

Pressure Management—Reduces Not Only The Effect of Water Loss Volumes, But One of the Key Causes Ensuring Sustainable Results

by Julian Thornton (Author of *Water Loss Control Manual*)

An introduction to Non Revenue Water (NRW)

NRW is a problem common to all water systems throughout the world and is a problem which has to be constantly monitored and controlled - there is no one time fix. The International Water Association (IWA) water balance clearly defines components of revenue producing and non revenue water as seen below in Figure 1.

Own Sources	Corrected System Input Volume	Water Exported	Authorized Consumption	Billed Authorized Consumption	Billed Water Exported	Revenue Water
		Water Supplied		Unbilled Authorized Consumption	Billed Metered Consumption	
Billed Un-metered Consumption	Unbilled Un-metered Consumption					
Water Imported			Water Losses	Apparent Losses	Unauthorized Consumption	Non-Revenue Water (NRW)
	Real Losses				Customer Metering Inaccuracies and Data Handling Errors	
		Leakage on Transmission and/or Distribution Mains				
Leakage and Overflows at Utility's Storage Tanks						
Leakage on Service Connections up to point of Customer metering						

Figure 1 IWA water balance

Water loss management

In many cases around the world, water loss management is the key to reducing NRW. Water losses are made up of two base components: apparent losses and real losses.

Apparent losses are almost always valued at some average retail value while real losses range from being valued at variable production cost to many times more than variable production cost where a utility is able to defer a capital construction project or a new source by reducing real loss.

It is important to note for those utilities which may have scarce resources that recovering apparent loss will in all cases increase the revenue stream of the utility but will not increase available resources whereas reducing real losses will effectively supply new water resources. Recovering real losses is often the cheapest new source of water.

Component analysis and intervention tool selection

Leakage from the network often makes up the largest portion of real losses. It is important when preparing to undertake a leakage control program to properly identify which component of leakage has the most impact on the real loss volumes and which tools to select to economically intervene against these volumes of loss. Figure 2 shows a simple diagram which separates the key components of leakage and identifies the tools which are most effective to reduce that component.

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Pressure Management—Reduces Not Only The Effect of Water Loss Volumes, But One of the Key Causes Ensuring Sustainable Results (continued)

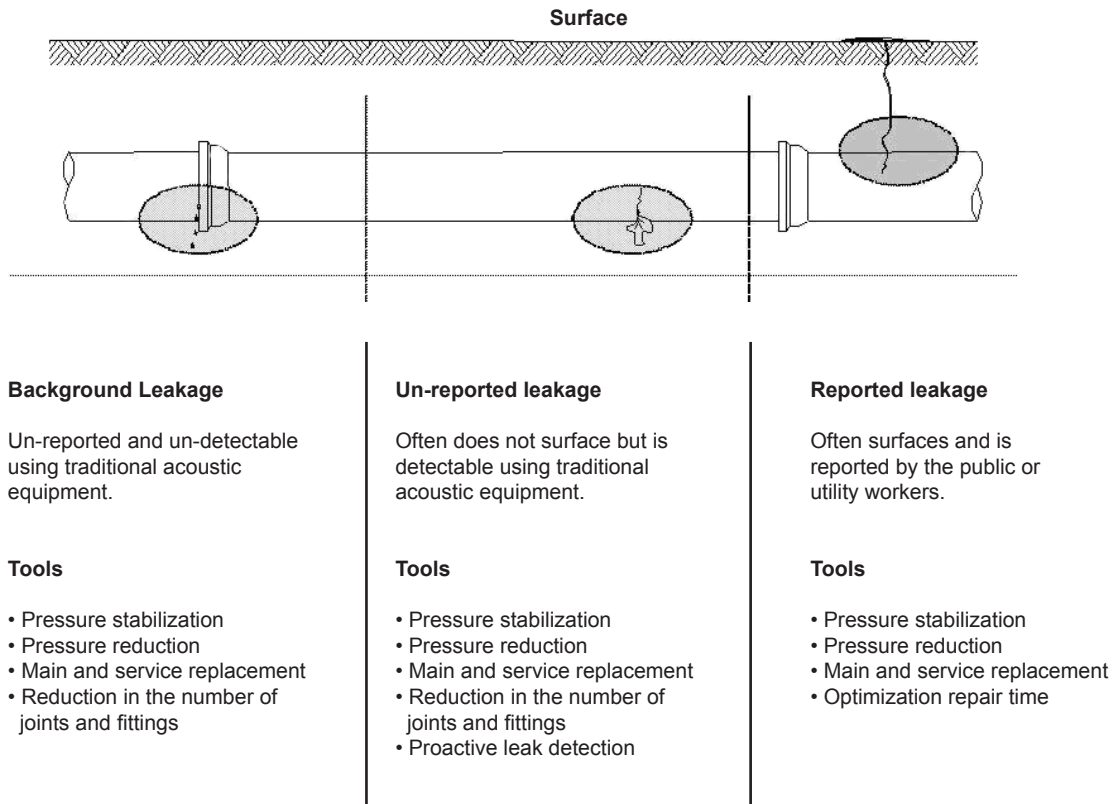


Figure 2 leakage components and intervention tools

It can be seen that pressure management is the only tool or action which immediately impacts on all three components of leakage other than infrastructure replacement which often forms part of a longer term plan. For this reason pressure management is often the first tool of choice for a utility which is starting a new water loss control program.

Pressure management

Pressure management can be defined as *“The practice of managing system pressures to an optimum level of service ensuring sufficient and efficient supply to legitimate uses and consumers, while eliminating or reducing pressure transients and variations, faulty level controls and reducing unnecessary or excess pressures, all of which cause the distribution system to leak and break unnecessarily”*.

Water distribution systems are designed to fulfill certain service standards. One of these is to maintain a minimum standard of service for operating pressure in the entire network at all times. In practice, this minimum pressure generally occurs only in certain critical points of the network, which are hydraulically disadvantaged due to elevation or distance from system inflow points. The rate of consumption varies significantly during each 24-hour period, producing peaks of system inflows in the morning and evening, and periods of low consumption during the night. As the distribution system has been designed to assure the minimum standard of service for pressure throughout the whole day, that same minimum is only actually reached during brief periods of time, during times of peak inflow to the network. The result is that most distribution systems are subjected to excess pressure for almost all of the time.

Excess pressures produce adverse consequences. Reduction of excess pressure reduces flow rates of existing leaks, including undetectable ‘background’ leakage. Reduction of excess pressure and pressure transients can produce significant and immediate reductions in new break frequency on mains and services attacking not only the effect of volumes of loss but also the cause, leading to:

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- reduction in annual repair costs
- reduction of repairs backlog, shorter run-times for bursts
- fewer emergency repairs, more planned work
- reduced inconvenience to customers
- reduction in insurance/compensation claims
- reduced real losses – fewer breaks, shorter run times, lower flow rates
- benefits arising from transition from intermittent supply to continuous supply
- improvement in several performance indicators
- increased infrastructure life

Reduction of excess pressures also influences some elements of authorized and un-authorized consumption. For all these reasons, well designed pressure management programs are increasingly recognized as fundamental to the effective management of distribution systems, real (physical) losses and demand. Pressure management is therefore the foundation of any effective leakage management strategy.

Implications for management of operations, infrastructure and energy

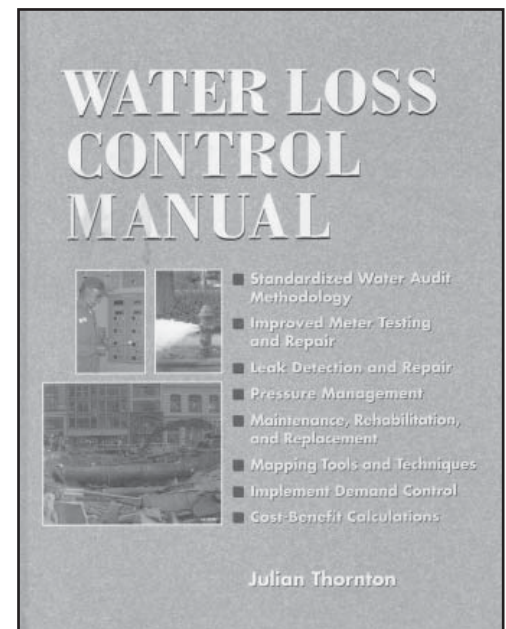
Replacement of mains and services – the most expensive aspect of distribution system management – is normally initiated by break frequencies that are considered to be excessive. Most utilities consider break frequency to be a factor outside their control, and something that can only be remedied by expensive replacement of mains and services. However, if pressure management can reduce break frequencies and extend the working life of parts of the distribution infrastructure by even a few years, the economic benefits (in terms of Net Present Value of deferred capital expenditure) would generally be even greater than the short-term reduction in repair costs

There are many different tools that can be used when implementing pressure management, including pump controls, altitude controls and installation of pressure reducing and pressure sustaining valves.

About the author

Julian Thornton has undertaken many successful pressure management projects throughout the world and is currently the IWA Water Loss Task Force “Pressure Management Team Leader”. He is also the Chair of the National AWWA Water Loss Control Committee “M36 Water Audits and Leak Detection Manual re-write committee” and is the author of the “Water Loss Control Manual” published by McGraw Hill New York June 2002 ISBN 0-07-137434-5. Julian can be contacted on thornton@water-audit.com.

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2. Garzon-Contreras F, Thornton J, “Pressure-leakage relationships in urban water distribution systems” WDSA conference proceedings Cincinnati USA 2006
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*Julian Thornton is the Author of “Water Loss Control Manual”
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