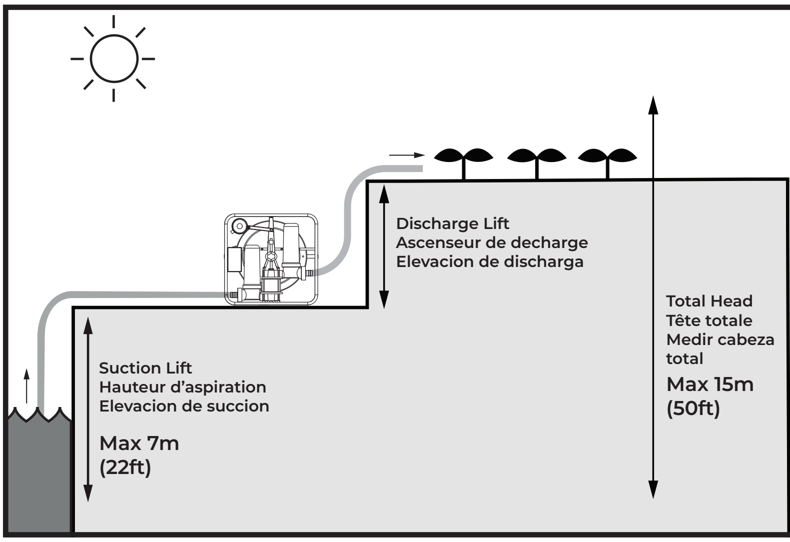
Technical Note:
Total Head & Impact of Hosepipes



Total head is the 'work' the pump must do to move a liquid. It is the sum of vertical, pressure and velocity head which are influenced by:

- *Vertical lift*
- *Hosepipe length, diameter and type*
- *Hosepipe restrictions (kinks, bends, connections)*
- *Irrigation type (i.e. adding sprinklers)*

At shallow heads, and with short hosepipe length, the Futurepump SF2 can deliver up to 1 L/s, this equates to up to 3,600 L/hr or over 21,000 litres per 6-hour pumping day.

As total head is increased, either through lifting the water higher (vertical head) and/or adding pressure in the system, flow rate will decrease.

1 meter lift	7 meter lift
3600 L/hr	2000 L/hr

VERTICAL HEAD

One of the easiest components of total head to visualise is vertical head in meters. Lifting water up uses up energy from the pump as it must push the weight of water up against gravity.

PRESSURE HEAD

The pump has to work harder to move water if pressure is increased. This is because the pump has to use energy to act against this additional pressure. Pressure head is measured in meters and is part of the total head value.

Most pump installations will experience around 1-3 metres of additional pressure due to system setup.

Because the pump has a maximum total head, increased pressure in the system will reduce the available energy to lift water vertically.

HOSEPIPE LENGTH + DIAMETER

The total length and diameter of hose pipe affects the maximum flow rate. The longer your hosepipe, the further the water has to travel within the pipe and the greater the friction effect and therefore, the lower the flow rate.

As water travels down a length of hosepipe it interacts with the pipe walls. The resultant friction is determined by pipe width, pipe material and restrictions along the length of the pipe.

Examples of the effect of different hose pipe lengths, diameters, materials and resultant flow rates are shown below:

Total length and diameter of hosepipe	Flow at 1m vertical lift head (L/h)
4m (1.25")	3600
12m (1.25")	3000
22m (1.25")	2500
7m (1.25")+ 15m of (2.5" lay-flat)	3600
7m (1.25") + 60m (2.5" lay-flat)	3000
7m (1.25") + 120m (2.5i" lay-flat)	2800

What this means for using your SF2

At the lowest vertical lifts (1m) a maximum length of 500m hosepipe can be used with the SF2.

As you add vertical lift, the maximum length of hosepipe you can use decreases. For vertical lifts of over 12m a maximum of 60m hosepipe can be used to remain within the 15m head limit.

To get the best out of the Futurepump SF2 you should be aware of the optimum hosepipe diameters for different vertical lift and hosepipe length, as shown in the table below.

Hosepipe diameter in inches		Vertical lift (m)								
		1-3	3-6	6-9	10	11	12	13	14	15
Hosepipe length (m)	15	1.5	1.5	1.25	1.25	1.25	1.25	1.25	1.25	1.25
	30	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	60	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
	120	2	2	1.5	1.5	1.5	1.5	1.5		
	200	2	2	2	2	2	2	2		
	300	2.5	2.5	2.5	2.5	2.5	2.5			
	500	2.5	2.5	2.5	2.5	2.5	2.5			

Note!

The longer the hose pipe the lower the flow rate. It is beneficial to use a shorter hose for a plot close by, then connect additional lengths to reach further ends of a field.

The pump will continue to work with smaller hosepipe dimensions but the back pressure will cause parts to wear faster and more maintenance will be required. The table below shows the hosepipe diameter you should **not use** for different vertical lifts and hosepipe length.

Hosepipe diameter in inches		Vertical lift (m)								
		1-3	3-6	6-9	10	11	12	13	14	15
Hosepipe length (m)	15	0.75	0.75	0.75	0.75	0.75	0.75	1	1	1
	30	0.75	0.75	0.75	0.75	0.75	0.75	1	1.25	1.25
	60	0.75	0.75	0.75	1	1	1.25	1.25	1.25	
	120	1	1	1	1	1	1.25	1.25		
	200	1	1	1	1	1.25	1.25	1.5		
	300	1	1	1.25	1.25	1.25	1.25			
	500	1	1.25	1.25	1.5	1.5	1.5			

For more details on avoiding unnecessary back pressure to your pump, check out our blog:

5 ways to get the best out of your Futurepump solar pump

REAL WORLD EXAMPLES

Situation	Radiation W/m^2	Total head (m)	Flow rate (L/h)	Explanation
Lifting water up 12m and 120m horizontally with 1.5” rigid pipe	870	13	1249	Total head is 13m due to friction caused by the length of hosepipe
Lifting water up 10m and 120m horizontally with 1,25” rigid pipe	930	13.5	1150	Total head is 13.5m as the smaller diameter hosepipe is causing increased friction and reduced flow rate
Lifting water up 8m and 60m horizontally with 1.5” rigid pipe	918	9	1640	Lower vertical lift and shorter hosepipe length results in just 9m total head
Lifting water up 8m and 60m horizontally with 1” rigid pipe	920	12	1350	Reducing the hosepipe diameter to 1” has increased the total head to 12m in this situation. This also reduces flow rate