Purpose of this example Demonstrate the implementation of an active leakage control solution to reduce water losses	
General information on the water utility or project	
Name of town/project/utility	Mei Modi'in Water Utility, Modi'in City in Israel
Type of project	Water Loss
Scope of project	Active leakage control
Contact (optional)	VP Sales, Ofer Cohen, +972-522-361003 Ofer.Cohen@aquarius-spectrum.com
Asset manager/project manager	Aquarius Spectrum, Ofer Cohen
Service contractor	Aquarius Spectrum, Ofer Cohen
Population (people served)	~100,000
Length of network and age of system	26 km
Number of service connections	20,000
Number of pumping stations	1
Special conditions	Average pressure: 44 meter
Project related ISO standard	ISO 24528
GIS in use, since when?	Yes, since 2013
Main methods and tools	**Platform detecting and monitoring water loss in urban environments based on wireless acoustic sensors – multi-layer leak detection solution:** • algorithm that processes acoustic signals; • high detection threshold sensor designed to allow firm fixing; • correlation at any measurement, to allow high accuracy of leakage location; • sensors detecting leakage in metal, steel and plastic pipes with similar detection ranges; • mobile system operation by smartphone, performing leakage investigation and precise detection.
Initiation and main features of the project (AM/water loss)	
Objectives and policy/regulation, if relevant?	
The main objective of the project is real water loss reduction and management, to meet a regulatory requirement of lower than 8% water loss level.	
What are the main actions in the recent past (lengths of rehabilitated network, acquisition of knowledge, active leakage control, pressure management, DMA…)?	
The Maccabim-Reut service area of Mei Modi'in Drinking Water Utility has PVC and PE plastic pipes installed. It is divided into DMAs; users are connected to an AMR system. The combination of these conditions facilitated an integrated investigation to confirm detection. Active Leakage Control had been conducted in response to reported leaks and leak detection in targeted areas.	
What are the tools, criteria, performance indicators, technologies, used to implement the project (see e.g. ISO 24523 or ISO 24528)?	

1. Sensors installation to detect water leakage in plastic pipeline within the drinking water utility's service area;
2. Sensors installation to detect water leakage in steel pipeline serving as a control group;
3. System performance analysis;
4. Correlation with the AMR system of the drinking water utility.

Project activities

Main activities (leak repair, pipe renewal, special techniques, …): (include figures or volumes if available

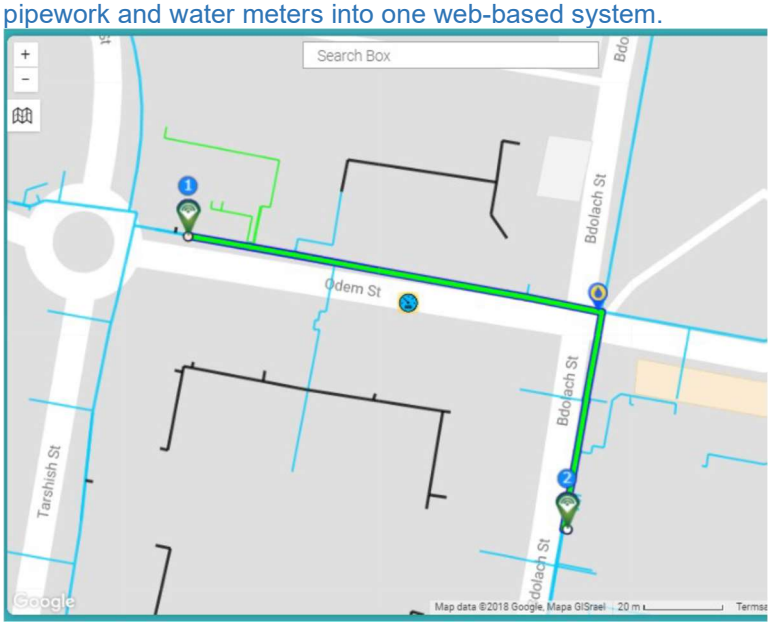
In this project, 200 remote leak detection sensors were installed – 100 on plastic pipeline and 100 on steel pipeline. The 200 sensors consisted of 50 hydroponic sensors, and 150 acoustic sensors, installed in different points of the Maccabim-Reut service area. The sensors were installed on fittings such as: hydrants, garden irrigation meters and valve trenches (on trenches and valves, sub-surface acoustic sensors were installed).

Sensor installations on steel pipeline:

In parallel, and as a means of control, hydroponic sensors were installed to detect water leakage on steel pipeline in the city of Modi'in. Data was collected and the results were analyzed in comparison to the plastic pipeline.

Integration with AMR system:

The design of an integrated module consisting of a leakage detection system and an AMR system is innovative. The system, which detects new leakage events and indicates their location, can, together with the AMR system, confirm notifications as being real water losses from the utility network, or from private premises / residential buildings. This innovative application is enabled with the integration of pipework and water meters into one web-based system.



System operation and water utility-supplier cooperation:

The drinking water utility Mei Modi'in and the supplier Aquarius Spectrum cooperate to control the system on a daily basis. The drinking water utility's engineering department performs daily tests and follow-ups on the different data. Where leakage is suspected, or an application is required, the drinking water utility consults with the supplier to analyze the received data. On a monthly basis, a representative of the supplier investigates the field to detect failure/leakage, informing the drinking water utility of the required repair work.

The cooperation of the supplier and the drinking water utility includes regular meetings once every few weeks, during which additional needs and system improvements are characterized, and consecutive steps are considered.

Outcomes of the asset management policy

Results. What are the main outcomes in terms of impact on the assets, the operation, the planning of works, etc.?

Water loss savings:

The purpose of the system implementation was to reduce real water loss and alert small water leakages, to inform the design of pipeline modifications and maintenance as preventative actions rather than breakage maintenance.
The potential savings calculation assumes that leakage is developed in accordance with pipe hole size and system pressure, while reparation only takes place when water appears at the surface or when road/pavement submergence occurs.
According to accepted industry calculations, small and medium leakage (1.5 mm - 7 mm) detection time is 12 months or more. Large leakage detection time (more than 7 mm, no water burst) is at least 6 months. This is under the conservative assumption that the diameter of the leak does not grow in time.
Based on this calculation, and in view of:

- 36 sub-surface water leakages detected and repaired,
- 5 private premises leakages detected and repaired, and
- 5 continuous 24/7 irrigation plans changed –

It is estimated so far that there is a savings potential of 445,108 m3 of water for the drinking water utility, which accumulate to 2.5m NIS in savings. This should be compared to a system cost of 2m NIS. See following calculations.

Setbacks, failures, upcoming activities (optional):

Financial aspects

How is the project budget defined? What are the constraints? What is the impact on tariff? Is there a specific budget dedicated to asset management policy, on top or instead of usual budgets (OPEX and CAPEX)? For what duration?

Impact on the operational costs quantified or analyzed and which method is used?

2.5m NIS in savings compared to a system cost of 2m NIS. See attached calculations.

Indicate financial criteria (e.g. return on investment), give figures

Method for the estimation of the value of assets (optional)? Depreciation method used

Recommendations for a good management of assets

Conclusions, return of experience (lessons learned)

Applying Aquarius Spectrum's leakage detection system, the drinking water utility sees a decrease in water loss. The cooperative day-to-day work leads to many leakages detections, thus allowing the drinking water utility to operate immediately and avoid additional water loss.
Additional benefit is the detection of leakages in liminal areas between the drinking water utility's authority and private premises – this allows the utility to notify users about failures so that private costs can be saved. The detection of leakages at an early stage allows the utility to operate with minimal disturbance to population, while avoiding costly ad-hock repair-work.

Possible improvements

Improved algorithms for the analysis of information, including received signals, and integration with AMR.

Outlook and suggested improvements

Appendix water loss calculation:

System water leakage description						Water loss calculation	
Sensor type	Diameter	Pipe type	Leakage address	Leakage strength	Leakage No.	Annual loss	Hole diameter
GPS OG	6-8	metal	a	2	27709	563.88	1.50
GPS OG	4-6	metal	b	4	29847	1,315.71	3.00
GPS OG	14-16	metal	c	5	28278	1,886.50	4.00
GPS OG	4-6	metal	d	9	32848	6,046.61	6.50
GPS OG	8-10	metal	e	10	27494	7,679.67	7.00
GPS OG	6-8	metal	f	12	29849	5,201.89	8.00
GPS OG	4-6	metal	g	12	34204	5,201.89	8.00
GPS OG	6-8 close to connection with 8-10	metal	h	13	27406	5,201.89	8.00
GPS OG	8-10	metal	i	13	33796	5,201.89	8.00
GPS OG	4-6	metal	j	14	33862	5,201.89	8.00
GPS OG	4-6	metal	k	16	28336	7,604.49	10.00
GPS OG	4-6	metal	l	17	25707	7,604.49	10.00
GPS OG	4-6	metal	m	18	33311	7,604.49	10.00
GPS OG	6-8	metal	n	19	28291	7,604.49	10.00
Radio UG	6-8	metal	o	26	28479	7,604.49	10.00
GPS OG	6-8	metal	p	29	25489	7,604.49	10.00
GPS OG	4-6	metal	q	29	25646	7,604.49	10.00
GPS OG	8-10	metal	r	29	29230	7,604.49	10.00
GPS OG	4-6	metal	s	31	33460	7,604.49	10.00
GPS OG	4-6	metal	t	32	32482	7,604.49	10.00
GPS OG	connection between 4-6 & 10-12	metal	u	32	33841	7,604.49	10.00
GPS OG	4-6	metal	v	33	33720	7,604.49	10.00
GPS OG	10-12	metal	w	38	27701	12,931.33	12.00
GPS OG	4-6	metal	x	41	29476	12,931.33	12.00
GPS OG	6-8	metal	y	41	25504	12,931.33	12.00
GPS OG	4-6	metal	z	42	24181	12,931.33	12.00
GPS OG	4-6	metal	aa	45	29253	12,931.33	12.00
GPS OG	8-10	metal	bb	46	33436	12,931.33	12.00
GPS OG	4-6	metal	cc	49	33866	12,931.33	12.00
GPS OG	4-6	metal	dd	65	34075	12,931.33	12.00
GPS OG	4-6	metal	ee	69	33461	12,931.33	12.00
GPS OG	4-6	metal	ff	79	24518	12,931.33	12.00
GPS OG	4-6 close to connection with 10-12	metal	gg	81	33582	12,931.33	12.00
GPS OG	4-6	metal	hh	82	33574	12,931.33	12.00
GPS OG	4-6	metal	ii	84	25094	12,931.33	12.00
GPS OG	4-6	metal	jj	87	34253	12,931.33	12.00
GPS OG	10-12	metal	kk	89	27191	12,931.33	12.00
GPS OG	6-8	metal	ll	96	29019	12,931.33	12.00
GPS OG	4-6	metal	mm	107	33501	12,931.33	12.00
GPS OG	6-8	metal	nn	117	26982	12,931.33	12.00
GPS OG	8-10	metal	oo	165	27409	12,931.33	12.00
GPS OG	6-8	metal	pp	222	27983	12,931.33	12.00
GPS OG	2-4	metal	qq	415	28968	12,931.33	12.00
GPS OG	8-10	metal	rr	625	29408	12,931.33	12.00
GPS OG	4-6	metal	ss	1281	24312	12,931.33	12.00
Radio UG	2-4 close to connection with 6-8	PE	tt	2754	26258	12,931.33	12.00

Calculation explanation

Calculation is done under the assumption that a leak would have continued for one year at least. For large leaks (>8mm) the calculation is for 6 months.

Total water savings (m^3) 445,108

Total money savings (NIS) 2,537,114

System calibration data					
Annual savings (NIS)	Price of water (NIS)	Annual gallon for water loss calculation	Annual m3 for water loss calculation	Estimated leakage diameter (mm)	Strength according to AS's system
1,833	5.5	88,055.6	333.33	1.0	0
1,833	5.5	88,055.6	333.33	1.0	1
3,327	5.9	148,961.3	563.88	1.5	2
5,210	5.9	233,286.8	883.09	2.0	3
7,763	5.9	347,572.9	1,315.71	3.0	4
11,130	5.9	498,360.5	1,886.50	4.0	5
15,459	5.9	692,190.5	2,620.23	5.0	6
20,896	5.9	935,603.9	3,541.65	5.5	7
27,586	5.9	1,235,141.5	4,675.52	6.0	8
35,675	5.9	1,597,344.2	6,046.61	6.5	9
45,310	5.9	2,028,752.9	7,679.67	7.0	10
61,382	5.9	2,748,389.1	10,403.79	8.0	11
89,733	5.9	4,017,788.4	15,208.99	10.0	16
152,590	5.9	6,832,192.4	25,862.67	12.0	35