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CONCESSIONI AUTOSTRADALI VENETE

IRF WORLD ROAD MEETING 2017
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SWI group

I.T.S. AND INTEGRATED MANAGEMENT OF HIGHWAY STORMWATER RUNOFF: TREATMENT OF CHRONIC EFFECTS AND PROTECTION FROM ACUTE ENVIRONMENTAL EFFECTS CAUSED BY LIQUID SPILLS: CAV AND SPV EXPERIENCES

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ENVIRONMENTAL IMPACTS DUE TO HIGHWAY STORMWATER RUNOFF – CHRONIC IMPACTS

Pollutants that settle on the impermeable surfaces during dry periods are washed together with the atmospheric pollutants during rain events. Potential environmental impacts due to that are:

- Pollution in the receiving water body;
- Shallow waters pollution;
- Pollution in drinking water reservoir;
- Toxicity effects;
- Ground and sediment contaminations.

Copper

Lead

Zinc

Pollutant nature is known and predictable in terms of quality, quantity and place where pollution occurs

Platinum Group Elements

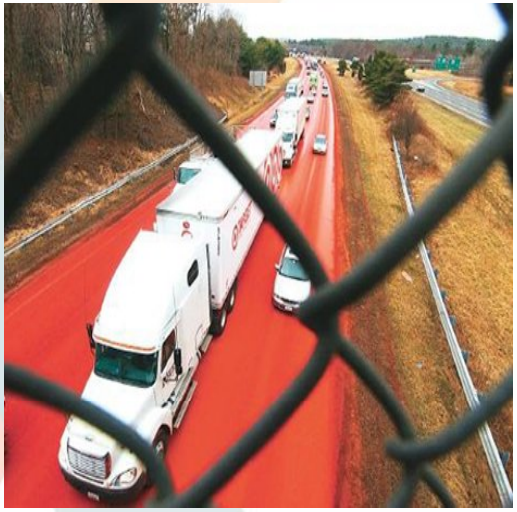
ENVIRONMENTAL IMPACTS DUE TO HIGHWAY STORMWATER RUNOFF – ACUTE IMPACTS

Acute impact is generated from accidental or arson spills. The environmental impact of accidental spills is remarkable, more than 8.000 m^3 every year* in Italy. The resulting costs for remediation, when remediation is possible, are extremely high.

Acute impacts are not taken enough into consideration and there's a leak in term of effective technical solutions regulations and technical standards.

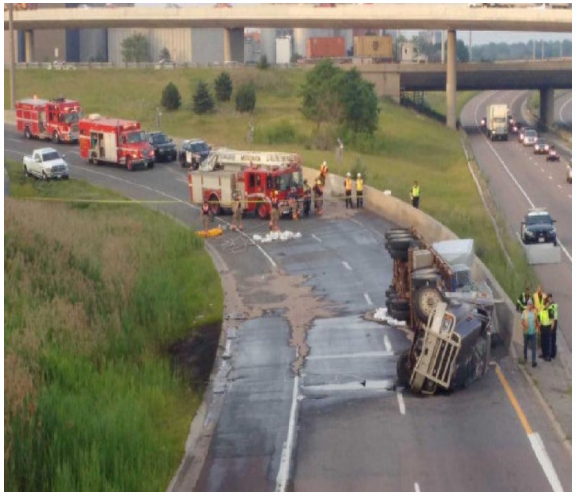
*Source: *Data from Italian Ministero dell'Ambiente e della tutela del territorio e del mare, 2011*

ENVIRONMENTAL IMPACTS DUE TO HIGHWAY STORMWATER RUNOFF – ACUTE IMPACTS



RED DYE

OIL AND FUEL



PAINT

ENVIRONMENTAL IMPACTS DUE TO HIGHWAY STORMWATER RUNOFF – ACUTE IMPACTS MANAGEMENT AND I.T.S.

These events are not predictable in terms of quality and quantity of pollutants and location where the spills take place

As a consequence of that, acute impacts are not easily manageable with traditional methods and plants designed for chronic impacts.

A global water and stormwater management approach is needed to integrate environmental protection in a concept of **Intelligent Transportation System**

SPECIFICITY OF THE VENETO REGION

- Core of the Italian Economy with an historical industrial vocation
- Many industrial, agricultural and touristic economic districts
- 6 million inhabitants
- Great cultural, naturalistic and historical heritage (Venezia, Verona, Cortina, Dolomiti...)

LENGTH: 90 km
AADT: 27.000
vehicles/day
250 Outfalls

PEDEMONTANA
VENETA

LENGTH: 32 km
AADT 2016: 51.257
vehicles/day
HEAVY TRAFFIC: 40%

VENICE
BYPASS

TOTAL LENGTH: 26 km
AADT: 105.013 vehicles/day
HEAVY TRAFFIC: 30%

VENEZIA
FREEWAY

EXPERIMENTAL MONITORING CAMPAIGN
CAV S.p.a. Experience in Venice Bypass highway

2011: in cooperation with **CAV S.p.A.**, study of a solution to overcome the lack of reliable and consistent data related to stormwater runoff composition to define **acceptance curves**:

- Creation of a reliable database related to highway stormwater runoff water quality;
- Definition of an average quality curve for highway stormwater runoff in “normal” conditions;
- Analysis and validation of the probes measured data and monitoring of temperature, rain duration, time between rain events, etc…
- Stress test to detect weakness and functional optimization

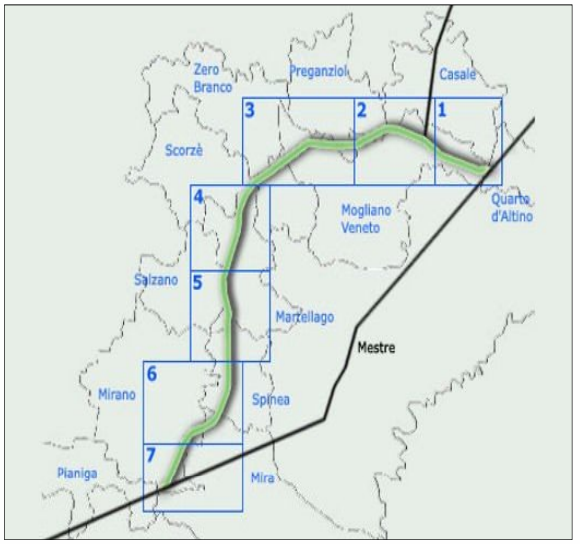
EXPERIMENTAL MONITORING CAMPAIGN CAV S.p.a. Experience – CONCLUSIONS:

The results was the definition of acceptance curves useful to detect and recognize spills integrated in the designed system called **SWERM®** that offer the following features:

- Possibile to detect groundwater infiltration, snowmelt runoff, presence of salt used for deicing in dry conditions;
- Different conductivity trend in function of some physical rain aspects (quantity of rain, rain duration, previous dry periods, winter period);
- Management of not easily interpretable data from probes due to hysteresis phenomena, location, maintenance aspects, biofouling;
- Integration of other physical variables as well as water quality data.

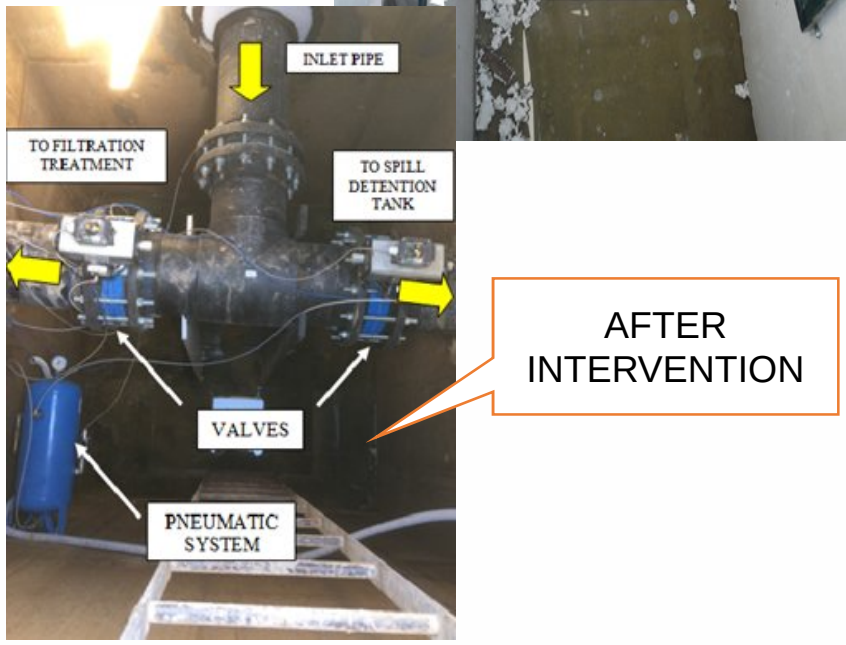
REVAMPING WORKS IN VENICE BYPASS HIGHWAY AFTER EXPERIMENTAL MONITORING CAMPAIGN

- The infrastructure was realized between 2006 and 2008, includes **64 plants** for the chronic impact treatment, providing a first flush detention section and a subsequent water treatment with Stormfilter® filtration system.
- After experimental monitoring activity, the existing plants were revamped to **Swerm03®** through the implementation of a specific SCADA for a centralized control of all the functions and the management of emergencies deriving from accidental spills.



REVAMPING WORKS IN VENICE BYPASS HIGHWAY AFTER EXPERIMENTAL MONITORING CAMPAIGN

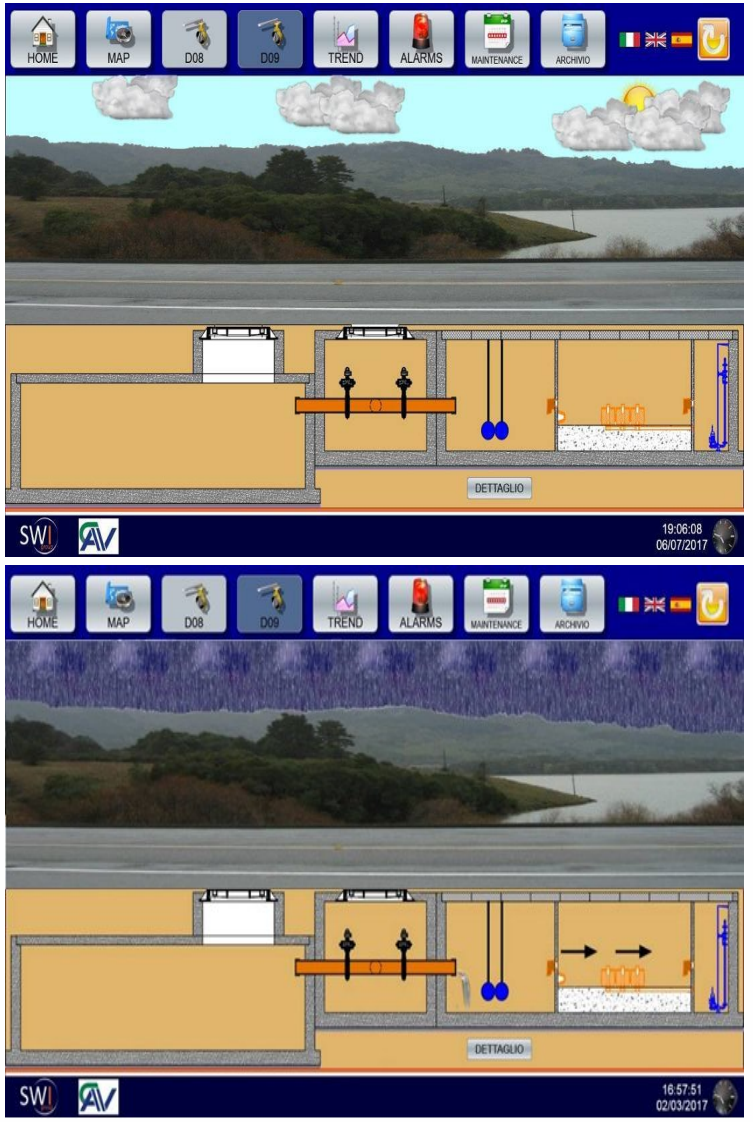
- Insertion of a closing system for the diversion of the flow to the ordinary treatment or to the spill detention tank, in emergency conditions. The pneumatic system acts in less than 1 second.
- Installation of multiparametric probes for measuring the water quality values analyzed by the software to define the acceptance of the inlet flow with a dedicated software.



REVAMPING WORKS IN VENICE BYPASS HIGHWAY SWERM® DEVELOPMENT FOR I.T.S. ARCHITECTURE

Two working logic:

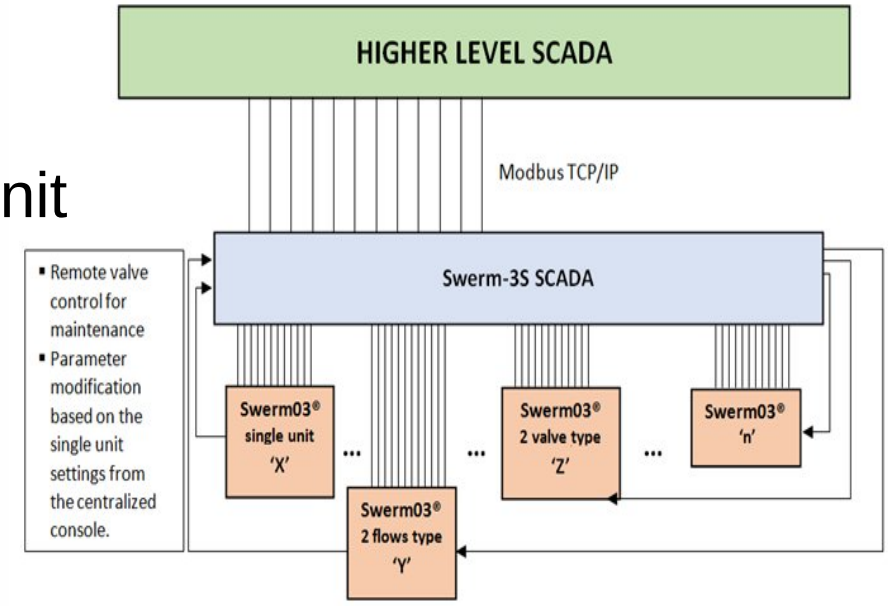
- ***Dry condition*:** liquid presence inside inlet pipes is abnormal. The system sends an alarm to control room and opens of detention tank valve
- **Wet condition:** the presence of liquid in the inlet pipe as a normal condition. The monitoring system determines if the incoming liquid is accomplishing the established value range. If not the system sends an alarm to control room and opens of detention tank valve



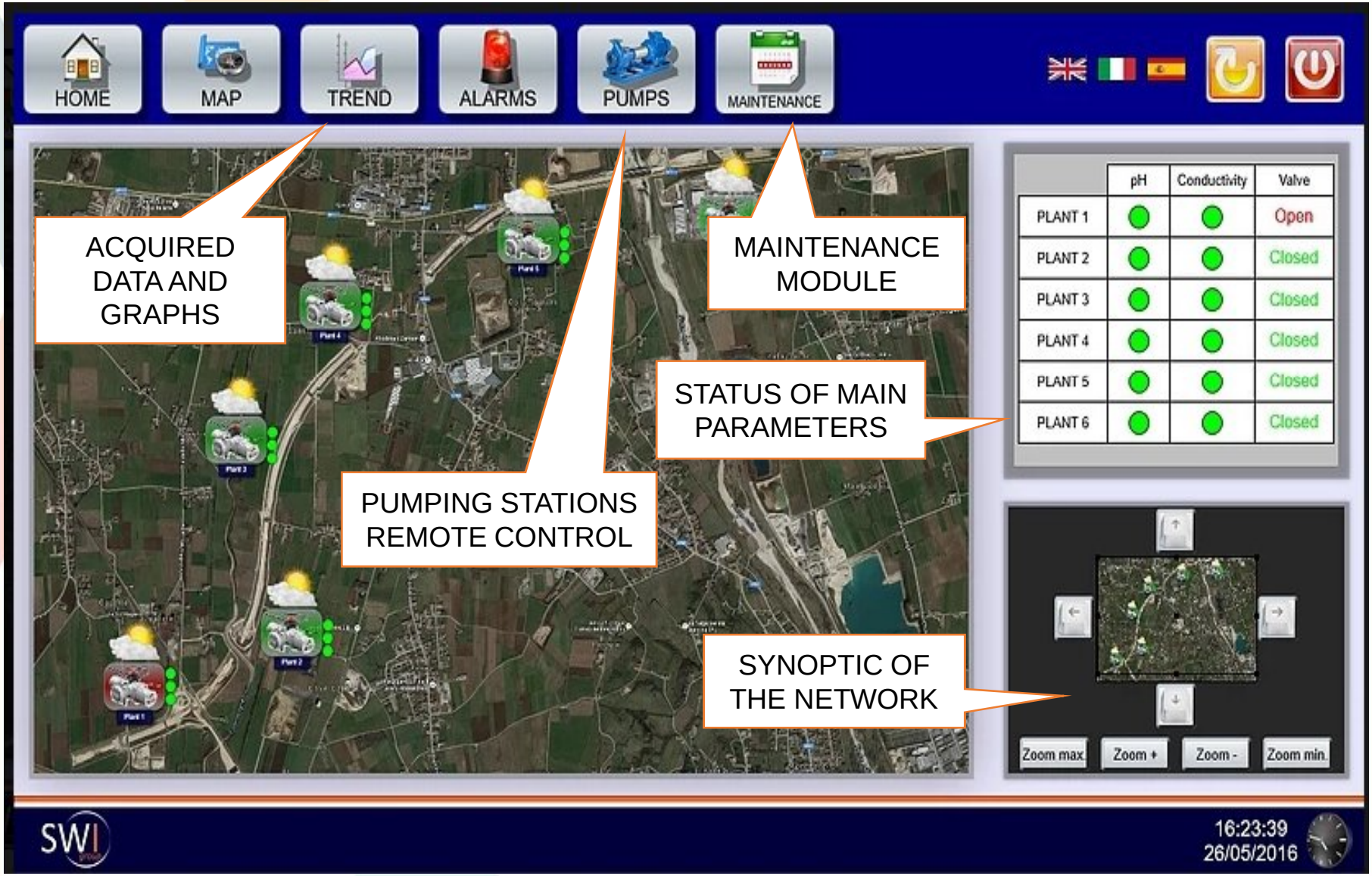
REVAMPING WORKS IN VENICE BYPASS HIGHWAY SWERM-3S® NETWORK FOR I.T.S. ARCHITECTURE

Swerm-3S® besides the command and control of a network of Swerm® units and fully scalable with higher level Scada and permits through a simple interface:

- Management of acceptability thresholds
- Storage of all acquired data
- Creation of graphs and trends
- Synthetic reports for each unit
- Maintenance schedule
- Creation of alarm list



REVAMPING WORKS IN VENICE BYPASS HIGHWAY
SWERM-3S® NETWORK AND SCADA SYSTEM



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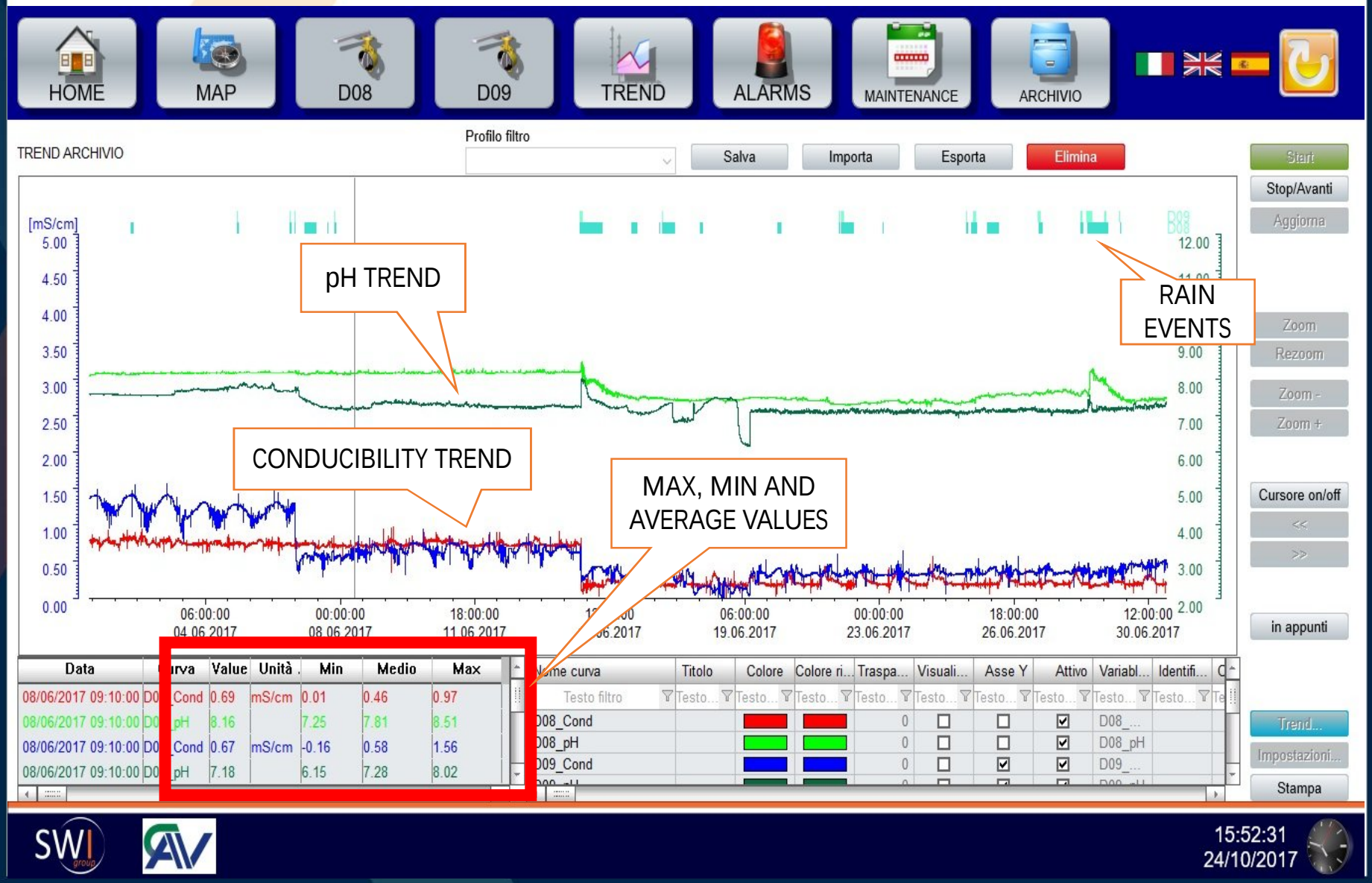
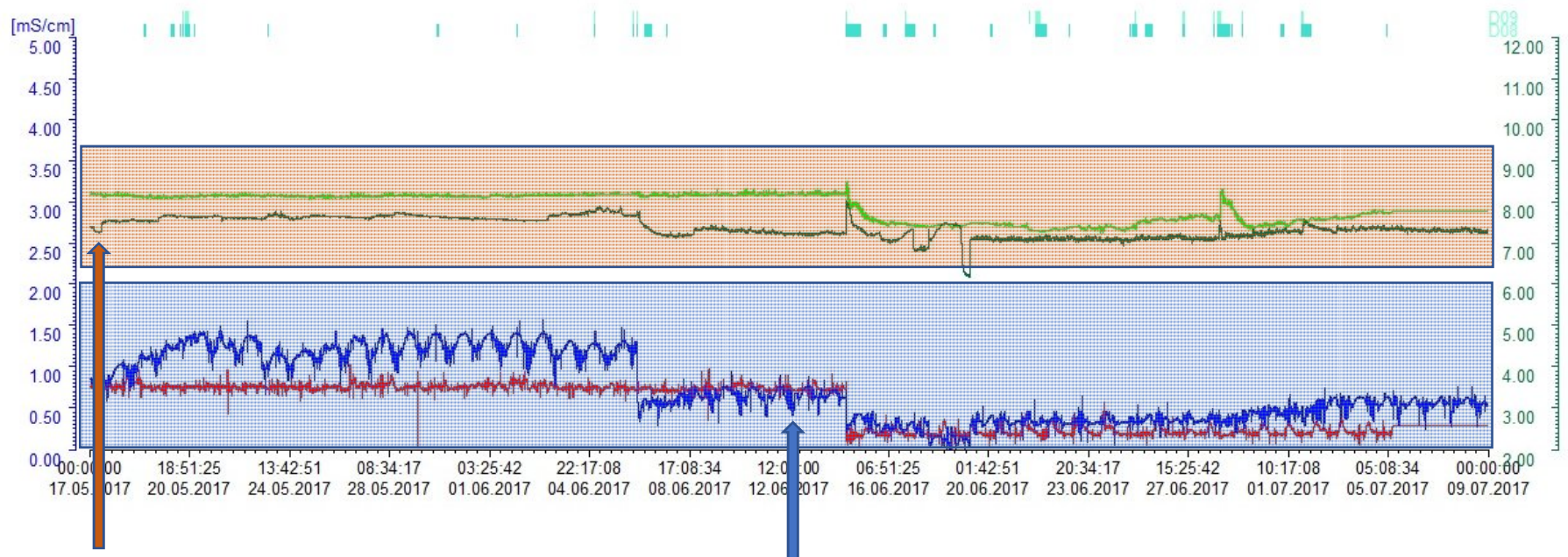


REVAMPING WORKS IN VENICE BYPASS HIGHWAY
SWERM-3S® REAL TIME OPERATION

All collected data from the probes in the monitoring stations of the Venice Bypass Freeway are included within the normal value range obtained in the experimentation period.



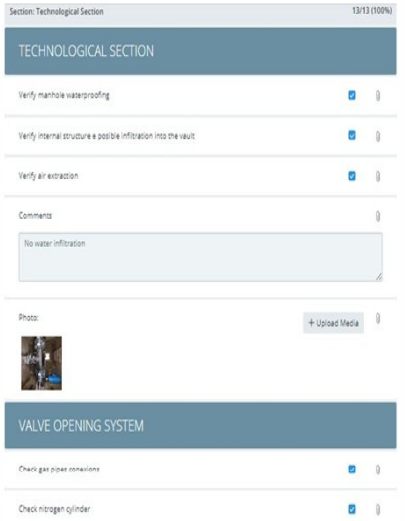
Acceptability range for pH

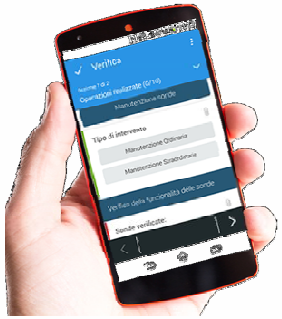
Acceptability range for electric conductivity

MAINTENANCE MANAGEMENT AND SCHEDULING MODULE

Development of an “Electronic plant copybook” interfaced with the SCADA system and available in a smartphone app:

- Technical checklist for each plant
- recording of interventions
- maintenance interventions calendar
- deadlines for each plant of the network,
- photographic reports

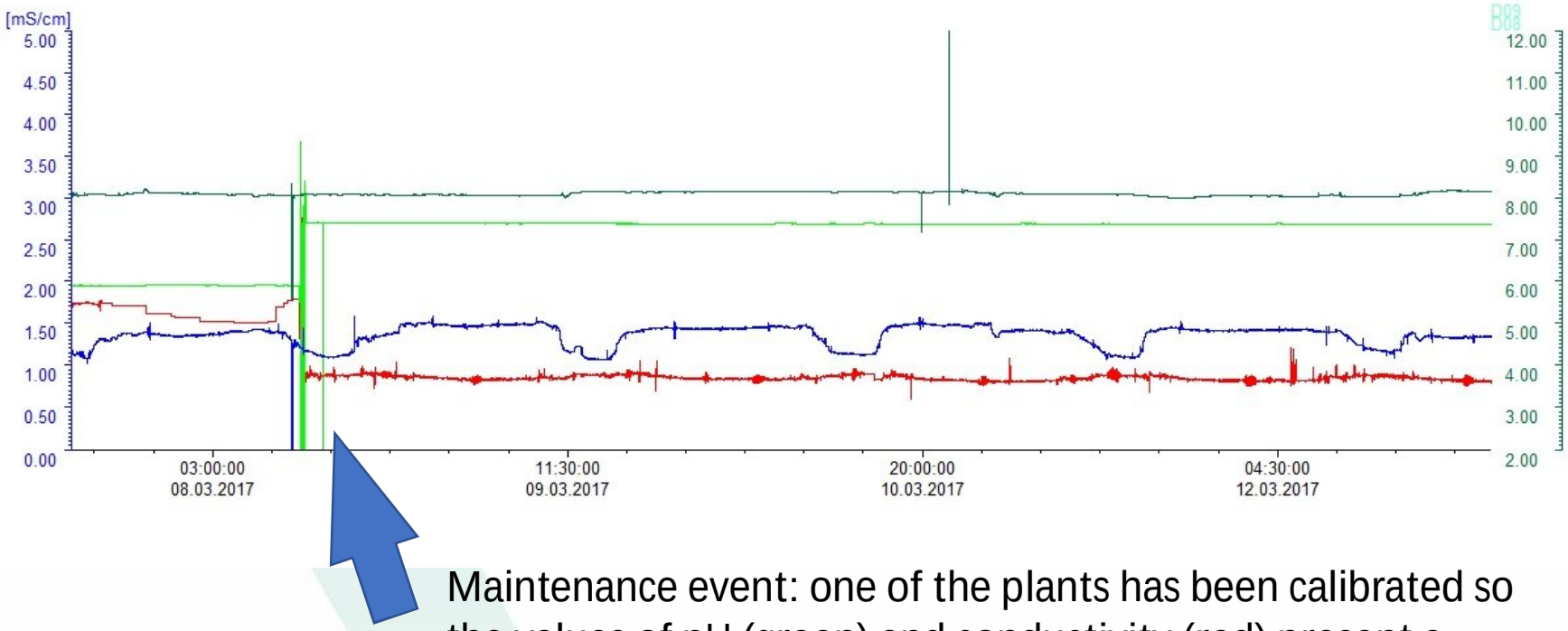




Management of Stormwater as an industrial process

REVAMPING WORKS IN VENICE BYPASS HIGHWAY SWERM-3S® REAL TIME OPERATION

Maintenance event: detailed inspection of the systems occurs every three months. All components, sensors and pneumatic systems are verified. The monitoring system status is also verified and corrected in case of deviation of the real value.

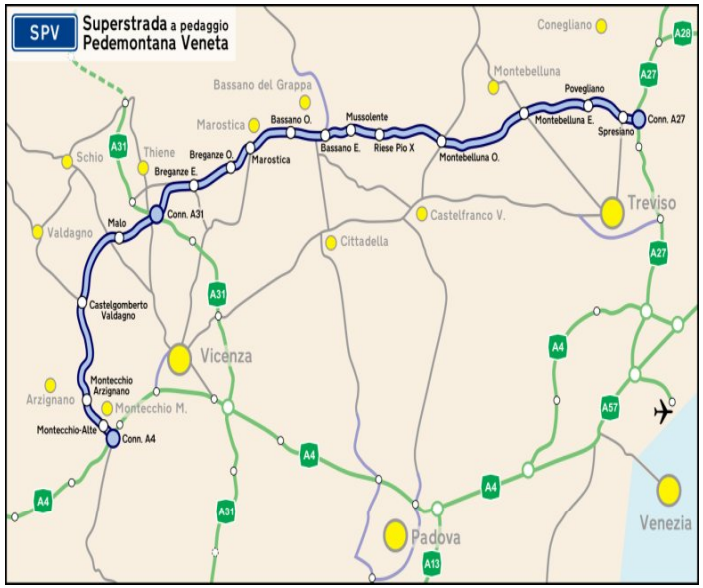


Maintenance event: one of the plants has been calibrated so the values of pH (green) and conductivity (red) present a change after the maintenance intervention.

CASE STUDY – PEDEMONTANA VENETA

The Pedemontana Veneta Highway is the biggest Italian new toll highway project. This infrastructure, 90 km total length, with 250 stormwater outfalls which require reliable **water quality treatment and spill containment.**

SWIGroup is realizing **189 stormwater treatment plants** (in line, tollbooth stations, pumping stations, detention and retarding basin) based on Stormfilter® filtration cartridges, each one coupled with a SWERM03® system for the automatic management of acute impacts interconnected through a centralized SCADA interface.



CASE STUDY – PEDEMONTANA VENETA - Details

CASE STUDY – PEDEMONTANA VENETA - Details

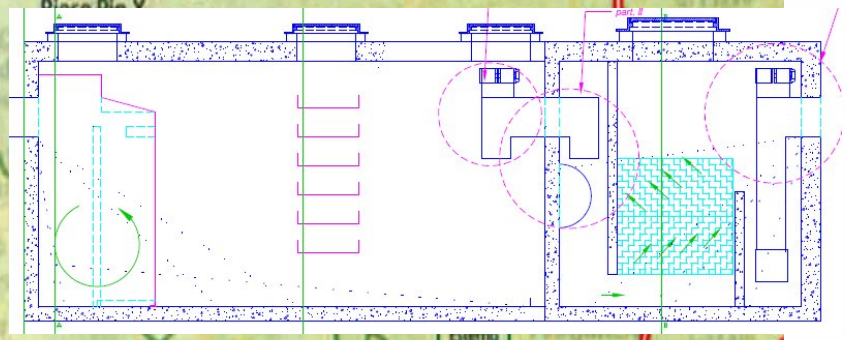
SPECIAL FIBERGLASS UNIT FOR UNDERWATER INSTALLATION

ID OF THE PLANT

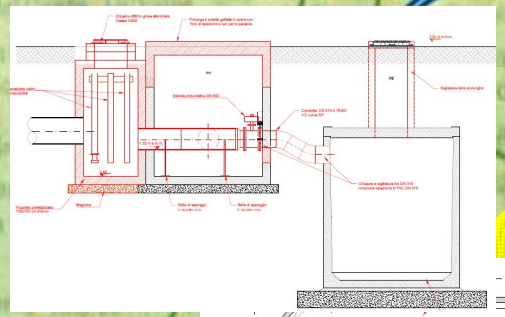
LOCAL CONTROL AND TRANSMISSION SWITCHBOARD

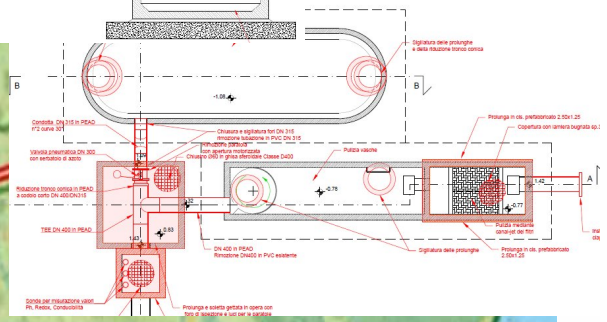
FURTHER DEVELOPMENTS: REVAMPING PROJECT OF THE EXISTING PLANTS IN VENEZIA FREEWAY

17 years ago: 19 hydrodynamic separator (settlers and oil separators) with a passive detention tank for accidental spills



Currently: revamping project with the insertion of a smart automatic spill management system with a centralized Scada integrated in a I.T.S. architecture





CONCLUSIONS

The need of a centralized system for stormwater runoff management in large infrastructure has become a strategic issue for environment protection that is often underestimated.

An approach to that issues I.T.S. oriented represents a significant evolution in terms of environmental efficiency, cost reduction, management and control capacity.

The SCADA system is accessible by insiders and public and the Maintenance module integration reduce costs and responsibilities.

The resulting network offers data availability, fully scalable, interfaced with existing network and available also for other purposes and for the collection of other environmental aspects (noise, weather and traffic conditions, air quality, etc.)

THANKS FOR YOUR ATTENTION

CONCESSIONI AUTOSTRADALI VENETE

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