Hydro Vortex Drop Shaft Selection Criteria

Shajie Khan, 07 July 2020

Hydro International®

Agenda

- Introduction
- Why do we use drop shafts?
- Selection Criteria
- Practices to avoid.

Shajie Khan

Applications Engineer

skhan@hydro-int.com

Hydro International ®

Objective

Hydro International

Safely convey a varying quantity of water from a high level to a low level along a desired path.

Typical power dissipation range: 0.01 MW – 10 MW

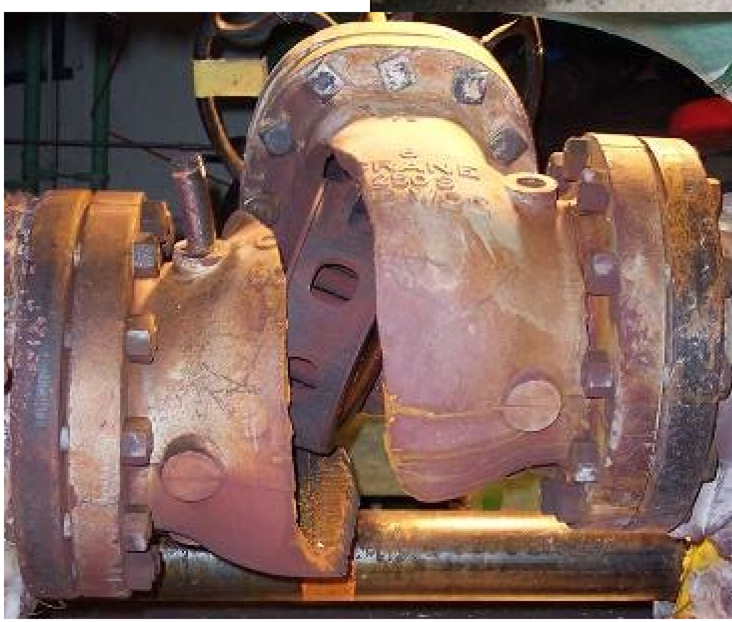
$$P = q\rho g h$$

- Hazards:

Erosion   Hydraulic shocks   Cavitation   Vibration

Hydraulic Shock (Water Hammer)

- Entrainment of air or rapid change in flow-rate

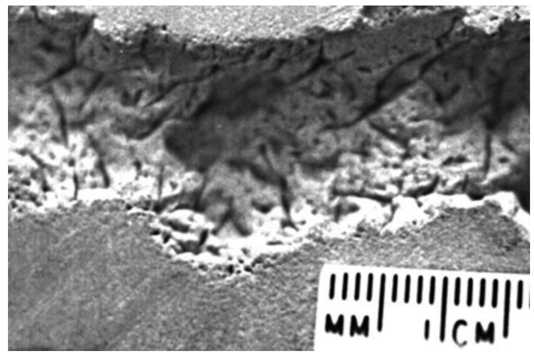


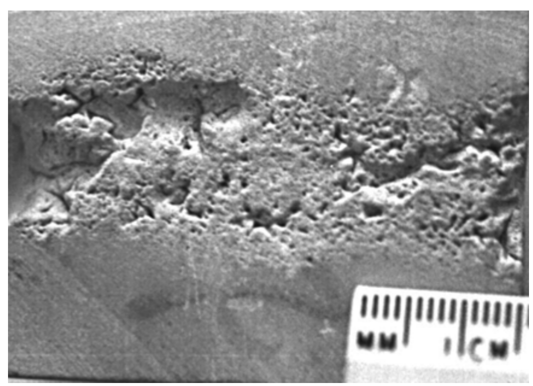
Hydraulic Shock (Water Hammer)

- Entrainment of air or rapid change in flow-rate

Cavitation

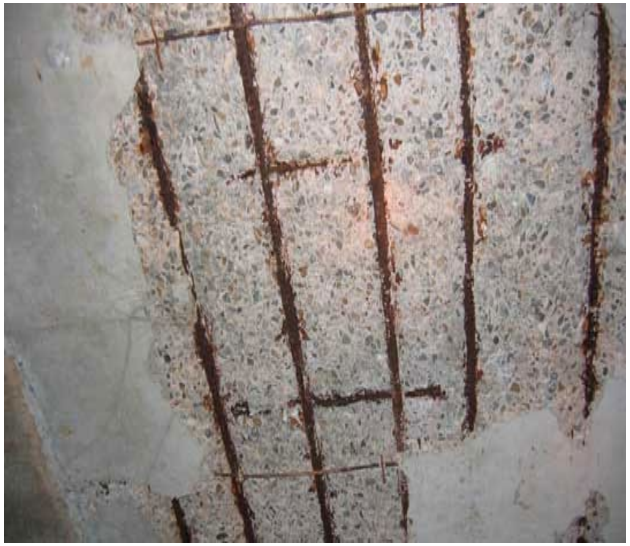
- Formation and collapse of water vapour bubbles





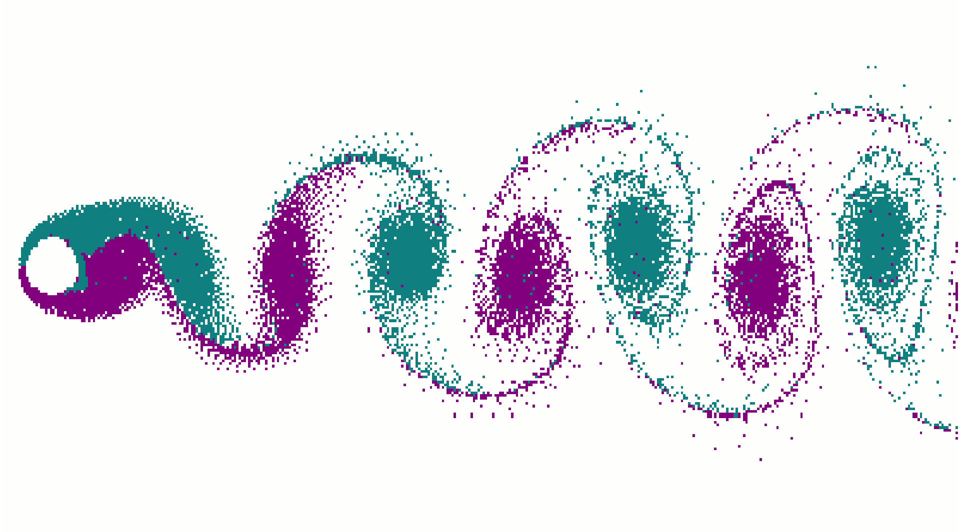
Erosion

- Thrust and shear force of water
- Impact of objects in flow



Vibration & Noise

- Vortex shedding + previous hazards

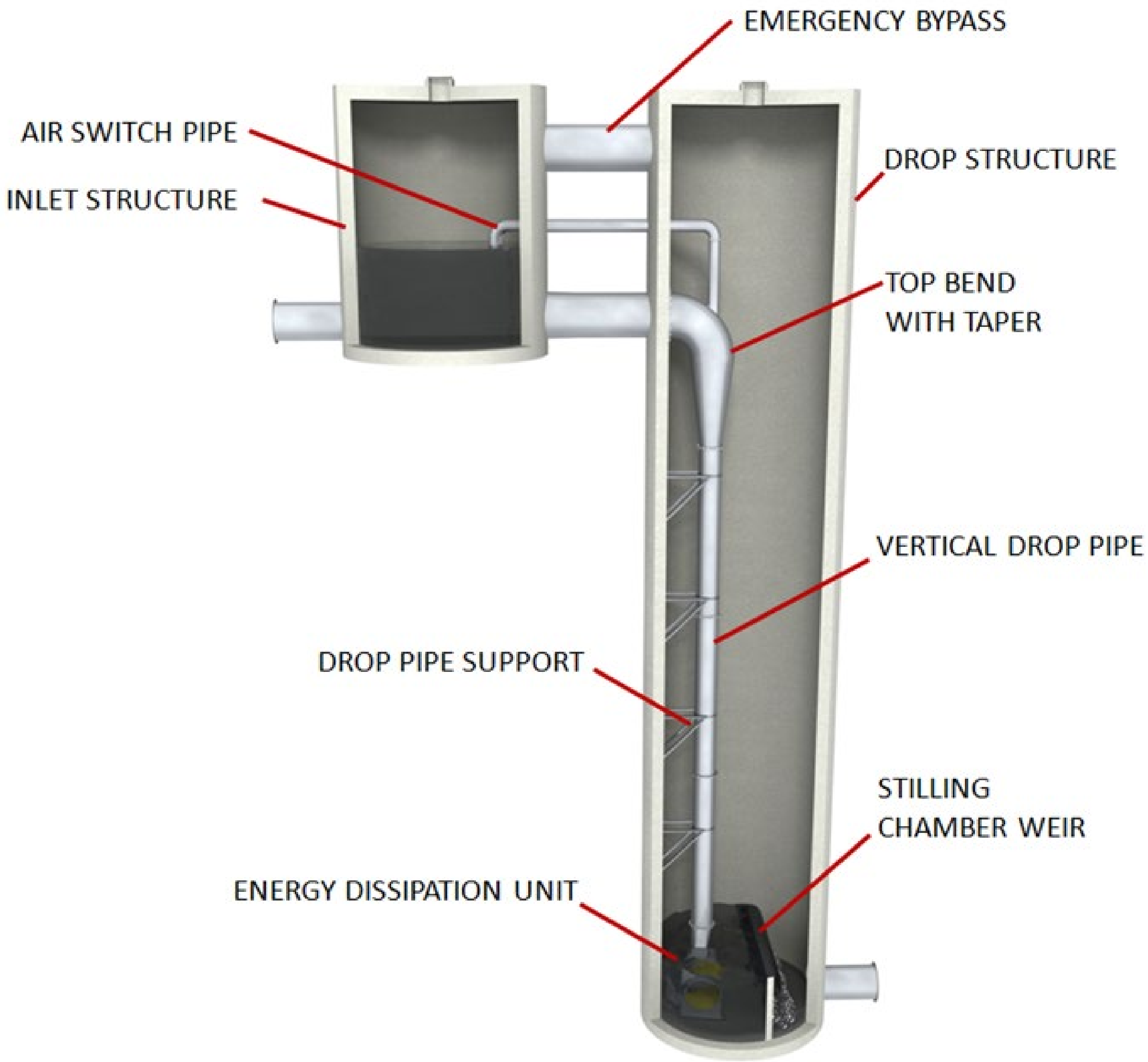


Hydro Vortex Drop Shaft

Hydro Vortex Drop Shaft

- ✓ Significant cost savings on construction
- ✓ Smaller footprint & pipe sizes
- ✓ Erosion, corrosion & odour control
- ✓ Reduction of noise and vibration at high flow rates
- ✓ No maintenance
- ✓ Versatile design with simple construction and installation

Hydro Vortex Drop Shaft Components



Integrated Inlet Design

Selection Criteria

Hydro International®

"Vortex shall be required only if the drop pipe is greater than 600mm diameter and the drop depth is greater than 6.0m"

- *6 m drop height*
- *600 mm pipe (equivalent flow 0.75 m^3/s)*

$$P = q\rho g h$$

Power at 6m drop

- Consider $Q = 0.75\ m^3/s$

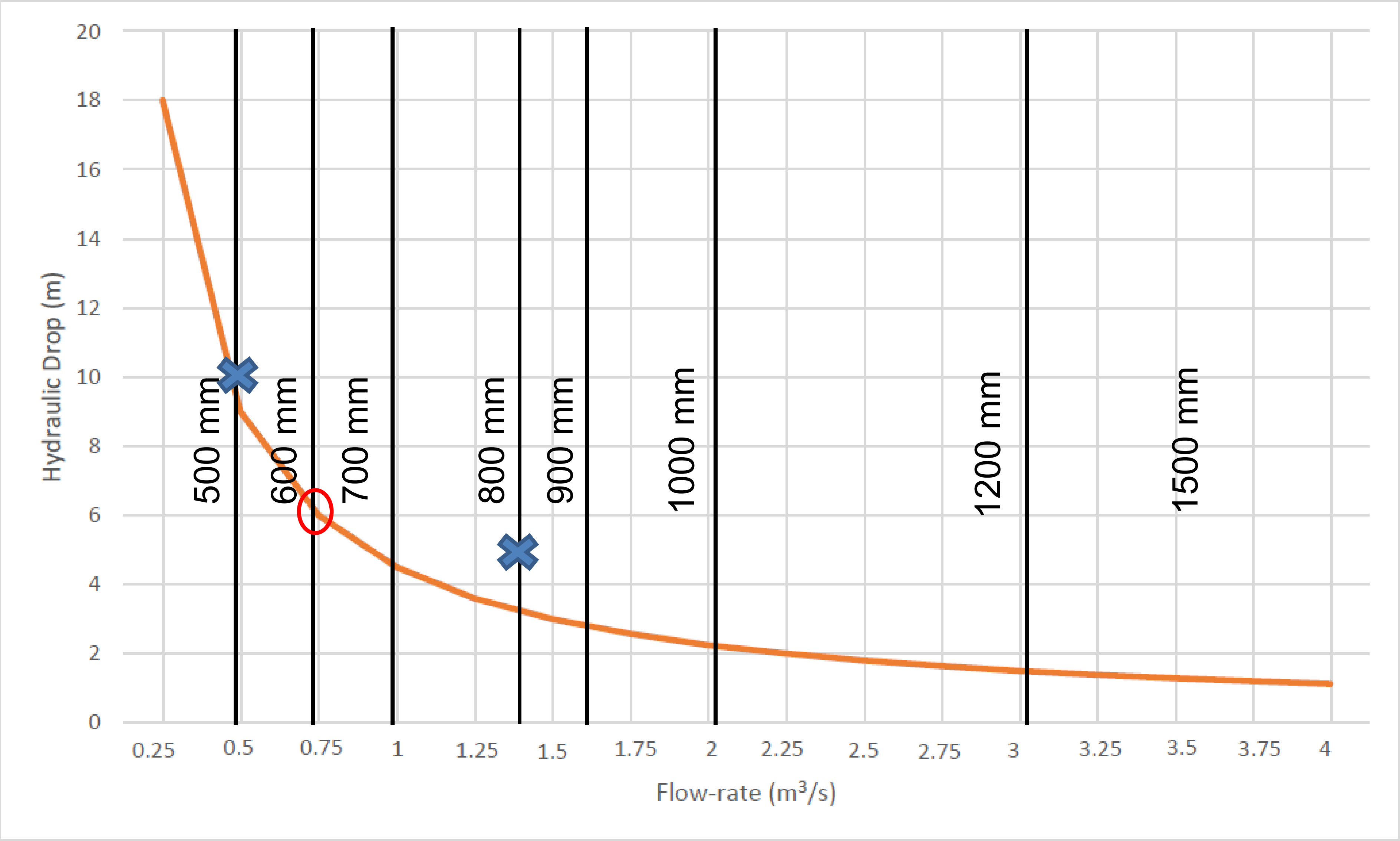
- $P = q\rho gh$

  $= (0.75)(1000)(9.8)(6)$

  $= 44{,}145\ W$

  $= 44.14\ kW$

Selection Criteria



Practices to Avoid

The vortex drop pipe is usually smaller than the incoming pipe as it operates at a full mode. Can we look at the drop pipe size and decide that vortex drop shafts are not required?

- Consider the incoming pipe size – Not the drop shaft pipe diameter.

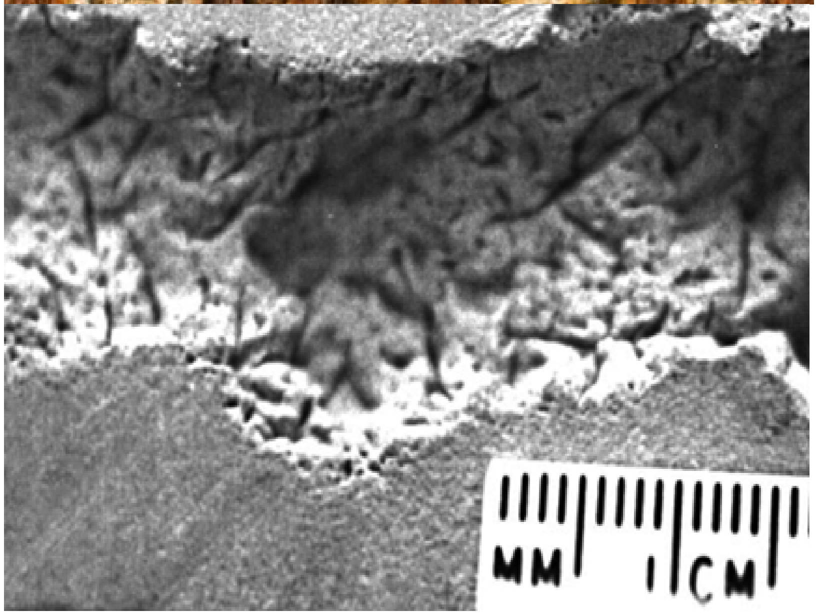
- The drop shaft diameter will always be smaller.

Practices to avoid

Hydro International

What is the risk in sloping the incoming pipe to make the drop depth less than 6.0m and eliminating the vortex drop shaft?

- Increased velocity
- Causes cavitation when velocity increases above 6 m/s.
- Cascading causes increased cost
  - Deeper trench
  - Multiple drop chambers
  - Increased maintenance



Summary

- Power Dissipation should be selection criteria
- Incoming pipe size is not necessarily equal to drop shaft pipe size.
- Cascading is not cost effective and does not reduce risks that a drop shaft can eliminate.

Thank you.

Shajie Khan, skhan@hydro-int.com

Hydro International ®