BUSH TECH #55

Water pressure issues

Centre for Appropriate Technology

OVERVIEW

This BUSHTECH is about water pressure in small water supplies; what influences it and how to deal with it.

Generally speaking, more water pressure is better. In some small communities, not having enough water pressure to do everything can be an issue.

Low water pressure can make some things difficult. Sprinklers don't work as well, showers might only dribble and buckets, sinks or toilets can take a long time to fill up.

HOW WATER PRESSURE WORKS FOR A WATER SUPPLY

A typical set-up for a water supply in a small community has a water source with a pump and a tank for storing water. Water is pumped to the tank through a **rising main** and then flows from the tank by gravity to the water users. Other systems might have treatment systems or extra pumps, but the concept is usually the same.

The pressure of water coming from an elevated tank is affected by a number of things:

- the height of the tank from which the water flows
- the length and size of the pipes that the water has to flow through
- how much water is flowing through a section of pipe (caused by users or leaks).

Taking into account all of these things, a good system design needs to balance **flow** requirements and **pressure** requirements.

ELEVATED STORAGE TANKS

Water pressure is determined by how much energy water has as it is moving through a pipe. In a gravity based system water is given energy by raising the tank above the level of taps and outlets.

The higher the tank is above an outlet, the greater the head. The greater the head, the greater the potential pressure at the outlet. The head given by a raised tank is called the **static head**.

Gravity can pull water flowing from a tank through a pipe very well, but sometimes it is not possible to put a tank up high. There might be no hills nearby or it might be too expensive to get a tall tank stand big enough for your tank.

LENGTH AND SIZE OF PIPES

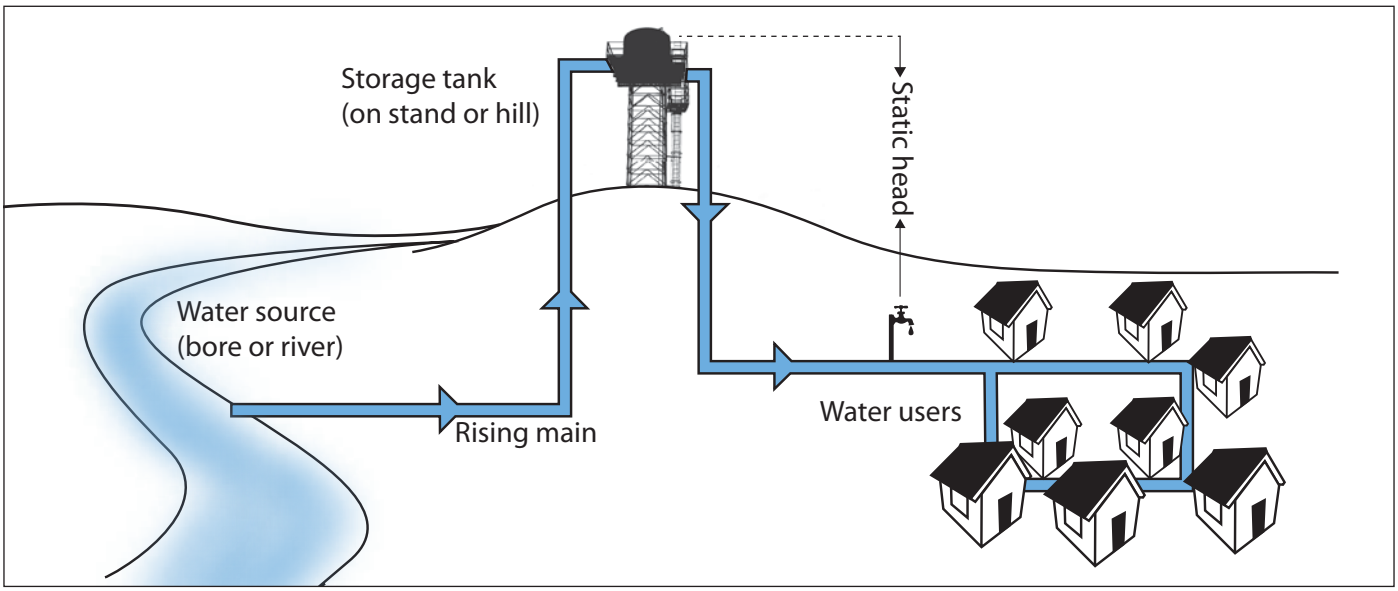
As water flows through the pipes, it loses energy through friction and turbulence against the walls of the pipes and fittings. The flow rate is how fast the water moves through the pipes. The faster water has to move through the pipes, the more energy gets lost. This causes a loss in pressure at the outlet.

If you have ever been in the shower when someone started using hot water in another room, you will know the effect on water pressure that changing the flow rate has.

Loss of pressure in pipes can be reduced by:

- reducing the distance that water has to flow from the storage tank;
- using pipe with a larger diameter (like 50mm pipe instead of 20mm pipe);
- keeping down the number of water outlets on one section of pipe;
- reducing pipe bends.

Where there is hard water, pipes can scale on the inside over time. The scaling makes the pipes narrower and increases the friction in the pipes. Using smooth pipe materials (like plastic pipes) and larger diameter pipes can help in this situation.



The height of a storage tank can have a big impact on water pressure.

SYSTEM DESIGN

A good system design is the best way to save money, avoid problems and materials. This means looking at what you need the supply to do now and what it will need to do in the future. Designing a water supply properly means thinking about:

Population: How many people and houses does the system serve now, and how many people and houses will it have to serve in the future?

Distribution: How to get the water to where people live?

Water use: How much water is used and what is it used for?

Other limitations: Other factors like money or geography might limit where you can put infrastructure or what type of infrastructure you can use.

The storage tank should be located as close to all water users as possible. This means that the length of the water main can be kept as short as possible (keeping pressure higher).

The size of the water main will depend on the population (or future population) of the community. The branches from the main to a house should be at least 25mm (DN25) and only one house should be connected to each branch. Where the pressure is not high to begin with (e.g. the tank is not very high), bigger mains and branches might need to be used.

A guideline for tank height is to try and have tanks sitting at least two metres above the highest outlet (like a solar hot water system) and five metres above the 'most hydraulically disadvantaged outlet'. The 'most hydraulically disadvantaged outlet' could be the furthest point from the storage tank, or on a pipe or main with many other water users.

USEFUL TERMS:

Flow rate: This is the amount of water flowing at a particular point in the supply. It is usually measured as the amount of litres pumped over a particular period of time, like litres per second (L/s).

Static head: How much water is above an outlet. Normally, this is based on how high a storage tank is above an outlet. It is measured in metres (m).

Total dynamic head: How much water seems to be above an outlet. This is the pressure you see. The total dynamic head changes with the amount of water moving through a pipe (flow rate), the size of the pipe and the length of the pipe.

Head loss: The amount of pressure that has been lost to friction and turbulence of the water flowing through a pipe.

A WORD ON PRESSURE PUMPS

Some people use pumps to boost the pressure to the supply. There are some advantages and disadvantages to using pumps to boost water pressure.

Advantages / Disadvantages:

- Can be used with just one or a few outlets (like a sprinkler or a shower);
- They use a lot of energy (usually electricity);
- Supply lots of pressure;
- Don't work with all electricity supplies (some solar systems don't work well with pressure pumps);
- Might be cheaper than replacing the tank stand or water main;
- Can be expensive to buy, install run and maintain.

FINAL NOTE:

Low water pressure is a common problem with small supplies but it is also possible to have pressure that is too high, which can cause pipes or fittings to break or wear out faster. If you think this might be the case you should check with an expert first.

For more information on water pressure and design of reticulation systems see the National Indigenous Infrastructure Guide.

REFERENCE:
National Indigenous Infrastructure Guide, Chapter B1 Water.