

# BACKFLOW PREVENTION DEVICES IN BRISBANE

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Sustainable Engineering Society 19<sup>th</sup> February 2013

No amount of backflow prevention devices will stop this, unless a massive levee is built around the area.

Recycling plant with Thiess Goodna STP site offices in foreground  
January 2011

Stick or snake – hard to tell



# Notice the weather

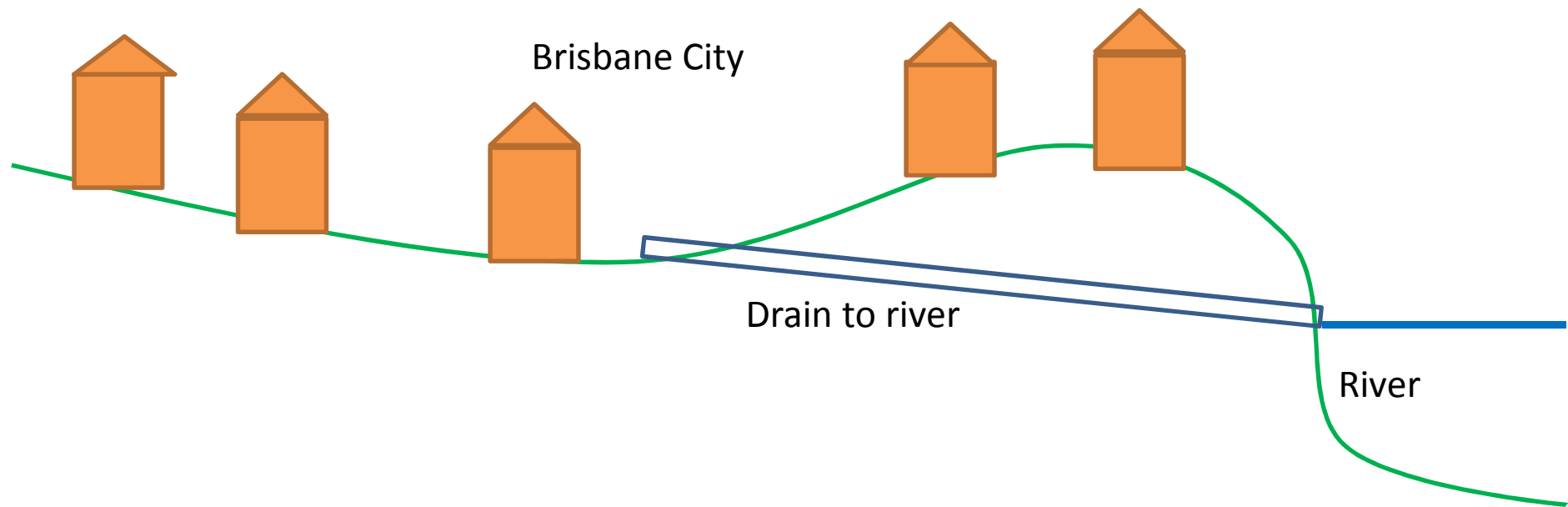


Bundamba Sewage Treatment Plant January 2011



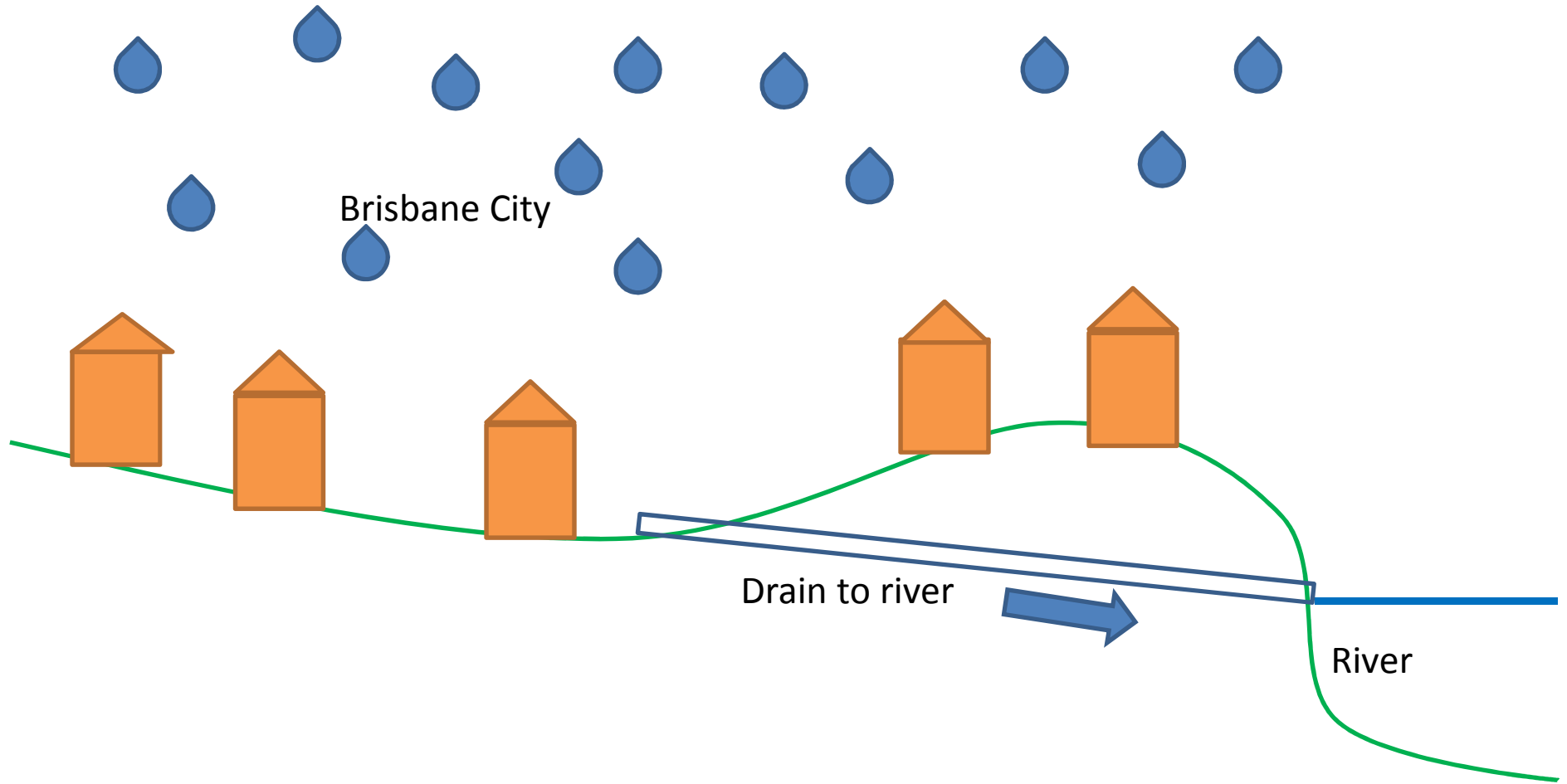
# As it was built

– some of it not last century but the one before

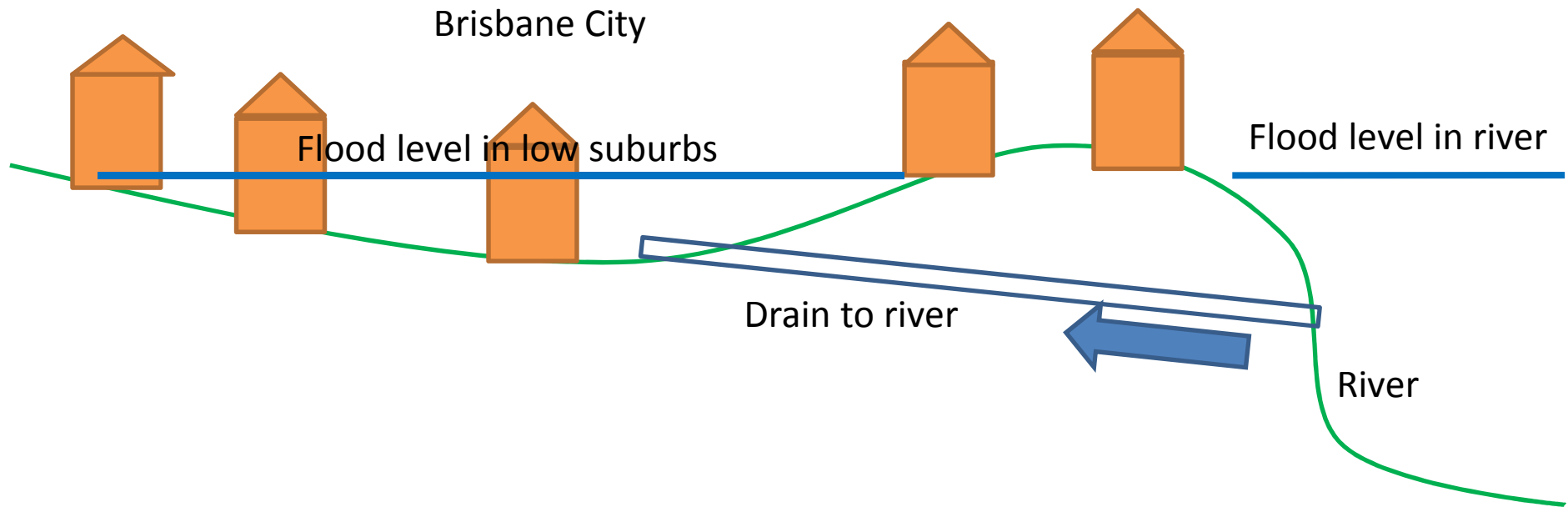




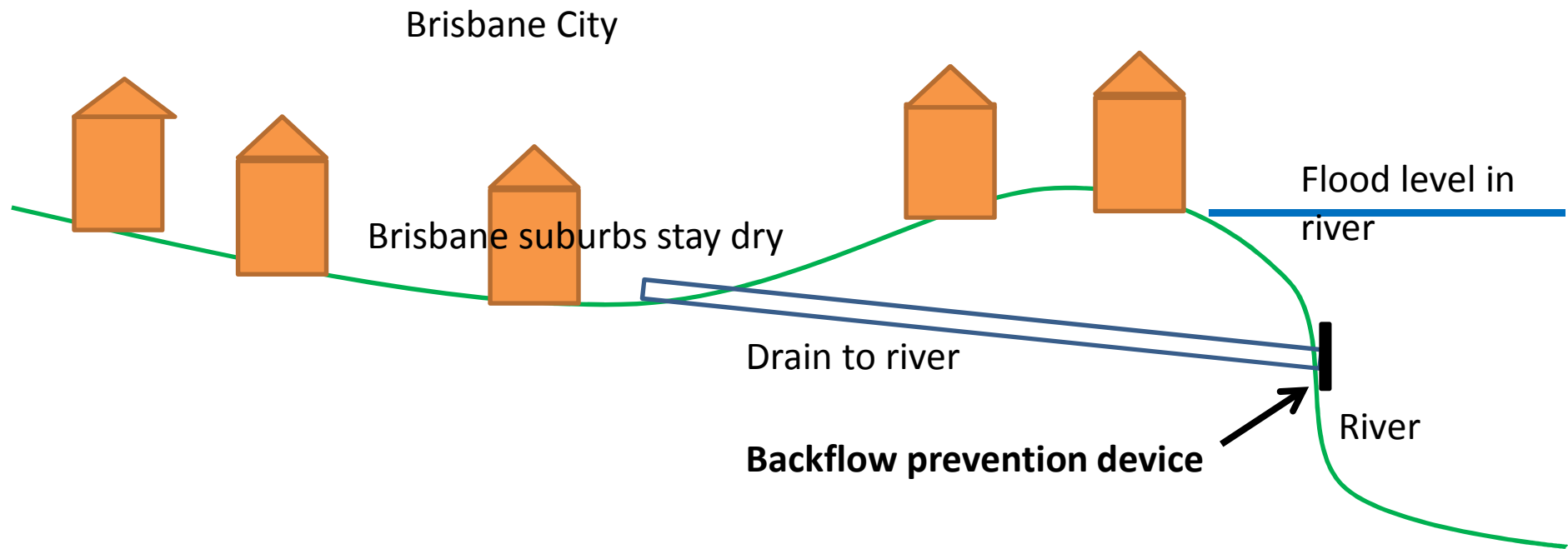
# The rain gets away



# But floods...



# So fit a device – not rocket science





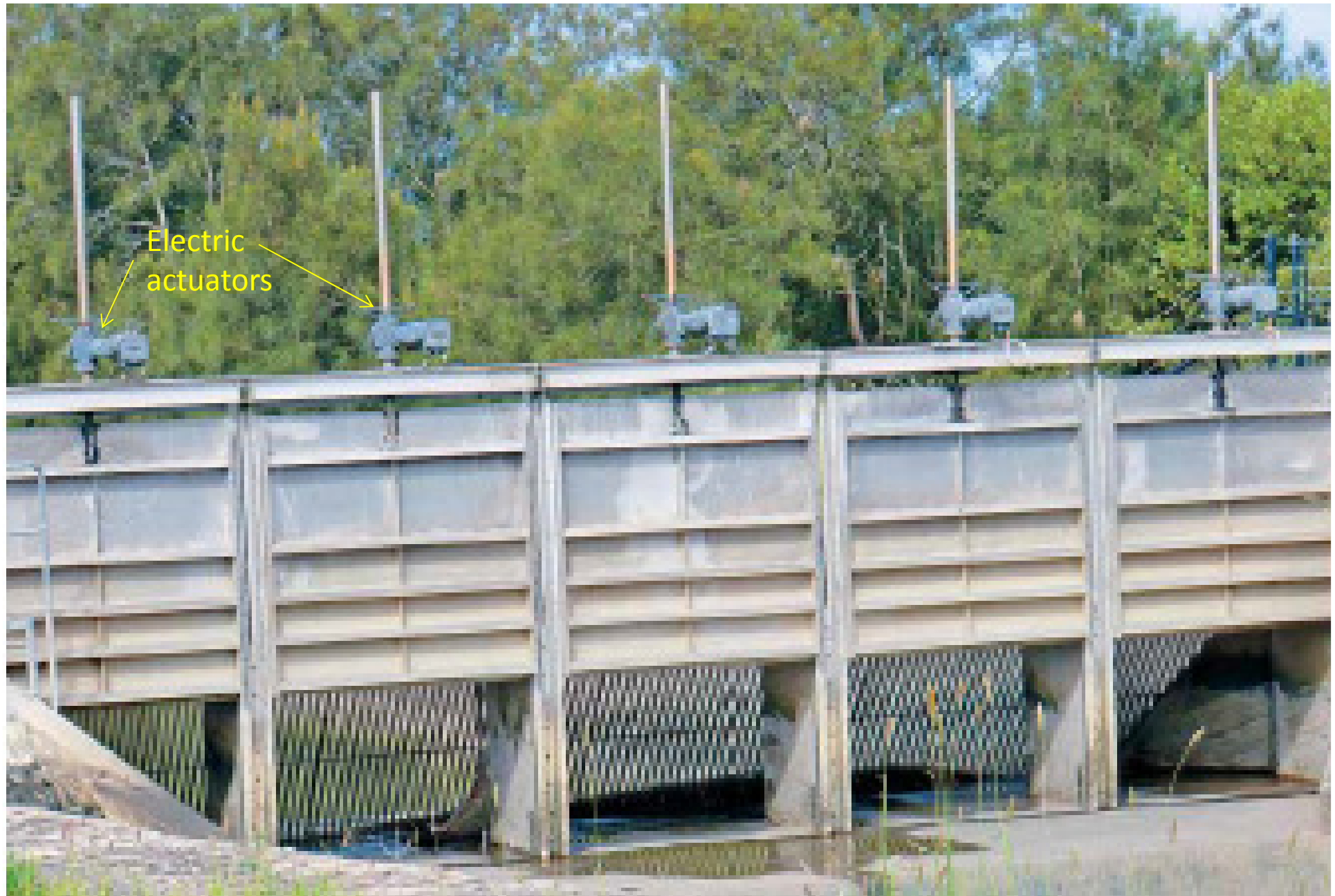
# Types of devices as requested by Brisbane City Council

- Penstocks
- Flapgates
- Duckbill Valves

A penstock needs something or someone to operate it

Flapgates and duckbills close from the water pressure allowing flow in only one direction

# Port of Brisbane – installed 1997



One job. Except for five on the left, all are different. Different seals, different construction, some rising stem, some non-rising.





Again, all different

Gussets for off seating



AWE Model ZW  
(Zero weld)





Wedge  
type  
penstock





Ready to  
leave the  
workshop  
after cycle  
testing

Thrust tube  
type

Instead of full  
frame

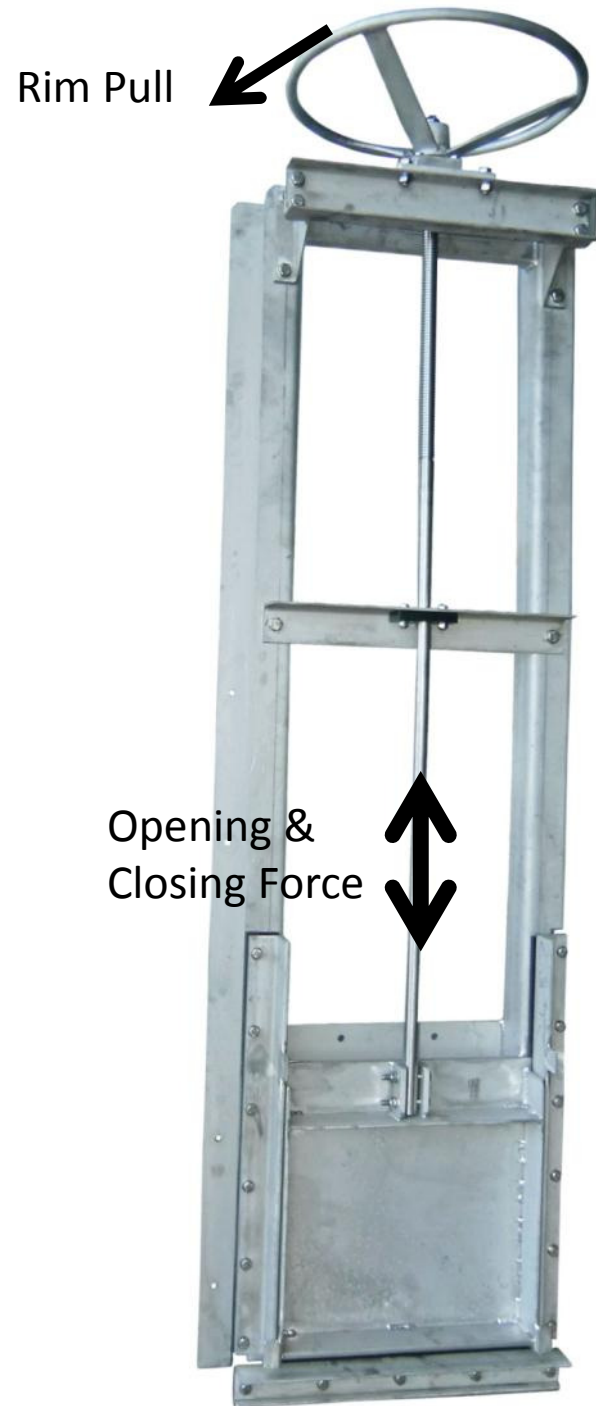


Penstocks vary – a lot

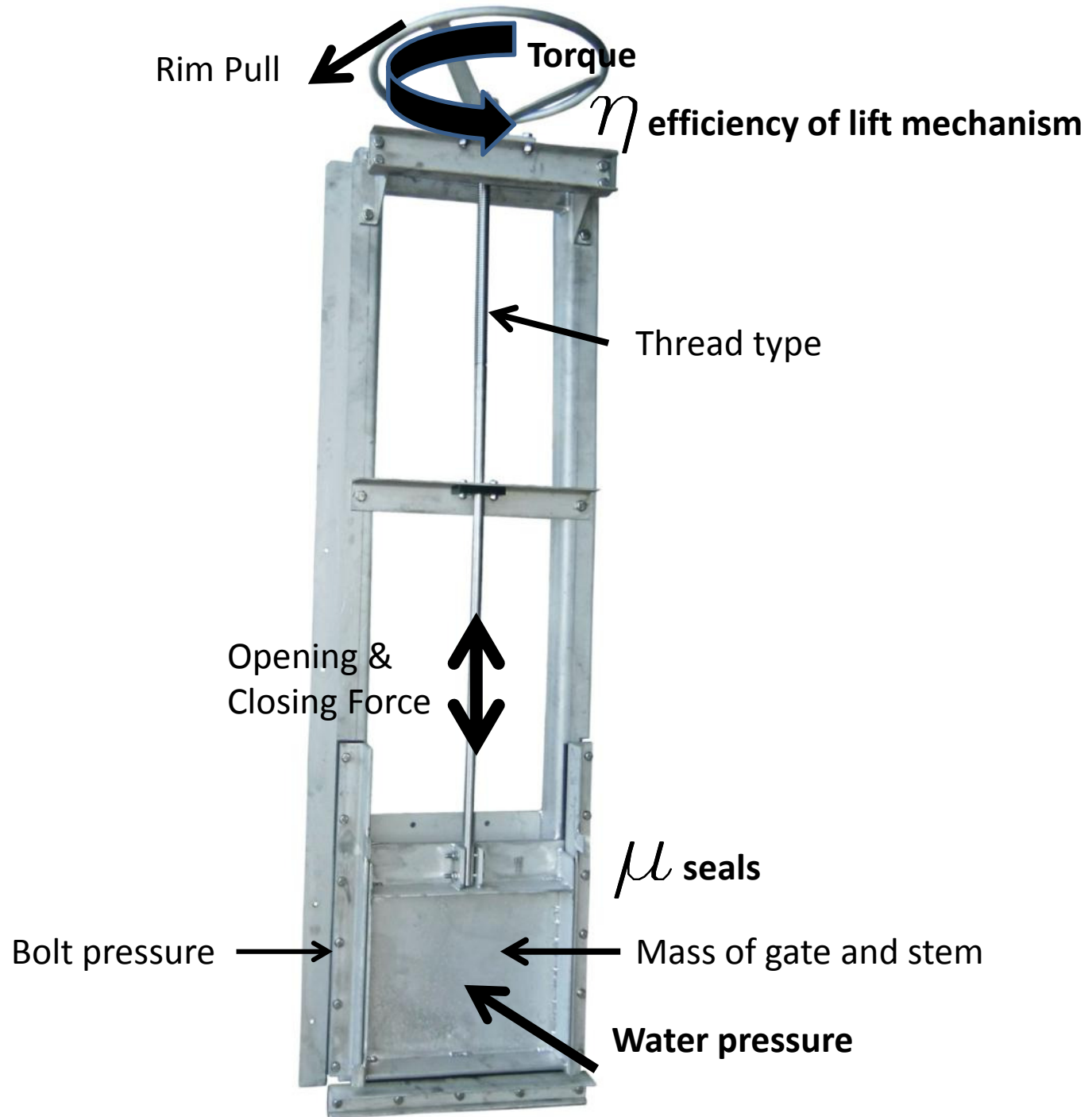
They come in many different shapes and sizes and are custom made to suit a given situation

Most people have no idea how difficult they are to make so that they work well and last many decades





What we want  
to know

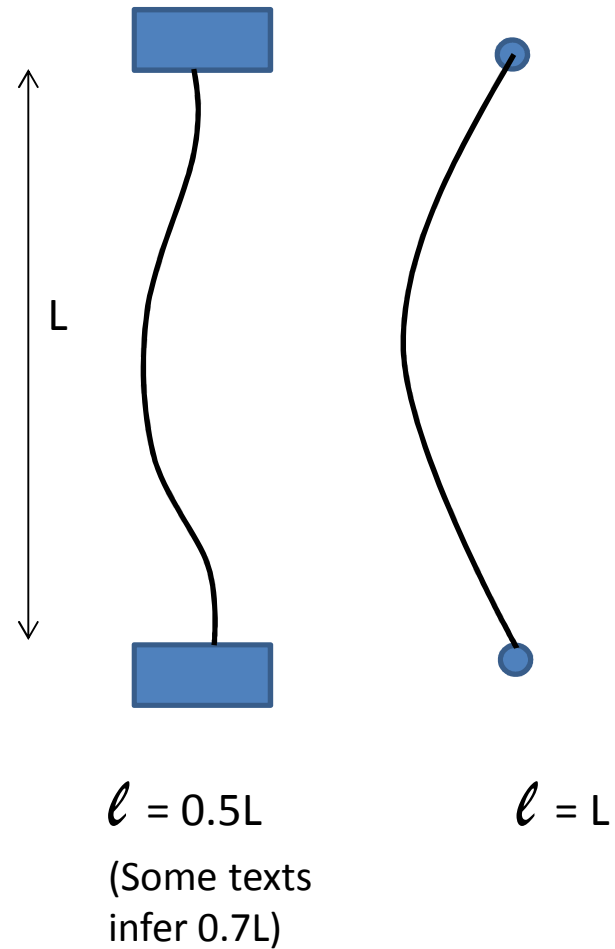
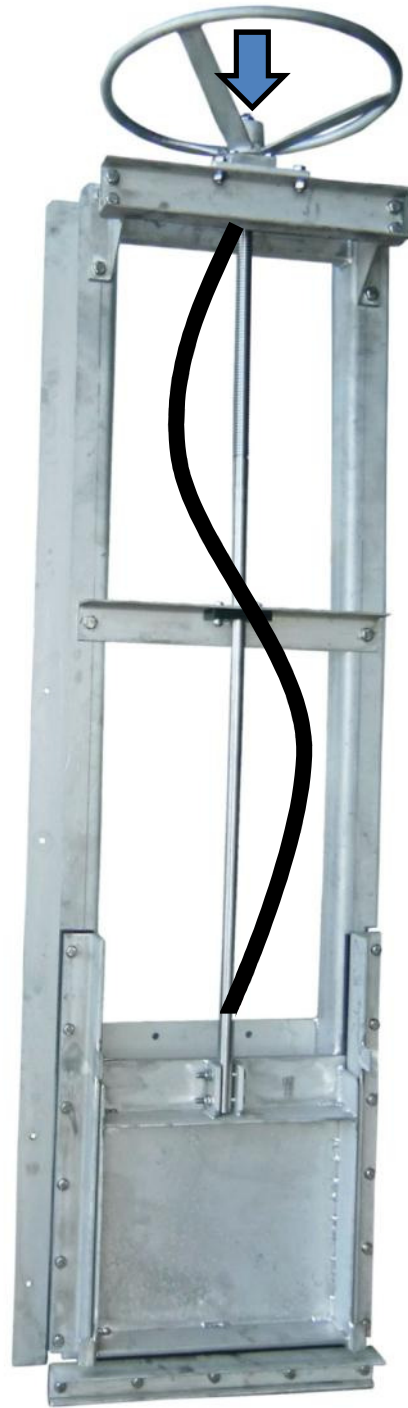


Slenderness ratio  $\ell/r$

$\ell$  = effective length

$r$  = radius of gyration

$$= \sqrt{I/A}$$



Probably settle for  $\ell = 0.85L$

For a solid cylinder,  $r = D/4$

# Euler: he is so important

Allowable stress in a slender column

$$\sigma = F/A = \pi^2 E / (L/r)^2$$

So the critical things are:

1. Slenderness ratio, which is at the root of the thread
2. Young's modulus (316ss pretty much the same as mild steel at  $2 \times 10^5$  MPa)

But flap gates are simple

Yeah right, in their most basic form yes,  
but there is still a lot to know to make  
them work well over a long period



There are many hundreds of drains and flap gates on our coastal rivers





Dual hinged  
flapgate

Water  
dribbles out  
without  
causing any  
ponding back  
up the drain





# Carrington NSW Flap gates installed after duckbills removed

Debris

Note

Hinge point



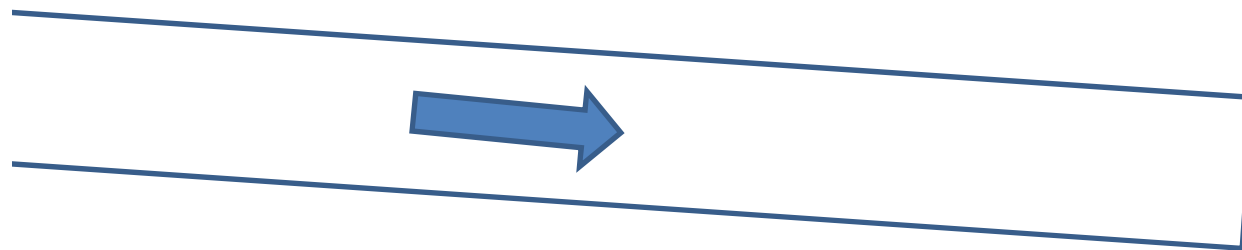




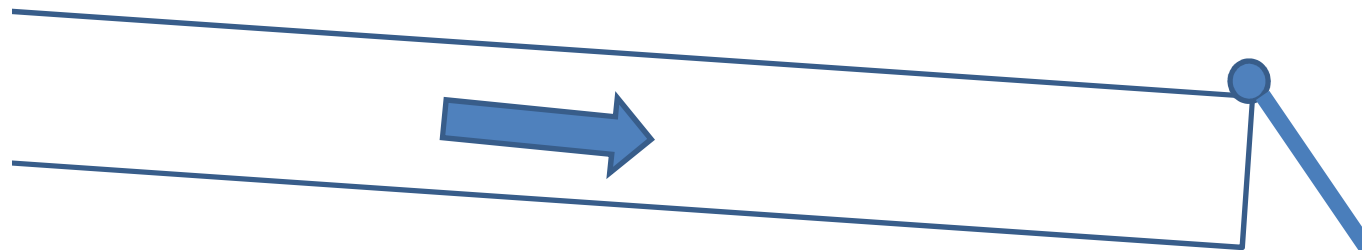
Single hinge point

Note

# Headloss



As water exits from the pipe the headloss is  $v^2/2g$



Add a flap gate and this roughly doubles

The factor is dependent on pipe size and velocity and varies a lot

Aluminium flapgate 900dia, 1m/s velocity:

Headloss = 60mm

This is much less than the order of accuracy for any hydraulic calculations



From a nominal website chosen with Google

Not the brand used by BCC

**RHINOFLEX**

Duckbill Check Valves

### **RUBBER DUCKBILL CHECK VALVE**

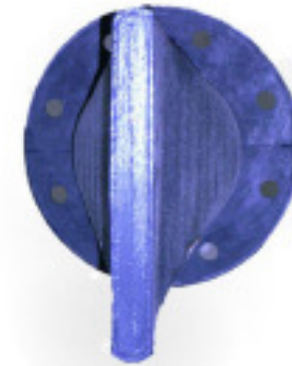
**RHINOFLEX** offers a variety of **Rubber Duckbill Check Valves**, and **Inline Rubber Check Valves** that are an exceptionally reliable and cost effective method to control back pressures in sewage treatment plants. These valves are fully passive flow devices, which require absolutely no maintenance whatsoever, no source of power or manual operating assistance, and are an excellent alternative to conventional flap-gate valves and other check valves. The flexible Rubber Duckbill Valve is normally closed but will open with the very minimum of head pressure and always providing maximum flow with minimal pressure drop across the valve. Conventional Flap-Gate Check valves, and other check valves are mechanical and have metal components that are commonly know to malfunction, rust, and seize. Rubber Duckbill Check Valves will even handle large obstructions without jamming or binding, and guarantee trouble free back flow prevention, and can even seal around trapped or suspended solids with minimum back pressure. The finest of engineering elastomers are used, and the outer layers, are designed to repel marine organisms.

#### **Features:**

Full rubber construction, totally wear resistant to abrasives  
No water hammer and noise, prevents back flow.  
Absolutely "NO" energy, actuation, energy costs and maintenance. Valve will not deform or freeze.  
Extremely easily exchangeable with other check valves.  
Designed to suit all diameters, and pressure ratings.  
Flanged type and Slip On Type available

#### **Typical Applications:**

\* Storm water outfall \* Sewer Interceptor Check Valve  
\* Flood control systems \* CSO / SSO / Effluent Discharge  
\* Pumping stations / Wet wells \* Submerged Outfall Diffuser Nozzles





# RHINOFLEX

## Available Elastomers

Note that it is not simple.

There is also protection against marine growth to consider as well as the materials listed here

**PGR:** Pure Gum Natural Rubber has excellent abrasion resistance and flexibility

**SBR:** Styrene Butadiene Rubber for general purpose use

**CR:** Chloroprene Rubber – Neoprene resists a wide range of moderate chemicals and inhibits growth of marine organisms

**EPDM:** Ethylene Propylene Rubber is used for water service and is also available in food grade

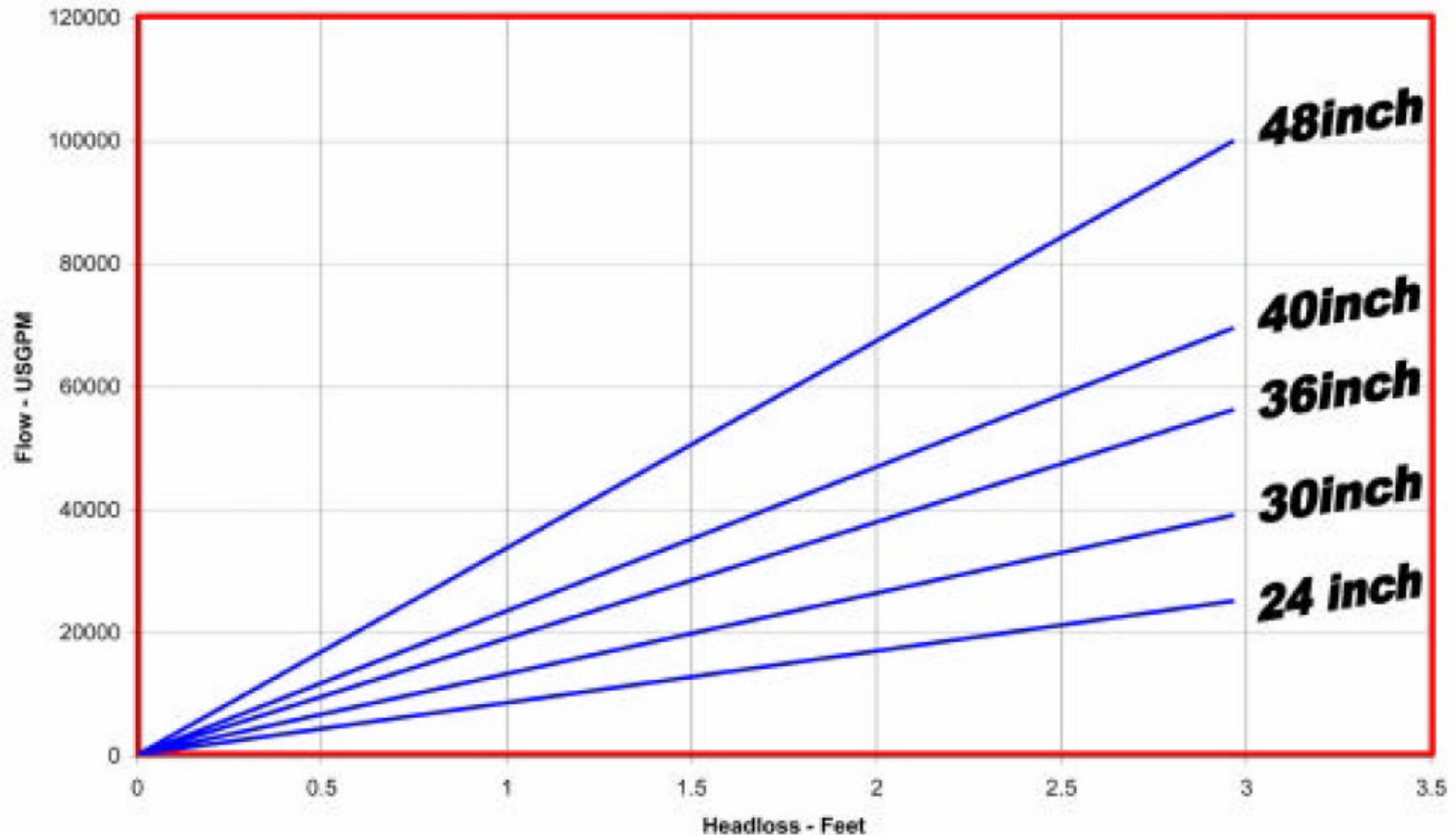
**CSM:** Chlorosulphonated Polyethylene – Hypalon provides excellent resistance to a wide range of strong chemicals and oxidizing agents, ozone, weathering, heat and sunlight

**NBR:** Nitrile Butadiene Rubber- Buna-N is used for resistance to fuels, oils, grease and other hydrocarbons

**CIIR:** Chlorobutyl Rubber – Butyl resists oxidizing chemicals, organic oils and greases and heat

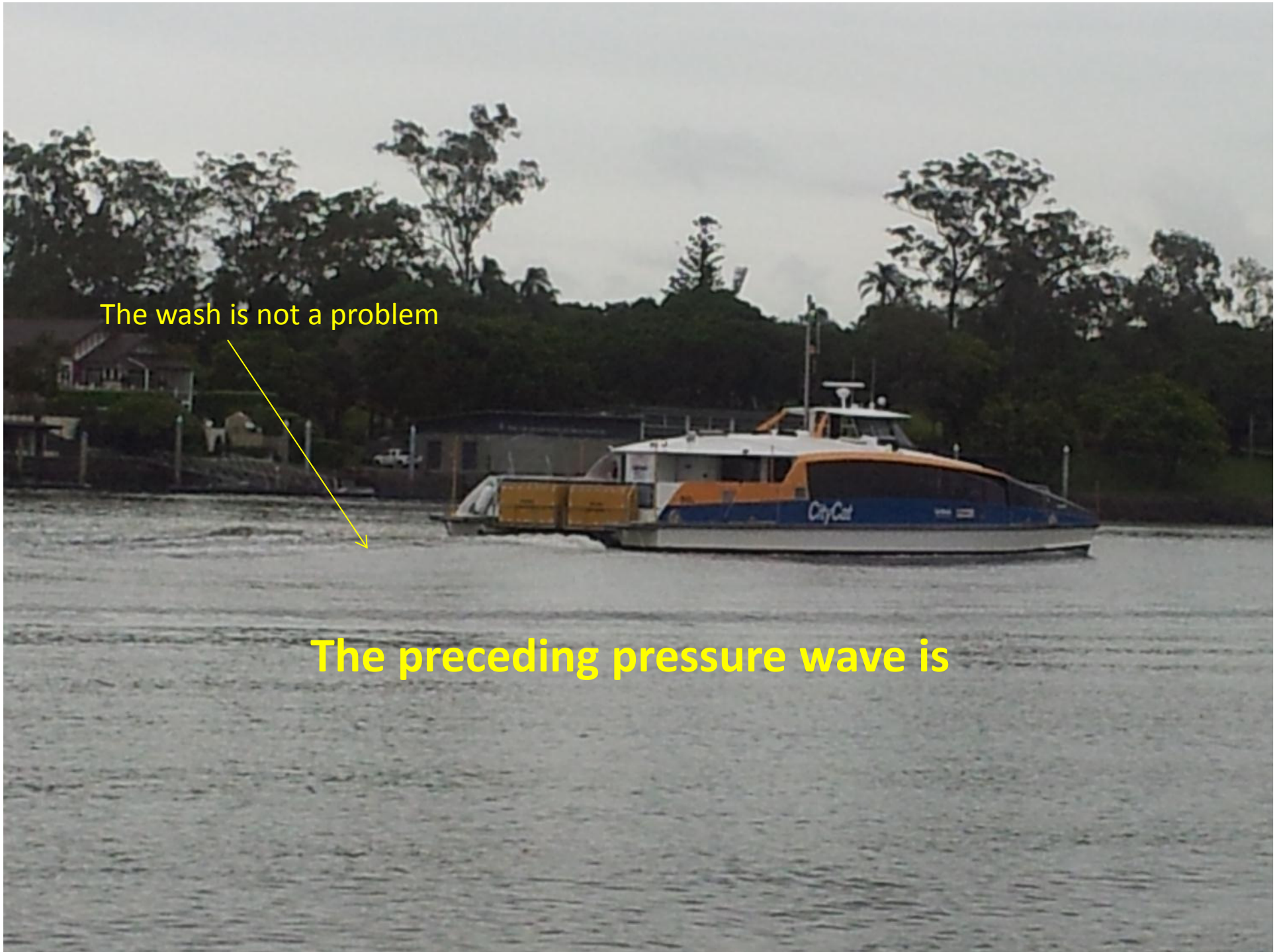
More information given on the web site.  
900mm 0.5m/s Head loss is about 800mm

Examples for Series RFL / RFS Duckbill Check Valves



Head loss is much greater than a flap gate  
but that is not the whole story





The wash is not a problem

The preceding pressure wave is





**Here it comes**



**Second one arriving**



Duckbills are better in this situation, provided the extra head loss is not a problem

But a humble flapgate can be made to cope with the waves from the CityCats





Sand is  
also a  
problem





Duckbills  
don't seem  
to fare  
much better





# A new duckbill at New Farm





Climb  
down  
and  
have  
a  
look



Looks  
to  
be  
working

But.....





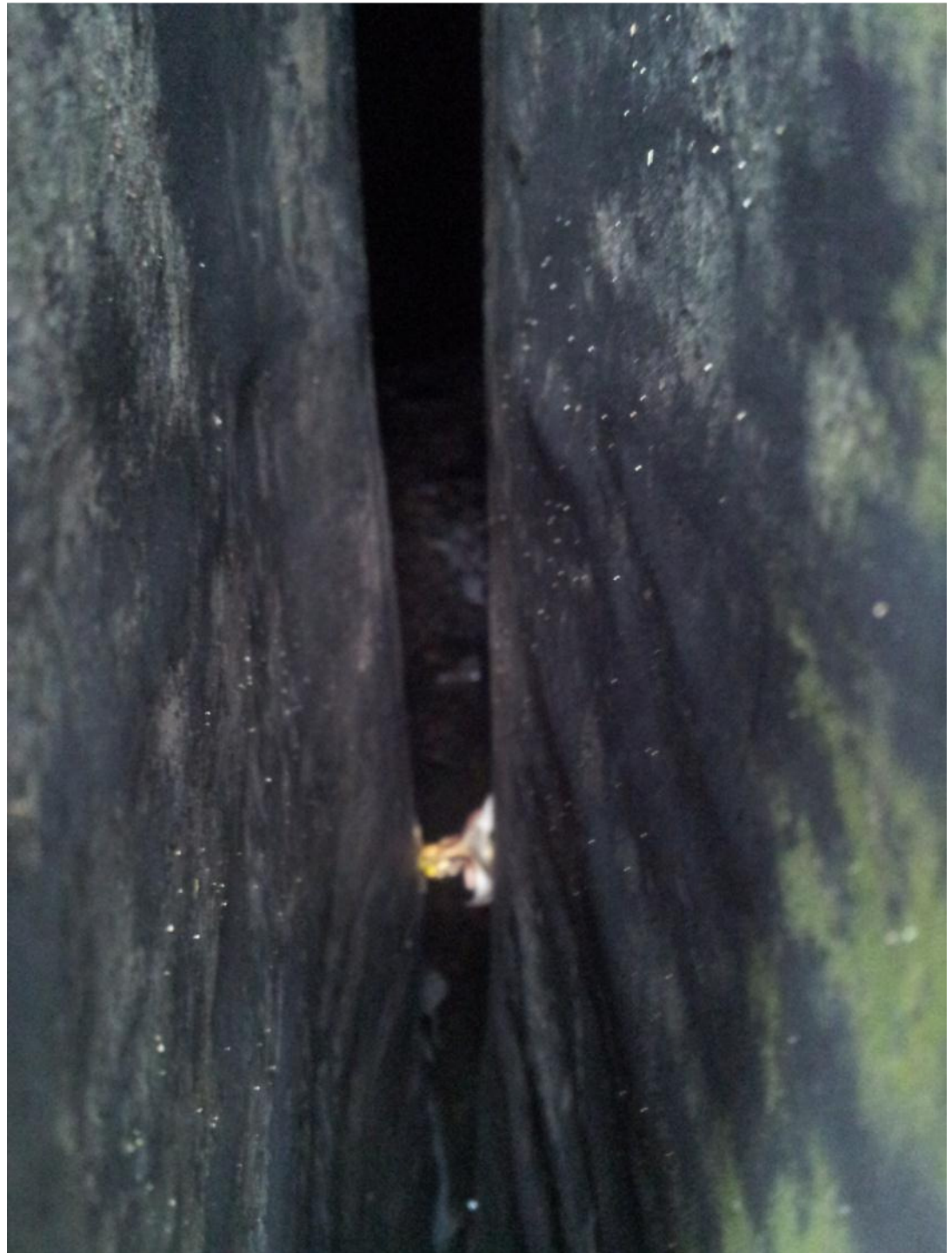
Take  
a  
peek  
inside



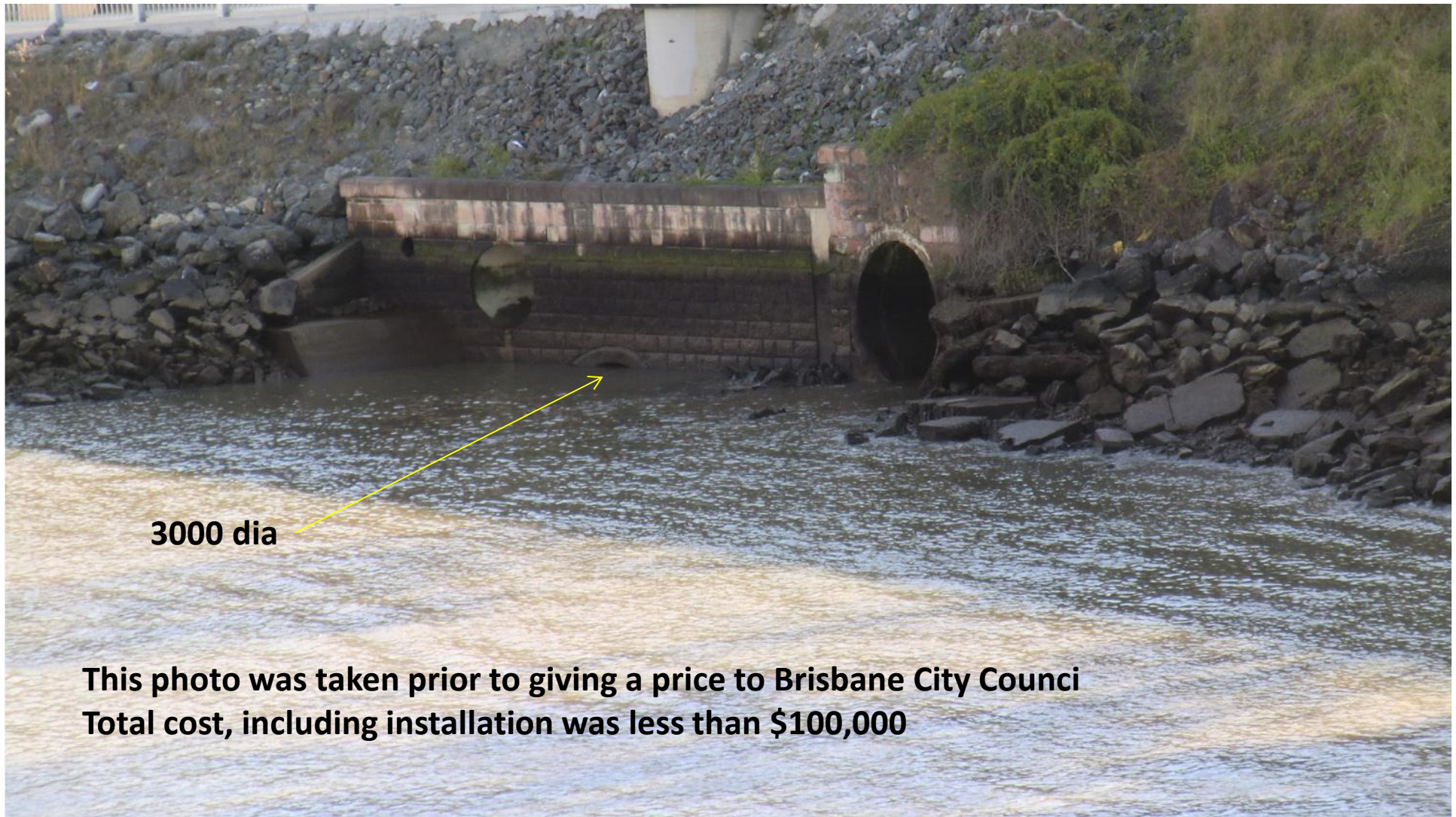


Uh Oh

About six  
months old  
and already  
marine growth  
is forcing it  
apart



# Coronation drive pipes July 2011



3000 dia

**This photo was taken prior to giving a price to Brisbane City Council  
Total cost, including installation was less than \$100,000**

Probably the biggest, most difficult, and most expensive situation in Brisbane





January 2013.

Water coming from the Coronation Drive Pipes

Note the weather



A small outlet







January 2013

Water flowing out a drain inlet

**WHY?**

Engineers can't be trusted any more.

Expert procurement people ensure that the best possible purchasing options are utilised.

BCC decided in their wisdom that a period contract would be issued for all backflow prevention devices, including penstocks for which opening sizes and some materials were specified.

Recent job in Queensland. Tenders currently being reviewed. Four tenderers. Three known to author.

4/10/12 - Spoke to Design Consulting Engineers – some time ago – they were not allowed to give out the prequalified tenderers names under orders of council or a list of the tenderers EOI.

25/1/13 Spoke to Water and Sewage Manager, he also would not pass on the names of the tenderers but did give me the name of the Engineer who is looking after the project.

25/1/13 and 29/1/13 Engineer was very sympathetic to my calls but his hands were tied by **probity** directions by higher up the in the council. He has received numerous phone calls requesting the pre qualification list and was in agreement that it should be released but his hands are tied.

Engineer has been told unequivocally that he cannot give out the names of the pre qual due to probity and was told by someone higher up in council or whoever designed the probity requirements that suppliers like us will make **salacious** (his words) phone calls to contractors.

Please note the engineers have at all times have been helpful and we are in the process of establishing and introducing ourselves to ....

*(Extracted from sales notes and edited for anonymity)*



Probity (secrecy) has permeated almost everywhere at all levels of government

It is a result of state purchasing policy

It is a result of employing expert procurement people to procure something that they have absolutely no idea about, probably not even a notional idea of the concept, let alone intricacies that can only be understood by a trained engineer.

Question the process, and most times a lawyer will be provided to explain the issues to you.

Talk to contractors and suppliers alike and they all say the situation is absurd.

This costs the state a lot of money.

What will the eventual outcome be?

**Corruption!**

Whenever there is secrecy, lack of transparency even, the environment inevitably breeds corruption

Our lives  
begin to end  
the day we become silent  
about things that matter

Martin Luther King Jnr