DRAINAGE & IRRIGATION

A guide to the essentials for a first class football field

FOOTBALL NSW

Contents

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Introduction

Poor drainage and wet weather increase the susceptibility to damage affecting the quality of the natural turf pitch and will generally cause the grounds to be closed rather than risk widespread damage that cannot be easily repaired.

Currently 38% of existing grounds in NSW have drainage issues.

Also, in areas of low rainfall, grounds without irrigation are susceptible to damage as the grass succumbs to lack of water.

Currently 34% of football facilities in NSW have no irrigation.

Both drainage and irrigation are two fundamental elements of a football facility that contribute significantly to its quality.

Drainage

Good drainage is a key requirement of a well maintained grass field and a naturally well-drained site will form a sound basis for a playing surface. On land where the soil tends to be impervious, adequate provision for supplementary drainage must be provided to meet the needs of the intended use.

Level adjustment

Many sites require major re-grading of levels. The first stage is to scrape off the existing topsoil cover and retain for eventual re-spreading.

Levels are adjusted in the subsoil, using the surplus 'cut' from high parts to fill lower areas. In some situations imported fill material may be required to build up low areas. Filling must be done in consecutive layers not exceeding 250mm. Each layer must be adequately consolidated to avoid subsequent settlement.

The final formation must be trimmed smooth to the required level before replacing the topsoil.

Design Issues

The pressure to get matches played means they sometimes take place at inappropriate times, for example during heavy rain. Frequently, maintenance routines during and after the season are unable to restore the pitch to an adequate state for quality play to take place. A vicious circle of deterioration sets in directly related to poor drainage and compaction of the playing surface.

The majority of playing surfaces require a designed drainage system to provide satisfactory playing conditions throughout the playing season. Upgrading a poorly drained pitch or constructing a new one does not necessarily solve the drainage and usage problem.

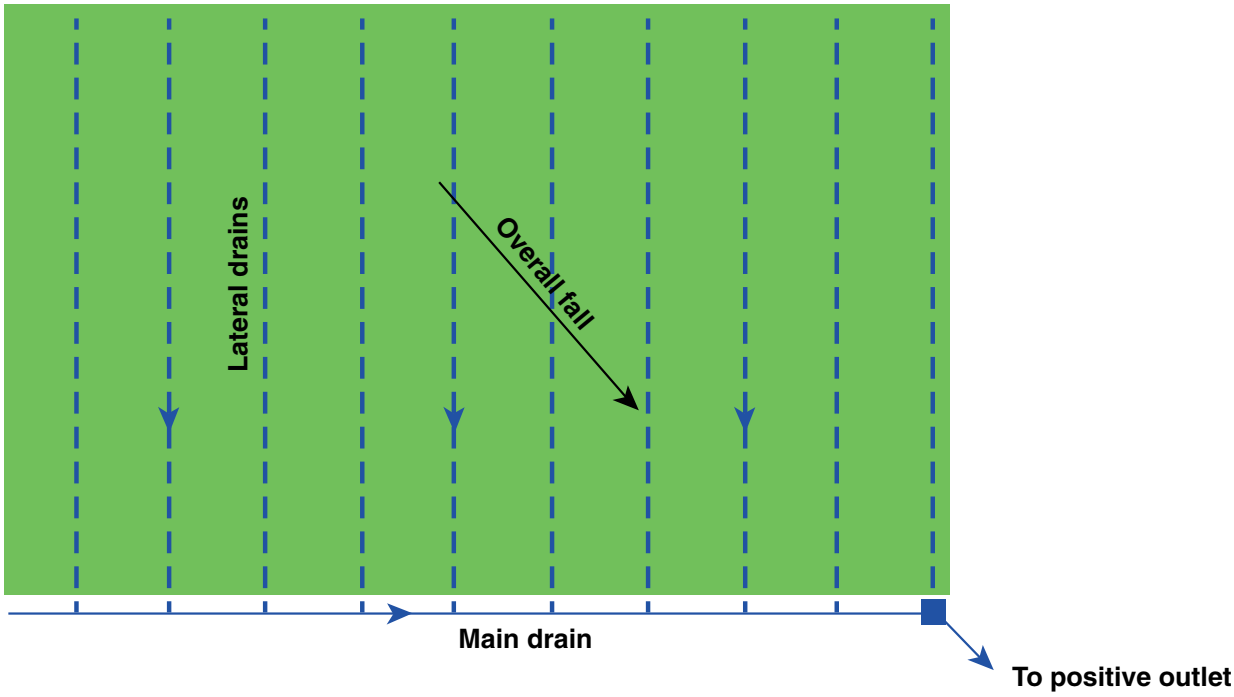
Poor construction, lack of effective maintenance and overuse of the pitch will, eventually, lead to poor drainage and unacceptable playing conditions. It is essential that pitches be designed taking account of the estimated intensity of use.

Players under the age of 15 are estimated to inflict about half the damage to a pitch than their more senior counterparts. Therefore, a pitch used predominantly by juniors can accommodate approximately twice the capacity of one used solely by more senior players.

The pattern of use must be taken into account when designing a pitch. Where use primarily takes the form of a large number of games played during weekends with little play during the rest of the week, demand cannot be staggered to make best use of a single 'high specification' pitch.

In these circumstances general upgrading of pitches using slit-drainage and sand amelioration would be more appropriate for the pitch.

Diagram 1 - Drainage



Source: Sport England, Natural Turf for Sport

Pitch Construction

Pitch Standard

Generally, depending on the standard of facility required, the playing surface should be no steeper than 1:100 along the line of play and 1:50 across the line of play. A well-constructed pitch could be in the order of 1:200 along the line of play and 1:100 across the line of play.

Pitch construction falls into four main categories according to the system of drainage used. They are:

- Undrained pitches
- Pipe-drained pitches
- Pipe and slit-drained pitches
- Suspended water table pitches

This Guide shows the methods selected as suitable for Australian conditions based on on-going cost of maintenance.

It is important to note that the most suitable method of drainage for any given field will be subject to a number of factors. The soil profile of the field is critical to this decision, and it is recommended that expert advice is sought before any drainage works are planned.

Undrained pitch

There are few situations where pitches of this type will provide a sustainable, quality-playing surface.

Pipe-drained pitch

Currently this is the most frequently used pitch drainage system (see diagram 2 below). However, unless the site has reasonably free draining sandy soil or sufficient gradients to remove large quantities of water by surface shedding, pipe-drainage alone is often inadequate and the pitch can be susceptible to wet weather cancellations.

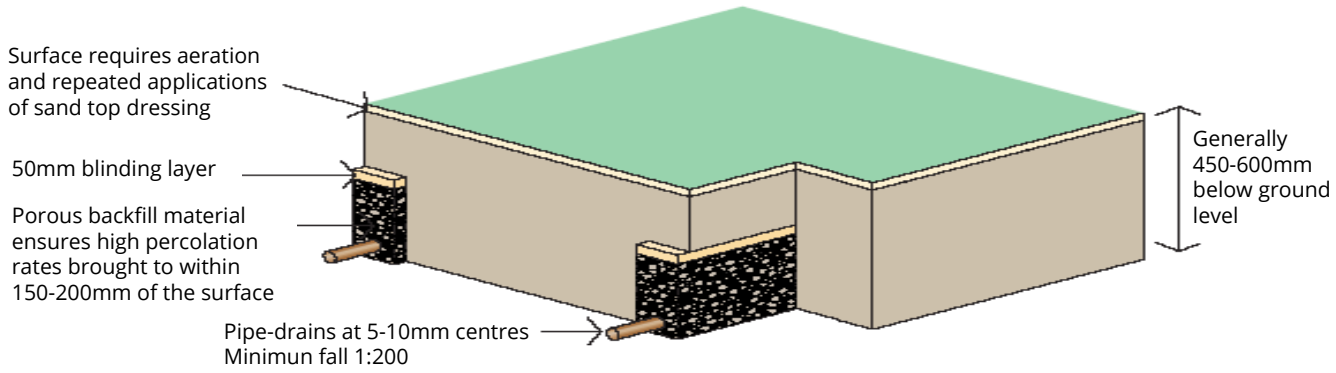
Dependent on drainage design, plastic pipe drains are commonly installed with laterals at spacing between 5m and 10m centres at a depth between 450mm and 600mm below ground level.

All drains must be laid with a steady fall, no less than 1:200. A positive outfall must be provided in the form of an existing watercourse or surface water system. When the drains have been laid, trenches must be backfilled with porous material to ensure the high percolation rates necessary for effective drainage.

Predominantly single-sized, hard, angular gravel or broken stone within the range 6–10mm must be used as backfill. This should be brought to within 150mm–200mm of the surface. The trench backfill is then 'capped' with a 50mm 'blinding layer' in the form of coarse sand or fine grit to prevent infiltration of the topsoil. The trench is backfilled to ground level with preserved or imported topsoil.

Given reasonably permeable soils and good management, fairly good playing surfaces can result. However, in many areas this method is not suitable in very wet weather and will require aeration and dressing with appropriate sand to ensure maximum use of the pitch.

Diagram 2 - Pipe drainage construction



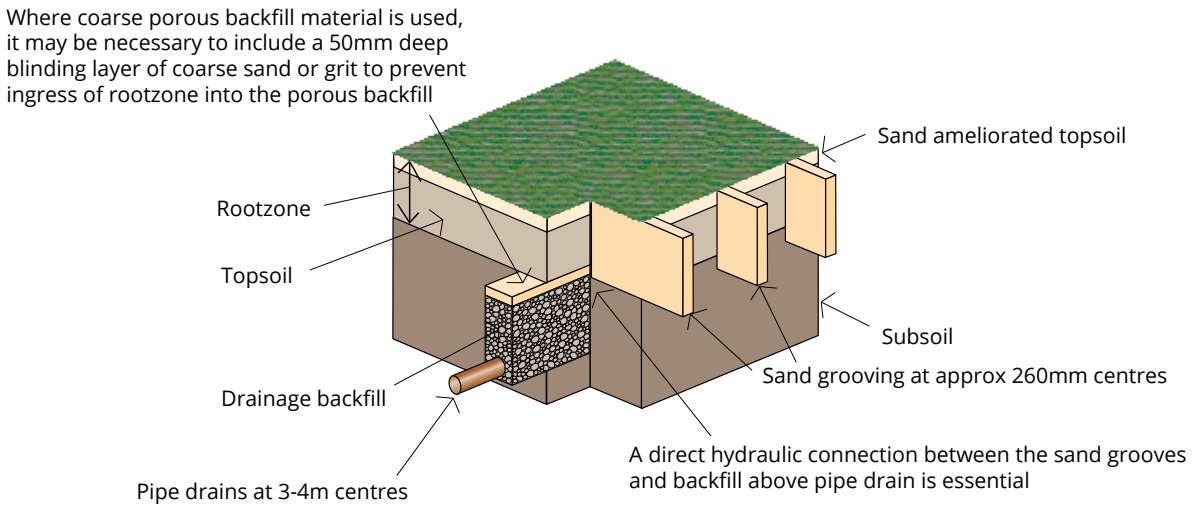
Source: Sport England, Natural Turf for Sport

Pipe and slit-drained pitch

Supplementary slit-drains will significantly improve the removal of water into pipe-drains. Basically the construction mirrors that of a pipe-drained system with the addition of a series of narrow, commonly 50mm, trenches cut across and into the porous backfill of the drains (see diagram 3 below). Heavy top dressings of suitable sand are essential for the successful construction and management of slit-drained pitches.

A drawback of slit-drains is that they can become capped and sealed over with topsoil, which can render them useless. Sand dressing must be designed to ensure that capping does not occur.

Diagram 3 - Pipe drainage construction on cultivated topsoil with supplementary sand grooving



Suspended water table

The term 'suspended water table' refers to water held in the lower part of the root zone and above the blinding or drainage layer. This moisture reserve helps sustain the grass sward during dry weather. This solution is the preferred option where:

- a very high standard of pitch performance is required
- the pitch is required to accommodate high levels of play during the season
- the required drainage rate is high, for example at professional football clubs
- a high level of reliable maintenance is available
- a fully automatic irrigation system is available

This is essential as the grass sward is likely to dry out due to the high sand content of the construction.

This type of construction (see diagram 4 below) comprises:

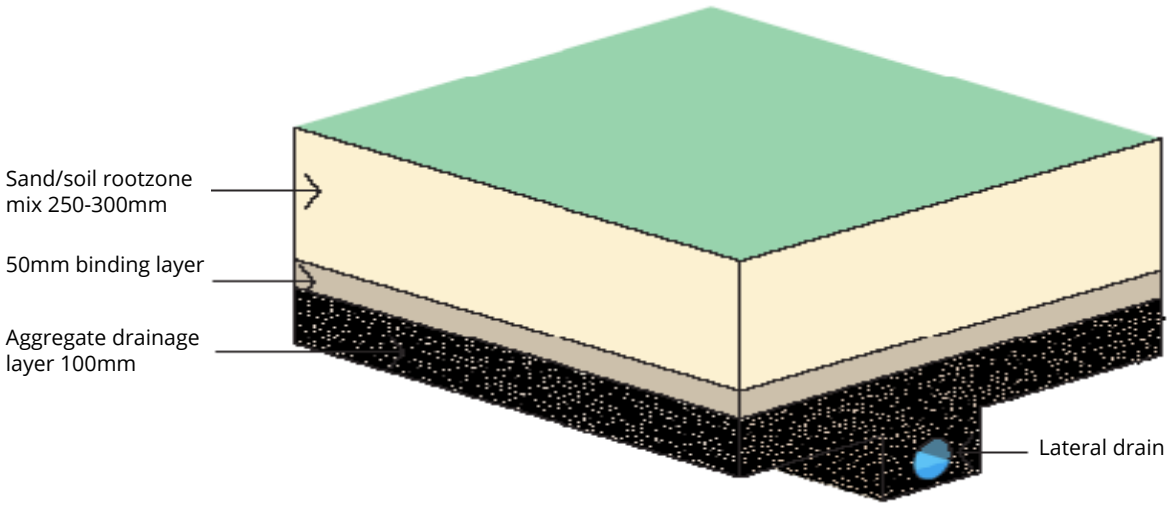
- a graded base drained by a series of drains, normally spaced between 5–10m.
- suitable gravel laid to a minimum depth of 100mm with a 50mm blinding layer of suitable coarse sand or fine grit.
- 250–300mm depth of specially prepared sand/soil root zone mix.

If properly maintained this construction provides a very high standard of playing surface. These very sandy constructions often benefit from some form of reinforcement to help stabilise the upper part of the profile.

Various materials have been developed in recent years for stabilising sandy root zones and these include polypropylene fibres, shredded mesh element sand artificial grass fibres. This type of pitch construction is more demanding in terms of management, particularly with regard to fertiliser and irrigation requirements.

The more efficient the drainage system the greater the need for effective irrigation.

Diagram 4 - Suspended water table construction



Irrigation and Ground Management

A standard football pitch requires a minimum of 50,000 litres of water per application.

Approximately 3 applications are required per week (150,000 litres per week) to keep a pitch in a healthy and safe condition.

Clubs are responsible for the inspection of their ground before the commencement of training or competition play. Clubs should have a Ground Safety Officer who checks the playing surface for hardness, grass growth and the general ground condition by completing a training day/match day checklist.

Clubs should also plan their training sessions to prolong the useable life of the sports field. Where possible clubs should consider rotating the area where training sessions take place and avoid training on wear areas such as those at the mouth of goals, boundary lines and floodlit sections of the football field. Avoiding the use of studded, screw-in or cleated shoes in training will also help to protect the surface where possible.

Clubs can continue to use football grounds in changing climatic conditions by working in cooperation with Council to maintain the grass surface by adapting training sessions, sourcing/utilising sustainable water sources and methods of watering and understanding the need for grounds to be unavailable at times for maintenance works.

Irrigation Strategies

Audit the current irrigation system to assist in deciding what improvements can be made. As part of the auditing process identify what types of irrigation systems are in place, the condition of the irrigation system, the scheduling of irrigation, sources of water, areas of irrigation, types of lawns and plants being irrigated, soil types, uniformity of irrigation, irrigation rate, quantity of water used for irrigation etc.

Avoid manually operated irrigation devices where possible. A typical garden sprinkler uses approximately 1000 litres/hour. If this is not possible use timers when operating manual irrigation systems to prevent excessive watering.

Irrigation systems should be designed and installed by an irrigation specialist.

Systems should be installed to irrigate areas uniformly. Non-uniform irrigation can usually be identified when dry and green patches are observed on the lawn area.

Perform a simple catch can test to determine the uniformity of irrigation and the amount of water delivered to the lawn areas per irrigation cycle. Distribution uniformity (average depth in the cans of the lowest 25% values divided by the average depth of all cans) should be greater than 75%.

Conditions such as overspray and runoff to adjacent non-irrigated areas, property or impervious surfaces should be avoided.

Avoid irrigation in windy conditions. Consider anemometer switching systems to override automatic irrigation systems during windy conditions.

Careful consideration should be given to irrigation on slopes, narrow areas etc. where runoff or overspray to adjacent non-irrigated areas, property or impervious surfaces can occur.

Consider installation of drip irrigation systems (surface and sub-surface). Subsurface drip-irrigation systems are particularly useful in public areas since they are below surface and a less obvious target for vandalism. Evaporation losses are minimised and water is delivered directly to the root zone.

Ensure subsurface irrigation systems prevent root intrusion. This can be achieved through either chemical (herbicide) treatment or physical barriers. Irrigation suppliers will be able to provide advice on this.

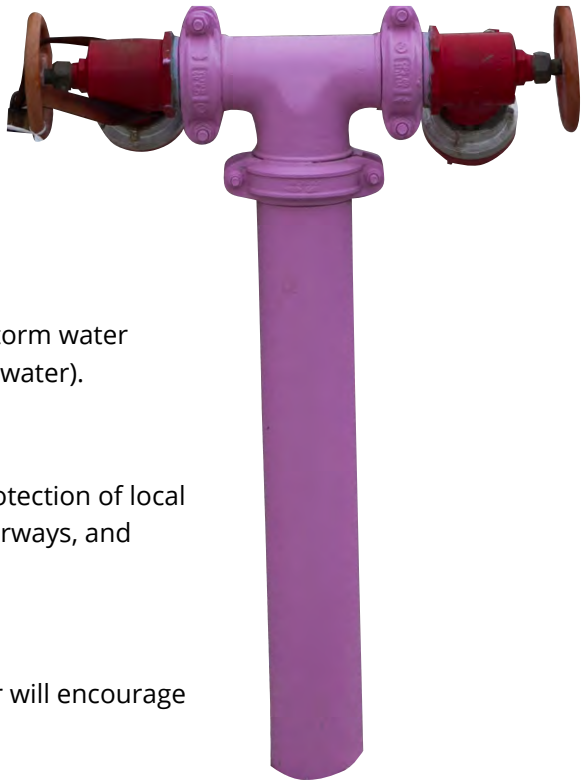
Ensure that the system is designed correctly to ensure correct pressure and flow for the irrigation outlets. Most irrigation suppliers will provide irrigation system design based on irrigation requirements and water pressure availability.

Ensure that the type of irrigation outlet is matched to the needs of the area being irrigated.

Irrigation should be applied in the early morning or evenings to avoid evaporation. Water savings of up to 25% can be achieved in this case.

- Soil moisture sensors connected to the irrigation system can assist in the control of water to the plants, minimising over watering.
- Water less often but more thoroughly to encourage deeper roots. This makes plants more tolerant to drought conditions.
- Use a trigger hose instead of leaving hose running. A typical garden hose uses 10-20 litres/minute.
- Installation should provide easy access to sprinkler heads for easy inspection and maintenance.

Benefits of efficient water use for Clubs



Efficient water use refers to the effective and efficient application of available water to get the best possible return on its use. This also avoids diverting more water from the environment than is absolutely necessary.

Financial

Cost savings from reduced water usage, reduced wastewater/storm water disposal costs, and reduced energy costs (i.e. from heating less water).

Environmental

Reduced storm water flow and erosion damage to property, protection of local aquatic environment through improved quality of flows to waterways, and reduced greenhouse emissions.

Improved turf quality

Efficient water applications and/or nutrients from treated water will encourage strong root system.

Preparedness for changed climate conditions

Efficient water use principles in facility design and operational practices will prepare the organisation for changed climate conditions.

Enhanced image and marketability

Efficient water use principles in everyday practices can improve the organisation's and sport's image, and contribute to their marketability.

Operation and Maintenance

- Regularly inspect all fittings to ensure the system is operating correctly.
- Repair faulty or malfunctioning equipment.
- Fix leaks when identified.
- Replace or repair malfunctioning nozzles.
- Redirect sprays and sprinklers if watering areas outside the irrigation area.
- Adjust systems that are not delivering uniform irrigation.
- Maintain a historical record of watering schedules for future reference and on-going improvement. This can be used to determine the Irrigation Index, that is the amount of water applied divided by the estimated water required. Values greater than 1.0 indicate more water was applied than required.

HANDY IRRIGATION TIPS

- Water efficient irrigation systems such as drip irrigation systems (surface and sub-surface) and/or automatic systems can significantly reduce water use.
- Drip irrigation is up to 95 % efficient. Conventional spray heads deliver only 55-65% of the water to the ground. Losses include evaporation, wind- blown losses, overspray, runoff etc.
- Can reduce fertilizer use and weed growth.
- Water can be delivered to various irrigation zones at predetermined times.
- Watering can be scheduled to occur at times of low evaporation (i.e. early morning or evening.)
- If installed, rain and soil moisture sensors or weather sensitive control systems can allow real time control of irrigation to prevent over watering during times of rain or sufficient soil moisture.
- The amount of water delivered to each area can be controlled to be consistent with the soil type.
- Drip systems and micro-emitters have become increasingly more cost effective when evaluated against water restrictions and rising water costs.
- Support may be available from grants and incentive schemes.

Key Australian Contacts

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To provide Clubs and Associations with opportunities to obtain further information and advice on the matters addressed in this Guide, Football NSW has identified the above suggested contacts. These are, however, suggested contacts only and their inclusion in this Guide should not be taken to suggest that Football NSW endorses or recommends any specific organisation.

Acknowledgements

Irrigation Association of Australia

Football Brisbane

South Australian Government

Sport England

University of Melbourne

Ararat Rural City Council

Appendix & Further Reading

How to manage water in a drought (Sport England)

Natural turf for sport (Sport England)

Best practice turf management (Sydney Water)

Irrigation Australia

Other guides in this series

Building Development

Field Markings & Equipment

Football Lighting

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