# Nursery Drainage System Design Basics

*Water that falls on growing areas and other nursery areas as either rainfall or irrigation generates wastewater. To minimise damage, and collect as much as possible of this wastewater for re-use or recycling, an effective drainage system needs to be installed.*

*Nursery developments change the fall of the land, and tend to concentrate water flows, increasing the erosive potential of the water. Wastewater may also contain sediment, litter and nutrients, which can affect the environment when this water leaves the nursery.*

*Nurseries are located on a variety of types of topography, from steep to flat, and each of these types presents specific challenges in designing and installing drainage systems:*

- *An absolutely flat site is not necessary for successful nursery production, provided drains and collection points are designed to carry the additional velocity and not erode.*
- *Sites on ridges or crests can contain rocky outcrops which can interfere with locating drainage systems.*
- *Side slopes require some degree of terracing, resulting in unstable areas and steep banks that can have potential erosion hazards. Sites that are too steep are more open to erosion problems.*
- *Nurseries located in flat areas may be prone to flooding, and achieving sufficient fall for an effective drainage system may be difficult, as will centralising wastewater flows. Flat sites may also be more prone to having low spots that collect water.*

*The first step in planning a drainage system is to assess the degree of slope and where the wastewater flows to. A good minimum slope on a site is 1:100, i.e. 1 metre fall in 100 metres. If the site has excessive slope, features to reduce the speed of water flow may need to be incorporated into the drainage design. For very steep sites it may be worthwhile engaging the services of a specialist*

*drainage engineer. A topographic survey is also worth considering, as it will enable a better quality drainage system to be built, and will also be a useful site plan into the future.*

*Nursery production Best Management Practice (BMP) recommends growing areas have an impermeable layer installed between the soil and overlying growing bed. This increases the amount of drainage water that is produced, but minimises saturated soil contaminating the gravel of the growing bed, thus reducing the requirement for topping up of the gravel. The impermeable layer also means the soil type the growing bed is constructed on is not important, as it won't contribute to or affect the drainage system. If the growing beds don't have an impervious layer underneath, the permeability of the soil will determine the degree of runoff, and how much deep drainage will occur, e.g. if the irrigation application rate is 15 mm/hr and the underlying soil is a poorly structured clay, 2-5 mm/hr of water will infiltrate into the soil, leaving 10-13 mm as surface runoff. Sandy soils may not generate any surface runoff at all.*

*The water table is the depth at which the underlying soil is saturated with water. The depth of the water table can be measured by sinking a tube into the ground and measuring where the water level is. Water tables close to the surface (less than 1 m) may cause problems with access and surface slumping. If no impervious layer is installed under growing beds, the water table will most likely to be at the surface, due to the*


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*constant irrigation. This may result in contamination of the underground water with leached nutrients and plant protection products.*

*The quality of water collected from different surfaces in a production nursery varies. Water collected off roofs and covered growing structures is high quality, and can be disposed of or collected with no further treatment. Water from roadways, carparks and paths may be contaminated with oils and/or sediment, and may be able to be disposed of without further treatment, but may require treatment if collected for reuse. Water from work areas such as potting areas may have high levels of particulate matter, plant pathogens and humic acid, and may require treatment before disposal or reuse. This also applies to water collected from growing areas, where water may also have a nutrient load.*

*In designing a drainage system, consideration needs to be given to the consequences of the system being unable to control drainage flows generated during storm events, and causing erosion and damage to stock and infrastructure.*

*The first step in the process of designing a drainage system is to calculate the likely volumes of water to be controlled by the drainage system during a storm event. The decision on the design of the drainage system requires some compromise. Ideally a system able to contain drainage flows from a 1 in 100 year storm event would be used, but this may cost twice as much as a system designed for a 1 in 20 year event. To assist in determining storm water volumes, data on rainfall intensity, frequency and distribution (IFD) can be obtained from the Bureau of Meteorology website, and is also contained in the WaterWork workshop resources.*

*When calculating flow rates from irrigation in growing areas with solid covers, assume all the applied water will be drainage. This overestimates the amount of drainage water generated, but is the easiest method to determine the design volume required.*

*A basic consideration when planning drainage systems is the design capacity of the infrastructure used to carry the water. While calculations of the amount of water that needs to be carried are important, the determination of the size of pipes and open drains is equally important in ensuring systems don't overtop and cause damage.*

*Pipes are generally used to carry high quality water and can also be used under infrastructure such as roads, or in areas where it isn't practical or aesthetically pleasing to have an open drain. The grade of a pipe will need to be equal to or greater than 1:100 to ensure the velocity of water will self clean the pipe. The most common pipes used in nurseries are slotted ag-pipes, PVC stormwater pipes and concrete pipes.*

*Begin designing a piped drainage system by dividing the nursery into sections so the pipes can be sized to suit the runoff from each area. Continue along the drainage system, increasing pipe sizes appropriately as pipes join from each section. Junction boxes can be used where pipes change direction or join.*

*Open drains need to be designed so they don't erode in heavy rain, but can still be easily maintained. Grassed waterways and concrete drains are the most common types of open drains used. Shallow drains filled with gravel can also be used, but can be difficult to maintain.*

*Grassed waterways have grades between 1:500 and 1:1500 and a depth of 0.5 metres. They should be shaped so they can be easily maintained by mowing. Side slopes of 4:1 or flatter, and bed widths of approximately 1 metre would be suitable for small mowers, or 1.5—2m for slashers. Grassed drains should only be used for carrying stormwater and not irrigation run-off. If used to carry irrigation runoff these drains remain constantly wet and are difficult to maintain in a closely mown state, reducing their capacity. Concrete or polythene drains can be used where access is difficult, the slope too steep or where irrigation water is constantly drained.*

*Information on flow rates in different pipe types and diameters and open drains are contained in 'Managing Water in Plant Nurseries'.*

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