Programme funded by the EUROPEAN UNION

MANAGED AQUIFER RECHARGE SOLUTIONS

DEMO Site 5: Brenta - ITALY

~~Vincenzo Marsala~~

Francesco Furlanis

STUDIO GALLI INGEGNERIA

“River Brenta Catchment, Vicenza, Italy (DEMO SITE 5)”

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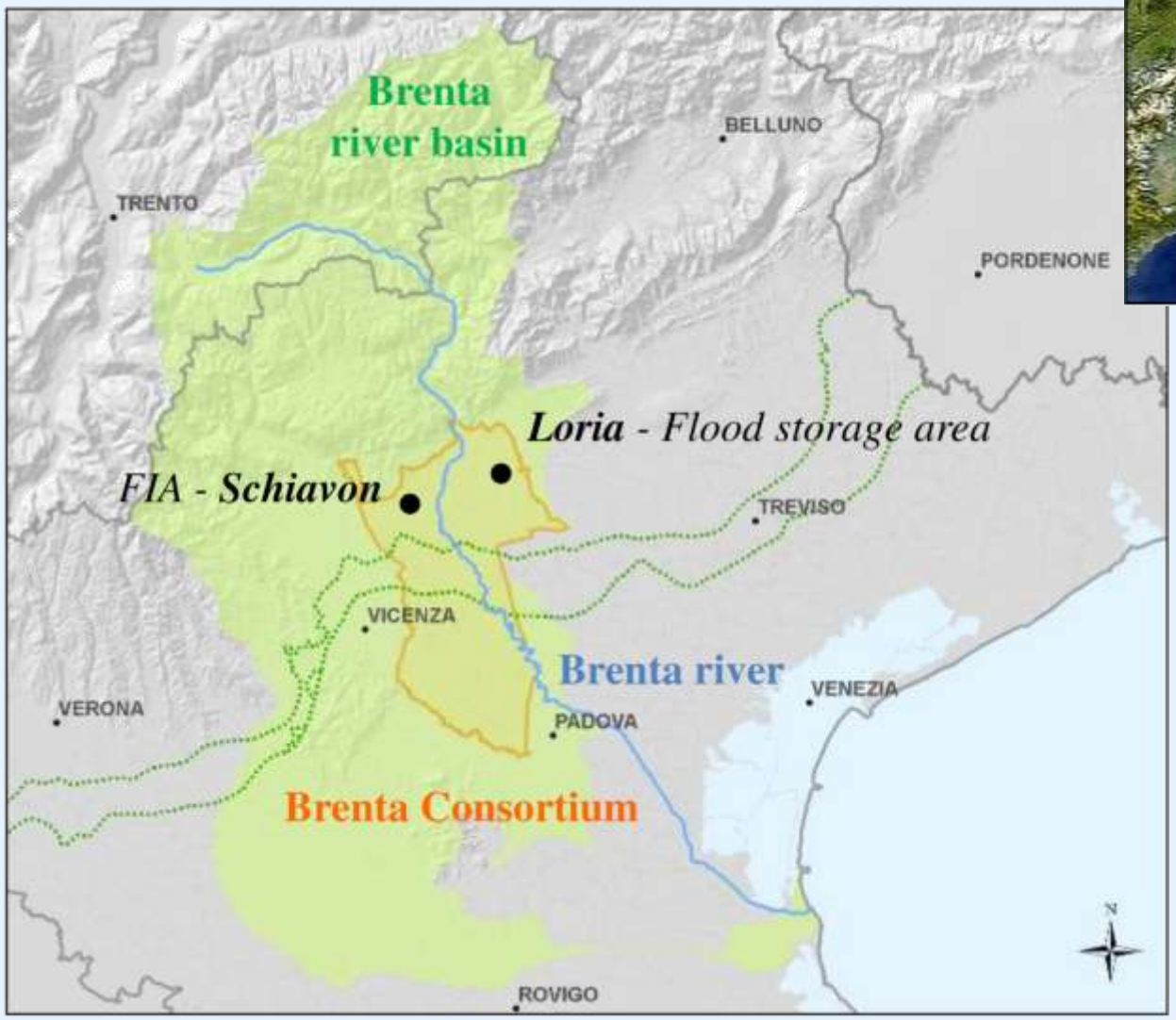

SPRING’S BELT

“River Brenta Catchment, Vicenza, Italy (DEMO SITE 5)”

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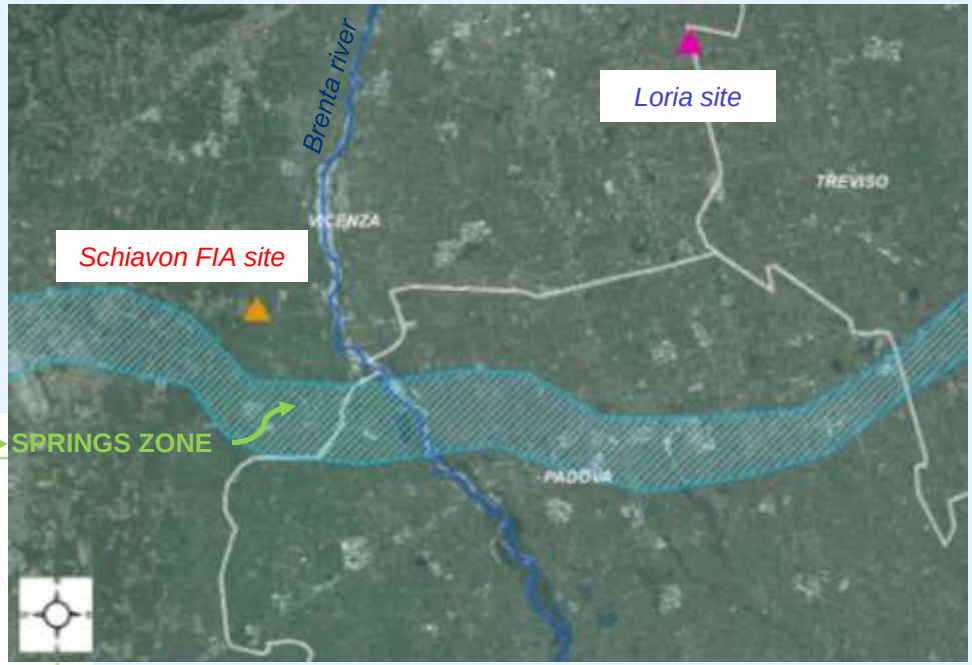
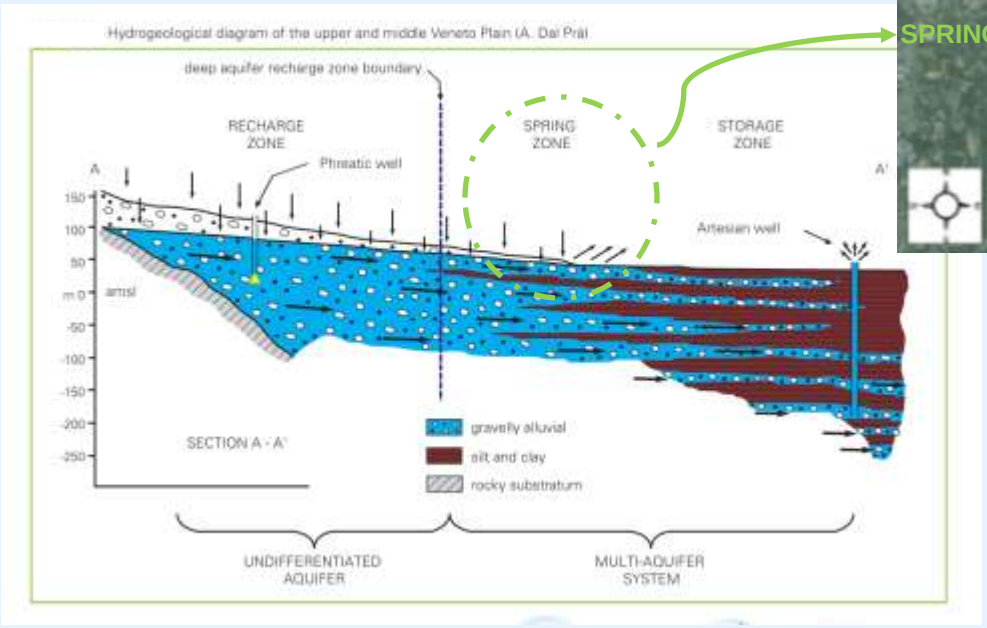
Vicenza Upper Plain is very important from the hydrogeological perspective, as it is the recharge area for the underground aquifers **representing the primary drinking water resource for large portions of the Veneto Region plain.**





Since 1960s the water reserve in the hydrogeological system of the alluvial plain have been progressively diminishing and consequently the springs zone is also suffering.

“River Brenta Catchment, Vicenza, Italy (DEMO SITE 5)”

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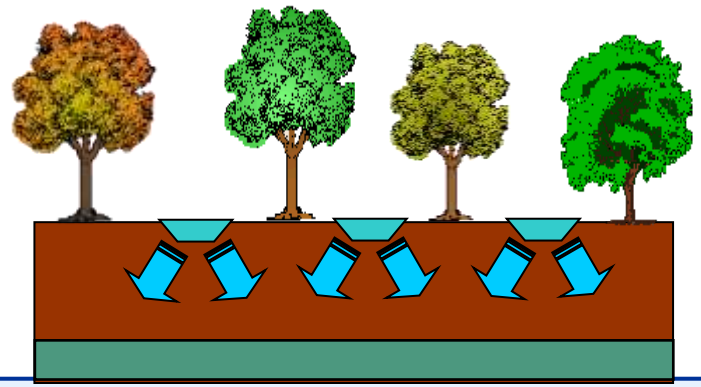
SCHIAVON Forested Infiltration Area

Programme funded by the EUROPEAN UNION

- 1.8 ha
- Water infiltration rate: 20-50 l/sec/hectare
- GW level: around -30 m b.g.l.
- Undifferentiated aquifer with high/medium permeability

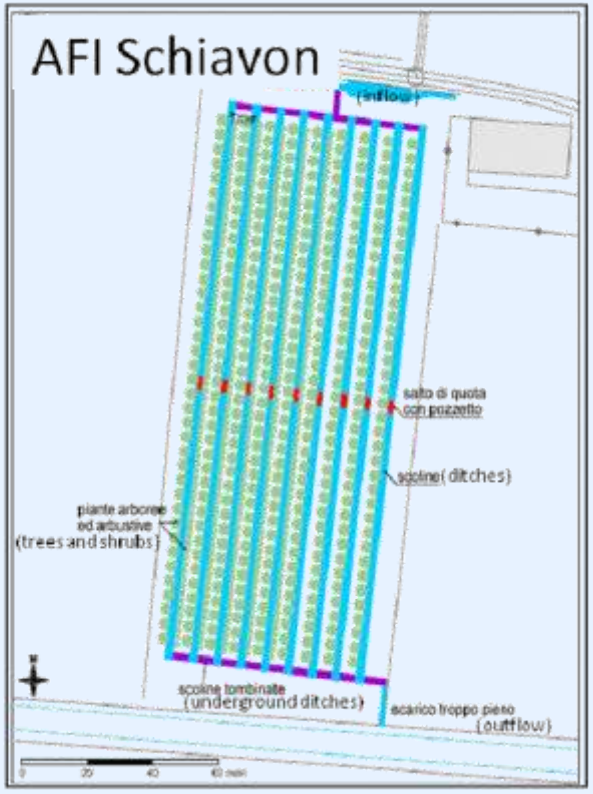
The watering of the pilot FIA area takes place generally during non-irrigation periods, using the existing irrigation water conveyance system (ditches, underground pipelines).

The irrigation water, seeping into the soil through the ditches, feeds the phreatic water table



SCHIAVON Forested Infiltration Area

Programme funded by the EUROPEAN UNION



Schiavon site chosen to represent the typical MAR settings within the river Brenta catchment:

1. Characterization of the heterogeneous river Brenta alluvial deposits – sediment type composition and distribution to evaluate infiltration capacity and its variability

2. Characterization of the shallow subsurface within the EU water framework directive

3. Evaluation / monitoring of clogging effects

SCHIAVON Forested Infiltration Area

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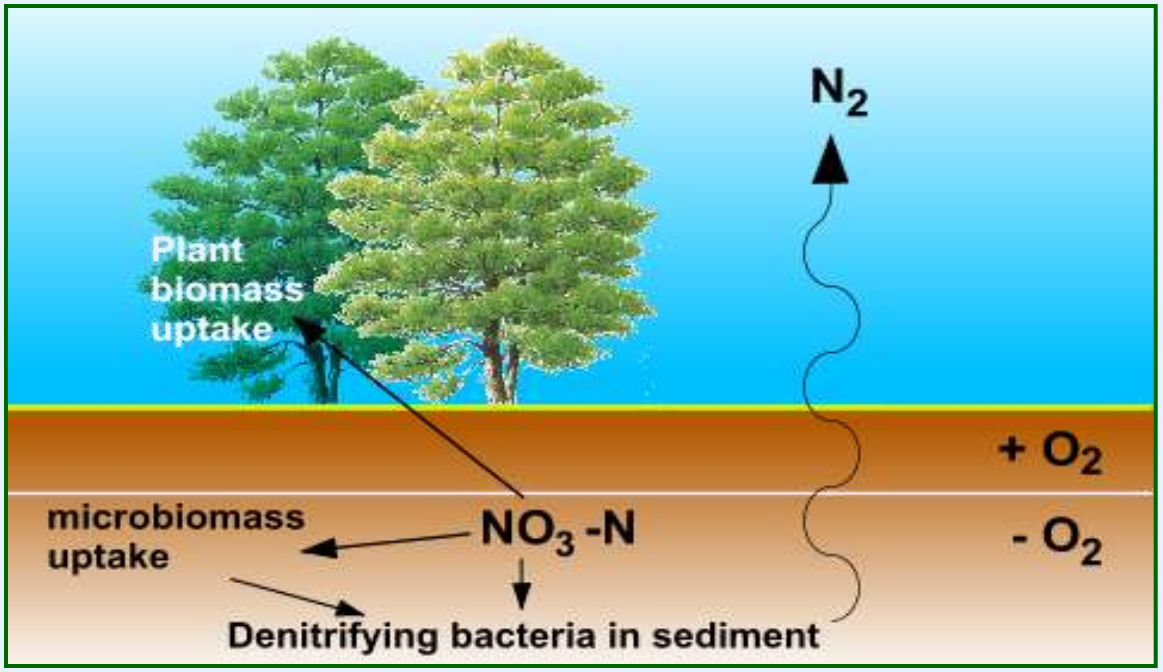
OVERALL OBJECTIVES:

- **Aquifer recharge/springs restoration**
- **Potential abatement of nitrates** in the GW and consequently in the GW resurgence area (“springs zone”)



Natural purification effect: ‘filter’ of plant roots and microorganisms that live in symbiosis with the vegetation

SCHIAVON Forested Infiltration Area

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The infiltration trenches

Site characterization:

- Direct push installation of 2 waveguides (for TDR)
- Soil sampling at every 10cm and measurement of volumetric water content (to calibrate TDR)
- 2” GW monitoring well
- Additional soil sampling and analysis of bulk density up to 8 m bgl
- 6 Direct push electrical conductivity profiling to assess presence of local clay-rich layers

SCHIAVON Forested Infiltration Area

Programme funded by the EUROPEAN UNION

Site characterization:

- Direct push installation of 2 waveguides (for TDR)
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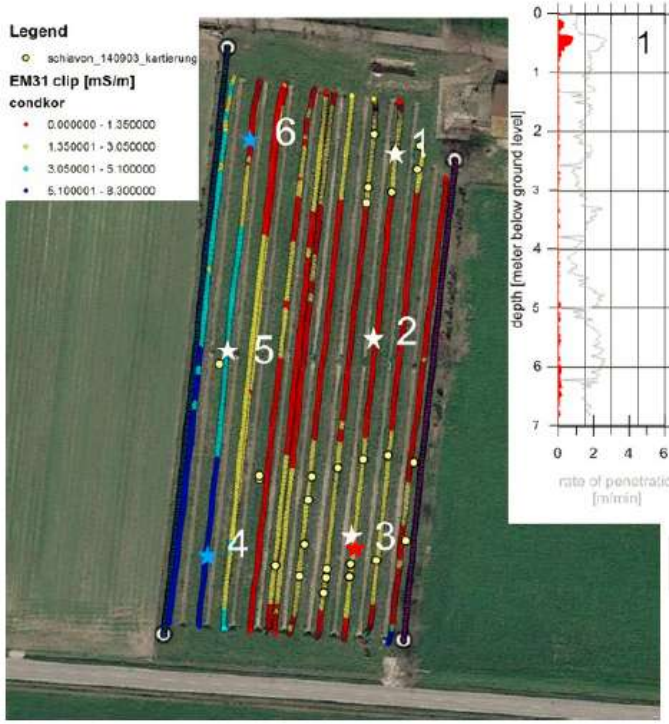

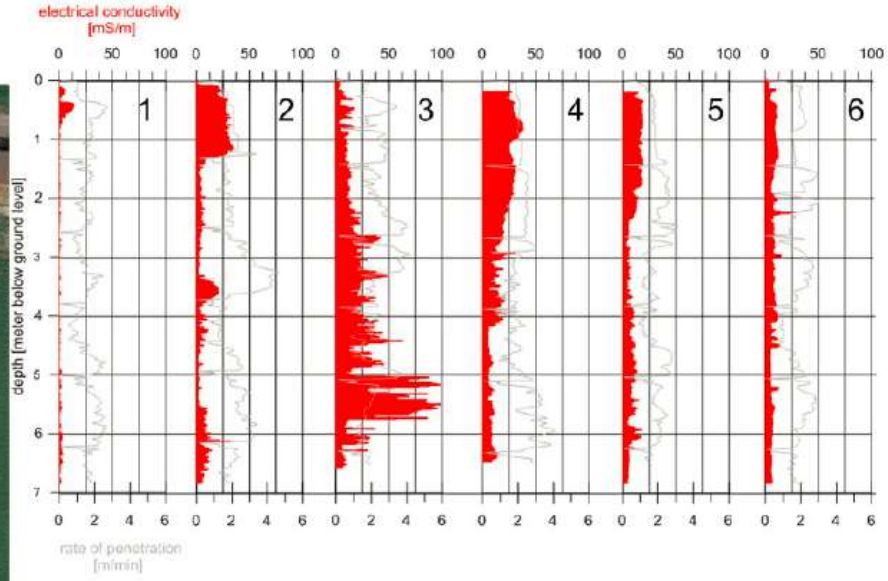

★ EC logging & soil sampling

★ EC logging

★ TDR and well installation

MONITORING: FIA – SCHIAVON site

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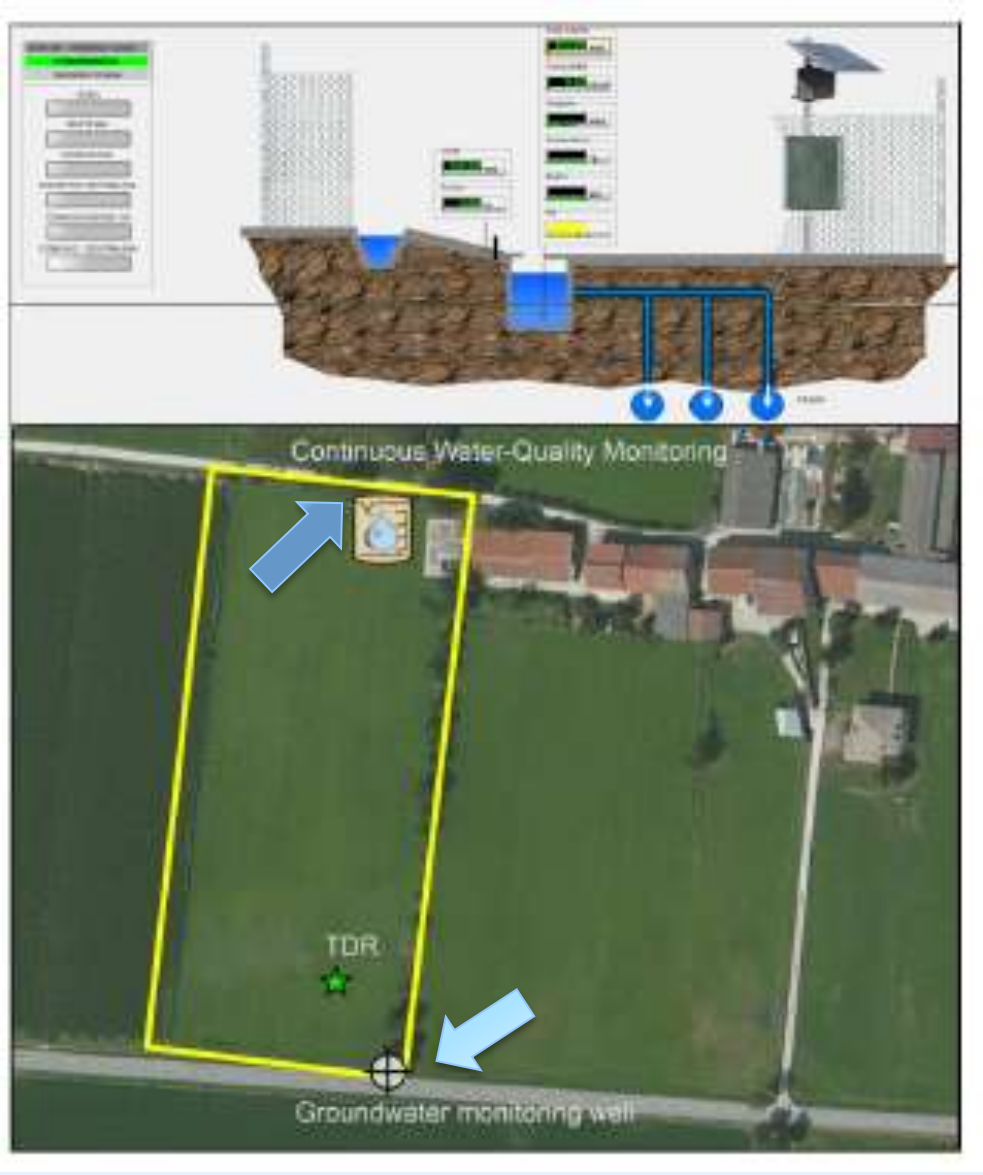

Monitoring equipment:

- SW monitoring of Roggia Comuna
- GW monitoring well
- Time-domain reflectometer (TDR)

Measured parameters:

- SW - Turbidity, conductivity, T, DO, REDOX potential, pH, water level, biomonitoring of trace elements (moss bags)
- GW – monthly chemical and physical lab analysis of water drawn from D/S piezometer, water table level.

LORIA Detention Basin

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LORIA Flood Retention and Infiltration Basin

- 2.4 ha
- On the Lugana river (maximum thirty-year discharge 10 m3/sec)
- The basin has a stock capacity up to 40,000 m3 and it fills up three/four times a year
- GW level: around -40 m b.g.l.
- Undifferentiated aquifer with high permeability

LORIA Detention Basin

Programme funded by the EUROPEAN UNION

Loria retention basin has been chosen taking into account two possible uses for the infiltration test site: infiltration capacity and potential flood basin area

MONITORING: Flood Storage Area – LORIA site

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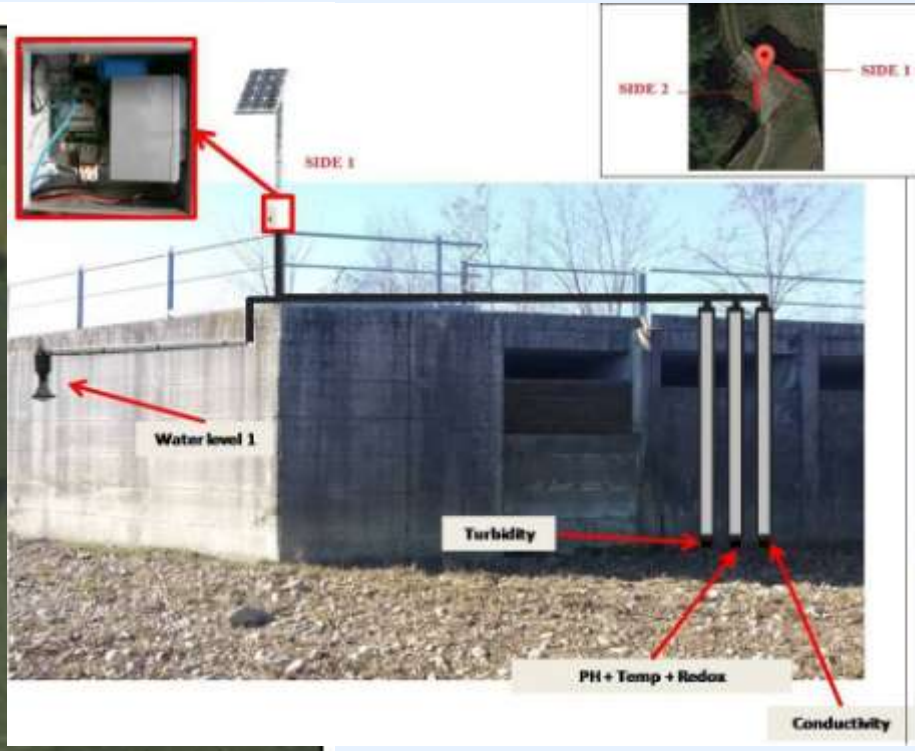
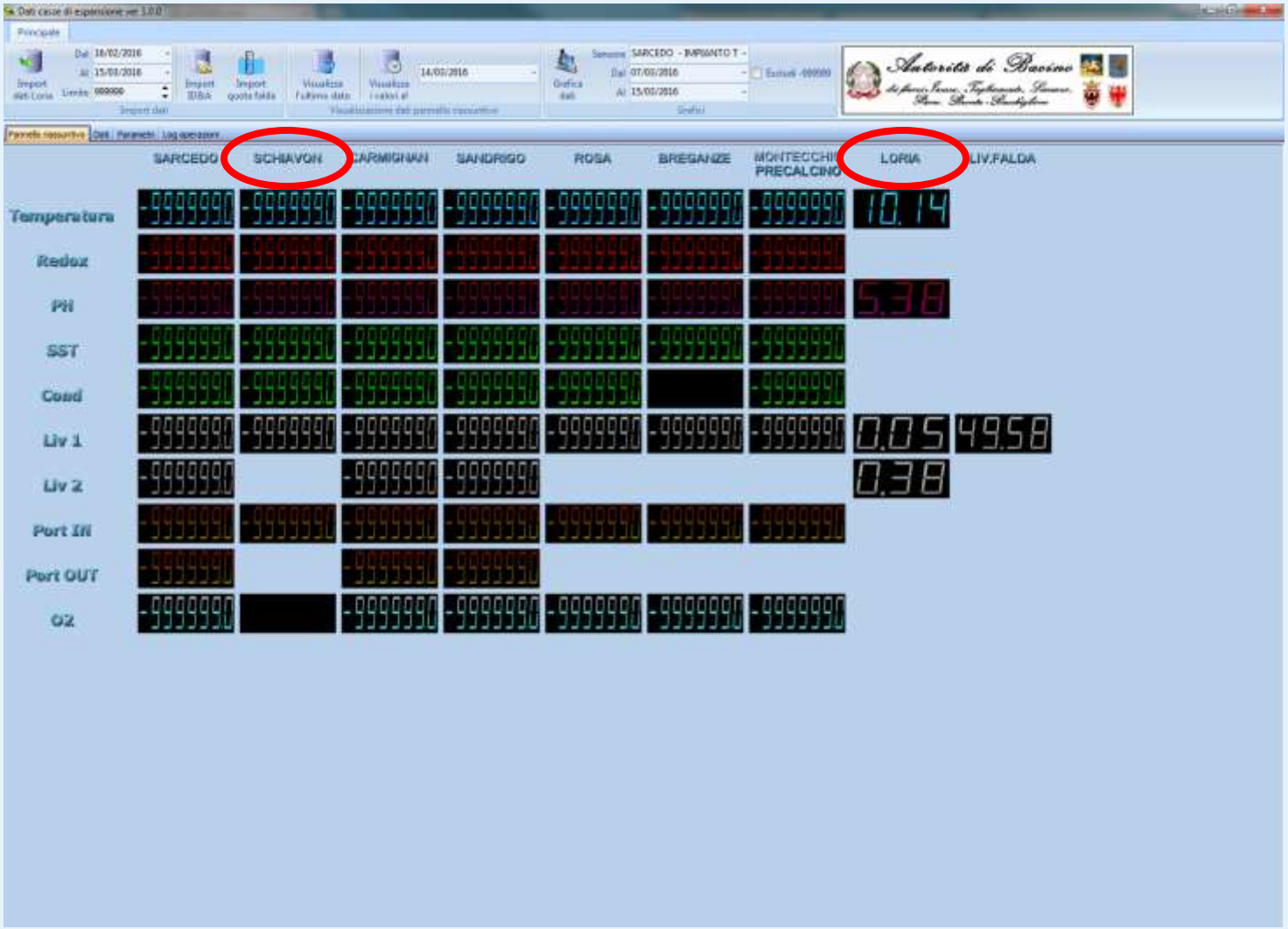


Monitoring equipment:

- SW monitoring of Lugana river
- GW monitoring well
- Time-domain reflectometer (TDR)

Online Monitoring



Modeling

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NEXT STEPS

MODEL SET-UP: boundary conditions / pollutants (nitrates) concentrations taking into account soil use, agriculture non-point impact from agriculture, etc. – **rough at large scale to catch the overall GW flow and quality trends, finer at local scale**

MODEL CALIBRATION: using historical/available GW quality monitoring data and also initial monitoring data from the new MARSOL campaign – **rough at large scale, finer at local scale**

MODELING SCENARIOS AT LOCAL SCALE: model simulations using the MARSOL quantity/quality monitoring data, taking into account different seasonal GW flow conditions, MAR configurations, possibly CC, etc., to evaluate the potential pollution (nitrates) abatement capacity

Schiavon FIA & Ecosystem Services

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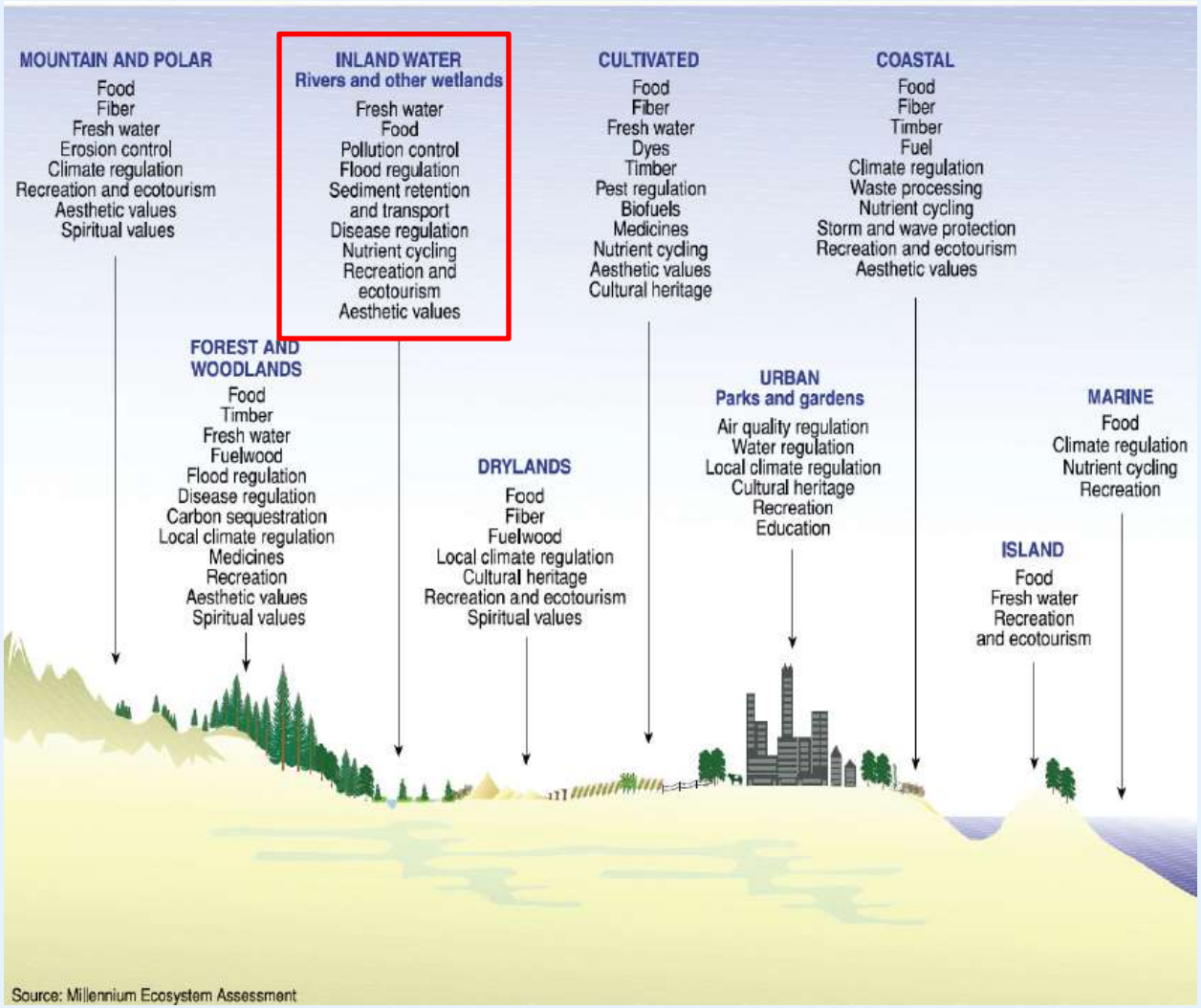

Resurgence ecosystems are comprised inside the category of inland water ecosystems and they can be classified as a wetland types

Schiavon FIA & Ecosystem Services

Programme funded by the EUROPEAN UNION

The ecosystem services associated to the resurgencies

	Ecosystem services categories											
Ecosystem Type	Supporting		Provisioning				Regulating			Cultural		
	Nutrient cycling	Soil formation	Food	Water	Raw materials (wood, fiber, etc.)	Genetic resources	Climate	Water cycling and water quality	Soil conservation	Educational	Aesthetic and recreational	Cultural and religious
Rivers, Lakes, Lagoons, wetlands (including resurgence ecosystems)	X		X	X	X	X	X	X	X	X	X	X

For instance the cultivation of fast-growing trees can turn out an economic benefit for land owners whilst providing an environmental service (**e.g. trees for paper production and biomass energy generation).**

Financial Analysis of the SCHIAVON site

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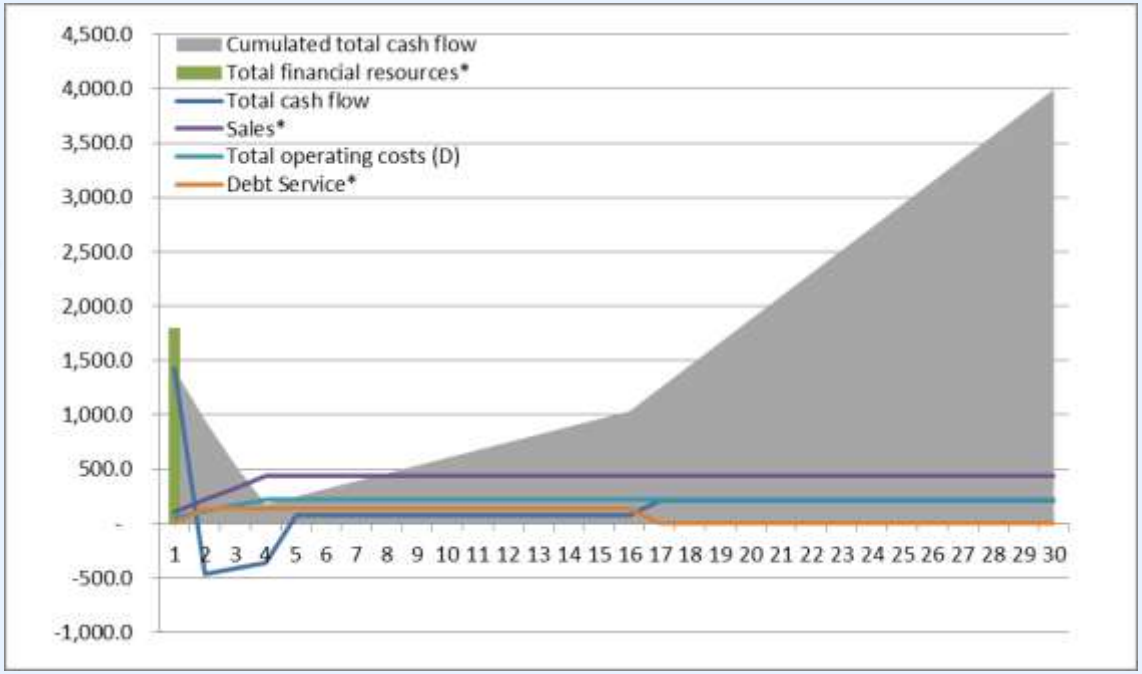
Cumulated total cash flow



Proposal	Description	Increase in tariffs	FNPV/C	FRR/C	FNPV/K	FRR/K
		%	€	%	€	%
#1	Recharge aquifer with required 20 MCM/y via 75 ha Forested Infiltration Area	1.5%	1,788,500	13.5%	290,900	5.2%

Upcoming events

Programme funded by the EUROPEAN UNION

MANAGED AQUIFER RECHARGE SOLUTIONS

Workshop on Water to Market:
Financial and economic analysis of MAR solutions

6 June 2016 - Venice, Italy

Organised by Autorità di bacino dei fiumi dell'alto Adriatico (Alto Adriatico Water Authority) & SGI

Autorità di Bacino dei fiumi Isonzo, Tagliamento, Livenza, Piave, Brenta-Bacchiglione

SGI life, first STUDIO GALLI INGEGNERIA

Citizen Observatories for Water Management

7-10 June 2016 - Venice, Italy

Organised by Autorità di bacino dei fiumi dell'alto Adriatico (Alto Adriatico Water Authority), in collaboration with RAI VENETO (Italian public broadcasting)

Autorità di Bacino dei fiumi Isonzo, Tagliamento, Livenza, Piave, Brenta-Bacchiglione

Rai Veneto

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