



**Non-Revenue-Water (NRW) Reduction –  
Key to improve economic performance of water and wastewater utilities**

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## Background

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In recent years substantial amounts have been invested in Water Loss Reduction programmes in Jordan with little effect on the overall NRW

High NRW is preventing the water supply utilities to operate cost effective and to achieve operational cost recovery.

## NRW figures and Investments in Jordan

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### Amman:

- Investment > 250 million EUR over last 10 years & MC
- Current NRW > 45%

### NGWA:

- Investment approx. 40 million EUR in last 6 years
- Current NRW > 45%

### Madaba Governorates:

- Outsourcing of subscriber management to private company
- Current NRW approx. 45%

### Zarqa / Balqa Governorates:

- No specific investments for NRW reduction
- Current NRW approx. 50%

# Traditional NRW Investment Projects

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## Scope of Work

- Network design
- Tendering of supply and implementation services
- Implementation of network rehabilitation

## Drawbacks

- Supply-side orientation
- Focus on water mains
- Focus on real losses
- Maximum investment, low impact on NRW

### Investment Program Amman, Jordan

Restructuring and rehabilitation of distribution networks

Volume: >250 Mio. €

Implementation: 1998 – 2008

NRW Reduction: from 52% to 47%

High investments addressing real losses - low effect on overall NRW

## Service Outsourcing (Apparent Losses)

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### Scope of Work

- Improve water and wastewater revenue and cash collection
- Reduce customer outstanding amounts
- Improve customer management efficiency
- Installation of IT-based customer management system
- Technical and administrative development of customer management organization

#### Micro PSP Madaba, Jordan

Outsourcing of subscriber management to private company

#### WAJ:

Project Costs: 0,76 Mio. €

Add. Revenue: 1,50 Mio. €

Benefits: 0,73 Mio €

#### Offtaker:

Costs: 0,76 Mio. €

Bonus Payments: 1,50 Mio. €

Total Contract Value: 0,73 Mio €

NRW Reduction from > 50% to 42%

Concentrating on cash collection and not addressing real losses

## Operations and Repair Services (Real Losses)

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### Scope of Works

- Re-engineering of work-flows
- Hydraulic modeling and improving network operations
- Use of modern information management / GIS / DCMMS results
- Improve repair quality and reduce response time
- Use of high quality repair material
- Systematic leakage control and detection
- Pressure reduction

#### PPP Ain Al Basha, Jordan

Effective leak detection, repair and maintenance management

Volume: approx. 0.35 Mio €

Network length: 32km

Implementation: 2007 – 2009


NRW Reduction: from 48% to 30%

Bottom-up approach concentrating on real losses – only on pilot basis

## Conclusion

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- Despite huge investments by utility companies and donors, most of the presently applied NRW reduction measures are not effective
- Outsourcing of subscriber management to private company is concentrating on cash collection not achieving a substantial and sustainable reduction of NRW.
- Outsourcing of maintenance and repair services is not common.
- Technical assistance projects anchored within rigid, bureaucratic institutional framework have only limited impact on NRW reduction



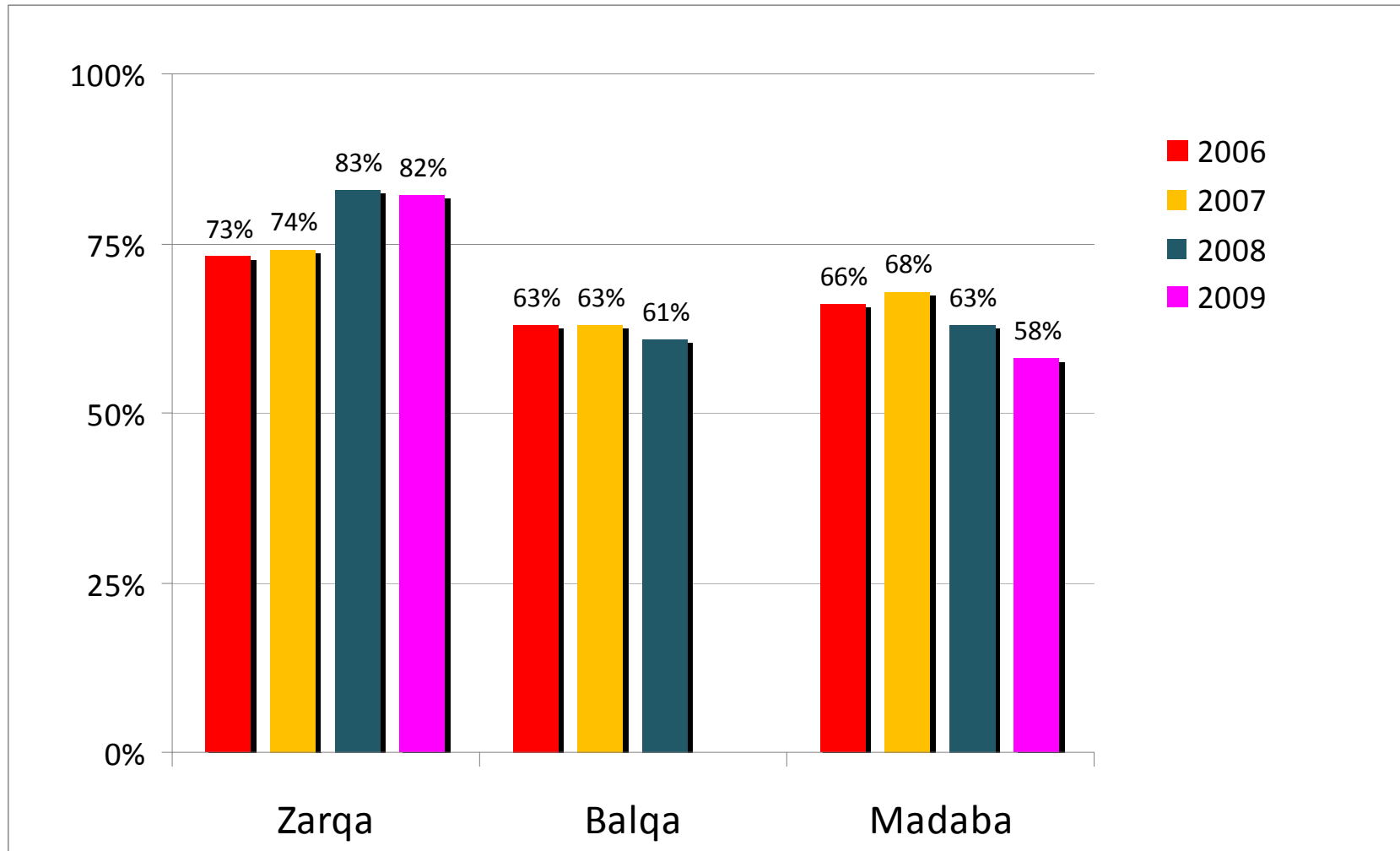
Required is a holistic and performance based NRW reduction approach tailored to the specific needs of the utilities

## Financial Performance - Cost Recovery

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- Majority Water Utilities in Jordan are not achieving O&M cost recovery
- Full cost recovery is not been achieved in any of the utilities
- In the Middle Governorates the operational cost recovery is only reaching between 58% and 83%
- Profit and Loss Statement according to international accounting standards are usually not prepared but are precondition for financial analyses and improved management

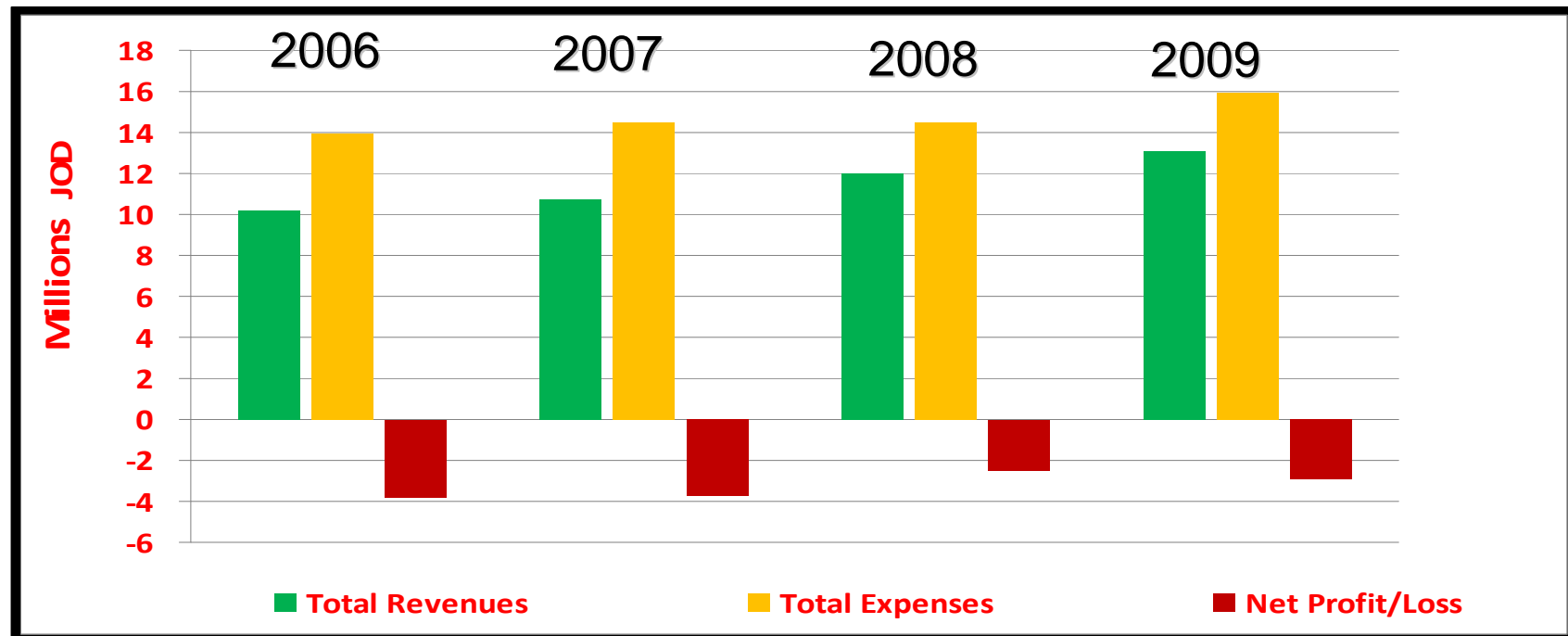
## Middle Governorates O&M Cost Recovery Ratio



Full O&M cost recovery is not been achieved in any of the utilities

## Despite sound financial operation - no O&M cost recovery

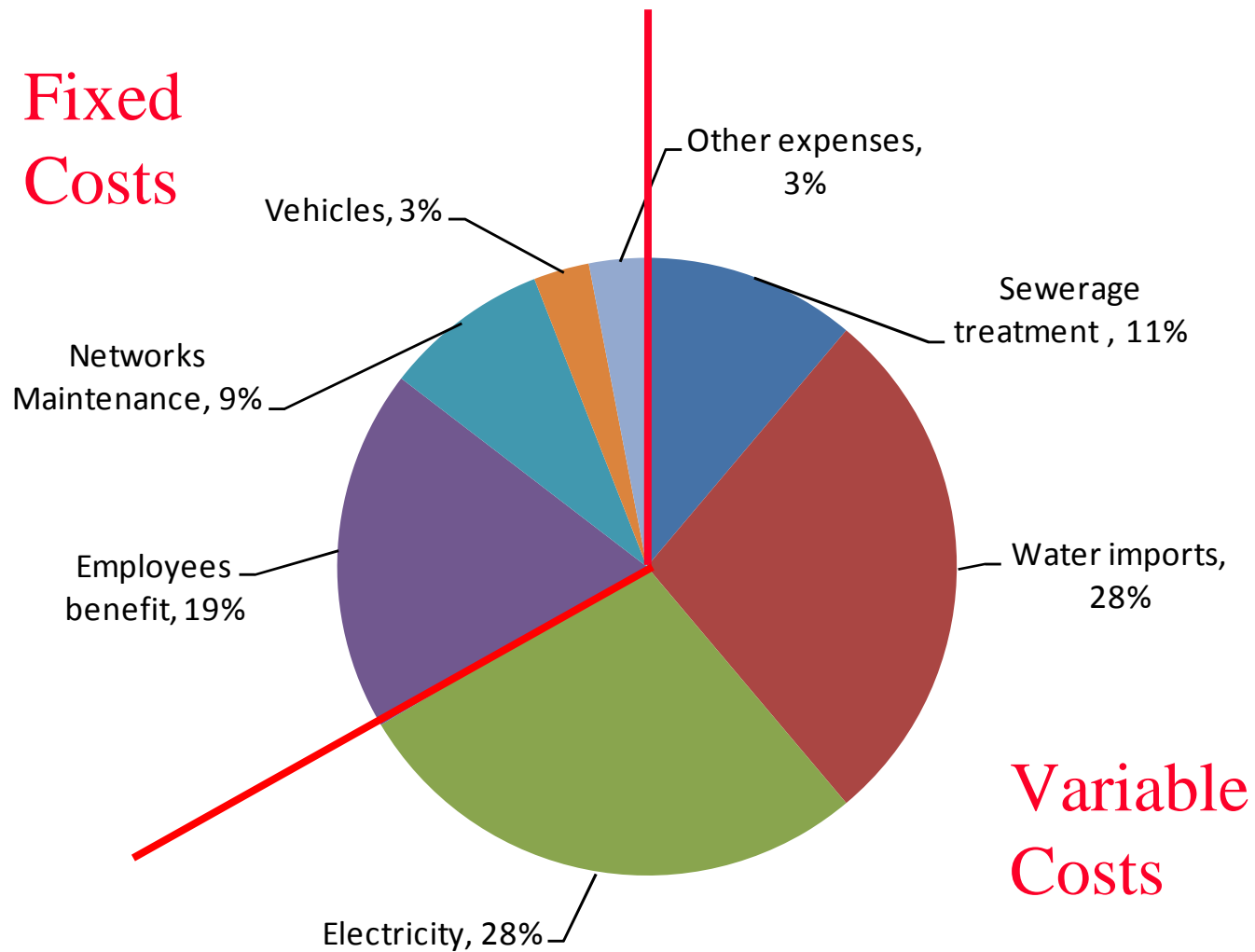
Financial Situation of Zarqa Water Administration during last 4 years



- Increase in revenues since 2006, approximately 28%
- Increase in expenses since 2006, approximately 13%
- Improvement of recovery ratio from 73% in 2006 to 82% in 2009

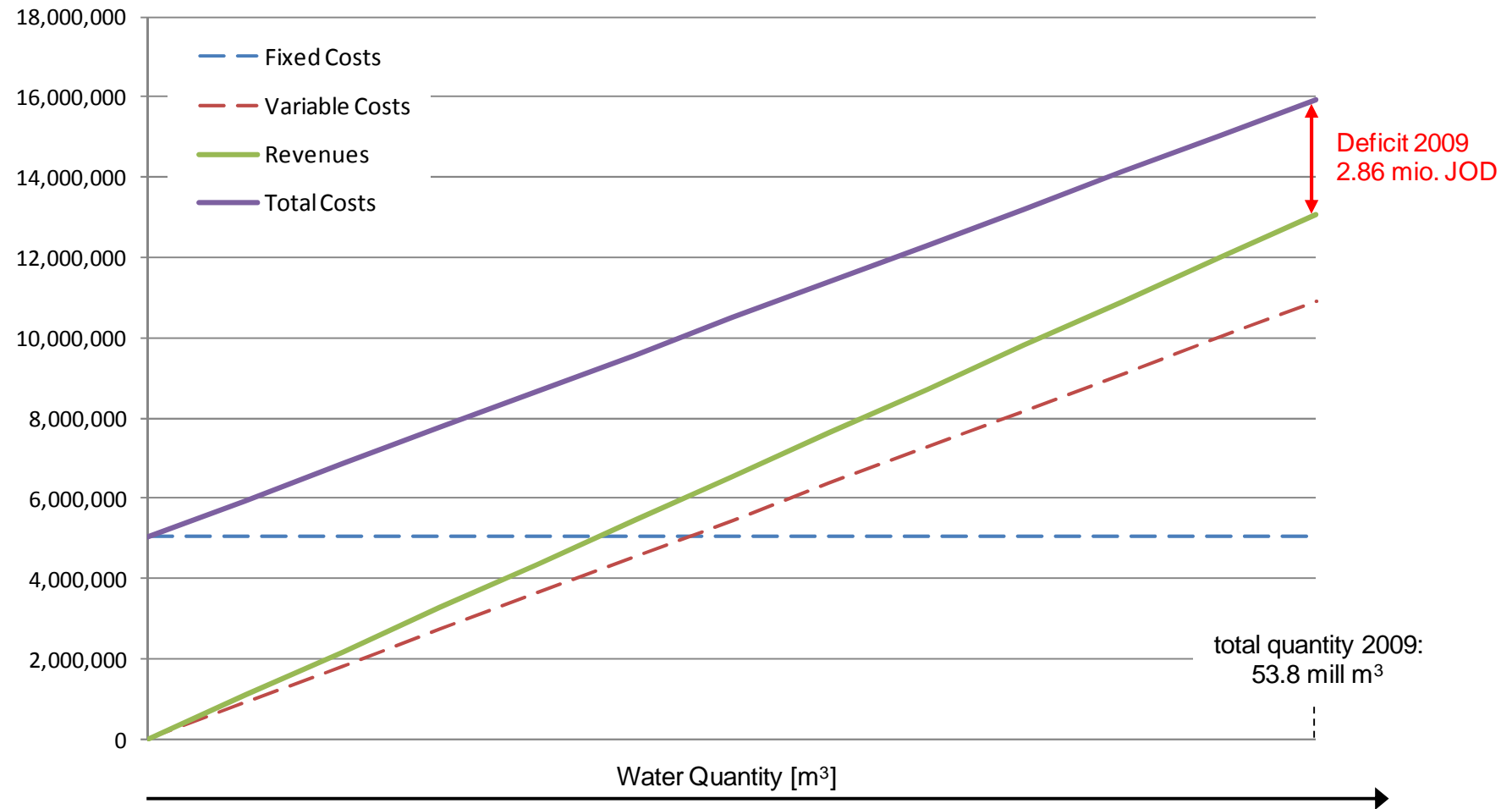
NRW varies between 48% and 54 %

## Variable and Fixes cost categories



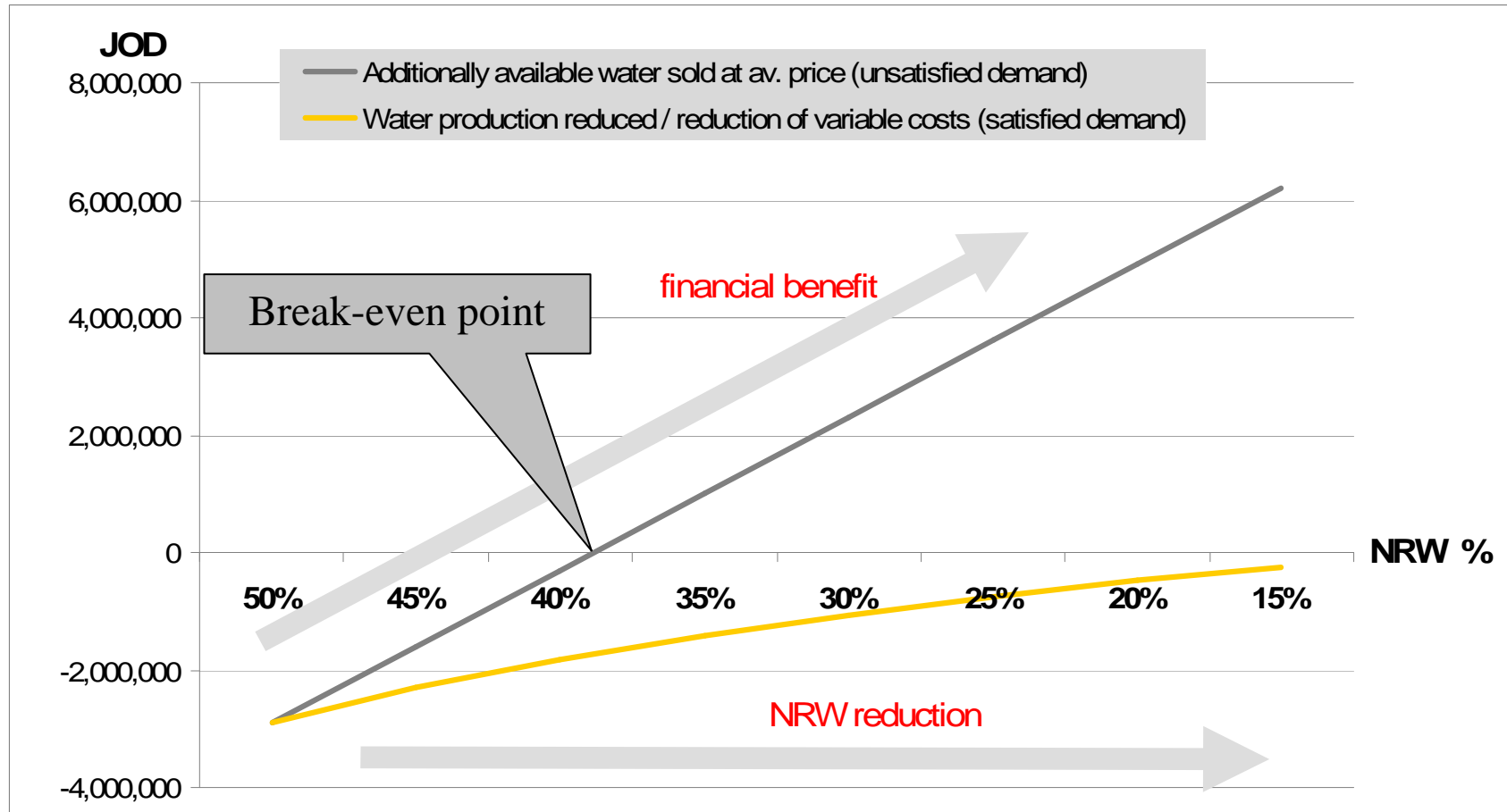
# Break-even analysis

Amount [JOD]



# Water Infrastructure Conditions determine effect of NRW reduction on financial performance

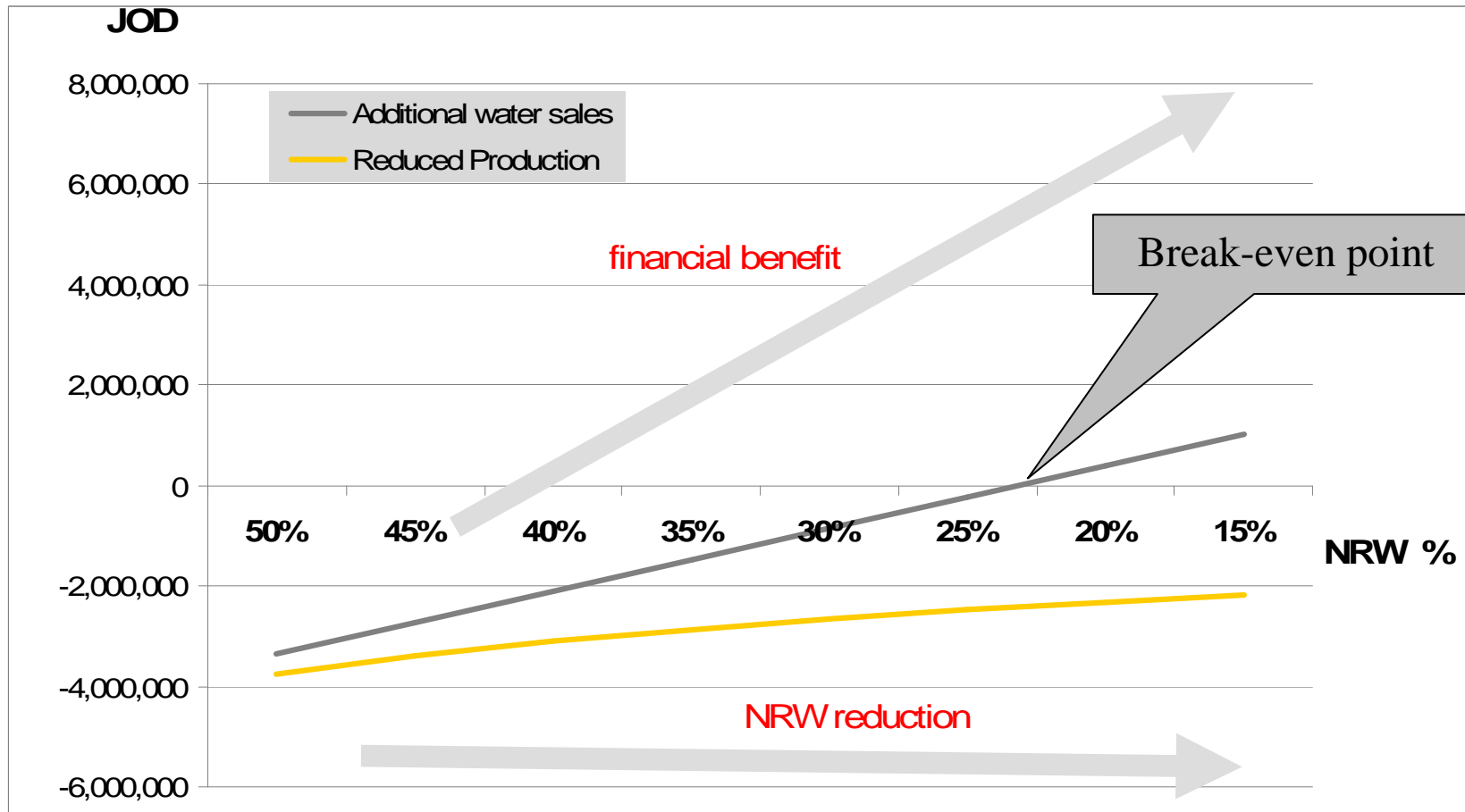
Zarqa: Urban structure – small elevation difference



Break-even point can be achieved if NRW is reduced to 40% and additional quantities are sold (unsatisfied demand)

# Water Infrastructure Conditions determine effect of NRW Reduction on financial performance

Balqa: Rural structure – huge elevation difference

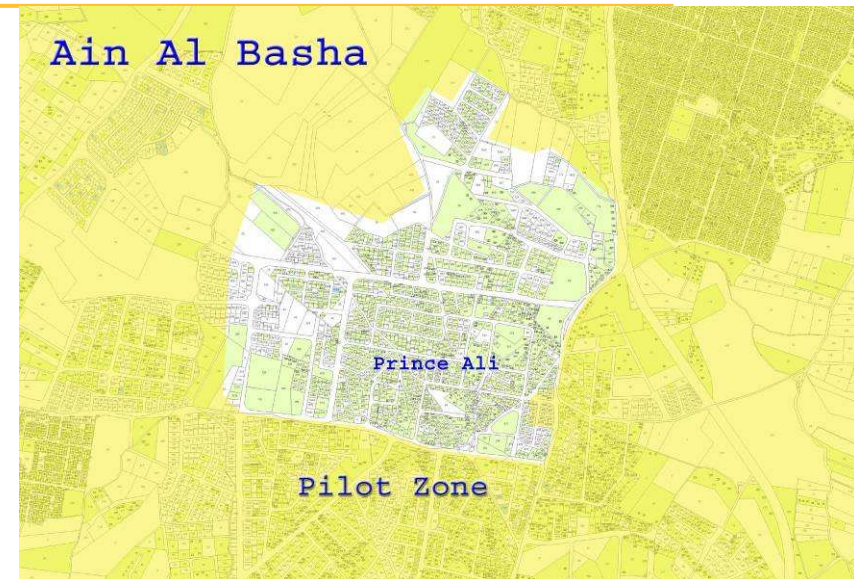


Break-even point can only be achieved if NRW is reduced to 25% and additional quantities are sold (unsatisfied demand)

## Effective network maintenance management combined with pressure modulation in Prince Ali Pilot Area

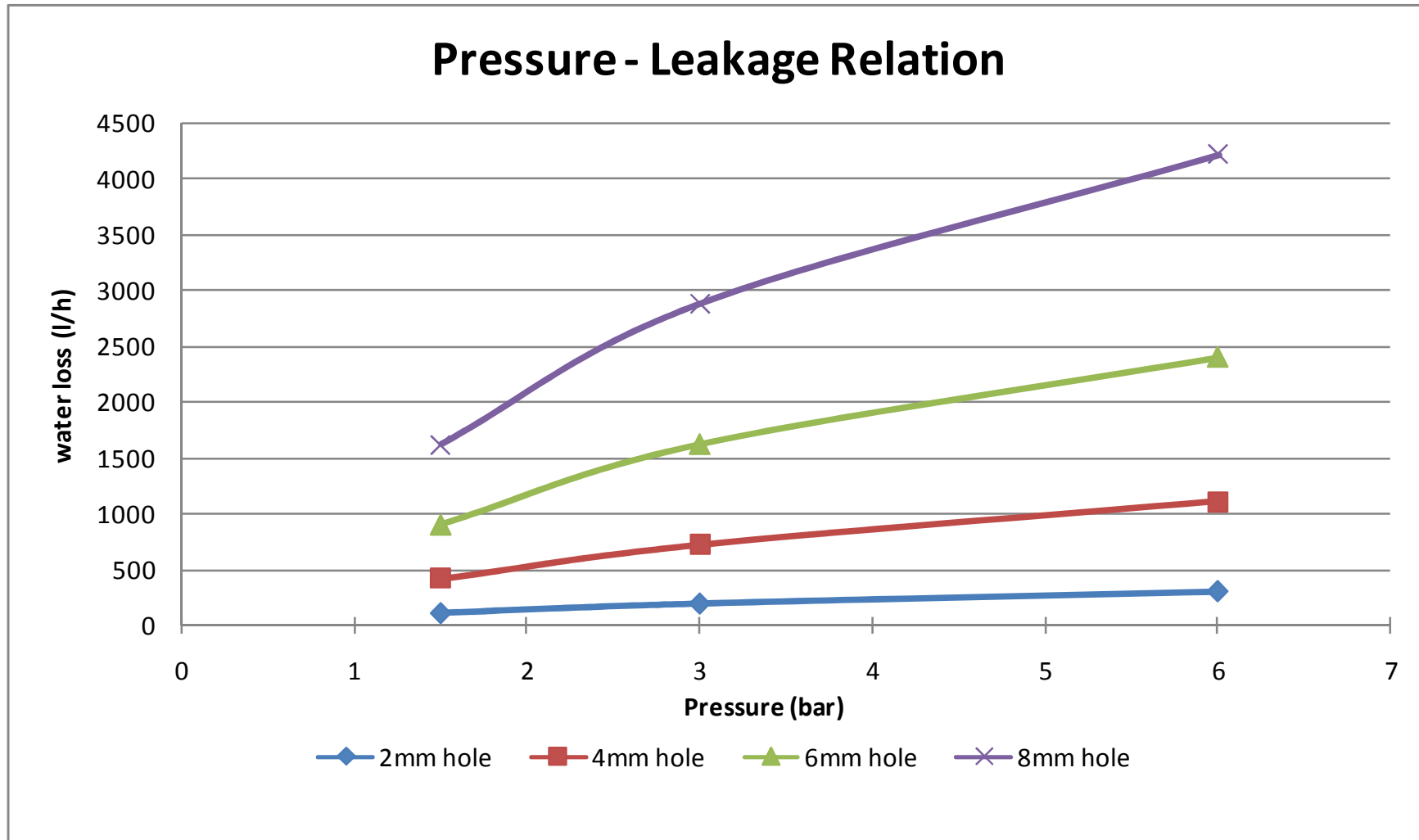
### Approach :

- Isolation of zone and continuous inflow measurements and analysis (BMFO)
- Reliable customer metering and reading (CSS)
- Updated GIS network maps
- Hydraulic Analysis of intermittent supply (DCWater Design Ext.)
- Reliable maintenance records (DCMMS)
- Re-engineered workflows
- Leak detection
- Availability of standard repair material
- Continuous supervision
- Pressure modulation controlled by pressure measurement on critical high point



In combination these measures did achieve a substantial NRW reduction from 48% to 30 % (during the implementation period)

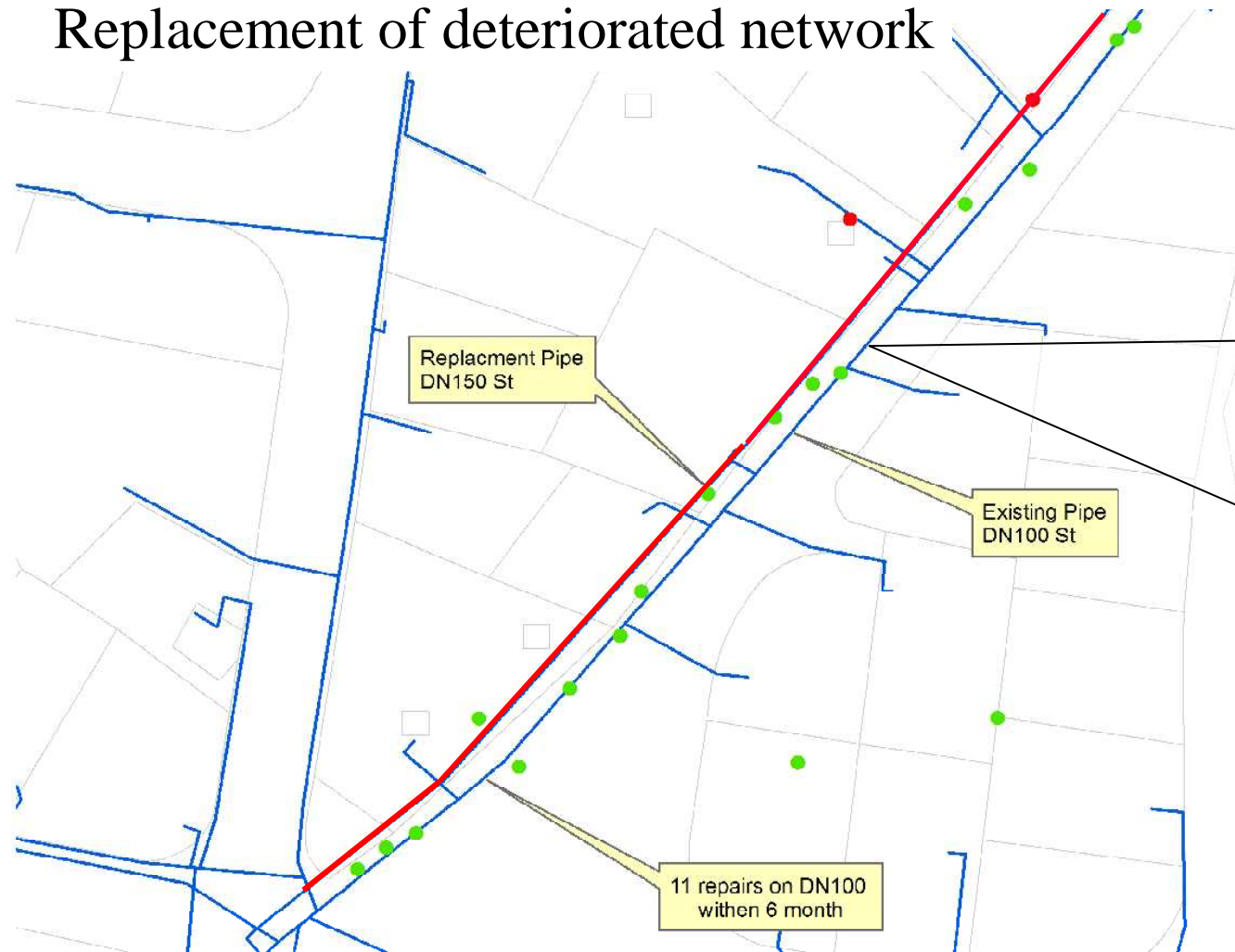
# Effect of Pressure Reduction on NRW



Pressure reduction of 3 bars will reduced losses by 30 to 40%

## Targeted investments and improved repair quality

### Replacement of deteriorated network

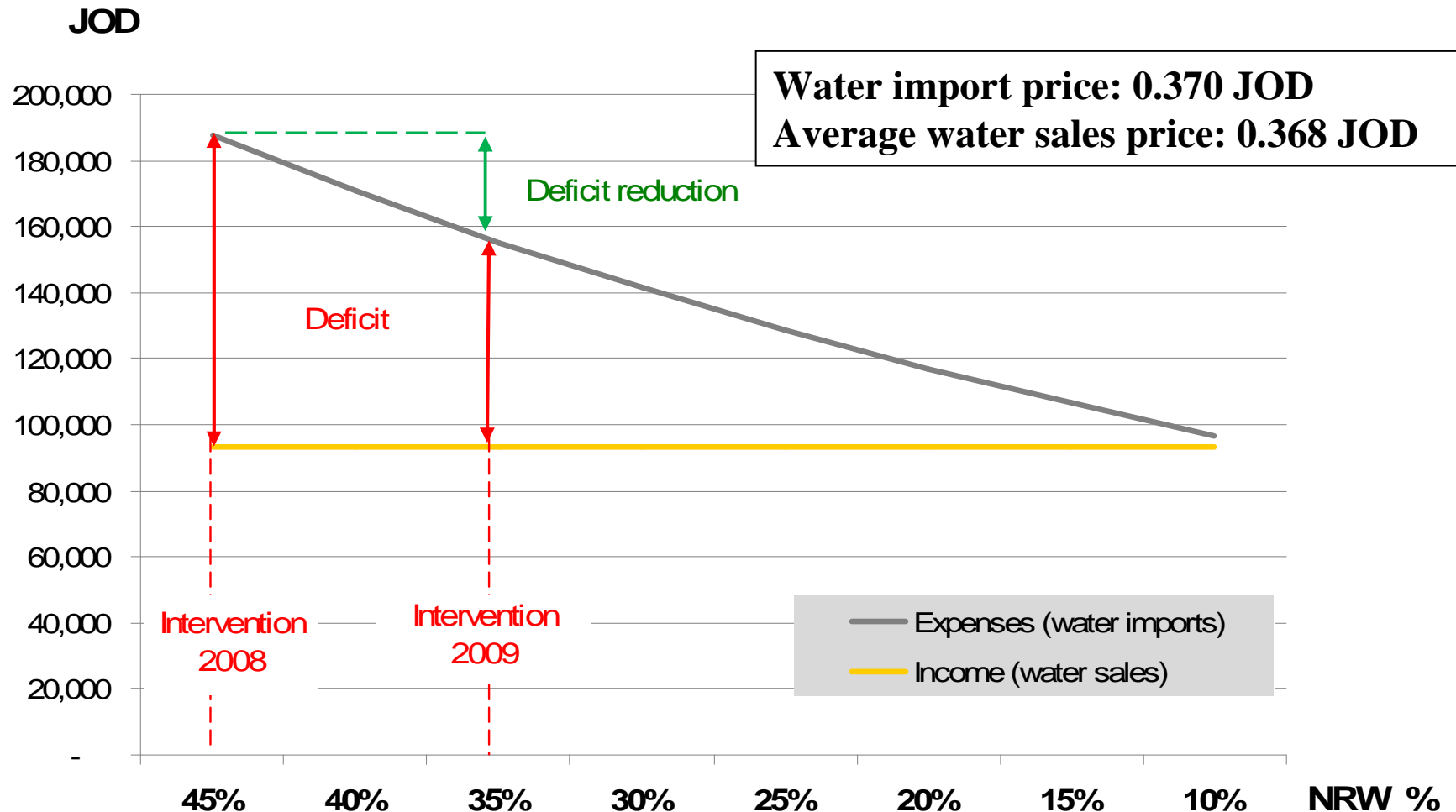


NRW Reduction from 1.91 m<sup>3</sup>/km/h to minimum 0.81 m<sup>3</sup>/km/h.

# Result of effective maintenance management and pressure modulation on NRW

	2nd Intervention 14.06.-06.12.07	3rd Intervention 06.12.07-10.07.08	4th Intervention 10.07.-27.11.08	5th Intervention 27.11.-12.07.09	6th Intervention 12.07.- 20.10.09
<b>Total metered m<sup>3</sup>:</b>	140,560	142,470	114,602	163,605	92,766
	<b>283,030</b>		<b>278,207</b>		
<b>Average m<sup>3</sup>/day/ss:</b>	0.55	0.45	0.54	0.45	0.57
<b>No. of Subscribers:</b>	1,465	1,467	1,548	1,575	1,620
<b>Intervention Period:</b>	175 days	214 days	138 days	228 days	100 days
	389 days		366 days		
<b>System Input m<sup>3</sup>*:</b>	272,626	248,299	162,762	271,665	155,540
	<b>520,925</b>		<b>434,427</b>		
<b>Avg. Inlet per day in m<sup>3</sup>:</b>	1,558	1,160	1,179	1,192	1,555
<b>Avg. Inlet per supplied day in m<sup>3</sup></b>	2,077	1,547	1,438	1,568	1,555
<b>NRW in m<sup>3</sup> / %:</b>	132,066	105,829	48,160	108,060	62,774
	<b>48.4%</b>	<b>42.6%</b>	<b>29.6%</b>	<b>39.8%</b>	<b>40.4%</b>
	<b>45.7%</b>		<b>36.0%</b>		
<b>Supply Mode:</b>					
full supply in %		49	36	57	100
pressure regulation in %		26	45	19	0
no supply in %		25	18	24	0
<b>ILJ</b>	18.8	14.8	13.9	13.2	
*measured by:	Mechan. BM	MD	MD	MD	MD

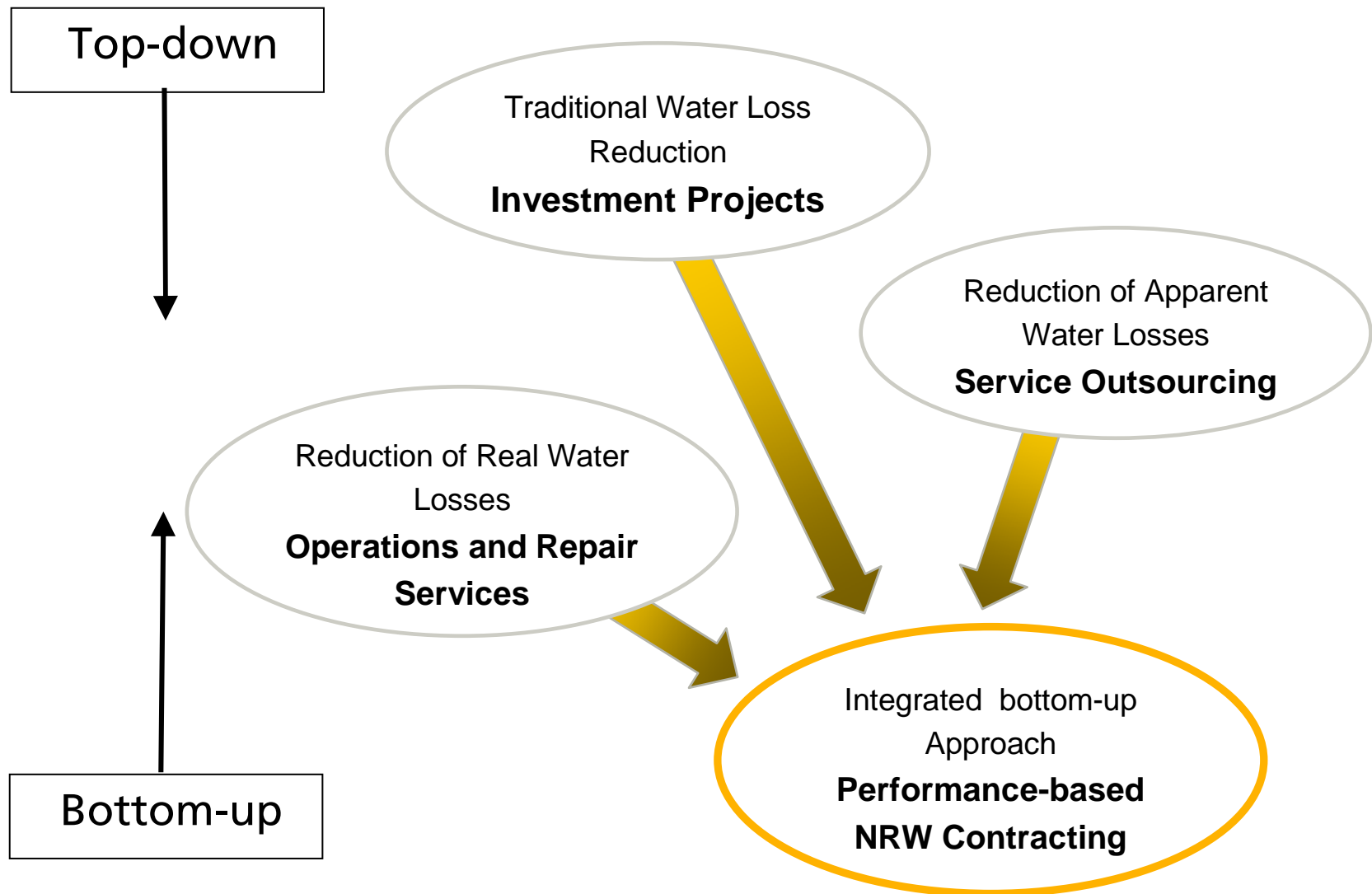
# Financial Benefit of NRW Reduction



O&M cost recovery can't be achieved if the production cost is higher than the sales price

# Introduction of innovative NRW Reduction Approaches

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## Development of new water resources vs. NRW reduction

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NRW is an untapped resource

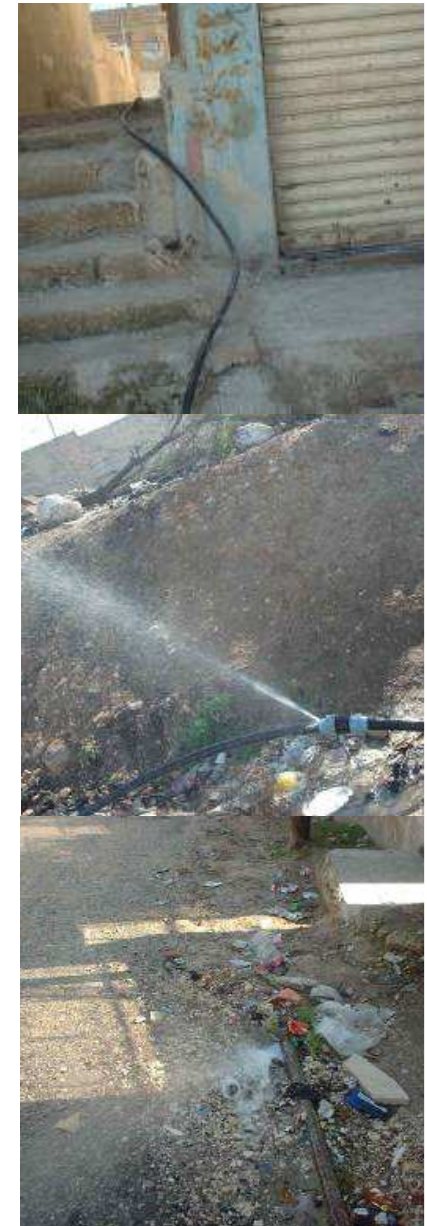
Development of new water resource (groundwater or desalinated brackish/seawater) to satisfy additional water demand is substantially more expensive than reduction of NRW

NRW Reduction	Development of new water resources
One time investment in distribution network rehabilitation	One time investment in new water resources, transmission mains and distribution network to increase transport capacity
Low recurrent costs for improved maintenance	High recurrent costs for operation of new system including personnel and pumping costs
<p><b>Advantage:</b> A permanent low NRW will ensure the best use of the available water resources</p>	<p><b>Disadvantage:</b> Increased water quantity will increase the stress on the already deteriorated distribution network which eventually will further increase losses at increased operating costs</p>
<p><b>Demand Side Management</b> Economic long term sustainable solution</p>	<p><b>Supply Side Management</b> Expensive non-sustainable solution</p>

## Conclusions / Guiding principles

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- Traditional NRW reduction programmes with high investment costs do not achieve the needed NRW reduction required for full O&M cost recovery. Ultimately the high investment cost make it even more difficult and at the current tariff regime even impossible to achieve full cost recovery.
- NRW has to be addressed in a comprehensive approach, as the impact assessment of only partial elements is virtually impossible.
- Performance base NRW contracting based on integrated bottom-up approach eventually will allow Utilities to cover O&M costs.
- Feasibility of future NRW Reduction Programmes should be based on full economic analysis using realistic financial data including profit and loss statements based on international accounting standards





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