

5.3. Track drainage

Water falling on all races needs to be drained once it flows off the crown. Drainage is extremely important because it extends the track's life, prevents scours caused by water channelling, assists cow flow, and reduces the risk of lameness and mastitis associated with poor quality, muddy tracks. A consistently dry track requires:

- a). A well-crowned and compacted base.
- b). A firm impervious surface.
- c). Minimal shading from trees.
- d). Clearing and maintaining drainage points regularly.

5.4. Materials for base surface layer

- a). Topsoil or clay is suitable for use as the foundation layer.
- b). Mixed scoria or coarse lime rock are suitable as the base layer.
- c). If required, hydrated lime evenly spread and uniformly incorporated to a depth of 125 mm, will allow soft clay to become stable once compacted.
- d). If required, cement can be used as a stabiliser in foundation layers - the usual recommendation 1-4%.

5.5. Materials for surface layer

- a). Crushed limestone makes a very suitable material for surfacing, generally spread a minimum 4 inches (100 mm) layer. It needs firm compaction. The higher the calcium carbonate content the better the lime is as a track surface. Water does not need to be added when laying, if the lime has a naturally high moisture level. An experienced contractor should be used to lay and maintain this surface. As with all track surfaces a limed track requires good maintenance.
- b). Rotten rock or volcanic rock, volcanic rock with a clay component that binds well to form a solid compacted surface. Excellent track maintenance is required when using this material to ensure there are no sharp stones at the surface. An experienced contractor should be used to lay and maintain this surface.

6. Maintenance

It needs to have two main objectives, firstly keeping surfaces repaired and maintaining effective drainage.

- a). Avoid using tracks and races as stand-off pads in wet weather. This adds stress to tracks and results in deterioration.
- b). Patch and compact pot holes as they appear. Holes on the track hold water and further damage the track surface.
- c). Minimise the use of farm machinery on the cattle tracks where possible. Use a motor bike, push bike or walk to get cows. Slow travel speeds on races will help to keep the surface in good condition
- d). Minimise wetting of tracks by irrigators, or manage the timing of irrigation to maximize drying of tracks prior to cattle walking on them. Heavy shading can also prevent the race from drying out.

All special backfilling requirements of the pipe manufacturer will be met. The final backfill material will be free of large rocks and other debris greater than 3 inches in diameter. The material will be placed and spread in approximately uniform layers so that there will be no unfilled spaces in the backfill and the backfill will be level or slightly mounded with the natural ground or at the design grade required to provide the minimum depth of cover after settlement. Rolling equipment will not be used to consolidate the final backfill until the specified minimum depth of cover has been placed.

Exposed PVC will be specifically manufactured for use in above ground applications or will be coated with a heavily pigmented latex or acrylic paint, chemically compatible with PVC. While color is not particularly important for UV protection, the use of light paint colors will reduce pipe temperature.

Saddles and supports will be installed and constructed as designed by the engineer and will be approved prior to commencement of construction.

Irrigation Schedule / Irrigation water management

Core milking platform has been designed for 2000 milking cows on 213 hectares (119 paddocks). Three centre pivots will be installed to irrigate effective 180 ha. The growth of Kikuyu allows 18 days rotation period with expected DM production per ha of 50 tonnes per year. The soil type is free draining volcanic soil and therefore its rest period from rain can be a little as 6 hours before we can irrigate, if rainfall is greater than 6mm/hour for periods of greater than 3 hours the soil will be too wet to irrigate. To meet the peak demand to irrigate the whole milking platform (180 ha) at a rate of 6mm/day will require 10800m³/day or 2,860,000 US Gal/day. In the case of a significant drought it is unlikely that the water supply from Waita reservoir would be significantly reduced. The weather data suggests a very few droughts over the past five years, the higher altitudes that feed the reservoir, receive very regular and very large amounts of rain.



All lining material should be free of damage or defect. Membranes will be carefully spread over the subgrade so they lie in a relaxed state. Polyethylene film requires about 5 percent slack for satisfactory results. Backfill in anchor trench will be compacted to a density equivalent to that of the surrounding area. All field splices will be made in accordance with the manufacturer's recommended technique, using materials furnished for the purpose. The joints will be watertight and maintain its integrity through the expected life of the lining.

The maximum particle size of soil cover material will be 3/8-inch unless the liner is cushioned by an 8-ounce or greater needle punched, non-woven geotextile padding material. The cover shall be placed to the specified depth without damage to the membrane.

The liner installation will be complete with product panel placement, seam placement and test results. As the liner is fabricated on site the information is documented post install.

A standard Quality assurance is completed post installation. This Q A includes.

- Material type/size/date deployed and roll number
- Technician details
- Subgrade material acceptance
- Trial weld log including shear/peel testing and machine settings
- Panel Placement log including pipe boots/attachments/appurtenances
- Non-destructive Testing reports (seam tested welds)
- Repair report logged in diagram also in panel log
- Completion Certificate
- Warranty Certificate

Nutrient Management

We assume that Kikuyu grass producing 50 MT DM requires 800 kg of nitrogen per hectare per year. All the manure which is collected at farm is applied on the pastures within limits that do not exceed nitrogen demand of the plant. Effluent is applied on grazing land significantly below the limits of nutrient loading. The soil type is free draining volcanic soil, and therefore its rest period from rain can be as little as 6 hours before it can be irrigated, if rainfall is greater than 6mm/hour for periods of greater than 3 hours the soil will be too wet to irrigate effluent.