

A.R.I. FLOW CONTROL ACCESSORIES  
The image features a collection of industrial flow control accessories, including a brass elbow fitting, a brass pipe cap, and a blue plastic cap with a water drop icon. These items are arranged on a reflective surface against a blue and orange background. The text 'A.R.I. FLOW CONTROL ACCESSORIES' is written in orange, serif font across the top of the image.

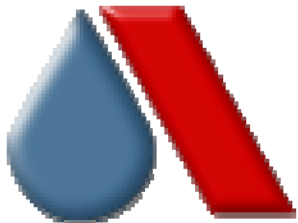
**A.R.I. U.S.A Inc.**

**The Energy Star Program of the EPA estimates that about \$4 billion are spent annually for energy costs to run drinking water and wastewater utilities. If the sector could reduce energy use by just 10% through investment in energy efficiency collectively it would save about \$ 400 million annually.**



## **THE COST OF TRAPPED PIPELINE AIR**

**If your system accumulated air last year that increased head pressure by 15% your pumps were forced to work 15% harder drawing 15% more electricity. If you spent 250,000 dollars on electricity to power your pumps you could have saved 37,500 dollars on electricity alone by just eliminating the air in the system.**



# *Hazards & Dissadvantages of Air in Pipes*

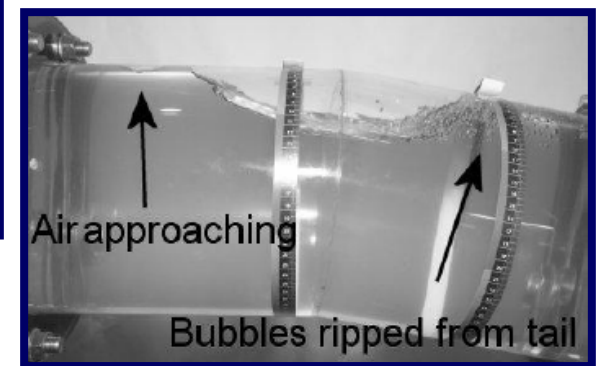
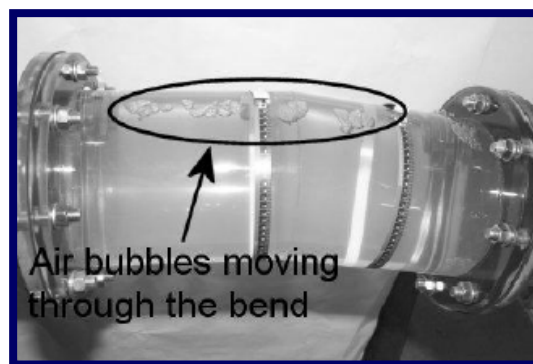
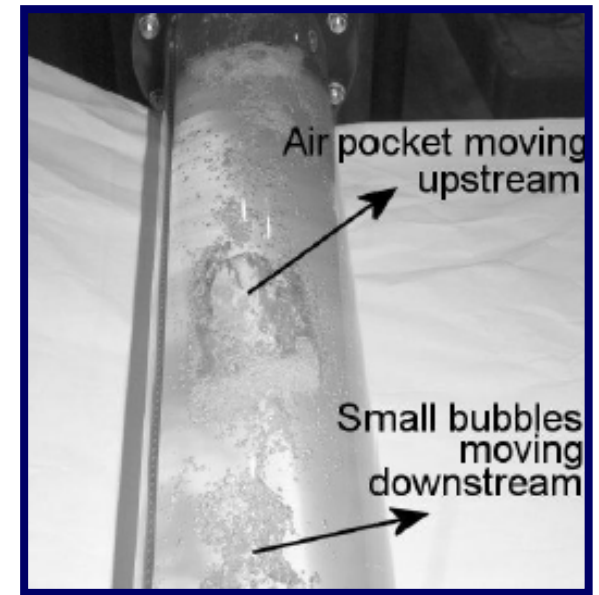
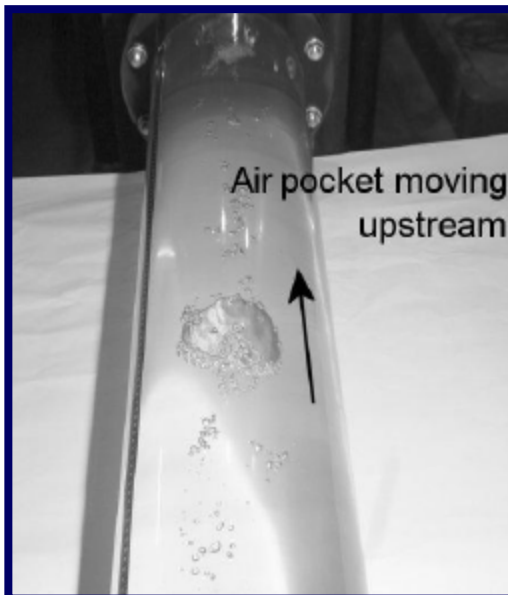
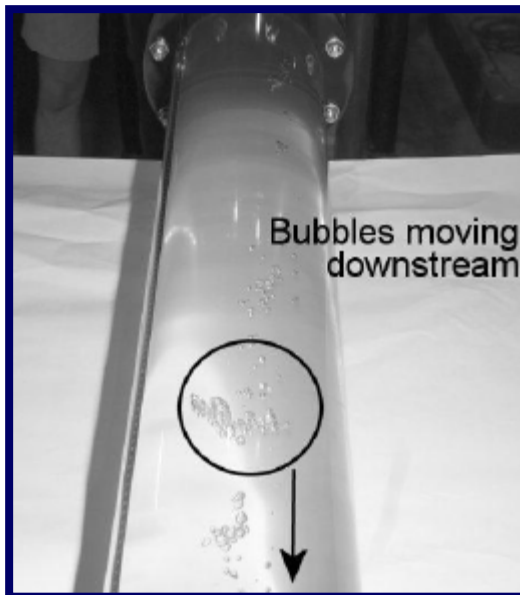
- 1. Impedance of flow in pipelines –up to complete stoppage, at times.**
- 2. Serious head losses - energy losses.**
- 3. Water Hammer damages.**
- 4. Inaccurate readings in meters and automatic metering valves.**
- 5. Inadequate supply of water to areas in the system,**
  - a. due to air obstruction to flow and accumulation of pressure losses.**
  - b. due to faulty meter and automatic metering valve readings.**
- 6. Serious damage to spinning internal parts of meters, metering valves.**
- 7. Corrosion and cavitation.**
- 8. Physical danger to operators from air-blown flying parts and from very strong streams of high velocity, escaping air.**

# *Hazards of Absence of Air*

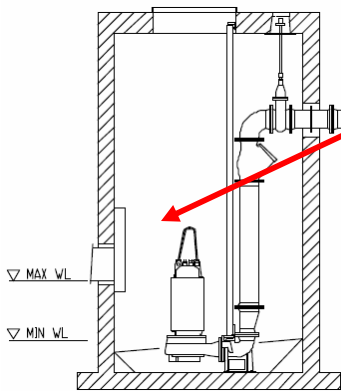
- 1. Vacuum enhanced problems and damages:**
  - a. Suction of mud and dirt through faulty connections, cracks in pipes and accessories, etc'.**
  - b. Suction of seals and gaskets, in-line fittings, and other internal accessories of pipes.**
  - c. Uncontrolled suction of injected chemicals into the system.**
  - d. Pipe or accessory collapse.**
- 2. In some cases, the absence of an air cushion can increase the damages of surge and slam phenomena.**



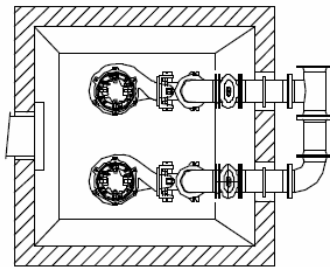
## Some example of air bubble behavior



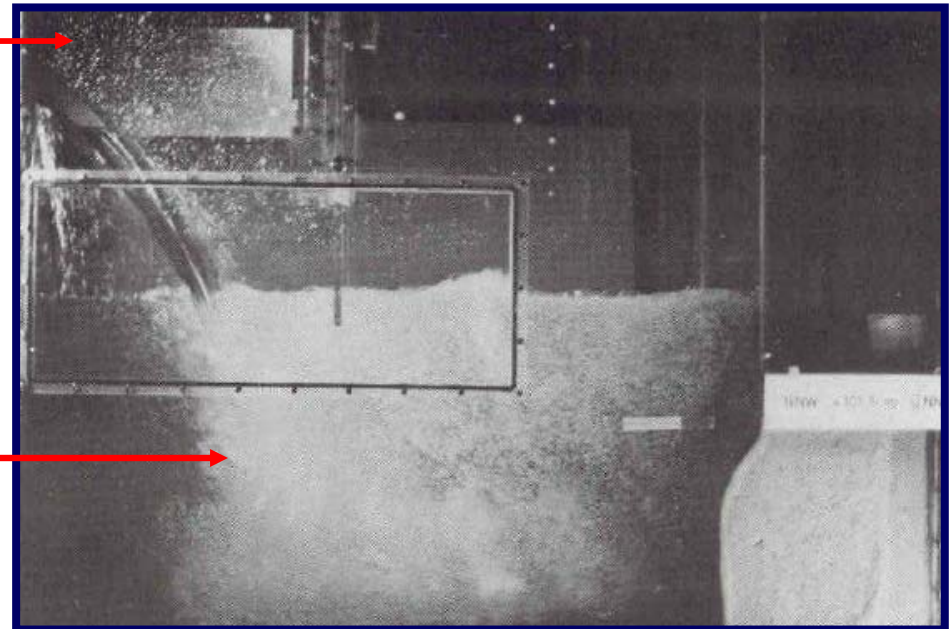
**Air entrainment is much more serious in wastewater force main systems than in water transmission systems because of their special operational processes and procedures. Whereas pressurized water transmission systems are operational and under pressure almost all of the time, force mains operate in intermittent cycles, where pumps turn on and off several times a day.**



**Sewage commonly enters the wet well above water level, very often as a plunging jet**



**entraining large amounts of air into the wet well**

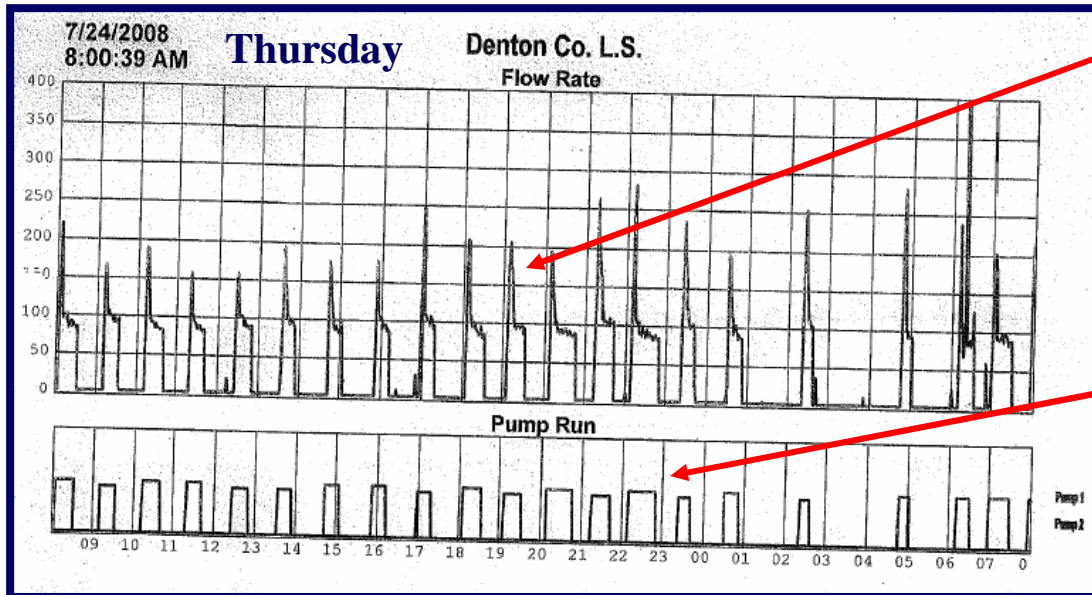
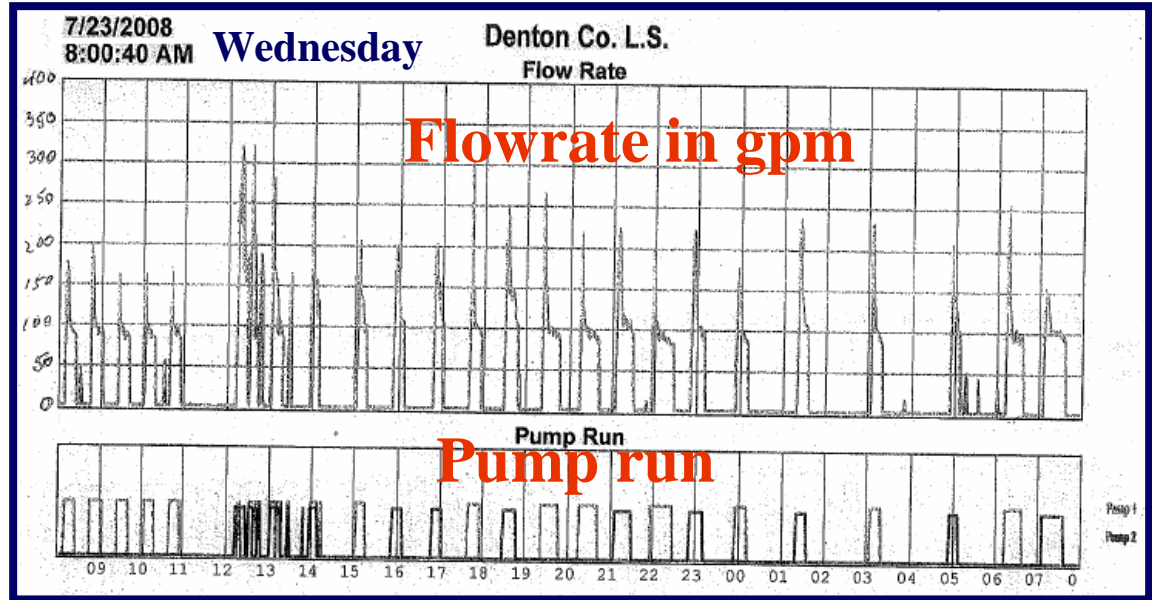


**Air entrainment at a plunging jet**



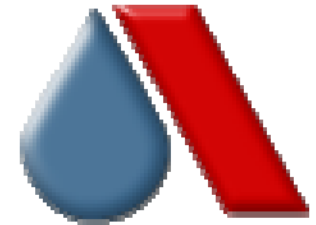
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**Pump records for a wastewater lift station in Denton County, Texas, with 5 conventional wastewater air valves on its force main.**



**Low flowrates**

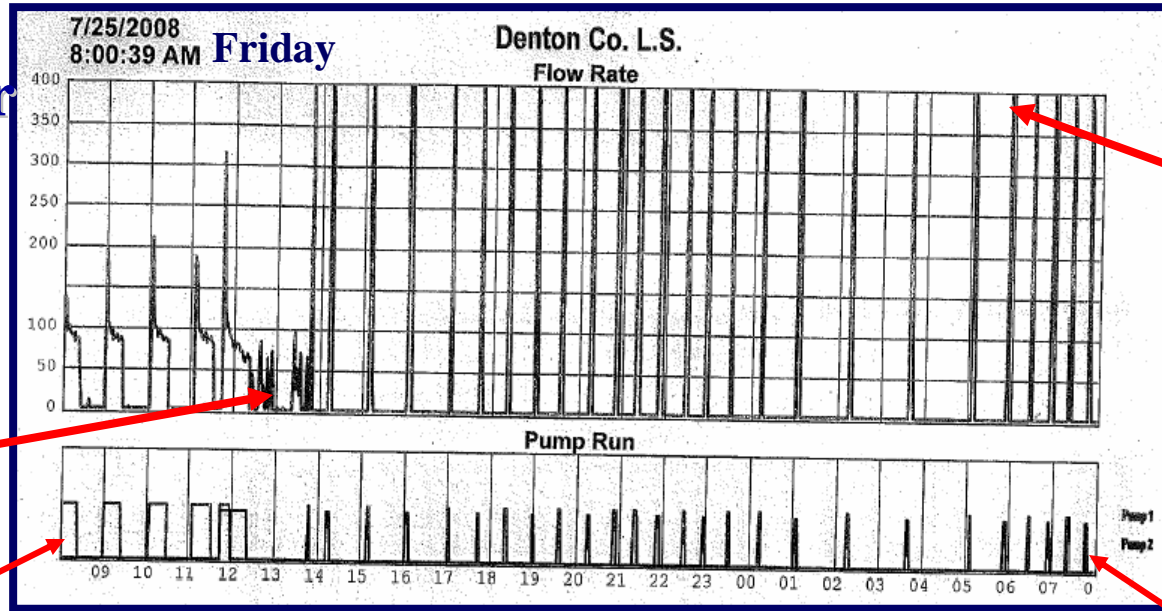
**Long pump runs**



Two of the 5 conventional air valves were replaced, here, by two A.R.I. D-025 wastewater air valves

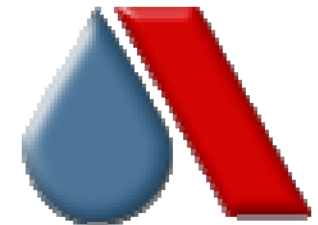
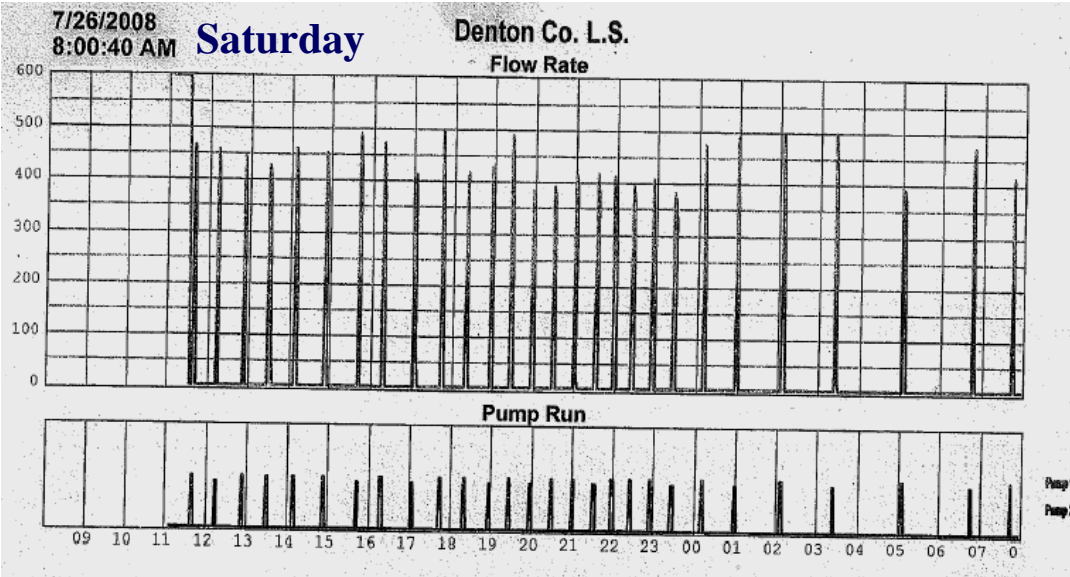
Long pump runs

Change of flowrate scale

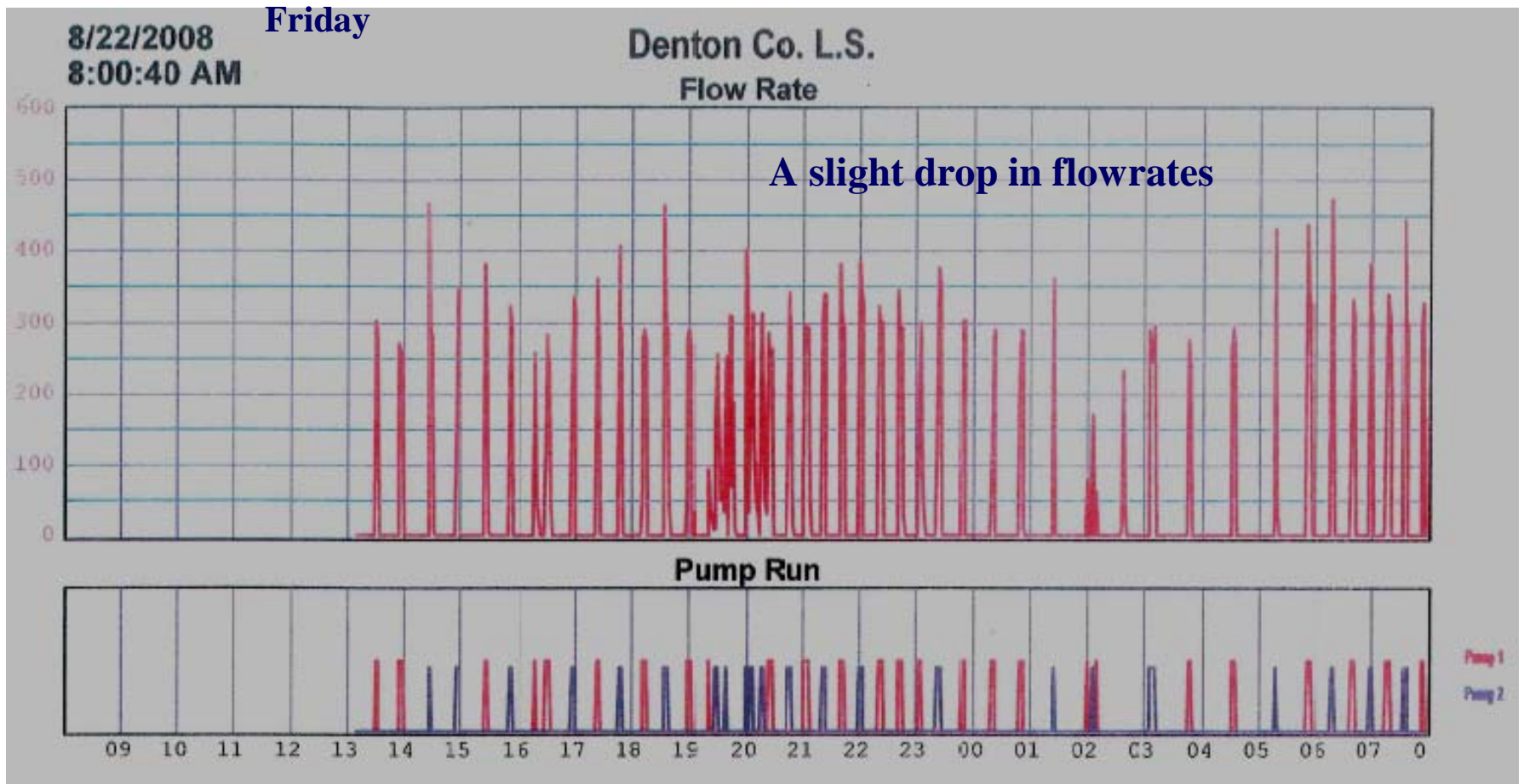


Flowrates rise off the chart!

Short pump runs



# A Month Later




**Utility administrators and asset managers are required to show increased efficiency over their assets.**

**Saving Analysis – Data provided by Horseshoe Bay, Texas**

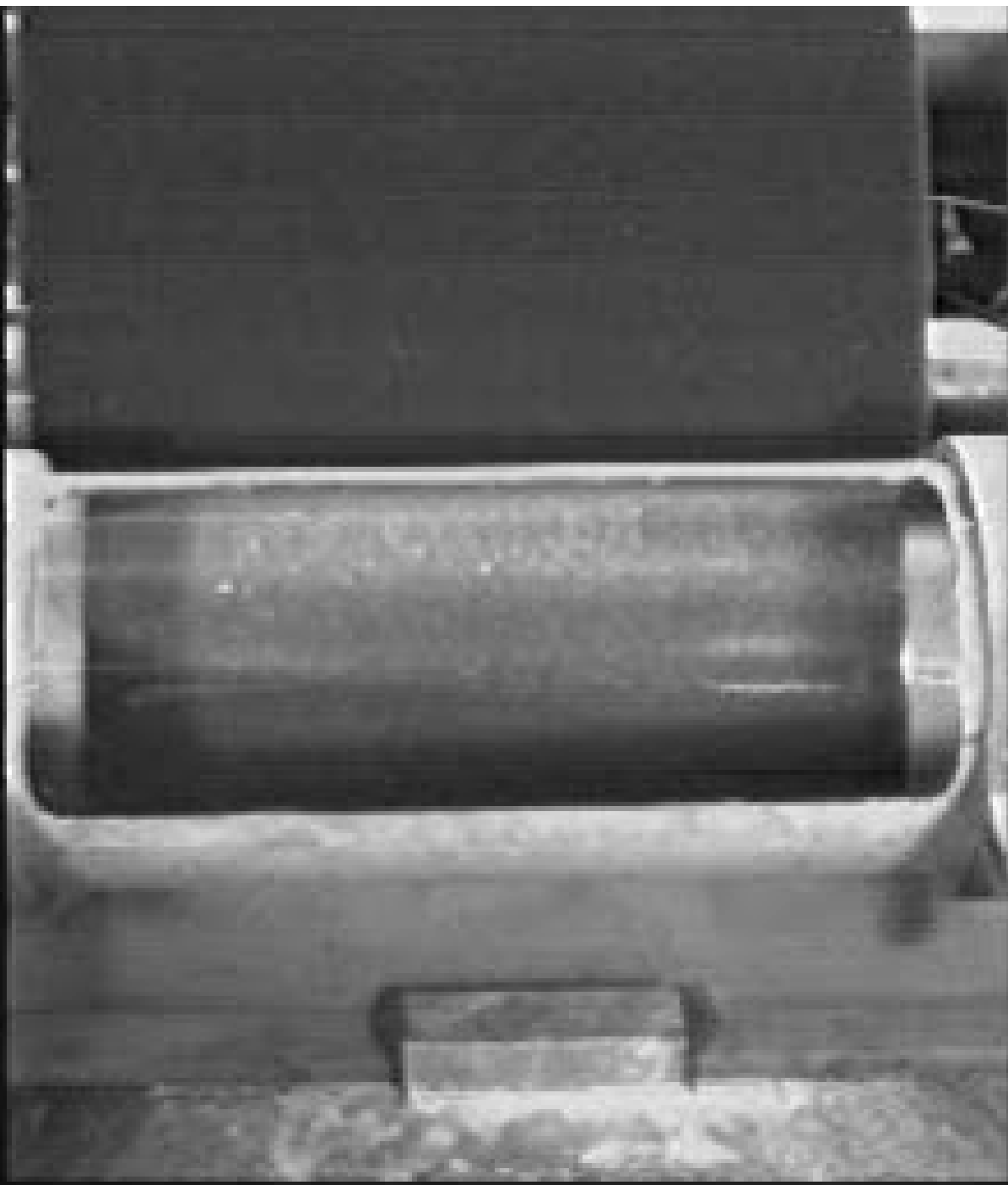
	<b>Option No.1</b>	 <b>A.R.I.</b>
<b>Years of operation</b>	<b>20 years</b>	<b>20 years</b>
<b>Days of operation (Lifetime)</b>	<b>7300 days</b>	<b>7300 days</b>
<b>Daily operating time</b>	<b>3.5 hours</b>	<b>0.5 hours</b>
<b>Operating time (annual)</b>	<b>1,278 hours per year</b>	<b>183 hours per year</b>
<b>Operating time (Lifetime)</b>	<b>25,550 hours</b>	<b>3,650 hours</b>

**Utility administrators and asset managers are required to show increased efficiency over their assets.**

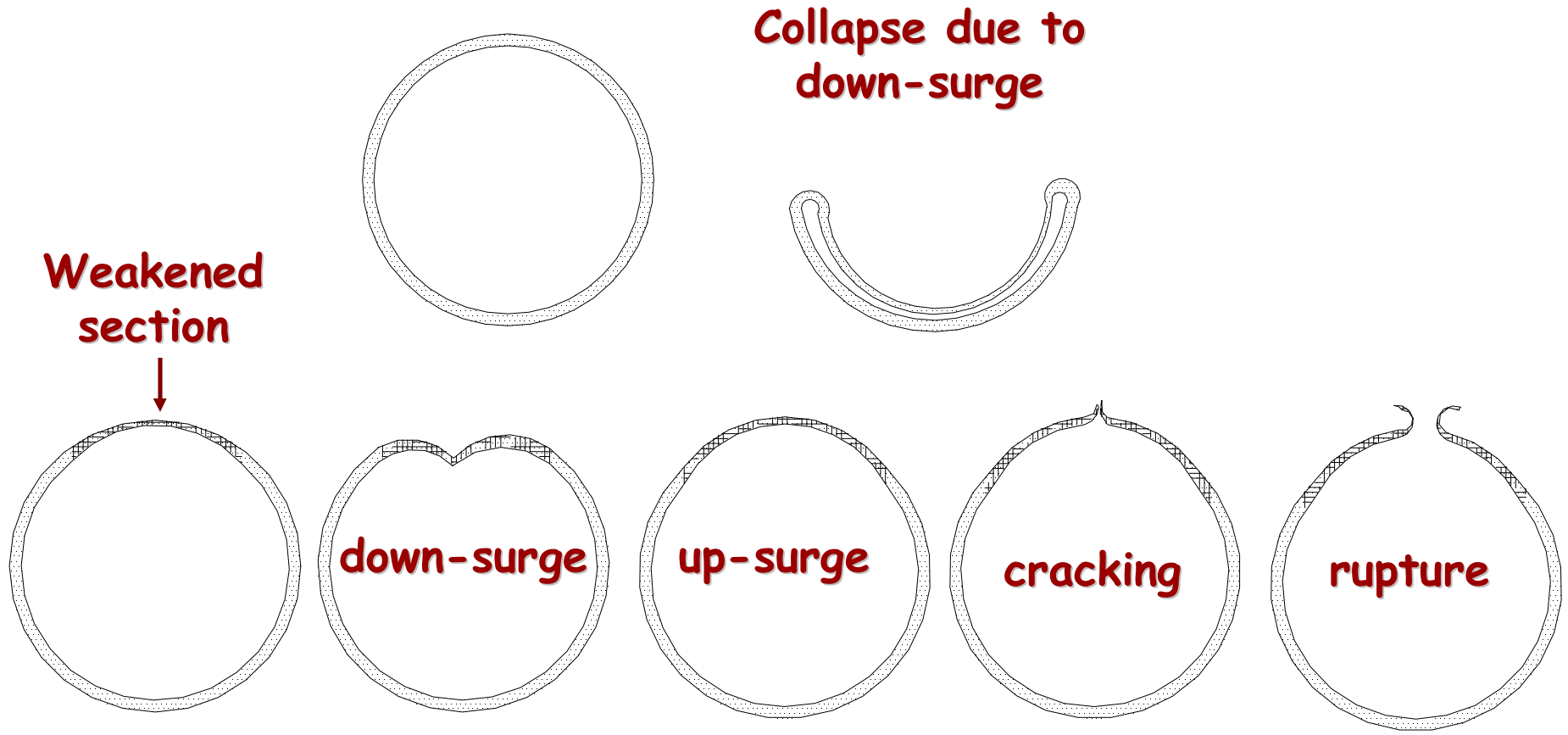
**Saving Analysis – Data provided by Horseshoe Bay, Texas**

	<b>Option No.1</b>	 <b>A.R.I.</b>
<b>Flow</b>	<b>5,000 gpm</b>	<b>5,000 gpm</b>
<b>Electricity cost</b>	<b>\$ 0.0817 per kilowatt-hour</b>	<b>\$ 0.0817 per kilowatt-hour</b>
<b>Pump efficiency</b>	<b>65%</b>	<b>65%</b>
<b>Motor efficiency</b>	<b>85%</b>	<b>85%</b>
<b>Cost per year</b>	<b>\$ 15,181.48</b>	<b>\$ 2,168.78</b>
<b>Lifetime cost</b>	<b>\$ 303,629.52</b>	<b>\$ 43,375.65</b>

**86% savings**



FRAME NO  
00056  
TIME SEC  
000.  
04033338  
REC RATE  
1125  
ID NO 3  
PLAYBACK  
PLAY  
LIVE  
BLOCK  
S  
E  
MULTI  
REC MODE  
START  
READY  
REC.



# PIPE DAMAGE DUE TO SURGES

*In the USA too!*



**URB. MANZANARES / BARUTA / Edo: MIRANDA**

**DOWN-SURGE  
INDUCED  
PIPE COLLAPSE IN VENEZUELA**

**COLLAPSE  
MAXIMUM LEVEL**

**Steel Pipe  
Diameter : 1220 mm  
Thickness : 7 mm  
Length of Collapse : 540 Mts  
 $e / D = 0.005738$**

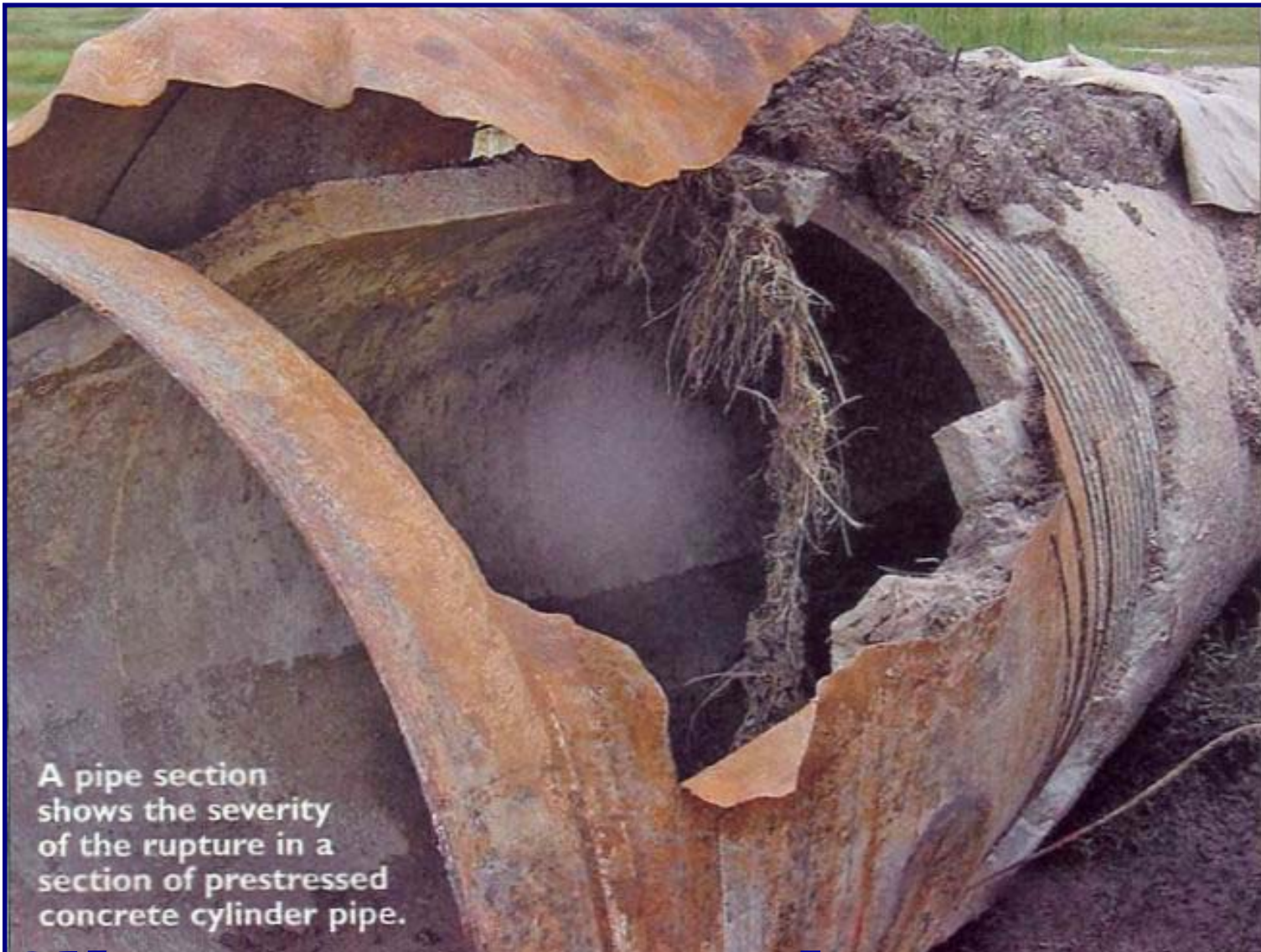




**Air pockets can create liquid flow and velocity changes within pipe lines. If the pump pressures are adequate the compressed air will release creating a sudden and rapid increase in line surges, pressure spikes and flow reversals.**

**These are the water hammer/shock events that over time damage pumps ,fittings, joints and valves. The majority of leakage and unaccounted for water losses can be attributed to these events.**





A pipe section shows the severity of the rupture in a section of prestressed concrete cylinder pipe.

**12 Year-old 42" PCCP Pipe in Houston 2004**







