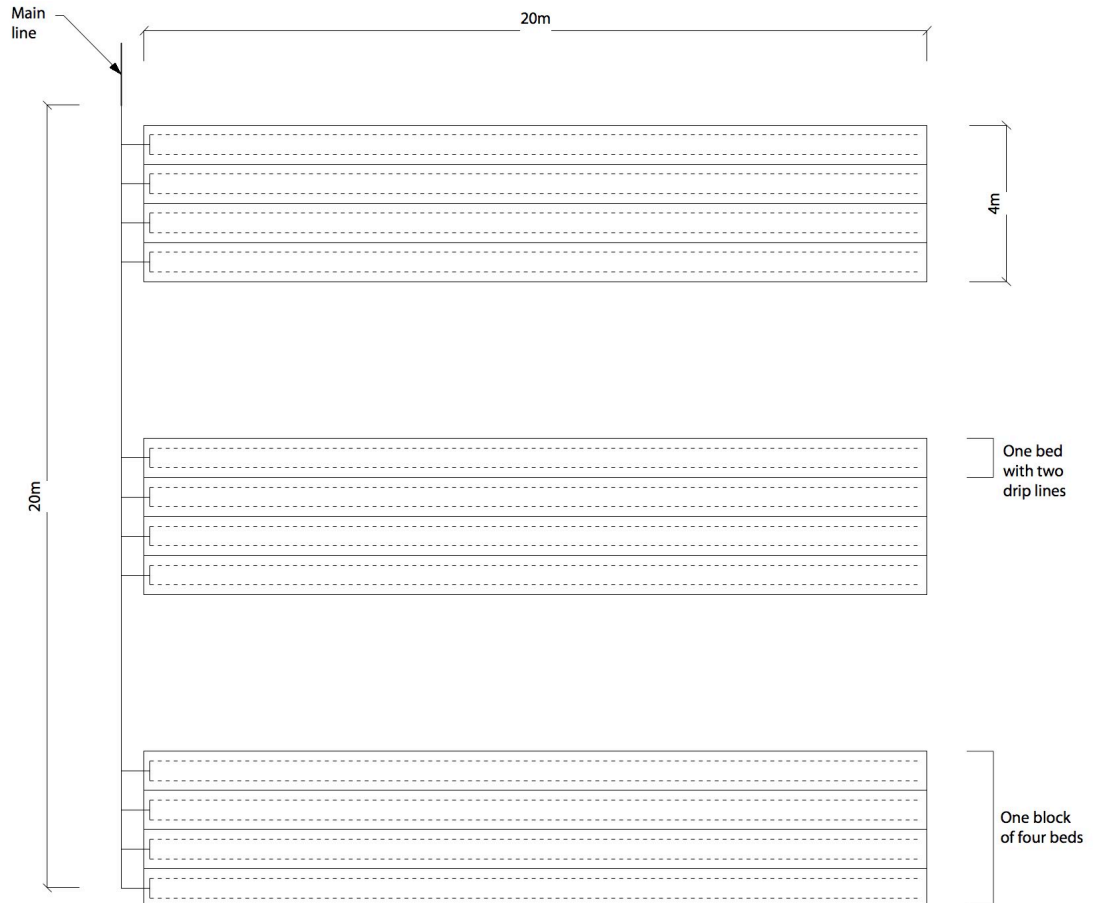


Design of a small-scale drip irrigation system

This irrigation design is for a small farm growing annual vegetables. The vegies are grown in rows in beds that are 20m long and 1m wide. The beds are organised into blocks of four beds. There are three blocks of beds with a 4m gap between each block.

The vegies will be watered with inline polyethylene drip hose with two hoses per bed. The hoses have drippers at 300mm spacing and each dripper delivers 2L/h. Water will be supplied by gravity feed from a header tank with 4m head which is 60m from the beds. The 1000L header tank is supplied by a small solar powered pump that delivers approximately 600L/h. A schematic of the farm layout is shown below.



Daily water use

ET_c 7mm/day

Area = 20m x 4m x 3 = 240m²

Volume of water required = 240m x 7mm x 1/1000 = 1.68m³/day
total

Volume of water per block = 1.68/3 = 0.56 m³/day

Volume of water per bed = 0.56/4 = 0.14 m³/day

Number of laterals

2/bed

8/block

24 total

Drippers/lateral

20m/300mm = 66

Flow rate/lateral

66 x 2L/h = 132L/h = 0.037L/s

System of operation	To allow for flexibility of operation and the use of low-head gravity feed, it is planned to water each of the three blocks of beds separately.
Number of laterals per block	8
Discharge required	8 laterals x 0.037L/s = 0.296L/s
Pressure tolerance	±10% of 4m = 2 x 0.4 = 0.8m
Operating time	560L/block / 0.296L/s x 1h/3600s = 0.53h/block

Lateral friction chart (lateral flow rate 0.037L/s)

Pipe size	H _f /100m	H _f /20m lateral	H _f actual (H _f x 0.33)
13mm	1.5	0.375	0.124m

Head loss using 13mm laterals is well within tolerance required.

Submain friction chart (submain flow rate 0.296L/s)

Pipe size	H _f /100m	H _f /20m submain
13mm	60	15m
20mm	7	1.4m
25mm	2	0.5m

Head loss using 25mm submain and 13mm laterals = 0.5+0.124 = 0.624m which is within the required pressure tolerance.

Main line friction chart (main line flow rate 0.296L/s)

Because the water supply is by gravity from a small head of only 4m, there should be negligible head loss in the main line.

Pipe size	H _f /100m	H _f /60m main
38mm	0.28	0.17m
50mm	< 0.1	< 0.1m

50mm pipe would be best for the main line.

Design summary

Main line	50mm poly pipe
Sub main	25mm poly pipe
Laterals	13mm poly pipe with 2L/h inline drippers at 300mm spacing
Method of operation	Water each of the three blocks separately for half an hour per block per day.

If the sun is shining and the header tank is full at the start of irrigation, the header tank (1000L) and the solar pump supplying water to the header tank (1.5h x 600L/h = 900L) will provide enough water (1680L) to irrigate the three blocks in a continuous 1.5 hour period.