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USING A MODIFIED HYDRAULIC RAM TO PUMP LIVESTOCK WATER

This Factsheet looks at a unique adaptation of the hydraulic ram pumping principle. Hydraulic ram pumps use the energy in a falling column of water to pump a volume of water to a higher elevation. The *Glockemann Pump* can deliver a volume and lift of water well suited for livestock watering requirements.

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Introduction

Livestock watering pumps are often selected with pump-driving energy as the limiting factor. Remote sites, such as many grazing areas of B.C., usually have few energy options which mean few pump choices.

On sites that have a flowing stream, water can be piped down a grade to power a hydraulic ram pump that will lift water to the chosen location (refer to Factsheet #590.306-7). A unique adaptation of these pumps is the Glockemann Pump.

Glockemann Pump

As with all hydraulic ram pumps, the Glockemann Pump creates a pressure rise in a falling column of water by alternately opening and closing the column to free flow. Each time the water flow is shut off (quickly) a pressure rise is used to pump a small volume of water up to the water trough. The excess water is “wasted” and returns to the watercourse.

Typically, the Glockemann Pump is installed at, or very near the edge of, the watercourse into which this “waste” or drive water empties (refer to Figures 1 and 5). The pumped water is separate water drawn up from the watercourse. The pump may also be installed remote from the watercourse, in which case it pumps part of the drive water (hydraulic rams typically pump part of their drive water) and the “waste” water channeled back to the stream.

The Glockemann has the ability to pump with only a small “head” (elevation fall) of drive water to the pump. For example, with a drive head of only 0.6 m (2 ft) it will pump 6,450 litres (1,700 US gal) a day up 10 m (33 ft) with a drive supply of 4 L/s (63 USgpm) using a 100 mm (4 in) drive pipe.

Another feature is the high lift possible. With 1.6 m (5.2 ft) drive head, it will pump 2350 litres (620 US gal) up 200 m (650 ft) with 5 L/s (80 USgpm) using a 150 mm (6 in) drive pipe. This is done by changing the cylinder bore and piston size (diameters available from 35mm to 124mm for various volumes and lifts). Contact the supplier regarding high lifts for specific installation requirements.

The Glockemann Pump is available in two sizes:

- the **320 Oasis** (as noted above): 50cm x 50cm x 78cm; 55kg
- the smaller **160 Water Dragon**: 26cm x 26cm x 72cm; 10kg

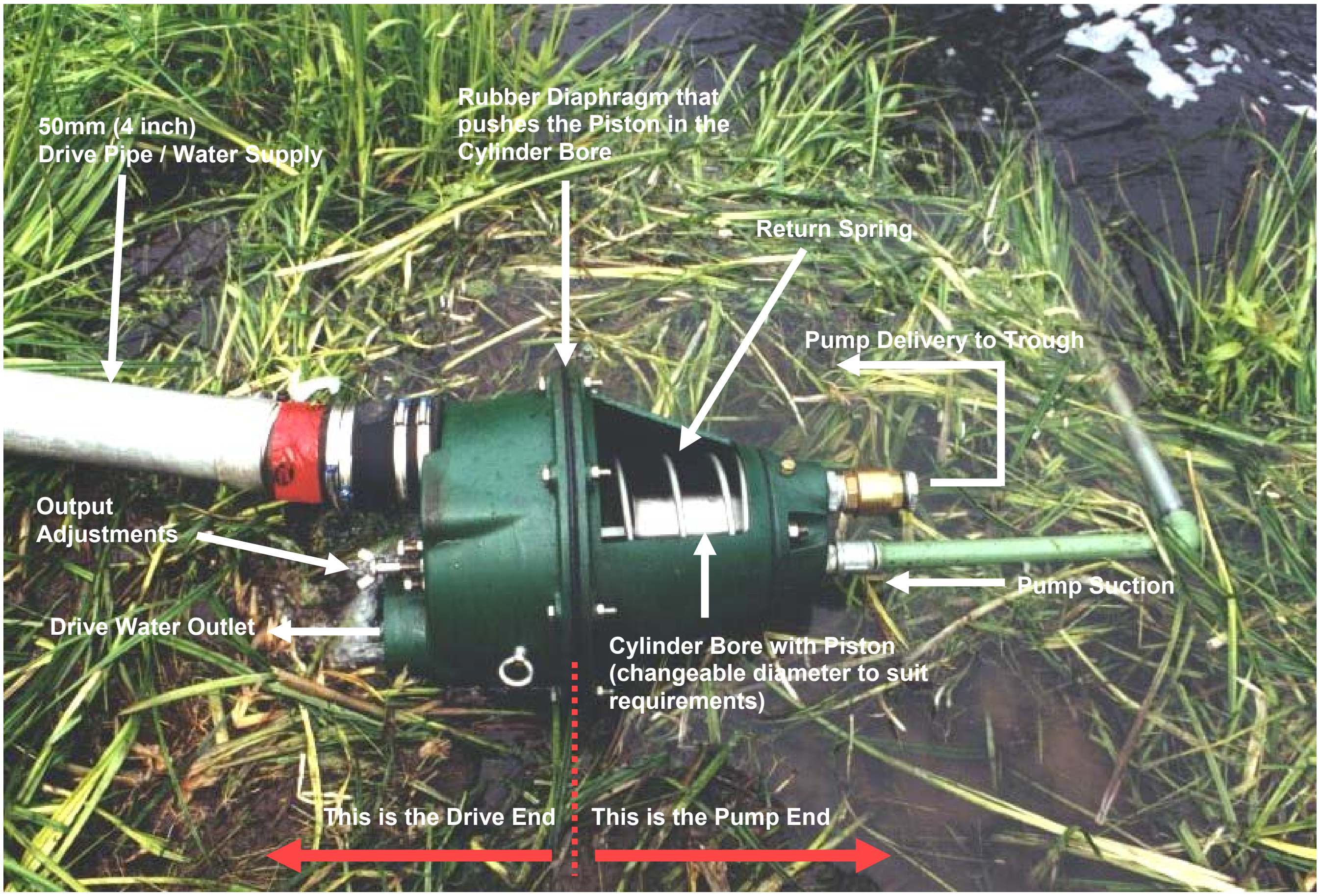

Figure 1 **Glockemann 320 Oasis Pump Installed Along Watercourse** (delivery line not shown)

Site Requirements

All pumps have particular installation requirements. For the *Glockemann Pump* they fall into two categories; the stream and the drive pipe.

To drive the pump, the stream:

- must have sufficient water volume
- must have sufficient fall over a 'reasonable' distance (to reduce complexity & cost)

Typical streams at a low gradient, say 1% (1m per 100m), will require significant water delivery line piping to place the pump at the required fall below the water intake (refer to Figure 5). Preferred sites have the fall in as short a distance as possible (i.e., close to the required drive pipe length).

To drive the pump, the drive pipe:

- must have the correct fall to the pump
- have a length in a certain proportion to this fall
- and be sized to match the pump (the *Oasis* requires either 100mm or 150mm pipe; the *Water Dragon* requires either 50mm or 62mm pipe)

Pump Operation

Drive pipe requirements are important to achieve the correct water flow and pressure conditions to power the pump (as required by all hydraulic rams).

The *Glockemann Pump* operation is shown in Figures 2, 3 and 4. Contact the supplier for more detailed setup and operational information (refer to page 4).

HOW IT WORKS

The Glockemann pump has three phases in its operations:

Due to gravity, water flows down the **drive tube**, through the **diaphragm chamber** and out the **exhaust valve**. The water speed increases as it moves down the drive tube, and after about two seconds the flow builds up enough force to trigger the exhaust valve to slam shut, just like a door slamming shut in the wind.

CHARGING STAGE

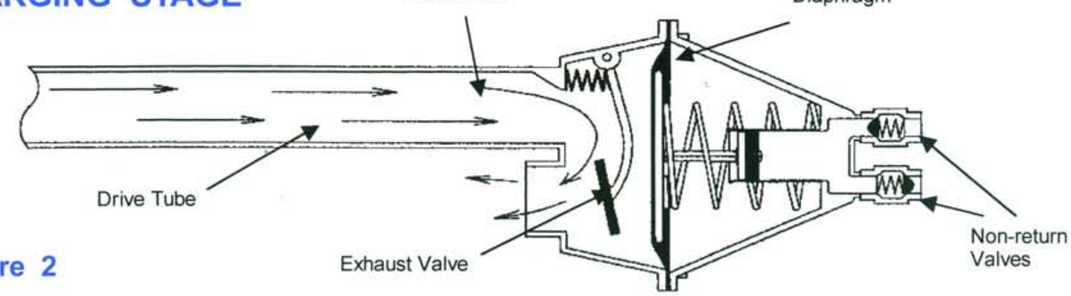

Figure 2

With the exhaust valve shut all the water in the drive tube comes to a sudden stop. This results in an expansion of the diaphragm, which causes the **piston** to move forward in the **cylinder** or 'bore', forcing water through a **non-return valve** & up the **delivery pipe.**.

PUSH STROKE

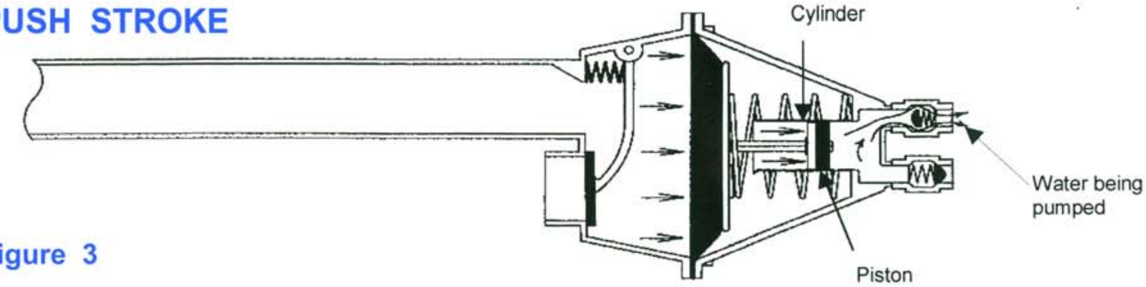

Figure 3

At the end of this stroke the water in the drive tube has used up its momentum, & as a result the pressure in the diaphragm chamber drops. This allows the exhaust valve to spring open. With the exhaust valve open the **return spring** pushes back the diaphragm resulting in the **return stroke**. This causes the piston to pull back in the cylinder and draw water through another non-return valve into the cylinder.

RETURN STROKE

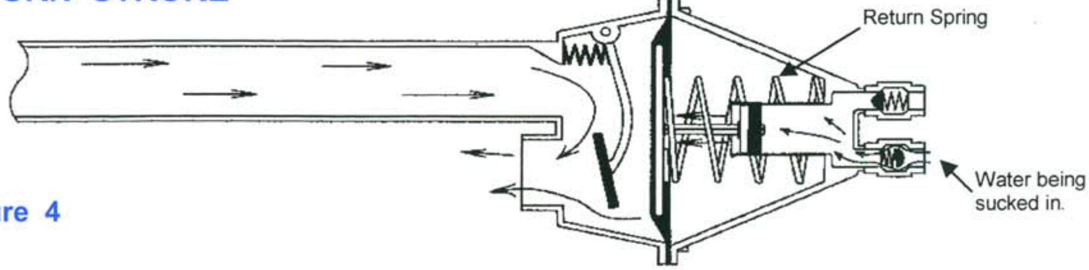

Figure 4

From: The Glockemann Water Powered Water Pump Installation Guide

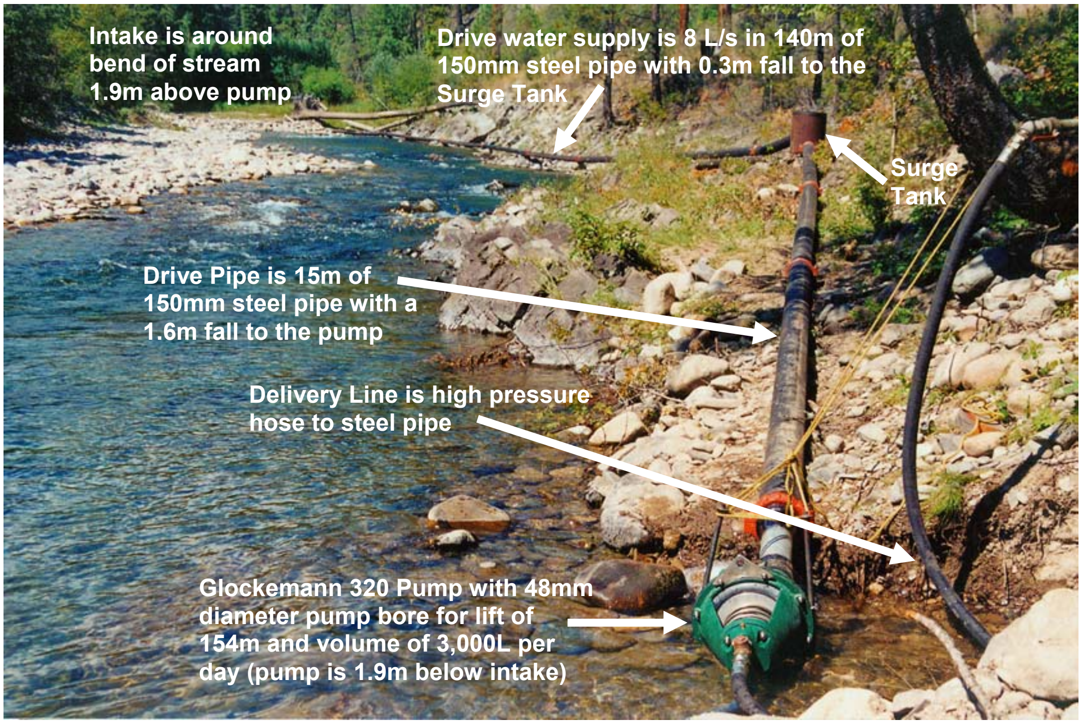

Figure 5 **Site Installation Along a River Pumping Up 154m to Water Troughs**

Pump Setup

This site is along a river with a low gradient (1.25%) that required 155m of supply and drive pipe for the required 1.9m total fall (0.3m supply pipe friction loss plus 1.6m pump drive requirement). The drive water is piped to a surge tank; from there the drive pipe goes to the pump. When using long supply lines, a surge tank allows proper drive pipe length and fall. Drive water exits to the river. Refer to Figures 5 and 6.

The pump intake is in the river with the delivery line running up the hill 475m with 154m lift (high pressure hose & steel pipe). Water is delivered to two, 1,200L water troughs. A 3,000L gravity storage tank is at the top end of the system to allow quick trough filling as livestock use the water. At this site the pump delivers about 3,000L per day, sufficient to water 60 to 75 cows.

* supply pipe must be sized for friction loss

Figure 6 **Surge Tank Setup**

Pump Supplier

Canuk Sales, 877-748-3048, or at www.canuksales.com

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