Farmlands Water Management guide

Your complete guide to the regulation, storage and distribution of water around rural properties.

Farmlands

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Farmlands would like to acknowledge the contribution

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of the following companies in producing this publication.

Introduction

Water is the world's most valuable asset. Applying it, transporting it and removing excess amounts of water is not only important for our ongoing economic success but is crucial in ensuring the long term sustainable stewardship of the land we farm.

Water management systems are critical components to the infrastructure on which successful modern farming enterprises are based. Whether supplying stock water in the required amounts to the right location maximizing growth potential, draining wet paddocks to encourage robust pasture growth or locating correctly sized culvert pipes for efficient access around the farm, pipelines, water hardware and tanks and troughs are playing their part.

This booklet is designed as a reference guide. It gives a brief overview of stock water systems, farm culvert pipes, subsurface land drainage and farm dairy effluent systems. It is the intention to impart useful and practical information from which farmers can make informed choices.

In a subject as complex and diverse as water management no one person has all the answers so we would encourage you to involve the team at Farmlands, your rural business partner, in the decision making process.

Stock Water Design

Many factors need to be considered when developing watering systems for livestock. Adequate amounts of water are needed to maintain good levels of production and stock health. Limiting water intake reduces animal performance quicker, and possibly more drastically than any other nutrient deficiency.

Planning

In planning the design of a piped water supply the availability of system components should be considered and two basic principles need to be followed. These principles are utility and economy.

Utility

Utility is an easy to operate, trouble-free system that delivers water in the quantity and at the points required, year in and year out, with no more attention than routine maintenance.

Economy

Economy means a system installed at a minimum expense, without sacrificing utility, that will operate for a reasonable period of time, without on going capital expenditure or excessive maintenance costs.

The correct choice and positioning of piping and fittings pumps and reservoirs and power sources, will give both utility and economy.

Design Parameters

Intensification

As livestock operations have intensified, farmers can no longer depend on traditional means of watering their grazing stock. In the past, farmers have generally grazed their animals where they were allowed direct access to a natural source of water. Due to intensive land use and increased stocking rates, more effective watering systems are needed to protect watercourses and to improve the availability of good quality water.

Stock health and performance

To ensure good herd health status and animal performance, livestock should be kept away from streams, ponds, wetlands and ditches by developing alternative watering systems. Livestock can damage the riparian zone by destabilising the bed and banks of the watercourse, the vegetation and add pathogens and excessive nutrients to the water. Limiting access to specific points by fencing along the watercourse and stabilising certain areas greatly reduces these negative impacts. However, total exclusion from the watercourse is recommended to eliminate contamination and degradation.

Environmental issues

Regional councils are leading the push for riparian retirement zones, to protect waterways from the increased sediment and nutrient loadings caused by stock using streams as a water source.

Pasture management

Improved pasture management practices, such as rotational and strip grazing, require a more flexible watering alternative. The system should encourage uniform nutrient distribution over the pasture and reduce trampling and overgrazing near watering areas.

Water quality

Water quality influences how much water livestock drink. They will be more reluctant to drink bad-tasting or contaminated water and therefore, may allow themselves to become more stressed before drinking. If animals drink less they will consume less dry matter resulting in production being affected.

Water quantity

Water supply systems should be designed to cater for the maximum possible demand. This is normally expressed as peak demand and is generally estimated on an hourly rate in mid summer.

Daily demand is the information on which scheme feasibility and storage capacity decisions are made. Peak flow recognises that stock do not drink water evenly over a 24 hour period and is the number on which pump duty and pipe diameter are calculated.

Table 1.

WATER CONSUMPTION OF LIVESTOCK		
Stock Type	**Litres/Head/Day**	**Litres/Head/Hour**
Milking Cows	70	14
Beef Cattle	45	7.5
Calves	25	4.1
Breeding Ewes	4	0.4
Lambs	2.5	0.25
Deer	3/6	0.3/0.6
Goats	4	.04

Source: Lincoln University – Farm Technical Manual, 2003

Productivity

System efficacy

A poorly designed or installed pipe system can result in an inadequate water supply to animals, even though the water source may be adequate. There are six main considerations in planning a pipeline system.

1. Discharge (flow - both daily and peak) requirments.
2. Pipe diameter and type of pipe (MDPE, LDPE, PVC, etc).
3. Distance from the source to the point/s of comsumption.
4. Elevation difference between source and end of line.
5. Elevation variations along pipeline route.
6. Possible future expansion of the pipeline system.

Other considerations

Pressure requirements for delivering the desired amount of water and the amount of pressure the pipe must be able to withstand, are considered implicitly in the preceding list, because they are functions of discharge requirements, elevation differences and the size and material composition of the pipe.

Productivity

Farmers know that stock can survive on a lot less water than they would like, but to maximize productivity we must do better than that. The quantity of water is only part of the system – the rest is how well is it reticulated around the property. An unlimited supply of water won't satisfy stock, if the pipe diameter is too small and the pressure too low.

Future proofing

In estimating water requirements, it pays to think well ahead as far as stocking rates are concerned. Although you can increase pumping capacity by using larger pumps or by duplicating pumps, pipelines once laid underground are almost impossible to recover. This is worth considering before selecting a pipe diameter.

Water Checklist

- Are the water requirements calculated with future development in mind?
- Is the pipeline routed following the most practical course?
- Does the pressure in the pipe exceed the maximum working pressure of the pipe at any stage?
- Does each trough receive the desired flow rate?

If the answer is **no**, then seek advice from the knowledgeable team at your local Farmlands store.
Quality water, available at all times, in the required quantities, is essential for top production and healthy stock.

Desired outcome

A stock water system designed around specific requirements which maximize production for economic development and operating costs.

Components of a Water Supply System

Source:	Springs, streams or bores.
Intake:	Powered by gravity or mechanical/electrical means.
Storage:	Tanks.
Reticulation:	Appropriate pipe size and type.
Outlet:	Troughs.

Water source

Thought needs to be given to the viability of the water source. This includes; volume of water available vs. volume required, annual consistency and seasonal fluctuations. Measurement of spring bore flow is easily determined by filling a container of known volume over a period of time. This can be done over a year to determine seasonal availability. Local knowledge is the best determinant of long term consistency of supply from springs, streams and bores.

Water intake

This can be either gravity supply from a dam or a pumped suction delivery system. Where pumps are involved thought needs to be given to power supply and pump duty, i.e. the delivery of the correct volume pressure of water. Water rams are another delivery option.

Water storage

There are two types of water storage on farms. These are broad based storage (reservoirs) for irrigation purposes and specific storage for stock water.

Tanks

Specific storage of water for livestock requirements generally can be found in the form of tanks, strategically sited around the property. Tanks form a very important function in most livestock farming situations.

Peak flow storage

Tanks act as a peak flow storage reservoir. This allows the ability to provide peak flow stock water requirements, even when the source of the water is not able to keep up with demand.

An example would be, the daily water requirement is 25,000 litres, but the peak demand is 4,000 litres per hour. The water source is capable of producing 40,000 litres per day (1,666 litres per hour) over a 24 hour period. The installation of tanks allows the water source to fill them over the full 24 hour period, whilst the storage of water allows the peak flow demand to be met.

Break pressure tank

Tanks can also act as break-pressure cylinders on gravity feed pipeline systems, to help control the pressure.

Tank Options

Tanks can be largely divided into two categories; concrete and plastic.

Concrete tanks

These are generally manufactured from Ferro cement or plaster. Pre-casting is a common method of tank manufacture, where reinforcing mesh is wrapped around a mould and plaster is applied in layers to the mesh. The mould is then dismantled and the tank is left to cure.

Site preparation

A full 25,000 litre concrete tank will have a site loading of over 30 tonnes. Given this weight, site preparation is extremely important, in particular if the tank is going to sit on infill ground. In these situations the site needs to comply with building code requirements, such as NZS 3604 1999.

Advantages

- Do not require anchoring restraints in high wind areas.
- No protection from stock required.
- Can be buried or partially buried (refer to manufacturer for technical specifications).

Disadvantages

- Due to weight, concrete tanks require specialist machinery to handle and place on site.
- Once installed it is preferable to leave in situ, as moving post installation can prove to be difficult.
- They can be prone to failure caused by natural occurrences, i.e. earthquakes.

Promax PE Tanks

- One-piece corrugated construction for strength and durability - 20 year guarantee.
- Household water supply and stock water - potable water approved.
- Available in the capacity range 120 to 30,000 litres.
- Easily plumbed.
- 14 colours.

Polyethylene tanks

These are predominately manufactured by rotational moulding. Polyethylene tanks come in a large range of sizes and colours. The PE material used is UV stabilized for longevity and typically resistant to algae growth.
As with concrete tanks, good site preparation is critical for the long-term performance of the tank and it is important to follow the manufacturer's installation recommendations.

Advantages

- Light weight, easier to transport and site on difficult remote locations.
- Choice of colours - visually appealing
- Large selection of dimensions and sizes - versatile
- Ease of plumbing
- Can be easily shifted at later date.

Disadvantages

- Must be secured against the possibility of high winds
- Should be fenced off for protection against animal damage
- Cannot be buried.

KBL Easyfit Water Tanks

- Sizes: 500, 1000, 2000 and 3,000 litres.
- Household watersupply.
- Plumbed to suit standard downpipe sizes.
- Complete with leaf screen channel.
- Pest proof.
- Easy to move.
- Designed to be installed bay any handyman.
- Built in leaf strainer.
- Built in over flow system.

Tank Accessories

There are a number of accessories available for both concrete and polyethylene tanks.

Tank level indicators

The water level indicator is very important, as it gives an immediate visual indication of what is happening with the farm water system and allows early intervention if required.

Inlet valves

These valves control the incoming flow and generally operate on a float mechanism where the water level and the float work in conjunction to open or close the valve. The valves are traditionally 32mm to 50mm in inlet size.

Single float valves work well on a gravity based system, whilst a dual level valve is available for pumping situations. This valve allows for the water level to fall to a set level before the pump starts.

There are an extensive range of tank inlet valves on the market and discussions with your local Farmlands branch should be had before making purchasing decisions.

Water reticulation

Pressurised piped systems are the most efficient method of reticulating water. Polyethylene (PE) and PVC are the two most common types of pipe used for stock water reticulation. Both of these pipe options have a place in stock water systems.

Pressure terminology

There are many ways of describing a pipes maximum working pressure. All manufacturers print the pressure rating on the pipe as a PN (nominal pressure) rating in Bar, some also print the PSI (pounds per square inch) rating. The following tables show the imperial and metric comparisons and conversion formulas.

Table 1.

PRESSURE CONVERSION			
Bar	**Metres/Lead**	**KPa**	**PSi**
6	60	600	87
9	90	900	131
12	120	1200	173
16	160	1600	232

PRESSURE CONVERSION FORMULAS						
1 Bar	=	14.564PSI		100 KPa	=	1 Bar
1 PSI	=	6.89KPA		1 mPa	=	1000 KPa
1 KPa	=	0.145PSI		1m	=	10 KPa

Pressure derating

Note: **Above ground** PE pipe systems, may need a derating factor applied to them, as elevated summer temperatures softens the pipe, thereby deceasing the maximum pressure rating.

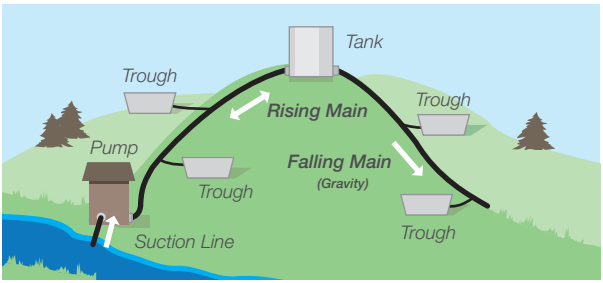
System type

There are three types of reticulated pressure stock water systems. The choice of which system best fits the farms requirements are dependent on the water source and delivery locations, farm topography, access to power and water demand. These systems are;

Natural gravity: Elevated water source, no power required.

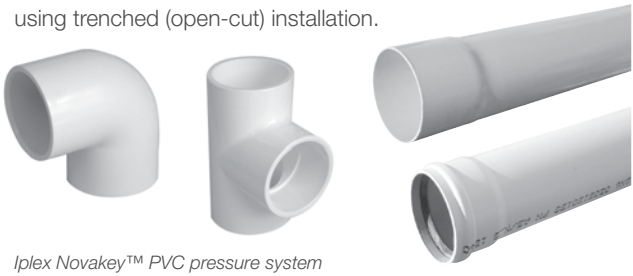
Pumped gravity: Low water source, pumped to elevated reservoir. Troughs can be feed off either the rising-main or falling main.

Hydro-pneumatic: Pressure regulated, pumped system. No reservoir, reliant on pump being operational.



PVC pressure pipe

Rigid pipe, supplied in six metre lengths, complete with either solvent cement joint or rubber ring joint sockets. PVC pipe when used in combination with the fittings range, i.e. couplings, elbows, tees, threaded adaptors, etc. make this a very versatile system. Typically used on farm for structural pipe work, i.e. head-works in pump and milking sheds and larger diameter pipe, greater than 100mm. PVC pipe is laid using trenched (open-cut) installation.



Iplex Novakey™ PVC pressure system

PE pressure pipe

Coiled pipe supplied in a range of standard coil sizes. There are two main systems in New Zealand; Alkathene™ Low Density Polyethylene (LDPE) imperial dimension pipe manufactured to a NZ standard and metric dimension PE manufactured to an ISO (International) standard. PE pipe can be installed by open-cut or trenchless (e.g. mole-ploughing) methods.

Alkathene™ LDPE

Dimensionally peculiar to New Zealand, this pipe has been the mainstay of low pressure stock water systems for many years. A relatively thick walled pipe, Alkathene™ is robust, easy to uncoil and install, without kinking issues. Being an imperial dimension pipe, Alkathene™ is known by it internal diameter (ID).

Alkathene™ is typically coupled by interference-fit (barbed) type fittings, such as the Easy Fit™ Hansen range of fittings.

Alkathene™ is manufactured from the latest generation pre-compounded LDPE, increasing the pressure rating, improving it's ability to withstand UV degradation and making it resistant to 'stress cracking' when used for in-line bloat remedy dispensing.

Table 1.

ALKATHENE RANGE								
Product code	Pipe size OD (mm)	Mean bore ID (mm)	Pressure rating*		Standard coil sizes (m)			
			(BAR)	(PSI)	25	50	100	200
300.15	17	12	12.5	182	☑	☑	☑	☑
300.20	25	19	11	160	☑	☑	☑	☑
300.25	31	25	8.5	124	☑	☑	☑	☑
300.32	38	31	7	102	☑	☑	☑	☑
300.40	44	38	6	87	☑	☑	☑	☑
300.50	57	50	5	73	☑	☑	☑	☒

*Maximum operating pressure at 20ºC

Hansen

Hansen Products manufacture a comprehensive range of cold fit pipe fittings used to join and connect Low Density Polyethylene (LDPE-Alkathene™) pipe together and to other components of a pipeline systems. These economical, one-piece fittings form a secure watertight connection by compressing the pipe wall between the fittings barb and nut. This simple mechanical joint, is quick and easy to make, requiring no specialised tools. Their Glass Fibre Reinforced Nylon construction makes the Easy Fit™ system robust and weather resistant.

Easy Fit Pipe Fittings Features & Benefits

- One piece fitting - no components to lose, rust or corrode.
- Fast and easy to assemble.
- Nut and Barbs provide superior double strength grip.
- Manufactured from UV Stabilised High Quality Glass Fibre Reinforced Nylon.
- Material Approved for use with Potable (drinkable) Water.
- Low Installation costs.
- Fittings demonstrate excellent hydraulic flow characteristics.
- Fittings provide flexibility and versatility.
- AS/NZS 4020 and SGS M&I approved.

Hansen Easy Fit™ Straight Coupling

True Fit Threaded Fittings Features & Benefits

- Large Range of Durable, High Strength, Quality Pipe Fittings.
- Manufactured from UV Stabilised High Quality Glass Fibre Reinforced Nylon.
- Material Approved for use with Potable (drinkable) Water.
- An extensive range of fittings in sizes 6mm to 100mm.
- Precision Heavy Duty Tapered Threads.
- Material is strong enough to minimise potential cross threading.
- Fittings provide flexibility and versatility.
- WRAS, SGS M&I, AS/NZS 4020 and MANARC approved.

Hansen True Fit™ Reducing Hex Nipple

Easy Fit Pipe Fittings Installation Steps

1. Cut the pipe and ensure square ends, clean burs off. When repairing a burst pipe make sure the length of the cut away matches the length of the replacement fitting between the screwed on nuts.

2. Ensure the nut is fully wound back onto the body of the fitting. Push the pipe onto the fitting and as far as possible into the nut.

3. Wind the nut onto the pipe a few turns. Tighten with spanner or pipe grips.

True Fit Threaded Fittings Quick and Easy Installation

1. (a) Use a thread paste sealant or (b) a teflon tape sealant. The right sealant for threaded joints is non-hardening, compatible with plastic and doesn't add slipperiness to encourage over-torquing.

2. **Screw pipe into fitting.** Do not over tighten. The recommended way to assemble a Threaded Pipe Fitting is hand tight. Tighten until firm with spanner or pipe grip. One to two turns should be all that is required.

Please Note:

- All pipe work must be adequately supported.
- Use a thread sealant on all threaded connections, we recommend Loctite 5331.

Metric PE pipe

Manufactured to an international standard, metric PE pipes are described by their outside diameter (OD) and pressure rating (PN). There are a number of pressure series in this range, with a coloured stripe on the pipe denoting the maximum working press in bar, e.g. Greenline - 6-bar, Redline™ - 9-bar.

Metric PE pipes are manufactured from new generation PE resins, such as PE80 and PE100, resulting in a decrease in wall section and larger pipe bore. The outcome is a constant pressure rating across the diameter range and improved flow rate i.e. Greenline on average delivers 30% more flow than Alkathene™, given the same hydraulic gradient.

External, push fit, metric compression fittings, such as the Plasson™ range are used to couple these pipes and connect them to valves, pumps and other pipe systems components.

By far the majority of modern high performance stock water systems are designed around metric PE pipes such as Greenline and Redline™.

GREENLINE

Diameters: *20mm - 63mm. Black pipe, green tri-stripe.* ***Pressure:*** *6.3 bar.*

REDLINE™

Diameters: *20mm - 63mm. Black pipe, red tri-stripe.* ***Pressure:*** *9 bar.*

RURAL BLACK

Diameters: *32mm - 110mm. Black pipe.* ***Pressure:*** *12.5 bar.*

BLACKLINE

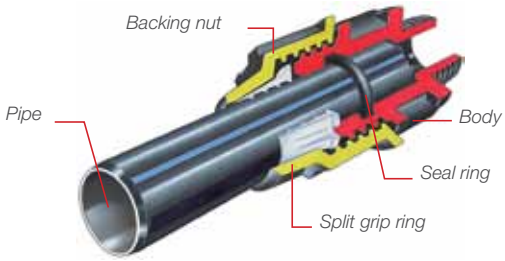
Diameters: *25mm - 110mm. Black pipe, blue tri-stripe.* ***Pressure:*** *16 bar.*

BLACKLINEHP

Diameters: *63mm, 90mm & 110mm. Black pipe.* ***Pressure:*** *20 & 25 bar.*

Plasson™ compression fittings

Plasson manufacture a complete range of mechanical compression fittings for the metric PE pipe diameter range 20mm to 110mm OD. These external fit fittings form a watertight seal, by compressing the rubber ring in the fitting's socket against the outside wall of the pipe.



The low pipe insertion pressure into the fitting's socket makes this connection a simple push fit and hand tighten of the fitting's nut. Tightening of the nut has no effect on the hydraulic seal, it simply secures the pipe within the fittings socket. Not having to disassemble the fitting, speeds the connection process and negates the chance of loosing components during joint assembly. The Plasson™ range is rated to 16-bar (232-psi), so can be used for all but the very high pressure (20 and 25-bar) metric PE pipe systems.

Note

Because the ODs of the same nominal bore metric pipe and 20mm and 25mm Alkathene pipe are the same in these two diameters, it's worthwhile noting that 25mm and 32mm Plasson fittings are capable of being used on 20mm and 25mm Alkathene pipe.

Innovation

Plasson™ have a number of innovative fittings that further enhance the ranges versatility. This includes the Universal Coupling which makes metric pipe connection to other pipe materials, i.e. PVC, galvanised pipe, simple. Another is the Plasson Reducing Set with allows in-socket pipe reduction, without the need for threaded reducing fittings.

Plasson Universal Coupling

Plasson Reducing Set

General instructions

Follow these assembly instructions for a leak proof connection which last a lifetime.

Before assembly ensure:

- That the end of the pipe to be inserted into the fittings is free of scratches and other imperfections.
- That both the end of the pipe and the fitting itself are clean of sand, mud, stones, etc.
- Do not overtighten nut when closing. NEVER use wrenches or spanners with handle lengths longer than 46cm – excessive torque during tightening can spread nut cone and result in pull outs.
- If fittings are reused, ensure split ring is sharp and bites into pipe to avoid pull outs. Alternatively replace split ring. **Note:** We strongly recommend the use of PTFE tape in threaded connections.

1. Cut pipe square, remove burrs and chamfer the end of the pipe with a file or chamfering tool.

2. Lubricate end of pipe.

3. Lubrication of the pipe end is optional, but will ease insertion of the pipe (use silicone lubricant).

4. Undo the nut up to the last thread. Do not remove nut from body.

5. Twist the pipe into the fitting through the nut and split ring until it meets the first resistance – pushing against the captive O-ring. Push and twist the pipe past the O-ring until it stops at pipe stop inside the fitting – the final stop.

6. Firmly hand tighten nut. Use a wrench for a further half turn past hand tight for final tightening of fittings diameters 40mm and greater.

7. The full hydraulic seal is achieved when the pipe passes through the O-ring. Nut tightening is only to achieve pullout resistance – the hydraulic seal is automatically created when the pipe is pushed past the captive O-ring.

Water Troughs

A wide range of troughs are currently available in both moulded polyethylne and pre-cast reinforced concrete. Polyethylene troughs are ideal for lifestyle blocks and small stock numbers. Their light weight makes them easy to transport and locate. Concrete troughs are heavy and less easily transported and installed, but are more durable and robust and are available in larger sizes for high stock numbers.

Sizing and shape

The size and shape of the trough will be determined by stock type, numbers and trough location. Round troughs, centrally located allow good access for high stock numbers. Rectangular troughs can be placed against or through a fence line. Small, easily moved polyethylene troughs are ideal for strip grazing.

Desirable trough features

- Valve protection – a cover to prevent stock damage and a baffle to prevent operation by wave lap.
- A stop valve to isolate supply to trough for maintenance purposes.
- Sloping sides to prevent undermining of the trough.
- A step at one end to allow exit of lambs.
- Limited capacity to avoid stagnant water.

Trough site

The choice of trough site is dependant on many variables.

These choices could include:

- Type of stock farmed i.e. dairy cows versus sheep.
- Size of paddock; one trough or two.
- A practical site to allow as many stock as possible to drink at any one time.

Site preparation

A foundation area should be cleared of all material not suitable for the base such as mud, manure, or vegetation. The foundation area and the close surrounding area should be smoothed to permit free drainage of any surface water. The prepared area should be level and smooth. Placing of gravel up to 150mm thick around the trough will aid in providing sure footing during wet periods.

Trough maintenance

A regular maintenance programme that includes cleaning the trough, making sure the ballcocks are functioning correctly and ensuring the area around the trough is suitable (not wet or eroded).

KBL PE Troughs

PT10 Little Slurp – 10L

- 330mm L x 380mm W x 200mm H.
- Rail mounted.
- Ideal for calf pens and sheep yards.

WT80 – 80L

- 850mm L x 500mm W x 350mm H.
- Ideal for break feeding and small paddocks.

WT150 – 150L

- 900mm diameter x 380mm H.
- Permanent round trough for easy stock access.

WT180 – 180L

- 1100mm L x 830mm W x 320mm H.
- Permanent trough for placement through fenceline to service two paddocks.

In conclusion

Remember the trough is basically a drinking utensil (large glass) and therefore all forms of hygiene should be considered. There is no sense in having large water reservoirs placed around the farm, if the main reason is only to provide backup water reserves. A correctly designed water supply system that incorporates adequate pipe sizing and trough positioning will ensure that all stock have the potential to maximise their overall health and production.

Humes Concrete Troughs

CB Troughs

- Capacity: 1000, 1500 and 2500 litres.
- Suitable for sheep/beef and lifestyle blocks.

CT Troughs

- Capacity: 500, 750, 1000 and 1500 litres.
- Economical trough suitable for beef and dairy stock.

RB Troughs

- Capacity: 200, 300 and 400 litres.
- Economical trough suitable for sheep, beef and lifestyle blocks.

Water trough accessories

Once a decision has been made on the type of trough, there is a range of accessories (hardware) decisions that need to be made.

Trough valve (ballcock)

The trough valve is a vital piece of equipment in the successful operation of a trough. There are a number of different types on the market and it is important to select the valve that will do the best job for your system.

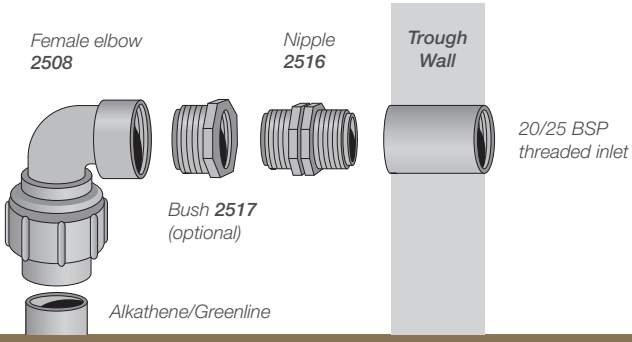
Considerations are:

- Is your trough side entry, top entry or bottom entry?
- What water pressure is at the trough, and what flow rate do you require? Trough valves can range in pressure from 0.2-bar to 12-bar (3-psi to 174-psi) and flow rates up to a impressive 1,000 litres a minute, depending on the inlet pressure.
- What sized threaded inlets are in the trough? (generally 20mm or 25mm).
- The ease of maintenance should be a high consideration
- What sized ball is recommended for the valve you have selected?

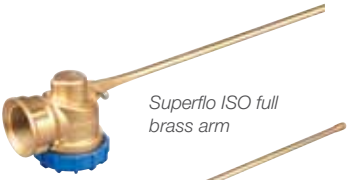
Entry connections

As previously mentioned most inlets into troughs are 20mm or 25mm. If connecting into a side entry trough, the following fitting regime should be followed:

Trough • 20/25 threaded nipple • (threaded bush, if necessary) • Female threaded elbow to incoming pipeline.

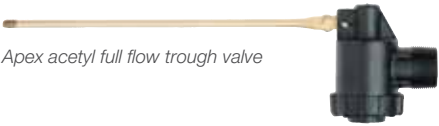


Hansen Maxflo trough valve

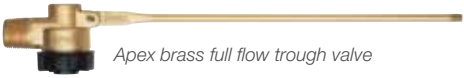


Superflo ISO full brass arm

Superflo ISO brass extended



Apex acetyl full flow trough valve



Apex brass full flow trough valve

Apex XtraFlo armless trough valve

Apex Valve

Jobe Rojo float valve

Jobe Topaz float valve

Jobe Megaflow trough valve

Isolating ball valve or gate valve

It is a good idea to install an isolating valve in the pipeline feeding the trough. This means that maintenance can be carried out on an individual trough without compromising the rest of the pipe network. Manufacturers' recommendations must be followed regarding the ability of these valves to perform under weather extremes.

These valves should be protected in a stock proof, robust valve-box.

Plasson Stopcock

- 10-bar.
- 20 and 25mm BSP female thread.
- Rugged polypropylene construction.

Plasson Compression Stopcock

- 12.5-bar.
- 20 to 32mm compression fitting – no threaded connections required.
- Rugged PP construction.

Check valves or backflow prevention

These valves are used in-line as a non-return valve to stop fluids flowing back through your system. If the house water supply is on the same pipe network as the stock water it is advisable to install a non-return valve at each trough higher than the house, to ensure there is no possibility of trough water being used in the household system. The non-return valve will also eliminate any possibility of water siphoning out of the trough.

Plasson Check Valve Insert

- Insert into a 25mm Plasson fitting.

Hansen Check Valve

- 20 to 50mm BSP female thread

Covers

It may be well worth investigating the use of trough covers to drastically decrease the possibility of algae build-up and stagnant water lying in the trough. At times when the trough is not in use, the trough cover will protect the water from outside rubbish, pollen or fertiliser etc. It has been suggested that most troughs without covers should be totally cleaned approximately four times per year.

Trough covers are a good idea on dairy farms.
If diary shed effluent is being sprayed back onto paddocks, trough covers will eliminate any chance of contaminating the trough water.

Other valves

A range of valves are available to perform specific jobs in a stock water reticulation system.

Foot valve

Spring loaded non-return valve located at the end of the pump suction line designed to keep water in the line so the pump doesn't need to be primed.

Hansen Foot Valve
- 25 to 50mm BSP female thread.

Pressure reducing valve (PRV)

Spring loaded valve design to reduce downstream pressure to meet the systems design criteria.

Main isolating valve

Design to shut off water supply to all or part of the reticulation system.

Plasson Angle Seat Valve
- 32 to 50mm male BSP thread.
- Full bore flow performance.
- Rugged PP construction.

Hansen Ball Valve
- 15 to 50mm female BSP thread.
- 16-bar.
- Full flow.
- Lightweight and strong.

Quick coupling valve

Spring loaded hydrant located at ground level, designed to easily access system water in remote farm locations. Another option would be a wingback fitting with a garden tap.

Plasson Wingback
- 20 and 25mm female BSP thread.
- Tap connection to PE pipeline.
- Rugged PP construction.

Plasson Quick Coupling Valve
- 20 and 25mm male BSP thread

Plasson Riser Key
- Insert into Plasson Quick Coupling Valve to turn water on

Air admittance valve

Designed to let air blockages out of high spots in pipe systems, improving the systems efficiency.

Farm Culvert Pipes

Well-designed and maintained tracks and raceways are one of the secrets to a productive farm business. They make it quicker and easier to get around the property, reduce wear and tear on farm vehicles and can help prevent lameness in stock.

Correct installation of strategically placed culverts is essential. Here we will deal with the placement and installation of culverts 100mm to 500mm in diameter. Larger culverts than this will require a degree of engineering expertise along with possible resource consents. In these instances a visit to your local regional council would be advisable.

Culvert pipe options

There are a wide range of materials used to manufacture farm culverts on the market today. These include; extruded polyethylene (PE eg. Nexus™ Culvert) and PVC (e.g. Farmtuff™), rotational or blow-moulded PE, corrugated metal, through to more traditional concrete culverts.
In general the more rigid culvert pipes, i.e. metal and concrete pipes, are used when the top of the culvert pipe is close to the surface. Each culvert pipe material has its own unique advantages, so visit your local Farmlands store to discuss your individual requirements.

Plastic culvert pipes

Smooth-bore plastic culverts are the material of choice for most rural culvert applications nowadays. Their light weight makes them both easy to transport and install, compared to heavier concrete culvert pipes. Smooth-bore culverts have less chance of materials being caught up in the bore of the pipe, leading to blockages. These types of culverts are required to be installed as prescribed by the manufacturer, as it is the compacted backfill material which carries the loading, not the culvert pipe itself.

Table 1.

FARMTUFF™ PRODUCT RANGE				
Product Code	Nominal OD (mm)	Length available		
		3m	5m	6m
550.110	110		☑	☑
550.160	160		☑	☑
550.200	200	☑	☑	☑
550.250	250	☑	☑	☑
550.315	315	☑	☑	☑
550.400	400	☑	☑	☑
550.500	500	☑	☑	☑

Table 2.

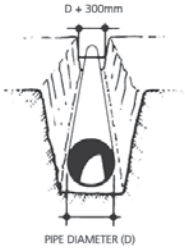
NEXUS™ CULVERT PRODUCT RANGE			
Product Code	Nominal OD (mm)	Length (m)	Coupling
Nexus Cluvert 1105	110	5	c/w push fit coupler
Nexus Cluvert 1605	160	5	c/w push fit coupler
Nexus Cluvert 2005	200	5	c/w push fit coupler
Nexus Cluvert 2506	260	6	socketed

Farm culvert installation

Whilst selecting the size of culvert and the type of material the culvert is manufactured from is very important, if the manufacturer's installation procedures are not rigidly adhered to, failure of the system is a high possibility, resulting in large repair or reinstatement costs.

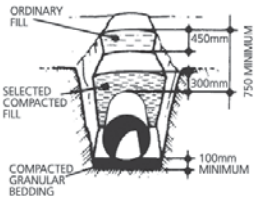
Installation instructions

Important for the correct performance of FARMTUFF™ and NEXUS™ Culvert Pipe.



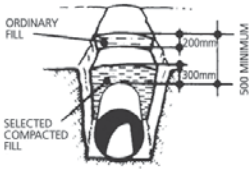
Excavation

When digging a trench, ensure that the width of the trench at the top of the pipe is no greater than necessary to allow the bedding and side fill to be properly placed and compacted. As a rule, 300mm wider than the pipe is normally sufficient. This will minimise loadings on the buried pipes.



Culverts under roads, farm tracks and raceways

Compacted granular bedding materials is preferred in the particle size range 5mm to 20mm. Suitable granular materials include scoria, pumice, river gravel, sandstone or limestone. The minimum depth of the cover for PVC culverts under roads, farm tracks, raceways, etc. should be 750mm.



Culverts under areas not subject to traffic or heavy stock movement

Selected excavation fill may be used as bedding. It should be substantially free from rock, tree roots or rubbish. Wet or saturated clay should not, under any circumstances, be used as bedding or surround material. The minimum depth of cover should be 500mm.

Compaction of bedding

FARMTUFF™ and NEXUS™ culvert pipes use their flexibility to transfer load to the surrounding bedding. One purpose of the bedding is to ensure longitudinal support to the pipe. Another purpose is to provide lateral support to the pipe and increase its load capacity. Thorough compaction of the fill along the pipe is important to ensure long, trouble-free service from your FARMTUFF™ and NEXUS™ culvert pipe. Fill should be carefully compacted by hand ramming along the sides and around the pipe, and build up to the finished ground surface.

Stream crossings

If you wish to construct a culvert in a stream, you are likely to need resource consent. Consent requirements for culvert construction vary throughout the country. Contact your local regional council to discuss your proposal, to find out if consent is required and what information you need to supply.

Hillside tracks

Where a track winds up a hillside, it usually crosses a few watercourses. These are usually passed under the track in small culvert pipes. If the culvert outlet is not reinforced with a flume or concrete sill, it scours, undermines the pipe, and could eventually take out part of the track. If these sorts of spillways are infeasible, spread medium diameter rock (200 – 300 mm) at least 1m^2 in the channel under the pipe outlet. Well secured Geo-textile or polythene may also be used.

Headwalls (wingwalls)

Headwalls around the culvert inlet and outlet are a good idea, to prevent floodwater from scouring the track. Inexpensive headwalls can be constructed from H4 treated timber planks held in place with iron fencing standards. Alternatively you could use sandbags or concrete pre-cast headwalls.

Farm culvert sizing

Using an undersized culvert is a common mistake. It may appear to save money in the short-term, but if the culvert fails, replacing it could cost up to four times more than the initial savings.

CULVERT SIZING	
Pipe Diameter (mm)	**Catchment Area (ha)**
150	0.05
300	0.2
450	0.6
500	1.0

***As a rough guide**, the larger the catchment area, the steeper the catchment, or higher the likelihood of high intensity storms – the bigger the culvert needs to be.*

Culvert maintenance

It is best to have a “little bit and often” approach to maintenance. Carry a spade on the farm bike, so you can clean out cut-offs and culverts as you attend to normal farming duties. Attend to storm damage as soon as possible after the event, to avoid further damage. Only do temporary repairs if you’re unable to do the job properly immediately.

Subsurface Drainage Systems

While the importance of good land drainage is tacitly understood by most farmers, being a buried system, its benefit’s are often underrated, because it’s “out of sight, out of mind.” On certain farms, land drainage is the single biggest contributor to productivity, as it enhances all other farm inputs.

Benefits of good land drainage

- Improved pasture growth crop yields – extended growth season, improved root systems, encourages worm activity for better soil structure, greater benefits from fertiliser and herbicide application, more consistent germination and crop development, decreased reliance on hay and other supplements.
- Increased productive pasture area – minimized areas subject to pugging, develop unproductive areas.
- Improved animal health – decreased ‘wet ground’ stock health issues, improved conditions for lambing and calving
- Increased land value – improved mobility around farm, easier operating conditions for farm machinery.
- Environmentally friendly – reduced soil compaction and the associated surface run-off issues to open waterways.

Planning

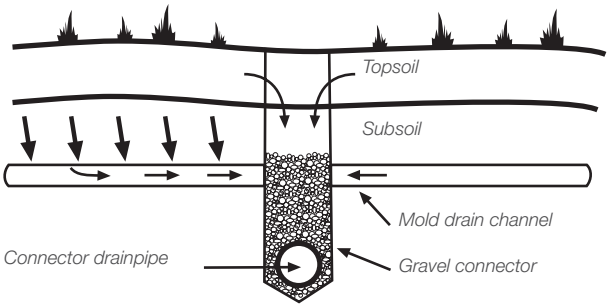
Planning an effective drainage system takes time and requires consideration of a number of factors, including:

- Land use – type of farming.
- Local and regional council regulations.
- Soil information.
- Wetland impact.
- Adequacy of system outlet.
- Field elevation, slope (grade) and topographical assessment.
- Economic feasibility.
- Present and future cropping strategies.
- Environmental impacts associated with drainage discharge.
- Quality of installation.

Other considerations

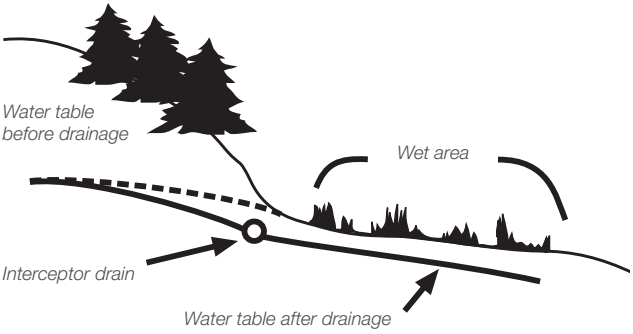
- Pipe selection.
- Bedding and backfill – native soil vs. imported granular aggregate.
- Drain spacing vs. soil type.
- Mole drainage.
- Connection to existing drainage lines.

Mole drain

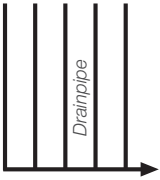


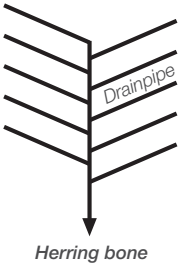
Drainage system layouts

Interceptor drain

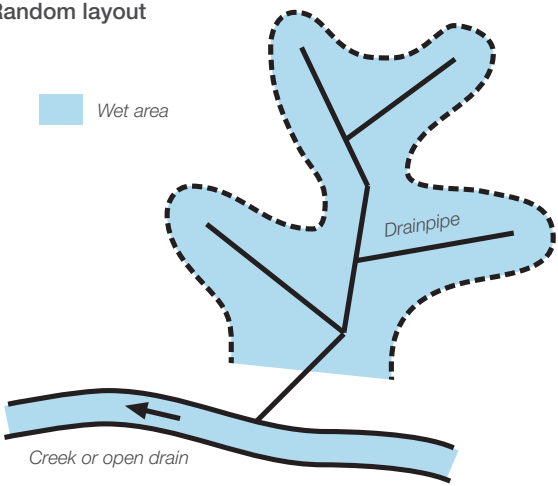


Regular layout





Random layout



Pipe selection

Pipe selection is an important consideration. The maximum amount of water a drainage pipe can carry (its capacity) depends on the pipe's inside diameter, the grade (slope) at which it is installed, and the type of pipe, e.g. clay field tiles, Novaflo™ polyethylene corrugated-bore pipe, Nexus™ polyethylene smooth-bore pipe. Given the same grade, a pipe's bore-size most greatly effects it's ability to transport water, followed by the smoothness of the pipes bore, i.e. a pipe delivering laminar (smooth) flow, rather than turbulent flow will transport a larger volume of water. Full-flow pipe capacities for given grades, pipe diameters and pipe types can be obtained from a number of sources:

- Manufacturers' literature.
- Local drainage contractors and engineers.
- Farmlands Trading Society Ltd.

Table 1.

NEXUS™ PRODUCT RANGE (SMOOTH BORE)			
	Nominal OD (mm)	**Length (m)**	**Colour of pipe and stripe**
Nexusflo™ (Punched)	110	15, 30, 50, 100, 450	Blue, black stripe 
	160	45, 185	
	200	5, 29	
Nexuscoil (Unpunched)	110	15, 30, 50, 100, 450	Black, yellow stripe 
	160	45, 185	
	200	29	

Table 2.

NOVAFLOW™ PRODUCT RANGE (CORRUGATED BORE)			
	Nominal OD (mm)	**Length (m)**	**Colour of pipe and stripe**
Novaflo™ (Punched)	65	15, 30, 150	Black, no stripe 
	110	15, 30, 50, 100, 450	
	160	15, 45, 185	
Novacoil (Unpunched)	65	15, 30, 150	Black, white stripe 
	110	15, 30, 150	
	160	15, 45	

Drainage coefficient

This is the depth of water (mm) that must be removed in 24 hours to allow a particular land use. Dairy farming land drainage systems are designed to deliver a high drainage coefficient.

To protect crops, a subsurface drainage system must be able to remove excess water from the upper portion of the active root zone 24 to 48 hours after a heavy rainfall event.

Table 1.

LAND DRAINAGE	
Land Use	**Drainage Coefficient (mm)**
Grassland Farming	5 -10
Intensive Livestock and Cropping	10 -15
Seasonal Dairy Farms	15 - 20
Town Milk Dairy Farms	25
Playing fields, horticultural crops	30 -50

Nexus™ land drainage pipe

This a double wall polythene pipe, combining a smooth inner wall with a corrugated outer wall. During manufacture, the two walls are welded together. The outcome is a pipe with improved crush strength and smooth bore flow performance.

Massey University tests demonstrate that 110mm Nexus™ delivers 49% greater flow than 110mm Novaflo™, while 160mm Nexus™ delivers 69% greater flow than 160mm Novaflo™.

Novaflo *turbulent flow*

Nexus *laminar flow*

Benefits of faster land drainage

This is summarised by the following points:

- Higher flow velocity - reduced silting - less maintenance - longer service life.
- Less short term pasture damage – more palatable grazing - faster pasture recovery.
- Less long term soil damage (compaction) - improved surface drainage - more pasture growth (kgDM/h).
- Reduced duration of water logging in the root zone - more pasture growth (kgDM/h).
- Put stock back onto paddocks faster after a major rainfall event - easier farm management.

Gradient

Because of its smooth bore, Nexus™ can work effectively at low gradients. This allows the drainage of paddocks with shallow outlets and permits longer laterals.

Larger diameter

Nexus™ is also available in a 200mm diameter, offering the opportunity to replace small open culverts and increase productive area.

Summary

Improved surface and subsurface drainage is necessary for most of our New Zealand soils, to optimize the crop environment and reduce production risks. To assure an effective and profitable system, a good land drainage design will be the outcome of a thorough evaluation of on-site factors, such as soil type, topography, outlet placement and existing wetlands. Seek professional advice and utilize the services of Farmlands or an experienced land drainage contractor, to maximize the production benefits which effective land drainage will deliver.

Farm dairy effluent

Safe, hygienic, economic and practical effluent management is necessary to maintain New Zealand's clean, green image and sustain the quality of our natural environmental resources. Without our clean, green status, New Zealand dairy products would be less able to compete in the international market place.

Legislative requirements

Public concern for environmental pollution has resulted in creation of legislation known as the Resource Management Act (RMA) 1991. This act promotes the sustainable management of natural and physical resources.

When planning an effluent system it is important that the correct procedures are followed. The first of these is to consult with your local regional council, to ensure that all the legal requirements are met in accordance with the RMA. regional councils are the bodies empowered to provide guidelines, recommendations and regulations under this legislation.

Waste or useful by-product?

Farm dairy effluent, when recycled back onto the land, offers a source of Nitrogen (N), Potassium (K), Phosphorus (P) and Sulphur (S) fertilisers and trace elements to enhance pasture or crop production. Environmental quality is the main reason for applying effluent to land, but the value of nutrients and a minor irrigation benefit, are significant bonuses.
Effluent correctly applied can substitute for some solid fertiliser use, as well as assist in the maintenance of environmental water quality.

Design parameters

Good spray application systems operate with minimal effluent drift, ensure even application, require minimal manual shifting and are readily expandable.

Spray application requires careful planning. It requires knowledge of the volume and nutrient content of the effluent, the area necessary to handle the effluent effectively and local soils and groundwater conditions. Pump type and duty, pipe diameter and pressure rating, paddock layout, applicator type and energy losses are additional design parameters. Pumps must be closely matched to the required flow rate and operating pressure of the system, be easily maintained and be constructed from corrosive resistant material.

Design summary

Listed below are the critical design components associated with three herd sizes and their effluent disposal systems.

Table 1.

CRITICAL DESIGN COMPONENTS ASSOCIATED WITH TH			
Herd Size (cows)	**Recommended Area Required (ha)**	**Pump Duty**	**Sump Size (m^3)**
200	9.0	Min. flow 15m^3/hr Min. head 34m	4.0
400	18.0	Min flow 15m^3/hr Min. head 34m	6.0
600	27.0	Min flow 15m^3/hr Min. head 40m	8.0

Collection and application

Dairy effluent is deposited either at the farm dairy during milk harvesting or whilst inhabiting the stand-off pads or herd homes. It is then washed or scraped to a single collection point where it can be:

Sprayed directly onto pasture

Piped to a holding storage pond.

Components

The components of a spray application system include:

- Farm dairy/Herd home.
- Stone trap.
- Storage facility – large sump, holding pond.
- Pump – electric or PTO drive.
- Delivery pipelines – pipe, fittings and hydrants.
- Applicator - traveling irrigator - pod irrigation.

HREE HERD SIZES AND EFFLUENT DISPOSAL SYSTEMS

Mainline Size	Effluent Applicator	Average Application Rate (mm/yr)	Annual Nutrient Deposit (270 Day Milking Season)		
			N	P	K
65/PVC/PN6 75mm Iplex Effluent Pipe	as required	33	1296.0kg	135.0kg	1674.0kg
65/PVC/PN6 75mm Iplex Effluent Pipe	as required	33	2592.0kg	270.0kg	3348.0kg
80/PVC/PN6 90mm Iplex Effluent Pipe	as required	34	3888.0kg	405.0kg	5022.0kg

Pipe options

Effluent pipe systems are typically six metre lengths of PVC (installed below ground) or coiled polyethylene (PE) pressure pipe (installed above or below ground).

Effluent pipelines include the Mainline and Sprayline. These systems use camlock fittings combined with hydrants to quickly and easily connect the mainline to the sprayline in the paddock.

Mainline

- from pump to hydrants.
- usually sized between 75 and 110mm OD.
- Polyethylene (PE) or PVC pipe.

Sprayline

- hydrant to applicator (travelling).
- usually on the surface and moveable.
- usually PE 63mm OD.
- PE 45mm low application pod irrigation.

Table 1.

PRODUCT RANGE								
Product Code	Nominal OD (mm)	Mean ID (mm)	Standard Coil Sizes			Pressure Rating		Application
			50	100	200	(BAR)	(PSI)	
2230.45PN5	45	54		☑	☑	5	72	Pod irrigation
2200.3.PN6.3	63	56.8	☑	☑	☒	6.3	91	Drag hose/ main line
2200.75PN6.3	75	65.8	☑	☑	☒	6.3	91	Main line
2200.75PN8	75	65.8	☑	☑	☒	8	116	Main line
2200.90PN6.3	90	81.3	☑	☑	☒	6.3	91	Main line
2200.90PN8	90	78.9	☑	☑	☒	8	116	Main line
220.110PN8	110	96.5	☑	☑	☒	8	116	Main line

For more information please talk to the friendly team at your local Farmlands store today.

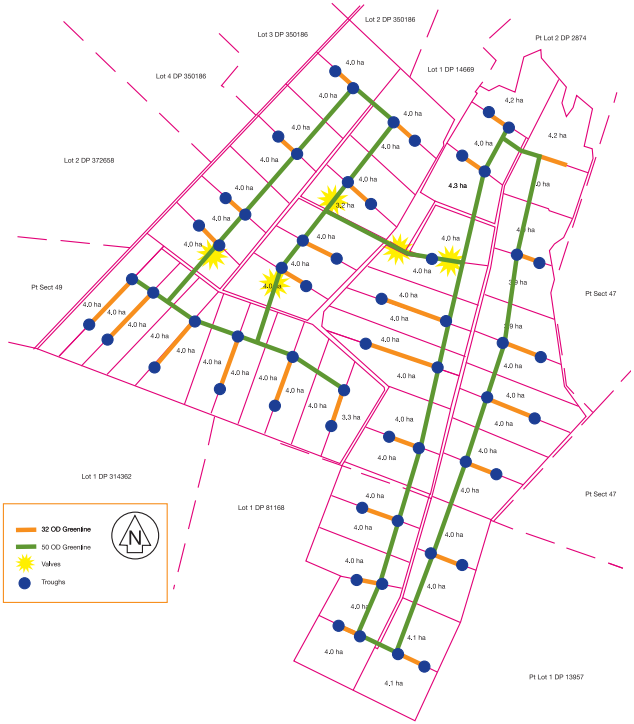
Farmlands Adding Value

Installing coiled PE water pipe?
Ask Farmlands about loaning a mole-plough and dispensing trailer it makes uncoiling pipe a breeze.

Planing to do some land drainage this season?
Ask Farmlands about the Farmtrac™ as-built mapping service and easily find your subsurface drainage for maintainence and system additions.

Need to update your stock water system, but unsure of pipe sizing and pressure rating?

Talk to the team at your local Farmlands branch about how we can help - determine water requirements for correct pump, tank and pipe selection.



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With 45 stores, we've got you covered.

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Gisborne
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