Reduction of Physical Losses

Non-Revenue Water Management Training

DMCI Homes Corporate Center, Nov 18-19, 2010

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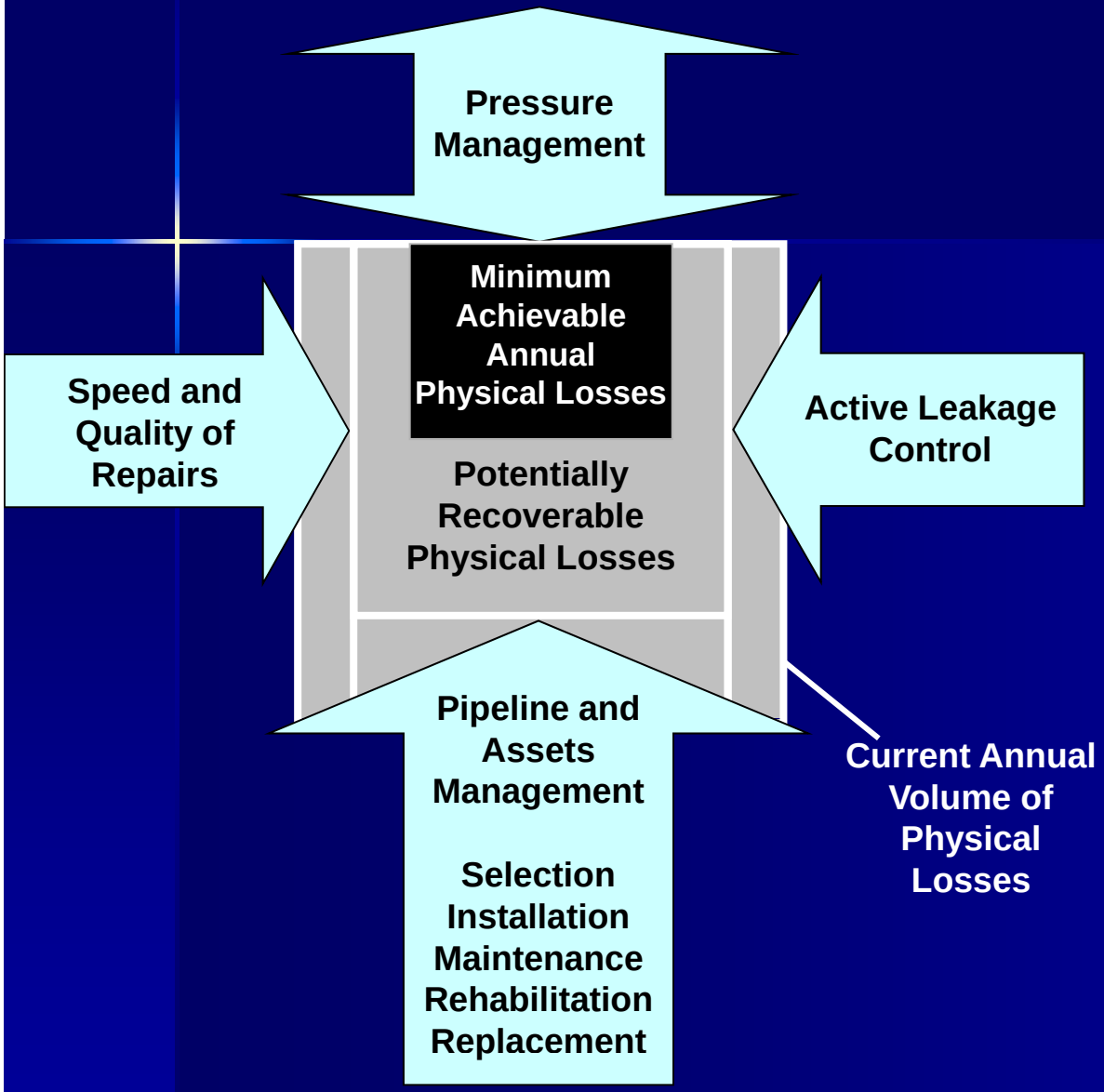
Content

- The four key elements of a leakage reduction strategy
- The leakage reduction check list
- How to get started?
- Conclusions

The 4 Elements of a Sustainable Leakage Control Strategy



A Challenge for Many Utilities: Move from Passive to Active Mode!

- **Three levels of sophistication**
  - **Doing the obvious (simple and cheap): Identifying, locating and repairing visible leaks**
  - **Second level of action: Localizing and repairing non-visible leaks (listening devices)**
  - **Third, the advanced and sustainable stage: Establishing district metered areas (DMAs) and introducing pressure management**

The Physical Loss Reduction Checklist

- Change Management Focus
- Improve speed and quality of repairs
- Introduce active leakage control
- Review, improve operating practices
- Introduce network zoning and DMAs
- Practice pressure management
- Apply good asset management

Changing Management Focus

- Often, leakage reduction ignored or not taken seriously:
  - misconceptions: it’s a one time, technical effort!!!
  - non prestigious, invisible work
  - politically sensitive; digging up streets
  - limited management attention
- level of effort underestimated
  - manpower intensive, often night work
  - Insufficient allocation of vehicles, tools and equipment
  - under-funding
  - job can’t be done in 'spare time'

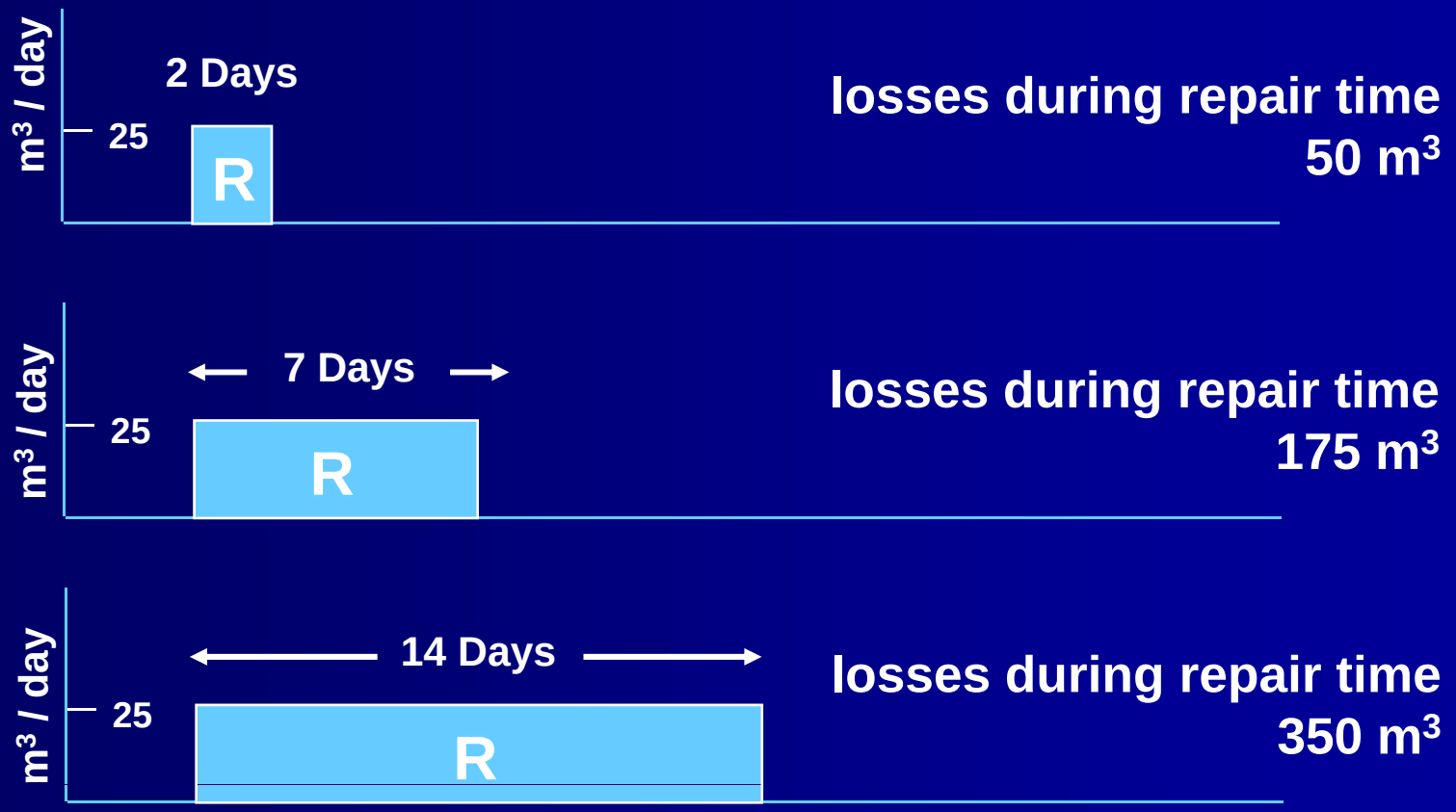
Changing Management Focus, ctd

- Management to understand and accept challenge
- Ownership, commitment and leadership by management
- Supporting elements/conditions:
  - enabling environment -- politicians, customers on board
  - mandate, empowerment, capacity
  - objectives, targets
  - organization and administration
  - financial resources, budget,
  - communication inside and outside of the utility
  - incentives for staff

Improving Speed and Quality of Repairs

- Clear repair policy and procedures
- Efficient organization from call through repair
- Availability of equipment and materials
- Sufficient funding
- Appropriate standards, specs for materials and workmanship
- Committed management and staff
- Outsourcing
- Repair supervision

Time is of the Essence – How Quickly do You Repair a Small Leak?



Quality of Repairs

- Too often leaks are repaired at sub-standard quality -- with sub-standard materials
  - wrapped-around plastic bags (or pieces from rubber tubes of tires)
  - wooden plugs
  - sub-standard, non-stainless steel repair clamps

Quality of Service Connections

- Service connection is the weakest part of the system
- A leaking service connection (e.g. corroded GMS pipe) should be entirely replaced and not repaired
- PVC is not an appropriate material for service connections (better use HDPE, copper, stainless steel, ...)
- High quality pipe saddles and fittings are the most cost effective long term solution due lower life cycle costs

Remember: Leakage Classification

- Reported Bursts
  - visible, often phoned in by public
- Unreported Bursts
  - non-visible, located through leak detection survey
- Background Leakage
  - very small; difficult and uneconomic to detect and repair individually
- Most leaks do NOT come to the surface, are mainly caused by leaking service connections

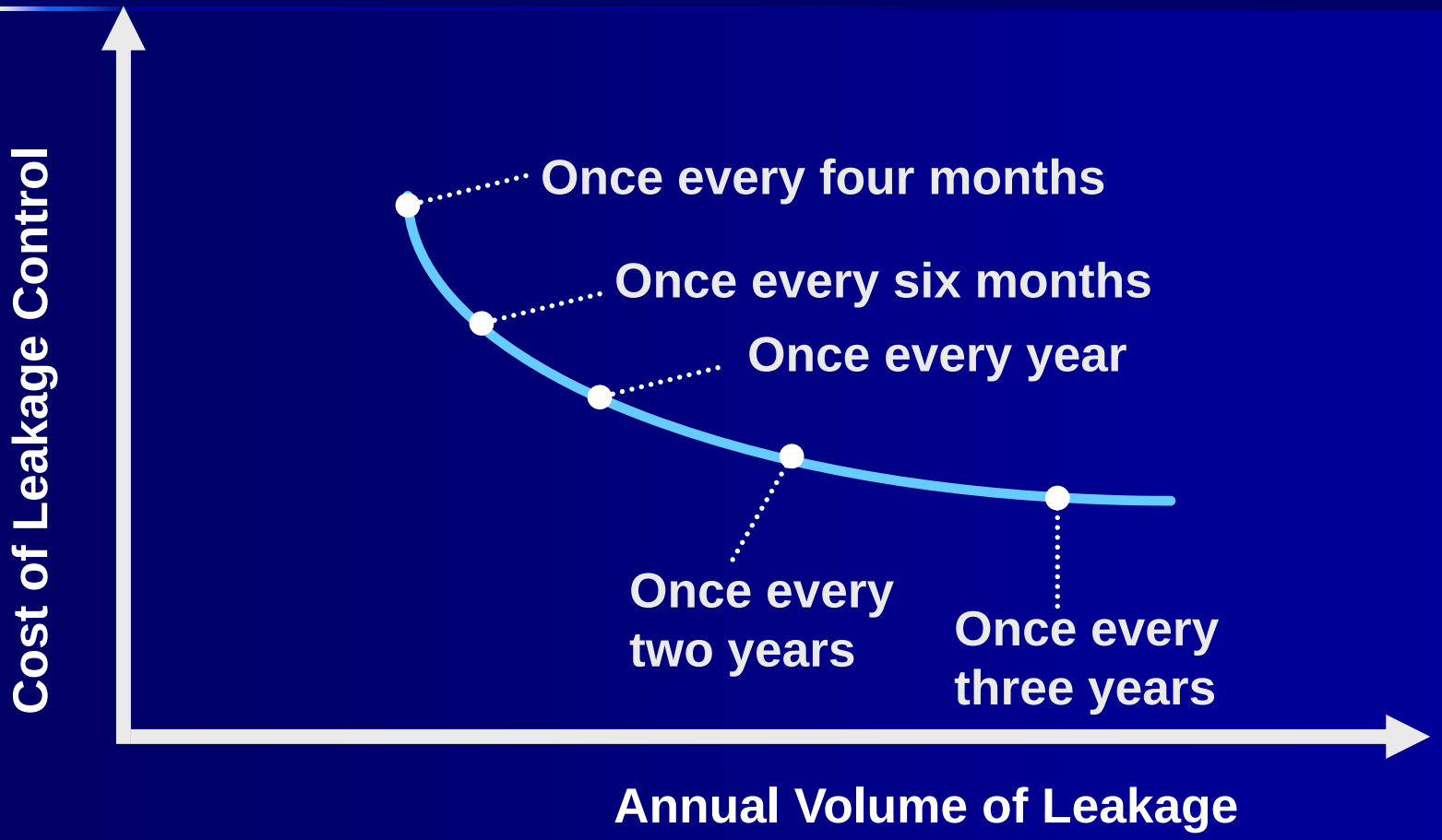
First and Immediate Challenge: Fix the Visible Leaks!

- Detecting, reporting visible leaks:
  - public vigilance, telephone hot line
  - meter readers looking out for signs of leaks
  - routine inspection of the system
- These measures are simple, obvious, inexpensive, but need:
  - technical capacity, organization, standards, procedures, sustained commitment
- Outsourcing of repair an attractive option

Locating Non-visible Leaks

- Routine program for finding and locating leaks
- Many techniques and instruments in use:
  - Listening sticks
  - Ground microphone
  - Leak noise correlator
  - Noise Loggers

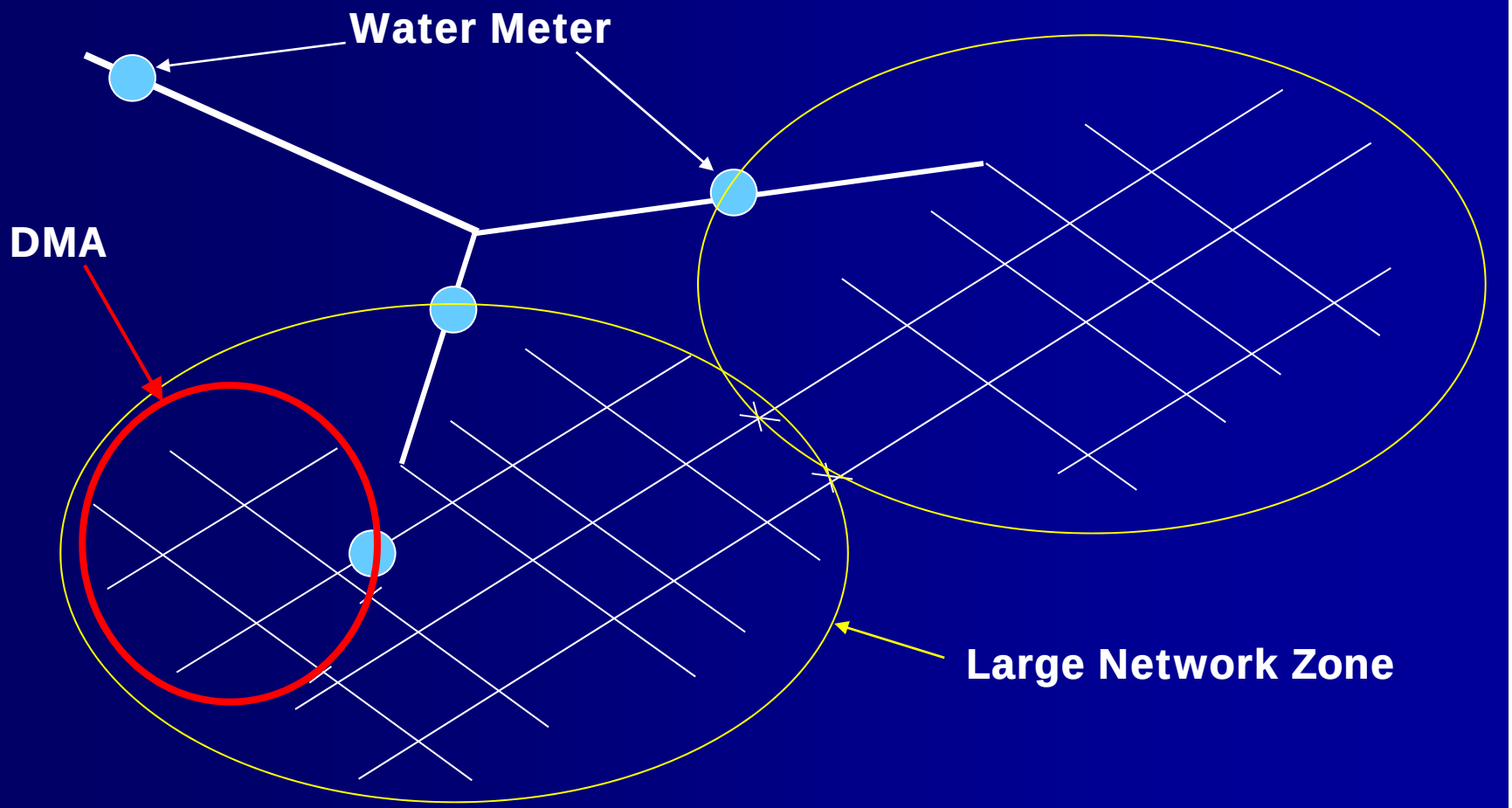
How Often Should you do Leak Detection?



Reviewing and Improving O&M Practices

- Avoid wide pressure fluctuations
- Intermittent supply: try to (re)establish 24/7 supply in some areas
- Inspect and maintain valves and hydrants regularly
- Operate reservoirs and pumping stations properly
- Keep network drawings or a GIS continuously up to date

Network Zones and District Meter Areas



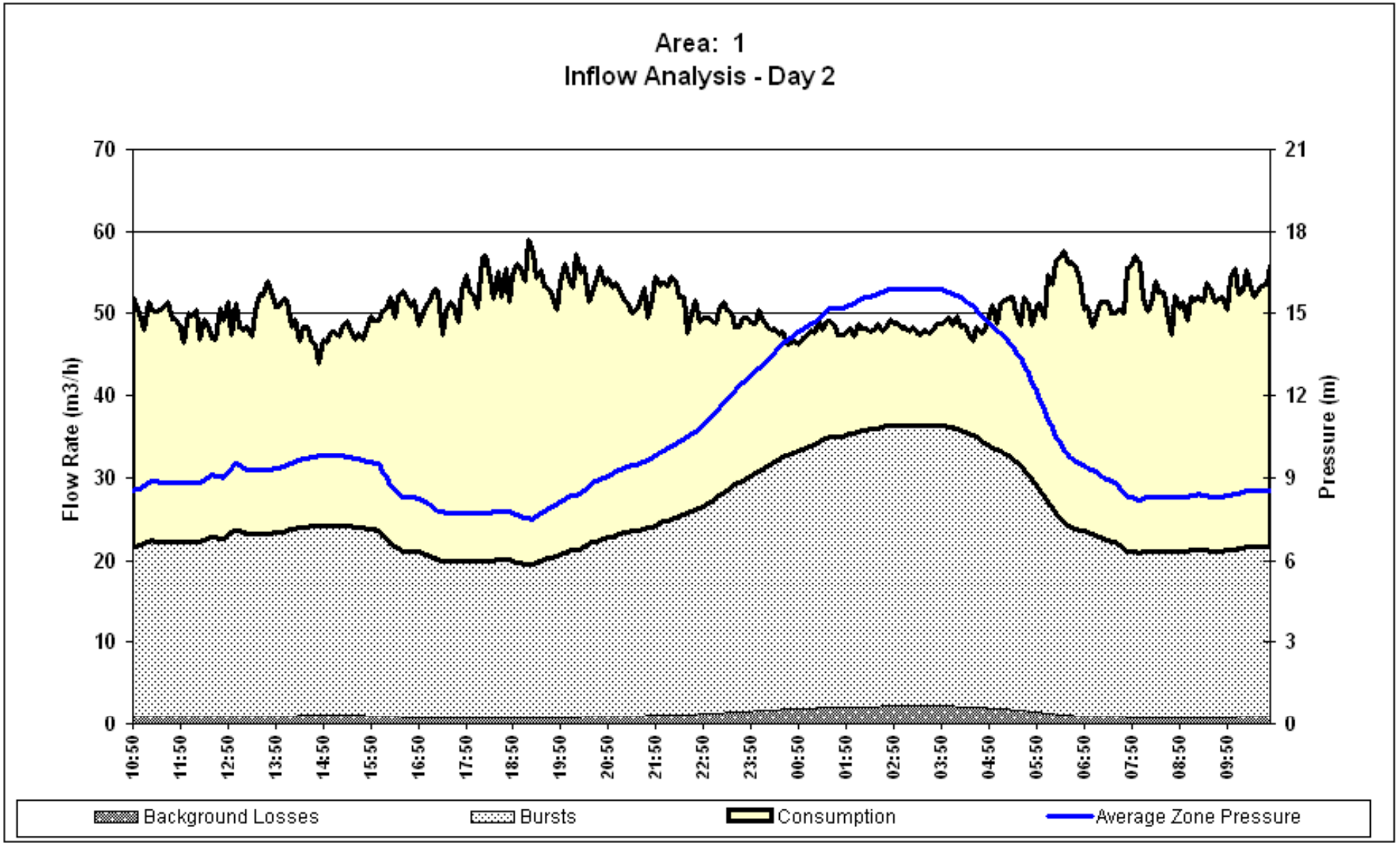
DMA – District Meter Area

- Principles of DMA approach
  - division of network into small hydraulically discrete zones
  - continuous measurement of flow and pressure
- Objectives
  - Reduction of leak awareness time
  - Prioritization of leak detection activities
- An excellent basis for pressure management
- The way forward for utilities with poor quality networks

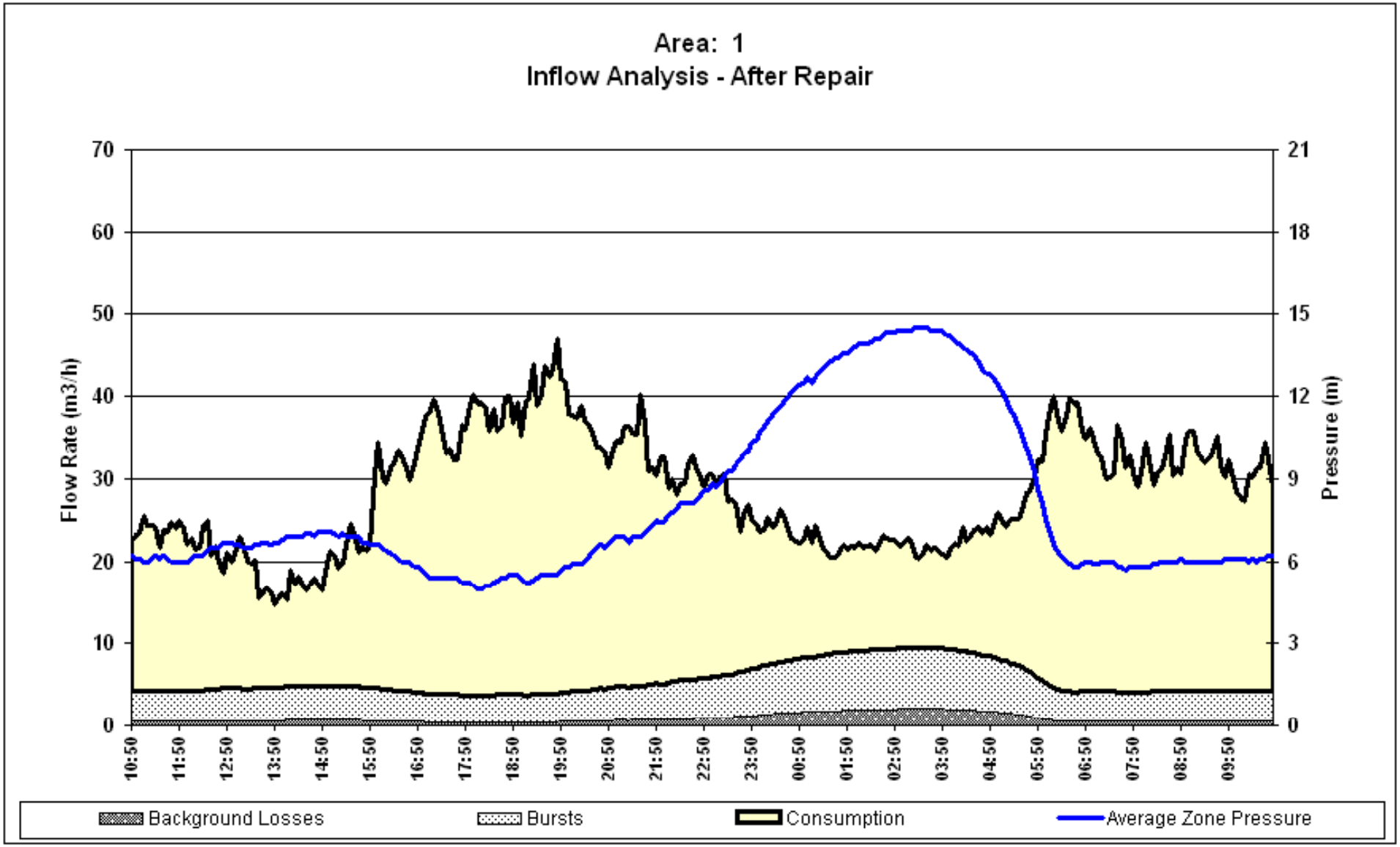
Designing, Establishing DMAs

- Based on hydraulic network analysis
- Design criteria:
  - one inflow point only (if at all possible)
  - size: between 500 and 3,000 service connections
  - variations in ground level to be considered
- Isolate zone through the installation of boundary valves
- Install devices for inflow and pressure measurement

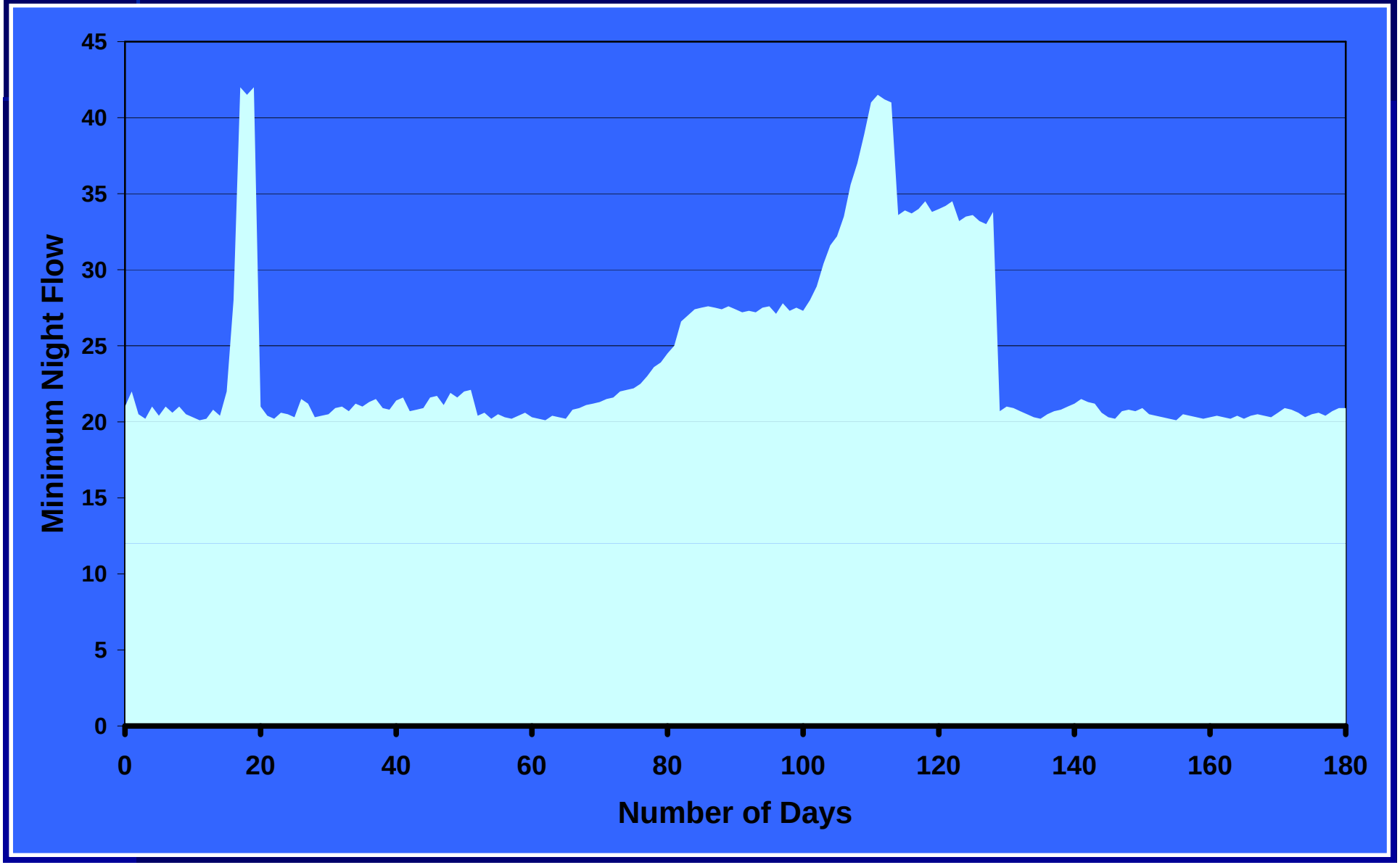
Data Analysis
Before Leak Detection and Repair



Data Analysis
After Leak Detection and Repair



Using DMA Night Flow Data



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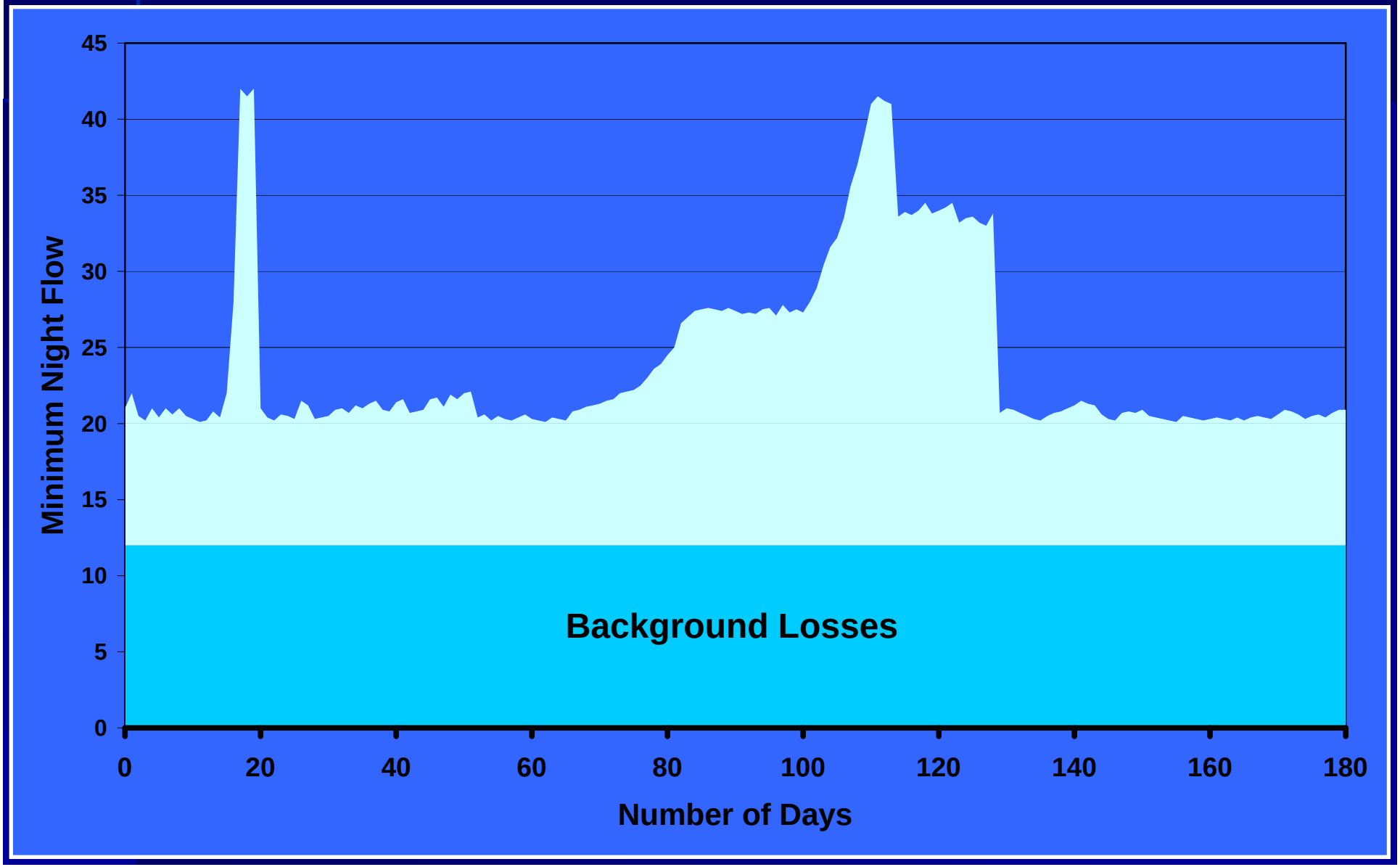

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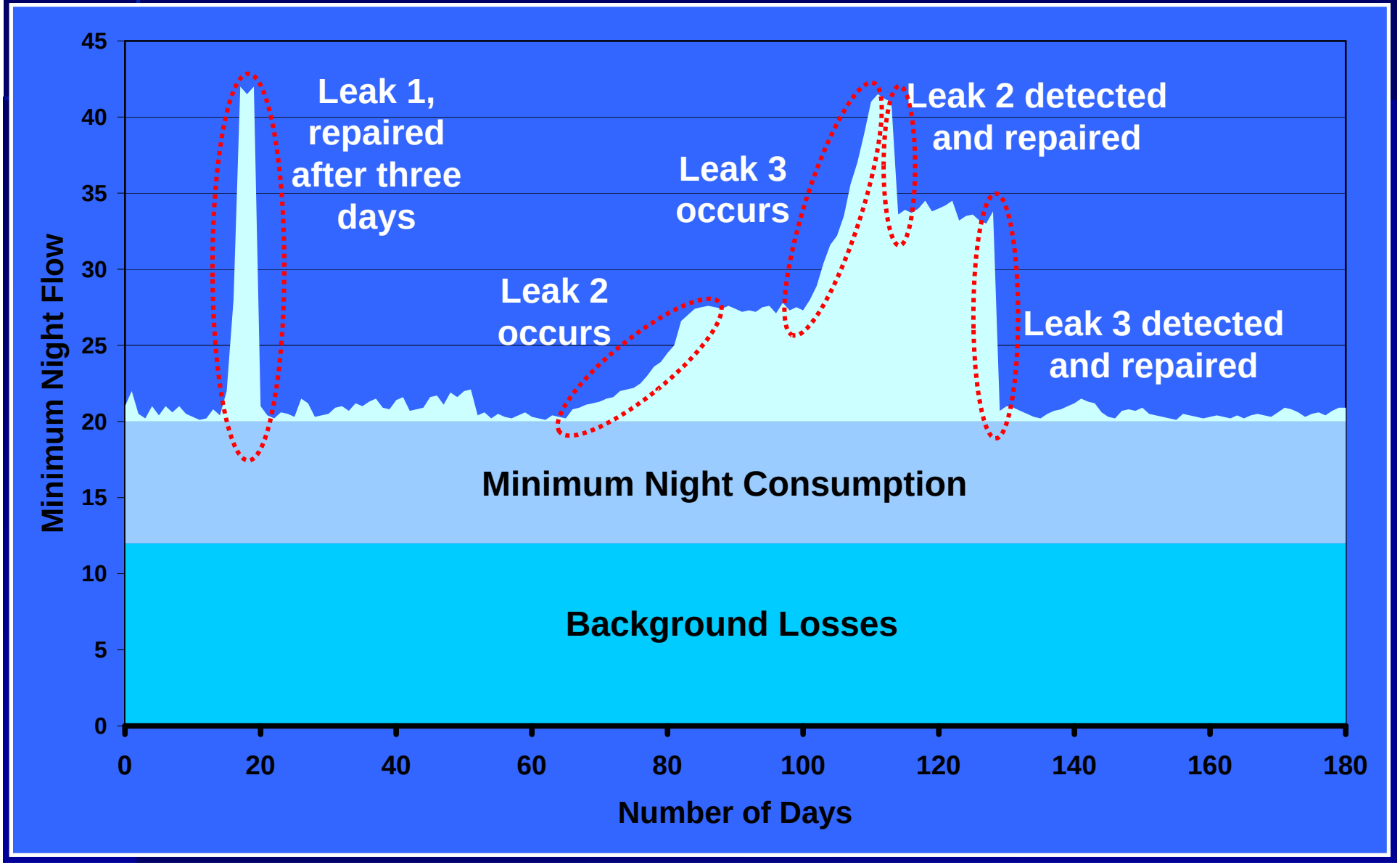


Implementing a DMA Program

- Conditions for successful DMA program implementation:
  - System knowledge - mapping may be necessary
  - Equipment: flow and pressure measuring and recording devices
  - Expert capacity to design DMAs, set up the process, train staff and interpret data
- Sustained commitment and support from management and staff
- DMA Program can be implemented in stages

Special Strategies for Intermittent Supply Situation

- DMA approach also useful for intermittent flow conditions
- Measurements during fully pressurized conditions yields information on leakage volume and location
- However, night flow monitoring not that straight forward (filling of tanks)
- Longer term strategy: gradually convert to continuous supply over time, DMA by DMA
- Continuous supply has many other benefits

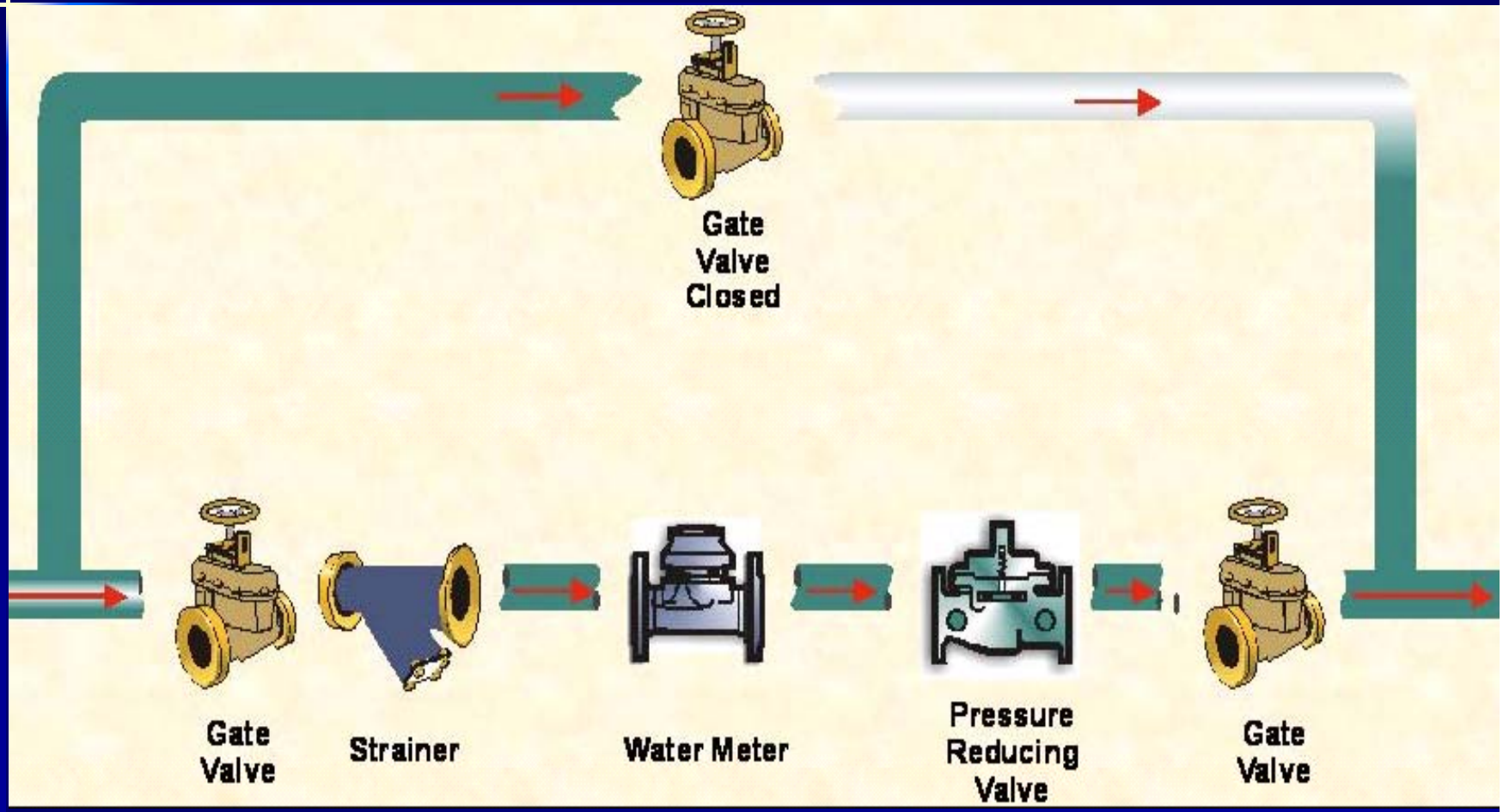
Leakage and Bursts are related to Pressure

- Excessive pressure is a major source of leakage and bursts
- Managing pressure in low pressure systems likewise beneficial
- Reducing pressure has direct impact on existing leaks with immediate results

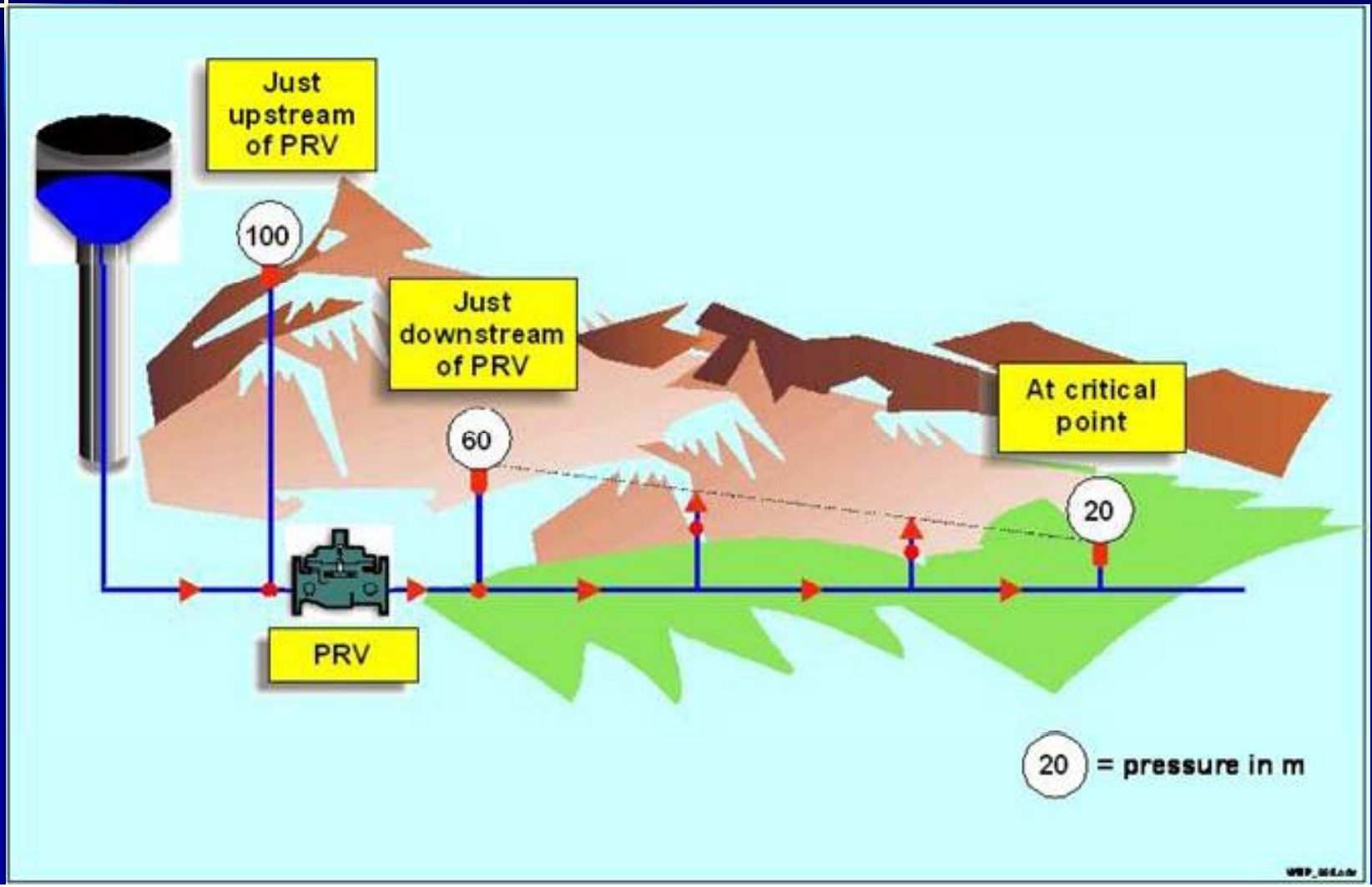
Ways of Reducing Network Pressure

- Zoning by elevation
- Throttled gate valves (not recommended, due to wear on the gate and poor control)
- Pump control --- variable speed drive
- Pressure Reducing Valves (PRVs), the most common method today

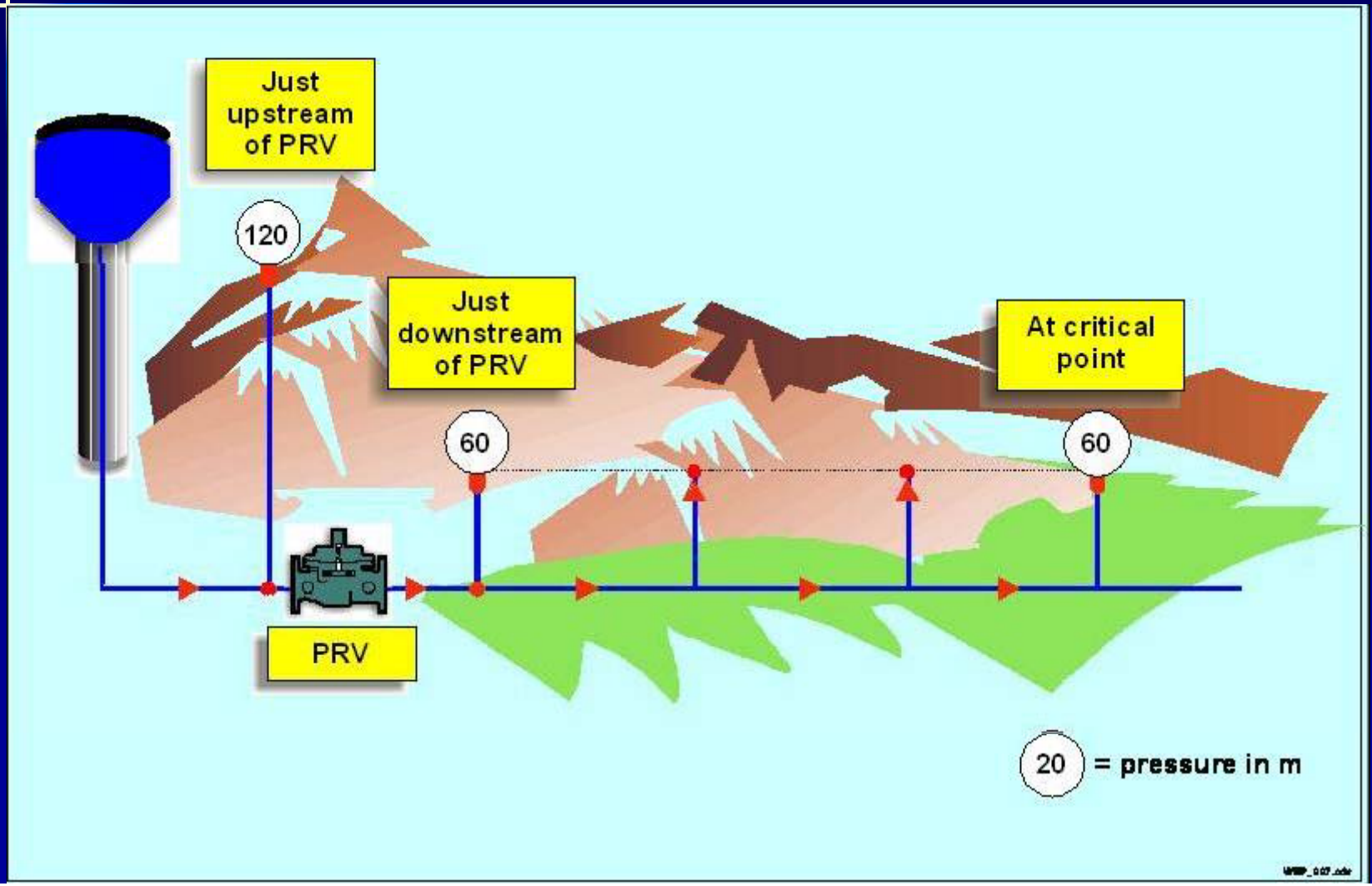
Typical Installation Arrangements



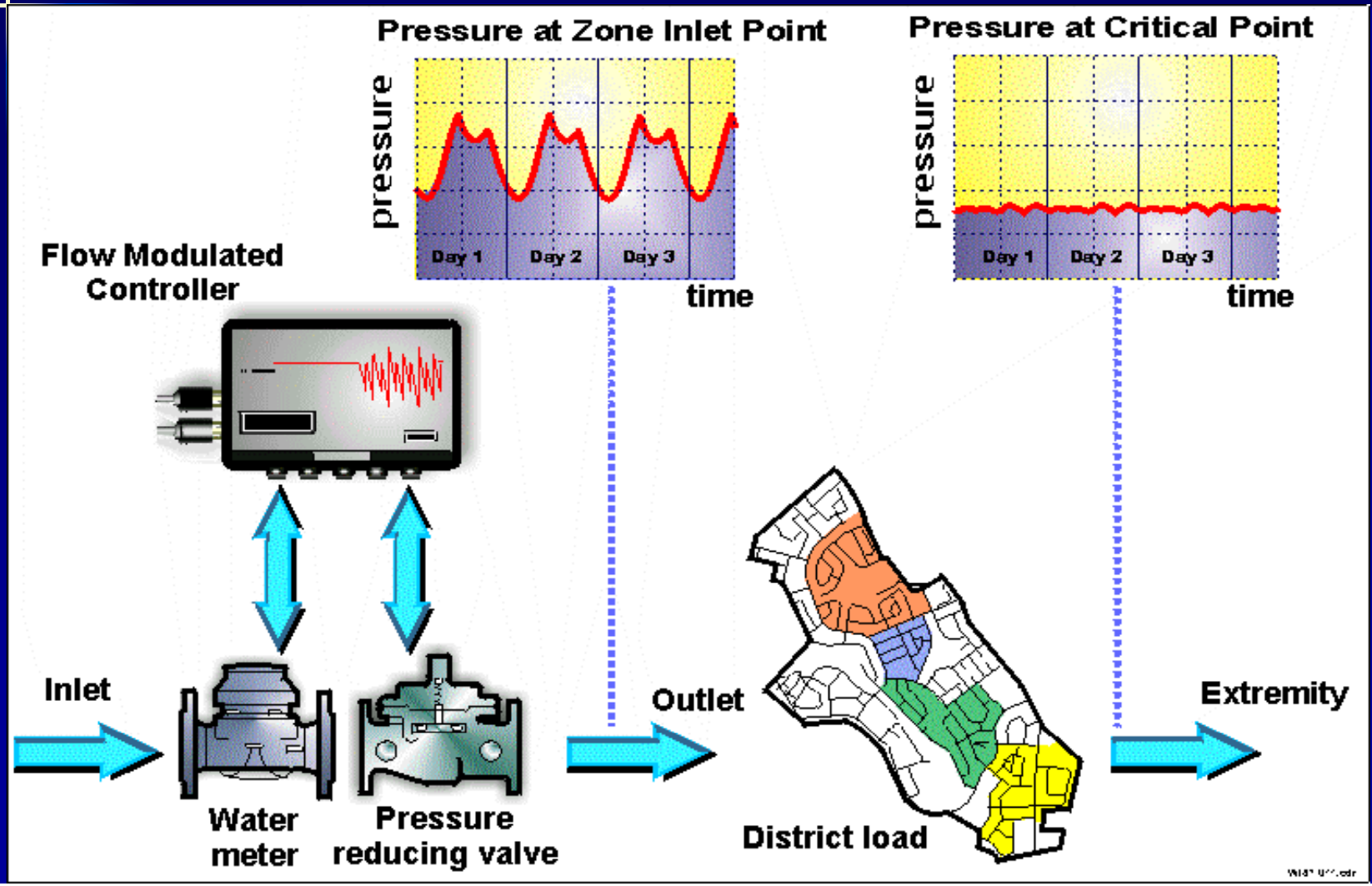
Pressure Variations During Peak Demand Periods



Pressure Variations During Low Demand Periods



Flow Modulated PRV Control: Keep Pressure at Critical Point Constant



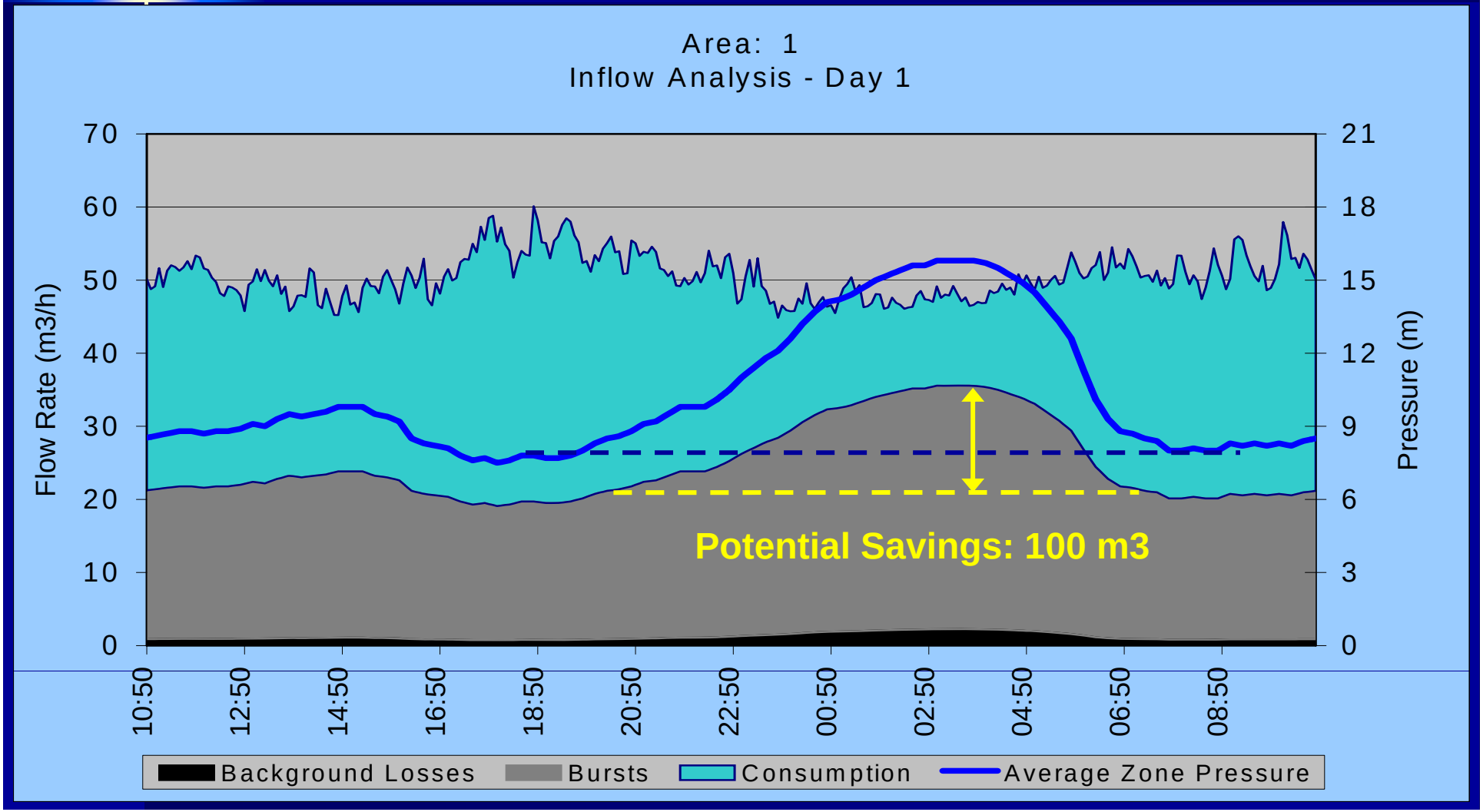
Assessing, Preparing for Pressure Management by Zones

- Identification of potential zones based on hydraulic modelling or pressure mapping
- Demand, customer analysis
- Pressure standards
- Hydraulic modelling to assess effects of pressure reduction on flow/ pressure regime
- Cost/benefit analysis comparing PRV installation with other possible solutions
- Specification (sizing) of PRV (important!!!)

Even in Low Pressure Situations, Pressure Management is Beneficial

- Normally not done – PRVs were traditionally installed to reduce excessively high pressures; but: pressure management also beneficial in low pressure situations
- 10 psi pressure: a 2 psi pressure increase results in about 20% more leakage!!
- In poor quality networks pressure increases caused by leak repair might compensate all savings!

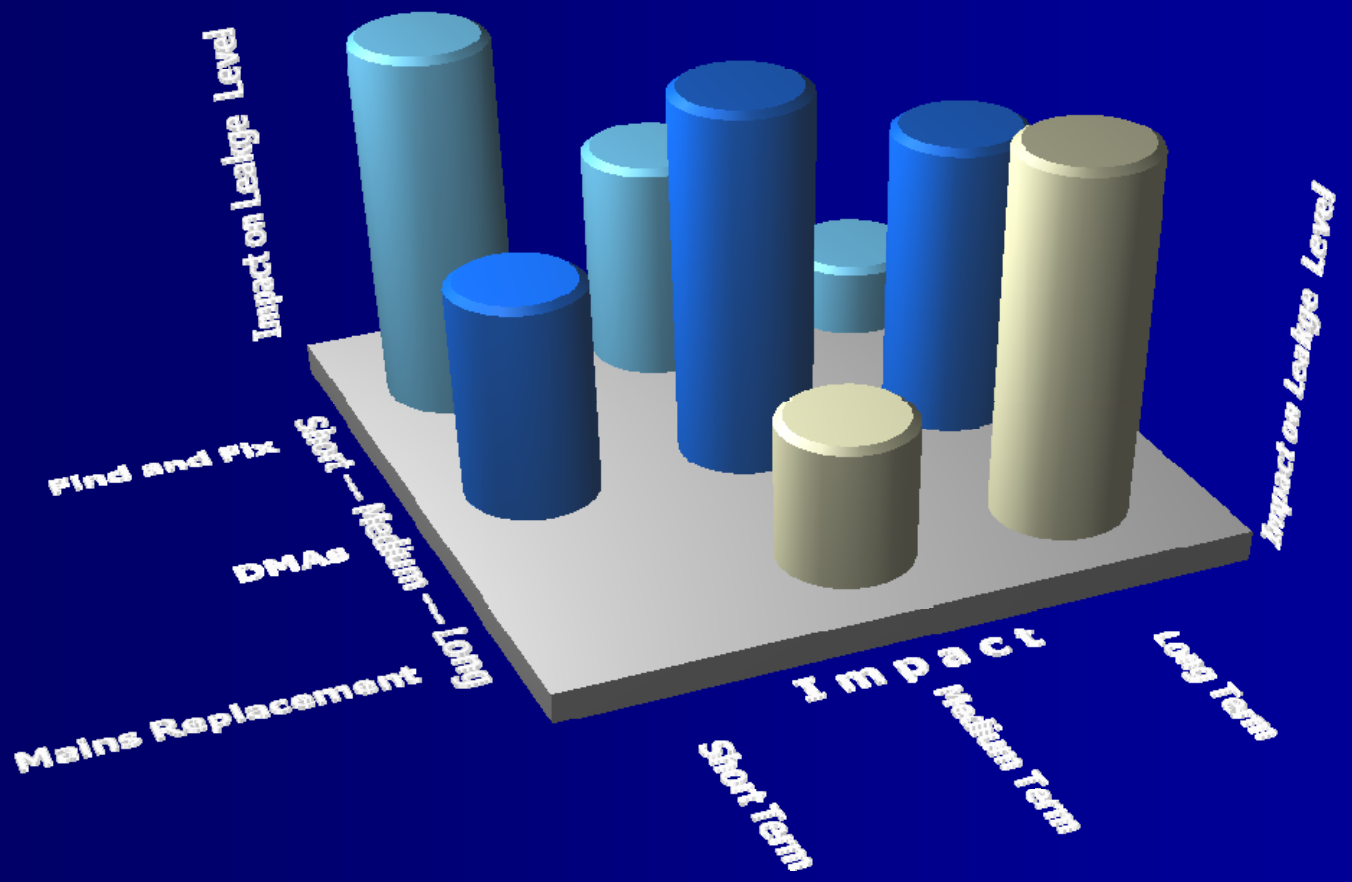
Example: Capping of Night Time Pressure



Key Questions: Repair, Replacement, or Doing Nothing?

- Objective: tackle leaks in a most cost-effective way
- Choices/Decisions
  - Repair or replace or rehabilitate or doing nothing?
  - Repair or reducing pressure, or both?
  - Where to start ?
  - How to set priorities?
  - What materials to be use?
  - Replace as is or in view of future extensions?
  - Operations improvements?

Short-Medium-Long Term Action ➔ Short-Medium-Long Term Impact



Approach for Utilities with Limited Data and Analytical Capacity

- Sophisticated approaches not necessary for many utilities initially; most likely
  - most leakage is way above the economic level and reduction could start immediately
  - savings from leakage reduction the cheapest next source
- Phased approach:
  - prepare, lay the ground for the future
  - begin action on the ground immediately

How to Begin?
Prepare, plan for the future

- Begin to understand
  - calculate water balance
  - initiate bottom-up leakage assessment
- Begin data collection, mapping
- Think about DMAs
- Vision with objectives and targets
- Install bulk meters
- Generate support and commitment
- Assess and build capacity
- Consider options for outsourcing

How to begin? Some Inexpensive Suggestions for Immediate Actions

- Locate and repair visible leaks!
- Improve response time and capacity to repair
- Repair, replace leaking pipes, connections based on common sense judgement:
  - age of pipe alone is NOT a criterion for replacement, but burst frequency may be
  - leaking service connections shall generally be replaced
- Initiate DMAs and pressure management

Specialized Knowledge and Skills Required

- Good analysis requires expertise and experience
- Much information is available, being developed
  - technical groups (IWA) working on manuals
  - many published articles, case studies
  - computer programs
- BUT, most utilities don’t have capacity
- Seek assistance from consultants with track record

Conclusion/ Key messages

- Reducing water losses is a complex, never ending challenge with the certainty of great benefits
- It is essential for improving service provision and operating efficiency of utilities, particularly those in the developing world
- Expert knowledge needed for efficient and effective implementation