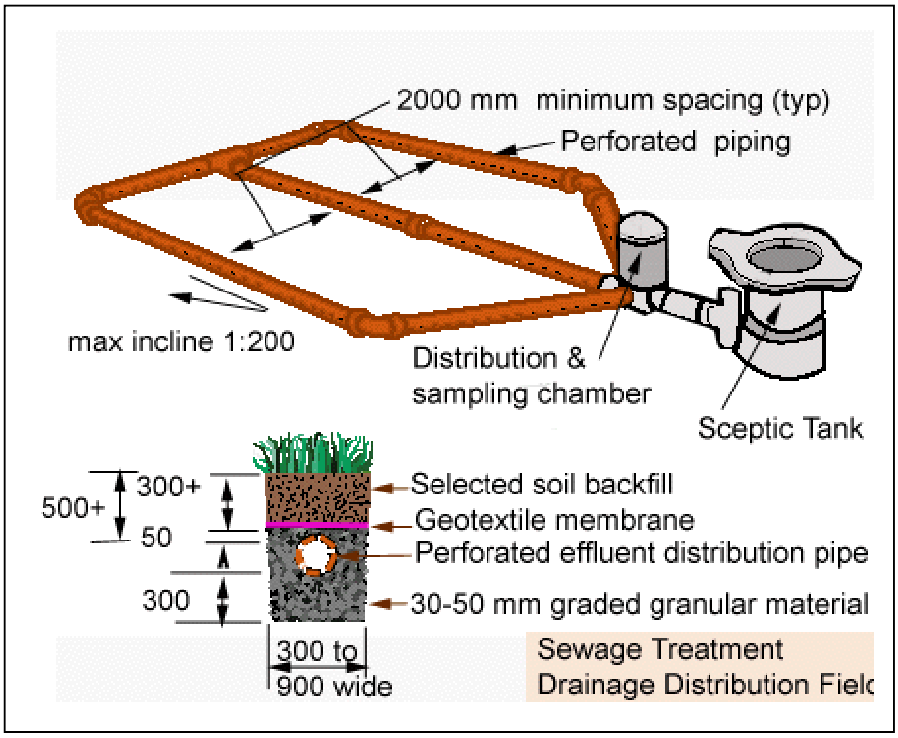
Check the level in the tank regularly, do not let it overfill. Have it emptied at regular intervals: these will become more frequent if you install a dishwasher for instance. Cesspools must be inspected at least once every two weeks.

3.6 Infiltration Field Summary

Following pre-treatment in a Septic Tank the discharge can still be harmful and will require further treatment either from a drainage field/mound or constructed wetland. In country areas a combination pre-treatment and drainage field or constructed wetland may be the solution to providing sanitary facilities. (See Regulations Treatment below.) The form adopted should be discussed and agreed with the Environmental Agency before applying for planning permission.

Drainage fields and mounds are not permitted in water source Zone 1 groundwater source protection zones.

Drainage fields need to be in well drained soils, 15m from any building, 10 m from

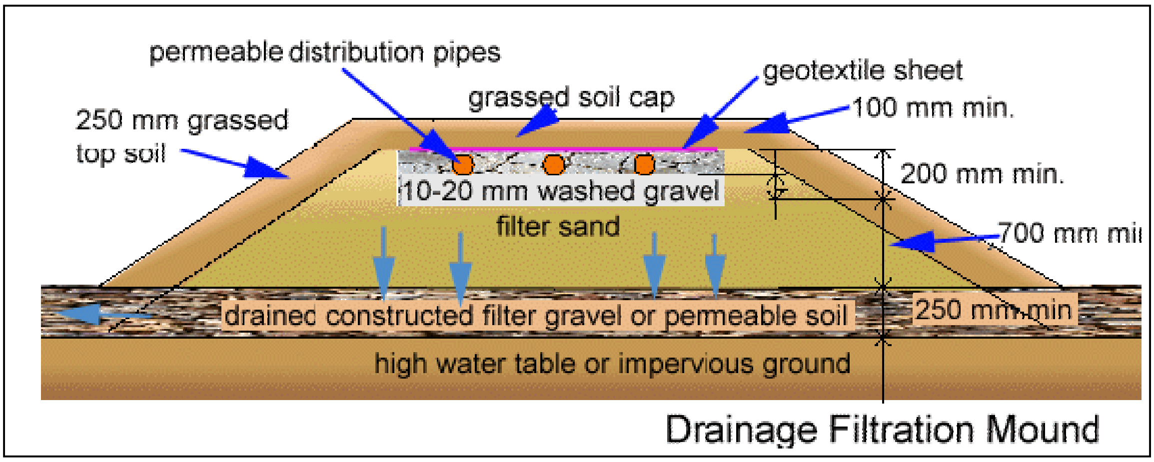


running water, 30m from any abstraction point and down hill from any running water. A soil engineer should be employed to check the suitability of the chosen treatment location. Treatment fields should be set back from any public path and fenced to exclude people, dairy animals and horses etc. (prevention of damage to pipes and possible contamination). The total area of the field should be based on the number of people, how busy the site is and the soil percolation rate.

These should be inspected at least once every two weeks to ensure there is no water logging or effluent back-up.

3.7 Filtration Mound

The site locations and distances are the same as given for infiltration fields.



To provide venting of the distribution pipes the pipes may be extended above the mound.

Separator/diversion drainage ditches should be used to intercept ground and surface water for diversion away from the mound. Seepage from the mound should not contaminate this diverted water.

If the mound is constructed on impermeable or slow draining soils the mound should be constructed on slightly sloping ground.

A geotextile sheet should be fitted 50 mm above the distribution pipes to prevent silting.

These should be inspected at least once every two weeks to ensure there is no water logging or effluent back-up.

3.7.1 Field & Mound Area

To calculate the floor area of the drainage field (A_1 in m^2), the following formula should be used:

$$A_1 = p \times V_P \times 0.25$$

Where p is the number of persons served by the septic tank, V_P is the percolation value (secs/mm) which should be provided by the Soil Report.

3.7.2 Filter Material (WHO)

Simple stone-sand filters

This works on the principle of passing untreated water over a stones, gravel and sand. The process is known to remove some bacteria, suspended impurities and ova.

- This type of filter, which is an arrangement of, gravel, stones and a bed of fine sand, can be constructed from different containers. For good results the sand and gravel bed must be changed from time to time to avoid clogging.

Charcoal filters

Crushed charcoal is used instead of sand in this process. The method is known for removing taste, odour and colour from water.

Commercial filters- ceramic or candle filters

The part that filters water is made up of ceramic material, a baked clay or ceramic, and is porous.

- This process is known to remove bacteria and other suspended impurities. Ceramic or candle filters are suitable for use in homes, offices and health facilities.

3.7.3 Marking

A notice should be fixed within the building describing the necessary maintenance.

An example of such wording is:

> 'The foul drainage system from this building discharges to a <insert type of primary treatment> and a constructed wetland.
>
> The <insert type of primary treatment> requires <insert details of maintenance of the primary treatment>.
>
> The constructed wetland system requires <insert details of maintenance of the constructed wetland>.'

Notices should be in clear print in at least 14 point text. Where needed drawings should be used to illustrate the instructions.

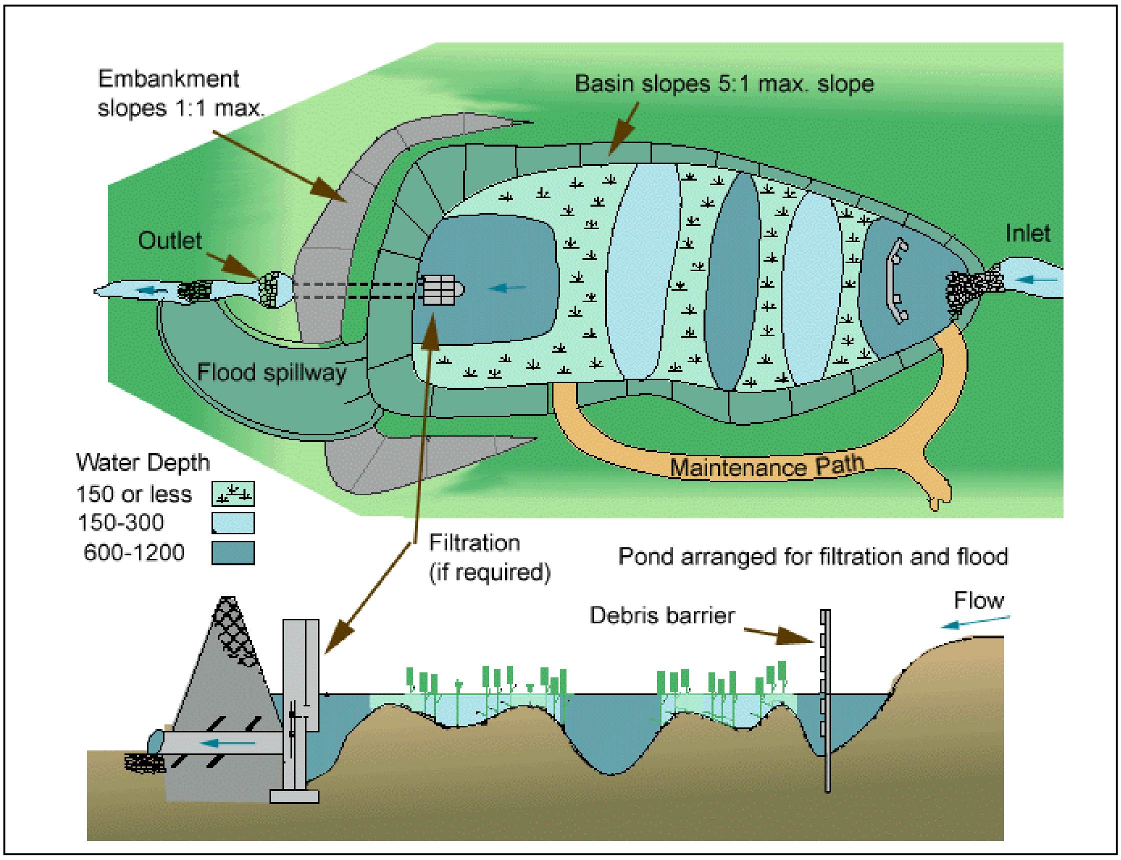
3.8 Constructed Wetland

Constructed wetlands provide a viable secondary or tertiary filtration and treatment process for sewage and effluent. These normally employ read beds in combination with graded sands and gravel to extract and process the matter.

The systems purify wastewater as it moves through the gravel bed around the rhizomes and roots, by removing organic matter (BOD), oxidising ammonia, reducing nitrate and removing a little phosphorous. The mechanisms are complex and involve bacterial oxidation, filtration, sedimentation and chemical precipitation.

Plants used include Common Reed (Phragmites australis); other types of plants used in constructed wetlands include the Reed Maces (Typha latifolia), the rush (Juncus effusus), the true Bulrush (Schoenoplectus lacustris) as well as members of the Sedge family (Carex) and the Yellow Flag (Iris pseudacorus).

Constructed wetlands should not be shaded by trees as this results in poor plant growth and reduced efficiency.

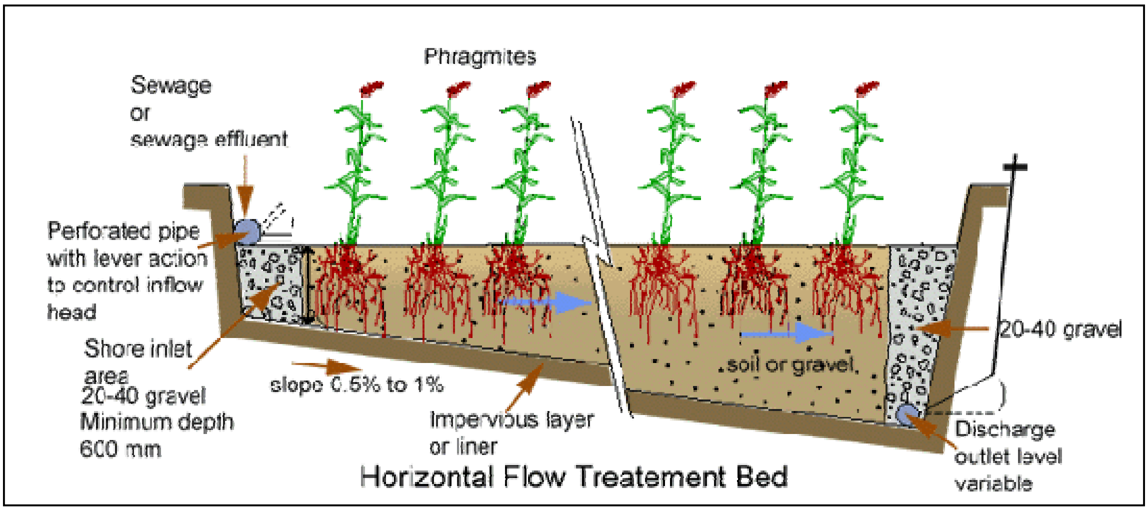


Treatment beds should be protected from inflow of water which may cause flooding and spill from the wetland permitting contaminated water entering the local hydraulic system.

There are two types of wetland used, horizontal and vertical flow.

3.8.1 Horizontal Flow

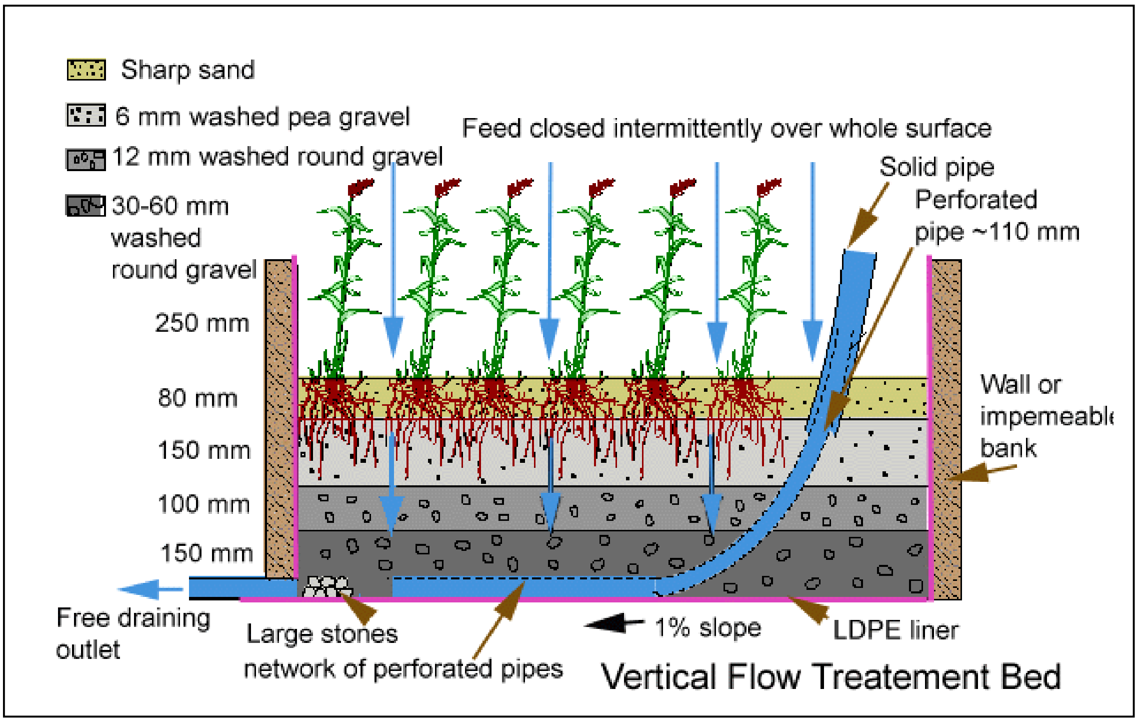
Waste water is fed in from one end of the bed; in larger units this flow is continuous. The effluent flows through the gravel from one end of the bed to the other across the full length and width of the bed. This is less efficient than vertical flow but requires less maintenance. These would be more suited to small flow, intermittent use such as would be needed on rural path head service areas and related structures. Ammonia is not always treated fully in this system and levels should be monitored.



These beds require level sites.

3.8.2 Vertical Flow

In this type the effluent is introduced intermittently to the surface water and slowly percolates down through the graded gravel bed to a



down slope outlet. The overall fall is normally between 1 and 2 metres across the length of the bed. The intermittent nature permits a rest period, for this reason two or more beds are used in rotation.

These beds give a more complete treatment including ammonia removal; they are therefore more suited to sewage treatment.

They are more maintenance intensive than horizontal and therefore more suited to larger more intensive use locations.

3.9 Regulations Treatment

The following paragraphs are taken from Building Regulations Part H2

> 1.4 Drainage fields typically consist of a system of sub-surface irrigation pipes which allow the effluent to percolate into the surrounding soil. Biological treatment takes place naturally in the aerated layers of soil.
>
> 1.5 Drainage fields may be used to provide secondary treatment in conjunction with septic tanks. They may be used where the subsoil is sufficiently free-draining and the site is not prone to flooding or water-logging at any time of year.
>
> 1.7 Drainage mounds are essentially drainage fields placed above the natural surface of the ground providing an aerated layer of soil to treat the discharge.
>
> 1.8 Drainage mounds may be used where the subsoil is occasionally waterlogged, but where drainage fields would otherwise be suitable.
>
> 1.9 Constructed wetlands (for example reed beds) are man-made systems which exploit the natural treatment capacity of certain wetland plants.
>
> 1.10 Constructed wetlands discharging to a suitable watercourse may be used to treat septic tank effluent where drainage fields are not practical. The consent of the Environment Agency may be required.

3.9.1 BOD5

BOD stands for Biochemical Oxygen Demand. ‘5’ stands for a test that takes 5 days to carry out. The test is essentially a measure of the ‘Organic’ or ‘Polluting’ strength of an effluent.

A measured sample is prepared for incubation and the oxygen level is determined. The sample is than incubated for 5 days at 20°C and the oxygen level is measured again. The difference in oxygen levels is used to calculate the BOD5. This represents the level of activity by micro-organisms naturally present in the effluent. The level of activity is proportional to the ‘Organic’ or ‘Polluting’ strength. If an effluent is too strong for a receiving aquatic environment then oxygen will be naturally depleted in the same process. mg/l stands for milligrams per litre. One mg/l is the same as one part per million. Untreated sewage typically has a BOD5 of 400-500 mg/l. The Biodigester reduces this to less than 20mg/l.

All normal products can be used in sensible quantities. Don't forget that the system works by accelerating the natural sewage degradation process. Some chemicals used are designed to destroy micro-organisms. So, overuse of bleach or antibacterial cleaners may upset the process. You should avoid products containing ammonia where the 'Consent to Discharge' has a limit for Ammoniacal Nitrogen. Avoid allowing significant quantities of grease to enter the system. Where there is a commercial kitchen (Hotels, Pubs etc) a grease trap must be fitted to the kitchen drainage only.

Appendix A - Reference

- Construction (Design and Management) Regulations 2007
- Confined Spaces Regulations 1997, SI 1997/1713.
- Building Regulations Approved Document H
- Water Industry Act 1991, - adoption of a sewer connection to mains
- BS 6297: 1983 Code of practice for design and installation of small sewage treatment works and cesspools
- Reservoirs Act. Wetlands contained by dams or embankments may require a licence under this Act. LA can give guidance.
- Discharge Consent. If a new wetland is allowed to drain into an existing watercourse then consent will be required from the LA.
- Drainage Consent. If any works are likely to affect drainage in the local area, then consent will again be required from the LA.
- Health & Safety regulations. These will influence who can legally carry out the required management; for instance, herbicides must only be used by contractors holding the relevant certificates. There may also be implications for allowing visitors onto a site and the safeguards that need to be implemented.
- Planning regulations. It is always sensible to discuss proposals with the local planning authority. New buildings and certain changes in land-use will require planning permission.
- The Code of Good Agricultural Practice for the Prevention of Pollution of Water (2003) document provides an extensive guide to aid farmers in dealing with the pollution issues.

Wildlife Protection

- European legislation, notably the Habitats Directive, 1992, has greatly strengthened the protection afforded to wild species and habitats.
- The Wildlife and Countryside Act, 1981 (as amended) is the key piece of legislation that underpins the conservation of the UK's species and habitats. The Act provides most of our wildlife legislation, parts of which may be relevant to site development or management. For example, plants can only be uprooted with the permission of the landowner and a licence is required to move or handle various protected species. It is illegal to disturb most nesting birds, and schedules for major works should be arranged accordingly. Further information about the Act should be obtained from the statutory conservation agencies

Other Referents

- **Protocol on Design, Construction and Adoption of Sewers in England and Wales, (DEFRA 2002.)**

Surface Water Sewers

- **Section 37 (Highway created by dedication may become maintainable at public expense) or**
- **Section 38 (power of highway authorities to adopt by agreement) of the Highways Act 1980, a highway authority may adopt, or agree to adopt in the future the drainage associated with a highway.**
- **Section 115 (use of highway drains as sewers and vice versa) of the Water Industry Act 1991, the highway authority may agree that a highway drain may be used to drain rainwater from buildings.**