Nursery & Garden Industry Queensland

Nursery Drainage Systems Design and Installation

Drainage systems are an integral part of efficient nursery production. A well designed and installed drainage system effectively captures, stores and allows cost effective collection of water for re-use or recycling, without affecting the day to day operation of the business. Drainage systems can be designed to collect different quality waters separately or together, depending on local environmental guidelines, and whether the water is to be recycled or re-used.

Nursery drainage systems fall into two categories:

- *surface drains such as open drains, gutters and grassed waterways to collect surface water and,*
- *subsurface drains including slotted pipes, ag-pipes, gravel beds and stone-filled trenches.*

Most nurseries will use a combination of these drainage types, with a good design minimising blockages and providing a long service life.

Different areas of production nurseries require different drainage systems:

Container plant production areas:
The production area should be levelled to have a minimum grade of 1:70. On very flat sites it may be necessary to grade the growing beds to a sump, then pump the water away using an automated sump pump.

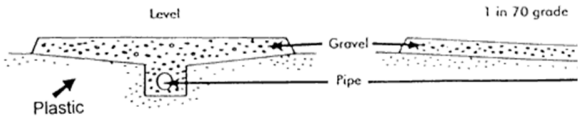

Figure 1: Grading configuration for produc-

The size of the subsurface drains in growing beds needs to be such that they will carry the anticipated water flows from rainfall events. A decision needs to be made as to whether the system will be designed to control a one in 10, 20 or 100 year event. There will be significant differences in the cost of systems designed to handle differing rainfall events, so a compromise may be required. In making the decision about which rainfall event is used in designing the system, an assessment needs be made of the consequences of the drains over topping during an event for which the system wasn't designed. Information on the flow rates which different pipe types and diameters can carry are contained in 'Managing Water in Plant Nurseries'.

Depending on the anticipated rainfall intensity, trenches are dug 5-6 m apart through the area on a herringbone pattern, and with a fall of at least 1:100. To protect the overlying impermeable membrane, rocks and stones should be removed or covered with a layer of sand or geotextile. The whole area is then covered with an impervious membrane, e.g. minimum 200 micron plastic sheeting, and then subsurface drain pipes, e.g. ag-pipe, are laid into the trenches.

Once the impermeable layer and subsurface drain pipes have been installed, the entire area is covered with a 75 mm minimum depth of 12-20 mm blue metal screenings or similar. The growing bed can then be covered with weedmat to prevent the gravel and subsurface drainage blocking from spilled growing media and plant material.

Roadways:
Roadways should be sealed (road base, asphalt or concrete) with a minimum side fall of 1:70. Where road base is used, geotextiles under the seal may need to be considered on some soil types to assist with the control of underground and surface water that may affect the road base. Shallow drains or channels should be located down each side of the road to collect wastewater. Causeways can be constructed, or drainage can be piped through culverts if drains cross paths or roadways. Concrete boxes should be used to eliminate erosion where there are sudden changes in grade, such as drop-offs.

Another alternative is for roads to be sealed with concrete and sloped to the centre to create a drain. This design may create slipping hazards if the concrete becomes slimy from biofilm, but this can be remedied by installing a grated strip drain in the middle of the roadway.

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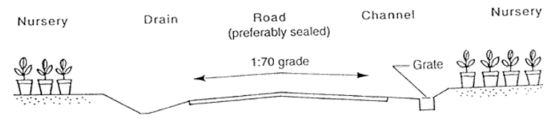

Figure 2: Typical cross-section of access roads

Roof wastewater:

Wastewater from roofs can be collected by guttering and downpipes. These will need to be installed to local building codes. This water can be used directly if captured in tanks, or it can be incorporated into other drainage systems, e.g. road drains. Guttering should have a grade of between 1:720 and 1:360, with standard capacity downpipes spaced no more than 12 m apart. The capacity of guttering on different grades can be found in 'Managing Water in Plant Nurseries'.

Run-off from outside the nursery:

The management of the quality and disposal of any water that enters the property becomes the responsibility of the owners of that property. Consideration should be given to intercepting and diverting overland off-site flows to minimise the size of drainage systems required within the nursery. Small diversion banks, low profile drains or grassed waterways can be used to effectively manage these water flows. If the flows are large, reducing the flow rate may be necessary to prevent erosion. Energy dissipaters, either temporary such as hay bales, or permanent concrete structures can be built across the water flow.

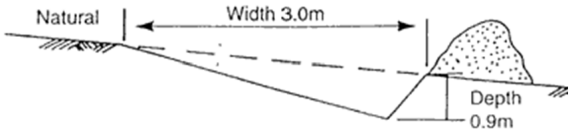

Figure 3: Section view of low profile open

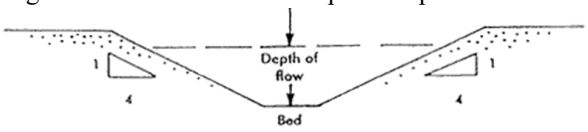

Figure 4: Cross section of open grassed waterway

If the overland flow can't be diverted into a watercourse it may need to be dispersed across a grassed area. Level spreaders, which are a constructed level area at the end of the channel, can be used to reduce the flow rate and allow the water to be disposed of across a stabilised disposal area.

Growing media storage and potting areas:

Due to the likely presence of solid and floating particles in wastewater from these areas, sediment and floating trash traps should be installed before the water is carried away through pipes or drains. Systems should also be put in place to minimise these materials contaminating the wastewater before it enters the drainage system.

Soaks and wet patches:

Soaks or wet patches can occur in low lying areas, or on slopes where watertables come to the surface. In these areas, sub-surface interception drains can be installed to lower and remove the watertable. If the watertable is kept below 200 mm deep there will be little damage from nursery traffic. The actual depth of the sub-surface drains depends on the rainfall, the weight of traffic accessing the area, and whether the system will also be required to assist in controlling surface water flows.

Sub-surface drains can consist of rubble or French drains, with slotted Ag-pipe or slotted PVC pipe to increase capacity. When installing these systems the design slope is established by a survey to ensure there are no high or low areas which can trap air or collect sediment resulting in reduced system capacity. Trimming the surface along the line of the drain to the design slope makes it easier to maintain an accurate consistent slope. The trench is dug using a trenching machine or backhoe, and the drainage system installed ensuring proper backfilling procedures are used where vehicles run over piping.

Other options include Stripdrain® which is a rectangular 40mm wide 100 - 900 mm deep plastic frame covered with a geotextile fabric. The advantage of Stripdrain® over rubble drains is that it can be used in most soil types without the need to backfill with sand or gravel.

For more information refer to 'Managing Water in Plant Nurseries'. Diagrams from Waterwork Workshop course materials.

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