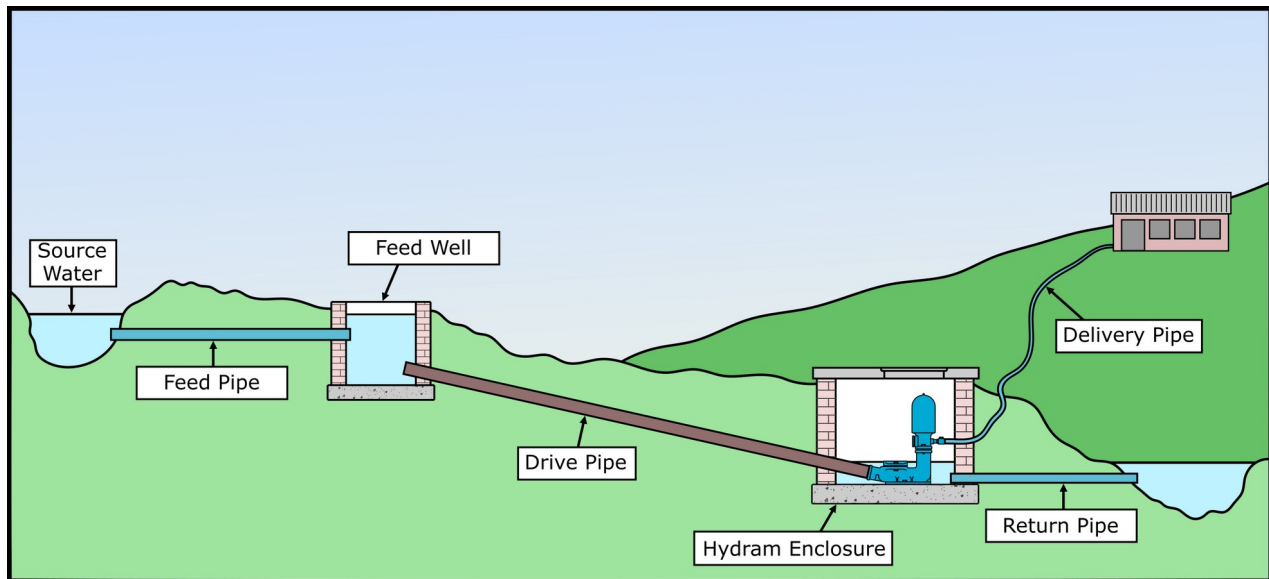




hydraulic ram pumps



A typical hydraulic ram pump system, with water flowing down the drive pipe to the pump, from where it's delivered to higher ground where it's needed.

what are they?

Called 'hydrums' for short, they're self-powered water pumps that can be used to pump water to higher ground for irrigation, watering livestock or human use. The power for pumping comes from the flow of water via gravity to the pump, and doesn't require a generator, electricity or even wind. Hydrums can lift water to ten times the height of the fall to it from the source of water. They operate continuously, 24 hours per day, 7 days per week.

How do they work?

Hydrums turn the potential energy in a head of water into kinetic energy, then re-convert it to potential energy again, in the form of pressure that pushes the water uphill. Above is a diagram of a typical set-up. A feed well contains water from a watercourse, from which there needs to be a fall. Water flows down to the pump via a 'drive pipe' to the hydrum. Very basically, when the falling water reaches a high-enough speed, its drag causes a valve in the pump to snap shut quickly, causing a pressure spike / shock wave that compresses a cushion of air in the air vessel at the top of the pump, which provides a steady pressure release to push the water uphill. Then the pressure falls, the valve opens and water starts to flow through again. When it reaches the right speed, the valve snaps shut and the pump kicks in again, in a continuous cycle.

History

Hydraulic ram pumps date back to the 18th century, with precursors developed in Britain, before one of the Montgolfier brothers (of hot air

balloon fame) invented the first true hydrum in 1796. The original design hasn't really changed very much at all. At around 60-80% efficiency, there's not too much scope for improvement. They've declined in popularity recently because many people would prefer to install cheap, disposable pumps and pay for electricity, rather than invest in a resilient, long-term, sustainable alternative. As with many aspects of society, the focus tends to be on ease and disposability rather than building a long-term asset. We'd like to see a reverse in that way of thinking (before nature steps in to force our hand).

what are the benefits?

- A hydrum is an environmentally-sound solution for water pumping. The main benefit is that they don't require a power source, therefore avoiding the pollution and carbon emissions associated with power generation.
- They're obviously even more beneficial if you don't have mains electricity on site.
- There's a reasonably large capital investment required to install them, but long-term, they provide better value than electric or petrol / diesel pumps in that running costs are minimal; they don't require electricity or fuel to run them, they require less maintenance and they last much, much longer.
- Spare parts are available for very old equipment – it's a technology that hasn't changed much over the decades.
- It's cheaper and easier than digging a borehole and using an electric pump to deliver the water from it.



what can I do?

First make sure your site conditions suit a hydam. There has to be a fall from the original water source, and a way to get the excess water back into the water course. So a steep hill stream is good, and on lower ground, maybe a waterfall or a bend in a river, with a fall to either the same water course or a different one. In some cases, the hydam can be located in a pit to allow an adequate fall, although excess water must be allowed to drain back to the source at a lower level somehow. The minimum fall from the top of the feed well down to the waste pipe from the pump is 1.1 metres. Water can be delivered to much greater heights than the fall to the pump.

Only a small amount of water that arrives at the hydam is pumped (90% is not pumped, and overflows back to the watercourse), but it can chug away 24-7, which means that even a small pump can deliver a few cubic metres of water per day, which will be enough for smallholders with a few animals or a small area of plants to irrigate. It can be used for household supply too if the source is clean – for example a mountain stream. You can use a UV filter if you're going to drink it (although people have been drinking from highland water sources since way before UV filters existed).

Let your local water authority know that you intend to divert some water. There are sometimes grants for installing ram pumps, so it might be a good idea to contact your local authority to check.

Installation: you'll need concrete pads for the feed well (which could be a concrete-lined pit or a large plastic barrel) and to bolt the pump to. The feed well can be at a distance from the source,

and needs a roof to keep out debris (the pump itself doesn't necessarily need a cover).

The drive pipe needs to be rigid, and to have a steady fall, and needs to be around 4-5 times the length of the overall fall. Galvanised steel is the best material, because plastic expands slightly and allows some of the shock wave to dissipate rather than using all the force to drive the water uphill. The delivery pipe can be of any material. It's best to pump the water to a holding tank, from where it can be delivered to where it's required by gravity. The delivery pipe should be fitted with a non-return valve as it leaves the pump, so that it stays full of water if it gets disconnected from the pump for any reason. Manufactured hydrams can pump water to a height of 120 metres over a distance of up to 2 miles.

Build your own: you can build your own hydam, although you're not going to get near the efficiency of a manufactured pump, and won't last anywhere near as long. But they're cheap and easy to build, and you can check that a hydam works well in your location before investing in a manufactured pump. Metal is obviously more robust and will last longer than plastic.

Maintenance: you'll need to change some fittings, such as the rubber valves, maybe every couple of years. One or two other fittings may need to be replaced every 10 years or so. It's not arduous. Easy to take apart – no specialist skills needed.

Make sure there's not too much mud, silt or sand coming down the drive pipe, as it will wear out the pump parts more quickly. Check after the installation, to see if you need to add any pre-filters to the feed pipe. If you're watering animals, you'll need to check the troughs every day to make sure that the pump is still working.



Range of cast iron, manufactured hydrams.

resources

- see lowimpact.org/hydraulic-ram-pumps for more info, products, links & books, including:
- T Jeffrey, *Hydraulic Ram Pumps*
- Simon Watt, *A Manual on the Hydraulic Ram for Pumping Water*
- Paul Hasluck, *Pumps and Hydraulic Rams*
- bit.ly/2S4oTz8 – how to install a hydam
- bit.ly/3hzB95J – how to build your own hydam for watering livestock
- judyofthewoods.net/diy/ram_pump.html – more on home-made ram pumps

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