ETV

VERIFICATION REPORT

Final

“Wetnet”

Report N° 2015-DG-MP-69

Revision N° 03

Prepared by: Felice Alfieri

Approved by (ETV Technical Manager): Laura Severino

Laura Severino

01/08/2016

Contents

1. INTRODUCTION

RINA SERVICES, hereinafter RINA, commissioned by the Ingegnerie Toscane srl, has verified the performance claim of the technology "Wetnet" according to the relevant procedures for EU ETV as for GVP Version 01 - July 7th, 2014 and the requirements set in the Specific Verification Protocol N° 2015-DG-MP-69, Revision N° 03 of 27/05/2016.

Wetnet was developed and brought to the market through the EU founded project "WETNET" "innovative in-pipe hot-tap insertion floW sEnsor plus smarT NETworks enable ecowise pervasive monitoring of water distribution grids". The WETNET project has received funding from the CIP-EIP-Eco-Innovation-2012 call under the contract number: ECO/12/332771 WETNET.

1.1. NAME OF TECHNOLOGY

Wetnet

1.2. NAME AND CONTACT OF PROPOSER

Name: Ingegnerie Toscane srl
Contact: Ing. Oberdan Cei
Address: Via De Sanctis 49,
Telephone: +39 (050) 843207
Telefax: +39 (050) 843400
Email: o.cei@ingegnerietoscane.net

1.3. NAME OF VERIFICATION BODY/VERIFICATION RESPONSIBLE

RINA, accredited EU ETV Verification Body, conform to the requirements of ISO/IEC 17020 for inspection bodies type A and of the GVP version 1.

1.4. VERIFICATION ORGANISATION AND EXPERTS

RINA personnel and external reviewers in charge of the verification activities are listed in the table below:

ROLE – VERIFICATION BODY	LAST NAME	FIRST NAME
ETV TECHNICAL MANAGER	SEVERINO	LAURA
INTERNAL REVIEWER	MARTI	LAURA
ETV SERVICE COORDINATOR/ETV INSPECTOR	ALFIERI	FELICE
ETV TECHNICAL EXPERT	MUSETTI	ALBERTO
EXTERNAL REVIEWER	MAFFINI	ANDREA

Tests were performed in-house by Ingegnerie Toscane. The main personnel involved in the testing activities are listed in the table below.

ROLE – TEST BODY	LAST NAME	FIRST NAME
TEST MANAGER	CEI	OBERDAN
INTERNAL AUDITOR	SUSSARELLU	FRANCA

The tests were conducted with the technical support of Acque SPA, the water distribution system operator.

1.5. VERIFICATION PROCESS

The verification carried out by RINA included the following activities:

- Eligibility Assessment: Wetnet is a technology eligible for EU ETV. This technology falls within the scope of the EU ETV pilot programme and in particular in the Technological Area 1 “Water Treatment and Monitoring” according to the GVP; it is already on the market and contributes to the efficient use of natural resources and a high level of environmental protection.

- Verification Proposal Assessment: The initial performance claim has been revised. RINA has provided a detailed cost estimate for the verification procedure. Based upon the cost estimate, the verification contract has been drafted and signed by Ingegnerie Toscane.

- Specific Verification Protocol review: Upon successful completion of the contact phase and proposal phase RINA developed the specific verification protocol following the provisions of the GVP. The drafted SVP was reviewed by an internal and by an external technical expert. The SVP includes:
    - Summary description of the technology, its intended application and associated environmental impacts
    - Definition of verification parameters (revised performance claim)
    - Requirements on test design and data quality
    - Requirements on test and measurement methods, definition of calculation methods for performance parameters
    - Description of the way in which operational, environmental and additional parameters are to be dealt with in the verification process
    - Assessment of existing data and conclusions on the need or not for additional tests or measures

- Test plan review: the test plan, drafted by Ingegnerie Toscane was subject to review and approval from RINA.

- Test system / test performance audit: a physical audit was conducted by RINA during the actual testing of the technology in order to perform a qualitative and quantitative evaluation of the measurement system as used in the specific test. The testing activities were performed from the 29th of May 2016 to the 2th of June 2016, performed in-house by Ingegnerie Toscane.

- Test report review: the test report, drafted by Ingegnerie Toscane, was subject to review and approval from RINA.

- Verification reporting. Based on the outcome of the assessment of data and verification RINA drafted the Verification Report and the Statement of Verification

- Verification Report / Statement of Verification review: the drafted Verification Report and Statement of Verification were reviewed by an internal and by an external technical expert. The verification report has been finally approved by the RINA’s ETV Technical Manager Laura Severino.

  A detailed time schedule of the activities carried out by RINA is available in the table 1.

Table 1: ETV Time Schedule

TASK	DATE
Eligibility Assessment	December 2014
Verification Proposal Assessment	March 2015
Specific Verification Protocol – Review	May 2016
Specific Verification Protocol – External Independent Review	May 2016
Test Plan Review	May 2016
Test System / Test Performance Audit	June 2016
Test Report Review	June 2016
Verification Reporting	June 2016
Verification Report / Statement of Verification - Review	June 2016

1.6. DEVIATIONS TO VERIFICATION PROTOCOL

No deviations from the specific verification protocol are reported from the implementation of the test activities.

2. DESCRIPTION OF THE TECHNOLOGY

2.1 SUMMARY DESCRIPTION OF THE TECHNOLOGY

Purpose

WETNET main purpose is to enable early detection of leakages and abnormal operational conditions in pressurized water distribution grids, hence allowing reducing the life of leaks, optimizing active monitoring and control of the volumes pumped and saving energy.
WETNET also allows time and space resolution of the information to unveil all energy and mass dissipation to analyze the link between flow and the energy to supply the water.

Principle of operation

The detection of the leakages, according to the ASAP Protocol, is based on the daily monitoring of the 'min_nigth' parameter, corresponding to the minimum water flow measured in the District Metered Area (DMA). In this application of the Wetnet System object of ETV Verification the min_night is calculated as average of the flow measurements collected during the night time (04:30 – 05:30),

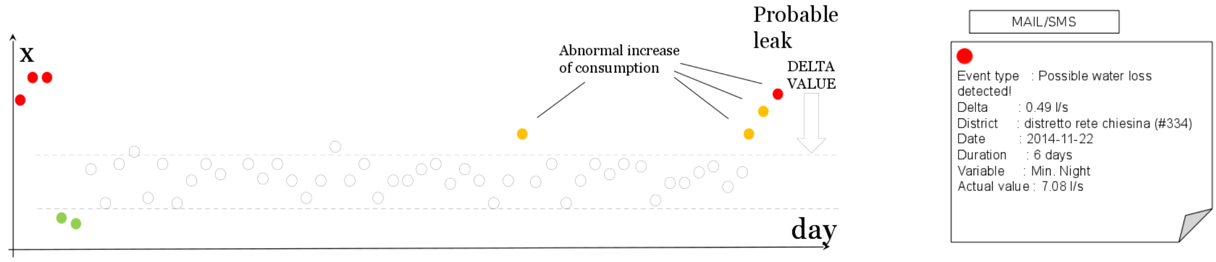

Fig.1: Event identification process in Wetnet.

How it works

WETNET is a highly configurable system which can be delivered as a service, as a software or an integrated system including sensors, datalinks, and the elaboration and presentation computer programs.

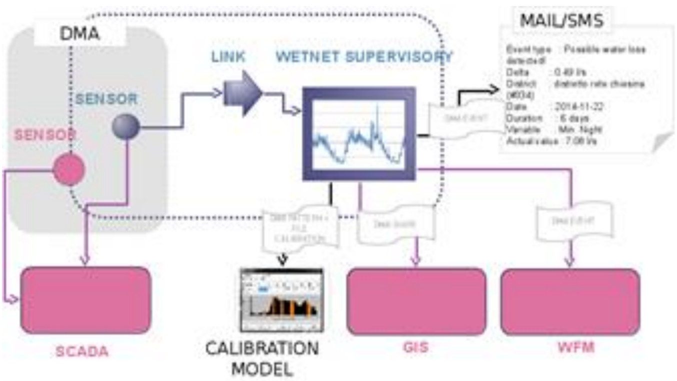

Fig. 2: Basic architecture of the WETNET system

The Wetnet System is conceptually built-up by three main subsystems (fig. 2): sensors, links, and supervisory services. More in details each subsystem acts as follows:

- Sensors collect water flow and pressure data for each given District Metered Area (DMA).
- Links store/send data (to supervisory services) adapting to different transmission conditions.

- Supervisory services elaborate data to produce and present new knowledge about water flow and associate energy, in a way that allows to decide/plan/act promptly and appropriately to reducing water/energy losses.

WETNET makes use of: (a) water distribution system modelling software (EPANET or COPAM), (b) tools, extensions and models that integrate or extend EPANET or its functions (i.e. eWISER - EPANET energy) (c) theory of calibration as set by IWA guidelines; (d) the patented WETNET sensor device (patent no. ITPI2010A000145; EPO 12722826.0).

Wetnet and its components do not fit for commercial transactions (i.e. metering).

In the specific Wetnet application to the Pisa's water grid the metering and communication are performed by the WUF (Wetnet Uplink Flowmeter). WUF includes an insertion low cost bidirectional flowmeter with a measurement range from 0.1 to 1.8 m/sec and includes a controller provided of internal GSM/GPRS module for data transmission, analogical inputs for reading external meters. The WUF was developed under the WETNET Project.

Fig.3: Wetnet Uplink Flowmeter (WUF) including the sensor inserted in the pipe (left side) and disassembled (right side)

2.2. INTENDED APPLICATION (MATRIX, PURPOSE, TECHNOLOGIES, TECHNICAL CONDITIONS)

Intended application of the technology		
Matrix	**Purpose**	**Technologies and technical conditions**[1]
Water grids in pressure. WETNET at the moment mainly addresses drinkable water distribution networks.	The purpose of WETNET is to reduce the quantity of water and energy that is dissipated in a water distribution district. This is done by making available measures of the water balance (instant and over a time interval) compared with optimal consumption profile of the district under control, automatically declaring the presence of a leakage in the district, and estimating its value.	WETNET configurations allow: (a) wide flexibility, incremental deployment and size scalability, keeping the system worthwhile from 5 to 500 nodes (in average 2-3 nodes for each district) on pipes 50 to 1000 mm DN with no infrastructure overhead (in case of web monitoring); (b) full or partial co-existence and/or integration with existing measurement and control systems and communication infrastructures (c) installation of the flow-meter insertion probe using standard hot-tap saddles similar to those for water branch connection, meaning that the device can be put into and taken out of the pipe without shutting off pressure, allowing reliable installation by in-house non-specialized staff on pipes ranging from 50 to 1000 mm DN with little or no site preparation; (d) programmable measurements from 1 per sec to 1 per day in a scale from 0.2 to 1000 litres/sec with a tolerance within +/- 2.5%; sensors tolerance to pressure bursts up to 16 bars if immersed; external operating temperatures allowed between -20°C to +60°C; (e) direct linkability to other systems via MODBUS and upper level XML-based protocols; (f) require little or no maintenance (MTBF > 3 years) during an acceptable operational life time (> 5 years), is replaceable and have a very low end-of-life impact; open elaboration capability.

2.3 VERIFICATION PARAMETERS DEFINITION

The list of parameters considered in the specific verification protocol is described in Table 2.

Table 2: parameters considered in the specific verification protocol

Parameter (list of parameters to be considered in the specific verification protocol)	Unit of measure
Abnormal Operational Conditions Detection Time	*days*
Water Leakage Detection Time	*days*
*The deviation from the normal range of min_night parameter (**Delta_value)***	*l/sec*
Water Leakage Resolution	*l/sec*
Water Leakage Space Resolution	*m^2*

[1] Conditions of operation and use come from the supplier and are not verified in the context of this verification.

3. EXISTING DATA

3.1. ACCEPTED EXISTING DATA

No existing data was submitted by the proposer.

4. EVALUATION

4.1. CALCULATION OF PERFORMANCE PARAMETERS

Min_night is the most important parameter monitored by Wetnet. The sensors perform a measurement of water flow every 6 minutes from each "x" measurement point of the given District Metered Area (DMA). Min_nigh is calculated according to the following formulas:

$$Min\_night_t = \frac{\sum_{x=1}^{n} Flow}{n}$$

Wetnet compares the min_night parameter with 2 values: **"Low band"** and **"High band"** discriminating "normal" events from "abnormal" (fig.4). The band limits are calculated by Wetnet starting from the average 'μ' of the "last good samples" for the variable min_nigth:

*Low band = μ – alpha * s*
*High band = μ + alpha * s*

Where:
μ is the average min_night of "last good samples" with last good samples ≥ 10
***alpha* = 2**, is the value of the coverage factor that produces an interval having level of confidence equal to 95,45 assuming a normal (or Gaussian) distribution
s is the standard deviation of the last good sample
n is the number of the measurement points

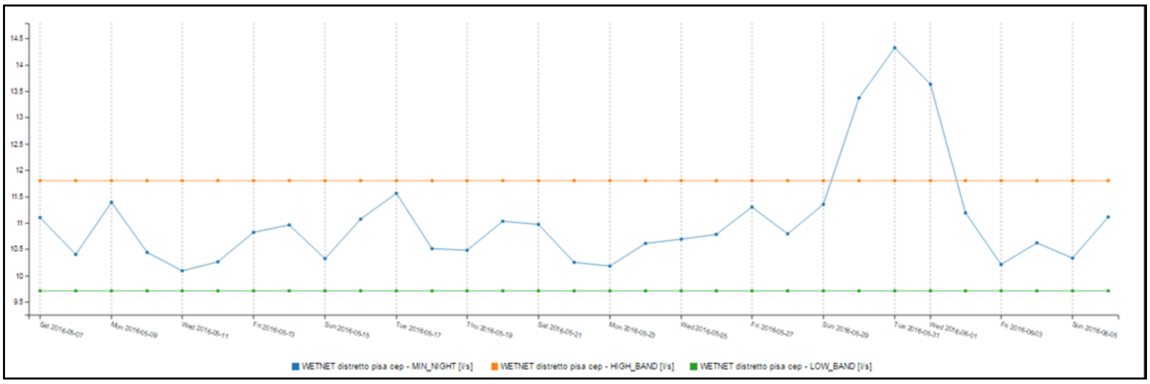

Fig.4: Wetnet min_night and normality band

Based on the daily Min_night measurements and on Low Band and High Band values calculated the Wetnet supervisor calculates:

- **the 'Delta_value'** as the deviation of the Min_night variable from the upper limit of the normal range calculated as

  Delta value= Min_nigth - (*μ* + Alpha*s)

- identifies **Anomal Increase** when Delta Value > 0 for at least 1 day 

- identifies a **Possible Water Loss** when Delta Value > 0 for at least 3 consecutive days

Water Leakage Resolution: the detection limits of Wetnet are linked to the variability of the consumption profile of the DMA under investigation expressed as standard deviation (s) of the min_night parameter for the last good samples.

Wetnet aims to identify possible water losses with a level of confidence > 95,45%. For this reason Wetnet identify as "Anomal Increase" or "Possible Water Loss" deviations greater than the width of the normality band width (± Alpha*s)

$$(\pm \text{Alpha}*s) = \pm 2s = 4s$$

Water Leakage Spacial Resolution. Wetnet provides spatial information at district level. The special resolution is calculated as the average surface of the districts of the Pisa's water grid tested.

4.2 EVALUATION OF THE TEST QUALITY
4.2.1 CONTROL DATA

The test of the Wetnet System was conducted from **29/05/2016 to 02/05/2016** as for the schedule in table 3.

Table 3: Test Schedule

Day / hour	Activity	Personnel Involved
Day 1 - 29/05/2016		
16.30 - 21.30	Test system control	Test Manager
22.00	Starting of the test: Generation of the water loss	Test Operator- Responsible for WD
22.00 – 23.00	Measurement and verification of test parameters and conditions -Data Collection (according to SVP and Test performance method and operations)	Test Manager Internal auditor VB
Day 2 - 30/05/2016		
All working day	Monitoring of the test conditions Monitoring of correct data recording	Test Manager
16:00	Verification of WETNET SYSTEM performance: recording of Abnormal Operational Conditions Detection Time	Test Manager
Day 3 - 31/05/2016		
All working day	Monitoring of the test conditions -Monitoring of correct data recording - Verification of WETNET SYSTEM performance: recording of Abnormal Operational Conditions Detection Time	Test Manager
Day 4 - 01/06/2016		
22.00	Closure of the test - Closure of the water loss	Test Operator Responsible for WD
22.00 – 23.00	Data Collection (according to SVP and Test performance method and operations)	Test Manager Internal auditor VB
23.00	Dismantling of the test site	Test Operator Responsible for WD
Day - 5 02/06/2016		
16:00	Verification of WETNET SYSTEM performance: recording of Water Leakage Detection Time	Test Manager
17:00	Wrap up discussions on test status: Determine the validity of the test or the need to repeat the test. Determine if any additional data may be needed	Test Manager Internal auditor

The test site selected was located in Pisa, in the district (DMA) “Pisa CEP” (id 1055). Via Tiziano Vecellio. 56122 Pisa. GPS coordinates: 43°42'25.4"N 10°22'01.9"E.

Fig.5: Test site (left), district (center) and Wetnet measurement points (right)

The DMA Pisa CEP is monitored through three Wetnet measurement points (via delle Cascine, Via Andrea Pisano, Via Tesio) (fig. 6). The three Wetnet measurement points as well the test site were inspected by RINA at the time of testing activities.

Fig.6: Wetnet Measurement Points: via Tesio (left), via delle Cascine (center), via Pisano (right)

The verification team performed the control of data at different levels:

- pre-testing requirements
- raw data collected and recorded at the time of the testing activities
- calculation and transfers of data between documents
- data of output provided by the Wetnet supervisor

According to the test plan on 27/05/2016 a written authorization was obtained from the water distribution system operator (Acque SPA) in order to perform the test.

The pressure and the 'min_nigth' in the DMA was crosschecked; the consistency with the normal operative conditions of the DMA was evaluated The CEP District showed absence of alerts (records an abnormal increase of consumption) in the district for more than 10 days (last good sample) and grid pressure was in line with the normal operative conditions of the DMA.

A water loss was generated in the tested district for a three days period (30/05/16 to 01/06/16) through the installation of a temporary pipe for the deviation of the water flow (fig.8 and 9). The water loss was set around to around 3 l/s in line with the range [4s – 8s] [2,1 – 4,2 l/s] set as requirement in the SVP.

The calculation of **'µ'** (average related to the variable min_nigth related to the period "last good sample") and standard deviation **'s'** for the last good samples calculated by the WSS was crosschecked. These values were correctly applied in order to calculate low band and high band limits. The time period used by the WSS supervisor to define the initial conditions of the statistical DMA (last good sample) is related to the period 24-04-2016 to 03-05-2016 (Fig. 7).

2016-04-24	2016-04-25	2016-04-26	2016-04-27	2016-04-28	2016-04-29	2016-04-30	2016-05-01	2016-05-02	2016-05-03	**Average 'µ'**	**Std Dev 's'**
10,69	10,19	10,66	12,08	10,58	10,60	10,97	10,80	10,24	10,51	10,73	0,528
High band *= µ + alpha x s, upper limit of the band of normality*						*l/s*			*11.8*		
Low band *= µ - alpha x s, lower limit of the band of normality*						*l/s*			*9.7*		

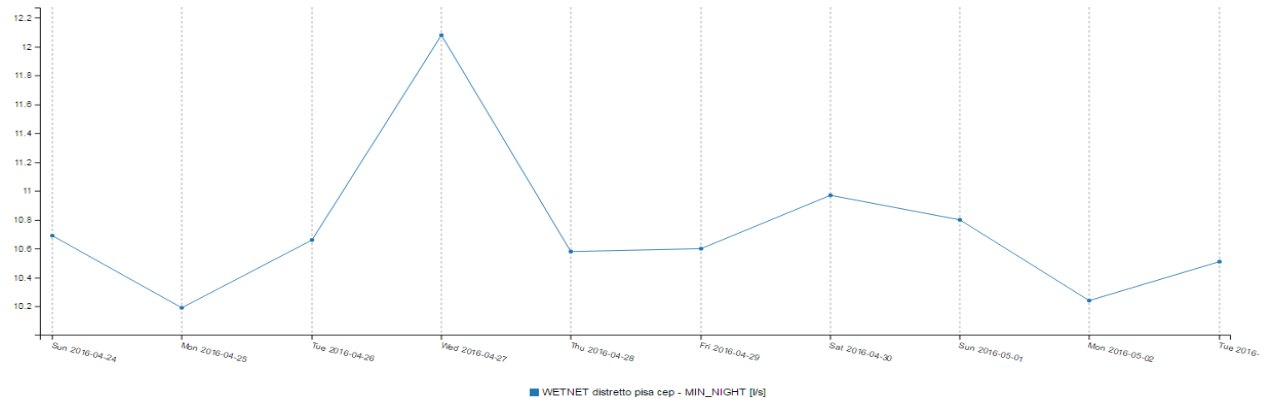

Fig.7: Last Good Sample data

The cumulative amounts of water flow measured by the residential flow meter was registered by the Data logger "Wetnet Link Box" (serial number: SN B-1016/80/0083WLBT68P10-GE-B1-WPCODE WLB082) connected to the meter and stored in a dedicated SD card (fig.8).

At the end of the test the SD card was transported by the Test Operator to the headquarters of Ingegnerie Toscane. Here the data were downloaded and transferred in a not editable Excel file. The Excel file was printed-out and signed by the Test Manager. The file was then stored in the archives of Ingegnerie Toscane.

According to the measurements performed by the residential flow meter SN FD001194-07-MADDALENA the average flow of the water loss generated during the three days period was 2,95 l/s, in the range [4s – 8s] [2,1 – 4,2 l/s] as required according to the specific verification protocol

Fig. 8. Temporary pipe (left), Flow meter, Water Loss (right)

Fig. 9. Flow meter (left) and data logger (right)

The deviation from the normal range of the min_night (Delta Value) was calculated by the WSS. Delta Value was found in the range [Lg – 4s; Lg] according to the expected results (Table 4).

Table 4: parameters considered in the specific verification protocol

	30/05/16	31/05/16	01/06/16
LG (Average water leakage generated during the test and measured by the residential flow meter installed on the field) (l/s)	2,95		
4s standard deviation related to the variable min_nigth related to the period "last good sample" (l/s)	2,1		
[4s – 8s] interval of the water discharge (l/s)	[2,1 – 4,2]		
Delta Value (deviation from the normal range upper limit of the min_night) (l/s)	1,83	2,52	1,56
4s standard deviation related to the variable min_nigth related to the period "last good sample" (l/s)	2,1		
[Lg – 4s; Lg] Acceptability range for Delta Value (l/s)	[0,85 – 2,95]		

4.2.2 AUDITS

A test system audit was conducted by Felice Alfieri (ETV Inspector) during the test performance on 30th of May and 1st of June 2016. The test system audit included the qualitative on-site evaluation of test, measurement system associated with the test of the Wetnet System, in order to ensure that the test performance is in line with with the requirement of the GVP, the specific verification protocol, and the test plan.

The test system audit included two phases (the test system performance audit and the quality management system audit) as described in the table 5.

Table 5: Aspects checked in the test system audit

Type of Audit	Aspect to be checked
Test System performance	□ Qualification of personnel involved in testing □ Testing premise and environmental conditions □ Test methods □ Test and calibration methods □ Results reproducibility □ Control of data □ Test equipment □ Measurement traceability □ Sampling and handling of test and calibration item

	□ Quality Control □ Result Reporting
Test body quality management system	□ Organization □ Personnel □ Methods □ Documentation □ Complaint management □ Management supervision

The test system audit aimed
The test system performance audit included the following activities:

- the review of relevant procedures (methods, instructions for the operators, forms, book logs);
- verification of personnel involved in testing
- control of the lab practices (e.g.: sampling and handling of samples);
- check of the calibration of the test equipment and measurement devices;
- check of the testing premise and environmental conditions
- Measurement traceability / quality control / result reporting

Measurements were conducted according to the test plan; testing premise and environmental conditions were in line with the SVP requirements; the relevant procedures were followed; the calibration status of the measurement equipment was correct; the measurement traceability was ensured; quality control and test reporting were in line with the GVP requirements.
Also the quality management system of Ingegnerie Toscane was object of audit. Organizational documents were checked including the organizational charts, staff training and qualification registrations. In conclusion the quality management system complies with the requirements set out in C.III. of the GVP.
Based on the audit activity conducted it can be concluded that the testing performed by Ingegnerie Toscane was done according to the requirements specified in the test plan and in the specific verification protocol.

4.2.3 DEVIATION

No deviations from the Specific verification protocol.

4.3. VERIFICATION RESULTS (VERIFIED PERFORMANCE CLAIM)

The verified performance is in line with the expected results. Three events were highlighted by the Wetnet Supervisor as for the picture below (Fig. 10).

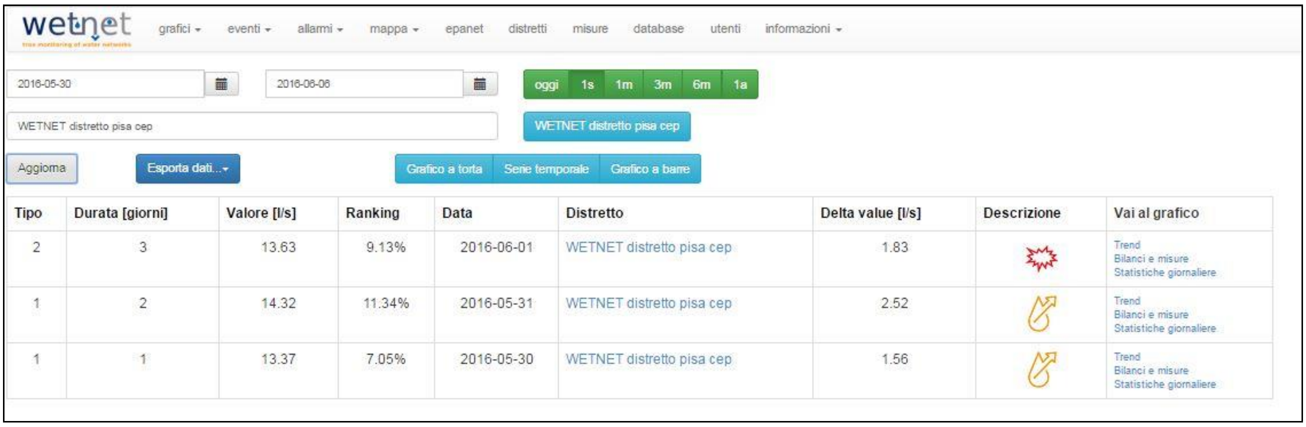

Fig. 10: Wetnet Supervisor System output

In the tested conditions and in the specific tested application described above Wetnet enabled early detection of abnormal operational conditions (within 1 day) and leakages (within 3 day) of the generated water loss.
As expected after one full day after the "birth" of concealed loss the Wetnet supervisor (WSS) automatically declared an abnormal consumption and after three full days after the "birth" of concealed loss (trigger) the system automatically declared the presence of a water loss in the district and estimated its value based on the min_night value.

4.3.1. PERFORMANCE PARAMETERS

In table 6 the verified performance parameters are presented and compared with the claimed parameters (as for the SVP).

Table 6: Performance Parameters

Performance Parameters	Unit of measure	Claimed Performance	Verified Performance
Abnormal Operational Conditions Detection Time	*days*	*1*	*1*
Water Leakage Detection Time	*days*	*3*	*3*
***'Delta_value'** is the deviation from the normal range for the min_night parameter* *Delta value*= Min_nigth-(*μ* + Alpha*s)	*l/sec*	*To be measured*	*1,83* *2,52* *1,56*
Water Leakage Resolution Leakage > 4s	*l/sec*	*To be measured*	*2,95*
Water Leakage Space Resolution	*Km^2*	*District (Average surface)*	*8,80*

As showed in fig. 11, Wetnet highlighted the deviation from the upper limit of the normal range of the min_night (Delta Value). The Delta Value provided by the WSS is included in the acceptability range [Lg – 4s; Lg] (l/s) [0,85; 2,95] l/s corresponding to the 95,45% of confidence interval. This acceptability range is calculated assuming that the behavior of the min night parameter is still affected by variation during the testing period and the same value of ***'s'*** (standard deviation related to the variable *min_nigth* related to the period *"last good sample"*) is also applicable to the three days of water loss. According to the coverage factor applied this interval has a level of confidence equal to 95,45% assuming a normal (or Gaussian) distribution.

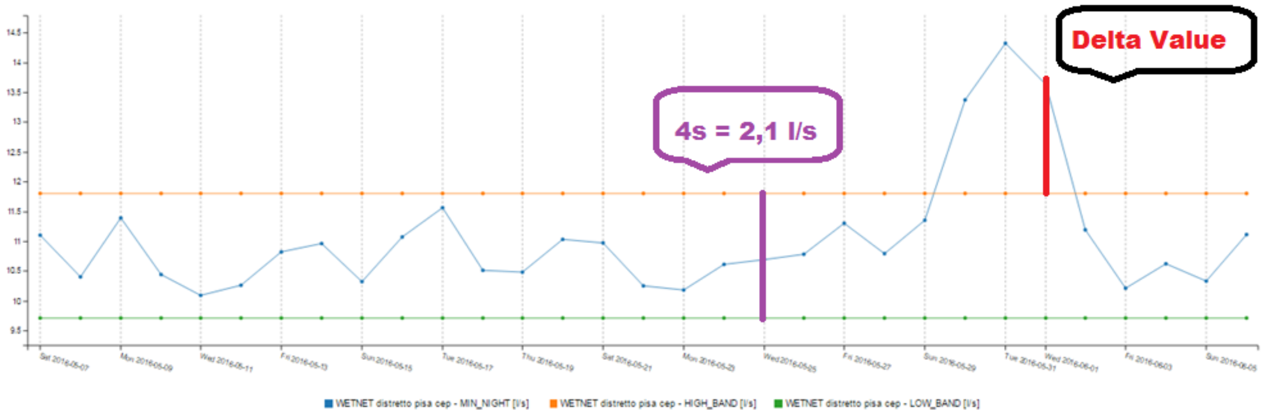

Fig. 11: Wetnet Supervisor: Delta Value (in red) and the 4s normality range (in purple)

In terms of resolution Wetnet enabled to identify a water loss of 2,95 l/s. In terms of spatial resolution Wetnet has been successful tested in a 8,80 km^2 DMA "Pisa cep" (id 1055) with three wetnet measurement points (via delle Cascine, Via Andrea Pisano, Via Tesio).

4.3.2 OPERATIONAL PARAMETERS

Appropriate environmental and operational conditions were ensured for the test performance. According to the specific verification protocol Wetnet the water leakage was set in the interval [4s – 8s] corresponding to the interval [2,1 – 4,2] l/s. See the details in table 6.

Table 6: Operational Parameters

Parameter (list of parameters to be considered in the specific verification protocol)	Unit of measure	Value
EVENT *any fact or happening, that already occurred or that may occur to which it is possible to attach a degree of truth within the boundaries and scope of a fact that is measurable and place in time and space.*		*30/05/16 – Anomal Increase found!* *31/05/16 – Anomal Increase found!* *01/06/16 – Possible Water Loss found!*
District (or DMA) *is the name and code of the district where the event took place.*		*Pisa cep" (id 1055)*
N° of nodes is the number of measurement points		*3* *Cod ID8154 (Via Tesio)* *Cod ID8152 (Via delle Cascine)* *Cod IT8153 (Via Andrea Pisano)*
'night time' *night-time interval in which the variable min_nigth is determined*	*hours*	*04:30-05:30*
'min_nigth' *Average of the flow measurements collected during the night time (04:30 – 05:30)*	*l/s*	*30/05/16 – 13.37* *31/05/16 – 14.32* *01/06/16 – 13.63*
'µ' *average* related to the variable *min_nigth related to the period "last good sample"*	*l/s*	*10.73*
's' standard deviation related to the variable *min_nigth related to the period "last good sample"*	*l/s*	*0.528*
'Last good sample' *time period, greater than or equal to 10 days required to define the initial conditions of the statistical DMA (min_nigth,s,high band, low band)*	*DAYs*	*10*
High band *= µ + alpha x s, upper limit of the band of normality*	*l/s*	*11.8*
Low band *= µ - alpha x s, lower limit of the band of normality*	*l/s*	*9.7*
'Alpha' *multiplier of the standard deviation*		*2*

'trigger' *number of consecutive days necessary to transform the state of an event of increase in the event from abnormal consumption to possible water loss detected*	*Days*	*3*
'Pressure night' *Average of the pressure measurements collected during the night time (04:30 – 05:30)*	*bar*	*1.97*
"Lg" *Average water leakage generated during the test and measured by the residential flow meter installed on the field*	*l/s*	*2.95*

4.3.3 ENVIRONMENTAL PARAMETERS

The relevant environmental parameters are included in table 6 above. Data on general ambient conditions was taken during test, please see detailed lab data table for more information.

4.4. RECOMMENDATIONS FOR STATEMENT OF VERIFICATION

Based on the verified performance described in section 4.3 above it is recommended to issue a Statement of Verification including the results highlighted in this Verification Report.

5. QUALITY ASSURANCE

The personnel and experts responsible for quality assurance as well as the different quality assurance activities are described in table 7.

- Review of the SVP: an internal technical review and an external technical review from an external technical expert. The internal review was performed by Laura Marti (qualified as ETV Inspector). External review was performed by Andrea Maffini (qualified as Technical Expert).
- test plan and test report review: the test plan and the test report was subject to a review by the technical expert Alberto Musetti. Felice Alfieri (Coordinator for this specific inspection activity) approved the documents.
- test system control: it was performed by Oberdan Cei (Ingegnerie Toscane) as described in the section 4.2.1
- test system audit / test performance audit: a physical audit was conducted by the ETV Inspector Felice Alfieri with the technical expert Alberto Musetti during the actual testing of the technology;
- The verification report and the statement of verification will require an external review according to EU ETV pilot programme GVP. Internal review was performed by Laura Marti and external review was performed by Andrea Maffini. The verification report was finally approved by the RINA's ETV Technical Manager Laura Severino.

Table 7: Verification and Quality Assurance plan

	ETV Inspector	ETV Technical Expert	ITR	E-ITR	Proposer	Proposer (Internal Auditor)
Personnel Responsible	Felice Alfieri	Alberto Musetti	Laura Marti	Andrea Maffini	Oberdan Cei	Franca Sussarellu
Task						
Specific Verification Protocol	Draft	Draft	Review	Review	Review and approve	
Test Plan	Approve	Review				Review
Test System at test site	Audit					Audit
Test Performance	Audit	Audit			Test System Control	Audit
Test Report	Approve	Review				Review
Verification Report			Review	Review		
Statement of Verification			Review	Review	Acceptance	

6. REFERENCES

(EU Environmental Technology Verification Pilot Programme) General Verification Protocol, version 1.1 of 07-July-2014

ASAP Protocol: Actions for Systemic Aquifer Protection – Implementation and demonstration of a Protocol to scale down groundwater vulnerability to pollution due to overexploitation (Rev. 1b) available at http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=ASAP_Protocol.pdf

APPENDIX 1 TERMS, DEFINITIONS AND ABBREVIATIONS

“Accreditation” has the meaning assigned to it by Regulation (EC) No 765/2008.
“ASAP” Actions for Systemic Aquifer Protection
“DMA” District Metered Area
“EU ETV – European Environmental Technology Verification” is the EU programme providing for third-party verification, on a voluntary basis, of the performance claims made by technology manufacturers in business-to-business relations.
“GVP – General verification protocol” means the description of the principles and general procedure to be followed by the ETV pilot programme when verifying an environmental technology.
“Performance claim” means a set of quantified and measurable technical specifications representative of the technical performance and environmental added value of a technology in a specified application and under specified conditions of testing or use.
“RINA” is RINA Services S.p.A.
“SVP – Specific verification protocol” means the protocol describing the specific verification of a technology and applying the principles and procedures of the General verification protocol.
“Test performance audit” means the quantitative evaluation of a measurement system as used in a specific test, e.g. evaluation of laboratory control data for relevant period, evaluation of data from laboratory participation in proficiency test and control of calibration of online measurement devices.
“Test system audit” is the qualitative on-site evaluation of test, sampling and/or measurement systems associated with a specific test.
“Test system control” is the control of a test system as used in a specific test. E.g. test of stock solutions, evaluation of stability of operational and/or on-line analytical equipment, test of blanks and reference technology tests.
“VB” Verification Body
“Verification” means the provision of objective evidence that the technical design of a given environmental technology ensures the fulfilment of a given performance claim in a specified application, taking any measurement uncertainty and relevant assumptions into consideration.
“Wetnet” Innovative in-pipe hot-tap insertion floW sEnsor plus smarT NETworks enable ecowise pervasive monitoring of water distribution grids.
“WD” Water Distribution system operator
“WUF” Wetnet Uplink Flowmeter.
“WSS” Wetnet Supervisor Services

APPENDIX 2 QUICK SCAN

The report from the quick scan is attached to the verification report as a separate file.

APPENDIX 3 PROPOSAL

The verification proposal is attached to the verification report as a separate file.

APPENDIX 4 SPECIFIC VERIFICATION PROTOCOL

The specific verification protocol is attached to the verification report as a separate file.

APPENDIX 5 AMENDMENT AND DEVIATION REPORT FOR VERIFICATION

No amendment report has been made for the verification of the GW Dryer.

APPENDIX 6 TEST PLAN (WHERE RELEVANT)

The test plan is attached to the verification report as a separate file.

APPENDIX 7 TEST REPORT (WHERE RELEVANT)

The test report is attached to the verification report as a separate file.