



FREEWAT
Free and Open Source Software Tools for Water Resource Management
EU HORIZON 2020 Project



 **ict4water.eu**

FREEWAT

(FREE and open source software tools for WATER resource management)

Final Meeting
September 20th – 22th 2017
IDAEA, CSIC - Barcelona

The Follonica-Scarlino coastal plain case study
and the H2020 FREEWAT participated approach. A common space for the participants to bring their experience and values to generate a shared knowledge on the value of water.



Regione Toscana

Pio Positano – Marco Nannucci

EIP Water Online Market Place
Matchmaking for water Innovation
*MAR Solutions - Managed Aquifer
Recharge Strategies and Actions
(AG128)*



idæa  **CID** CELEBRAR
INNOVAR
DEBATRE
CENTRE D'INVESTIGACIÓ I DESENVOLUPAMENT 1967-2017

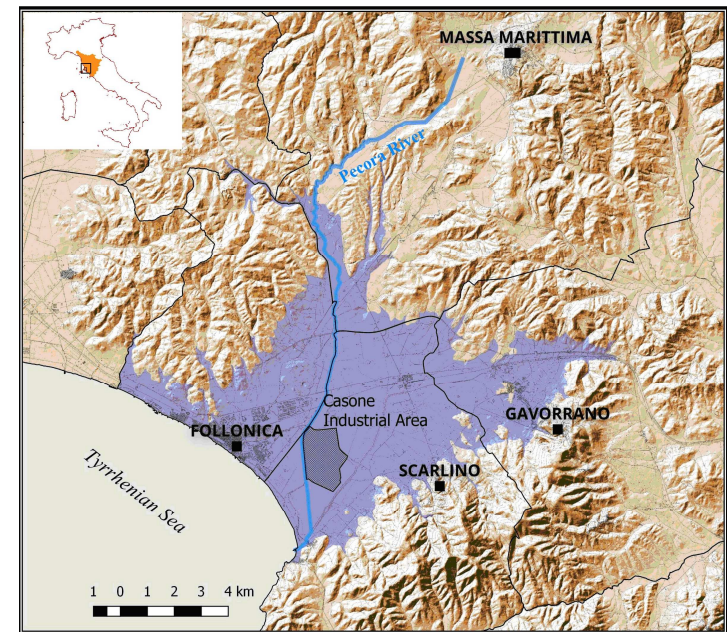


THE CASE STUDY

The **case study area** of Follonica-Scarlino is located in the south part of Tuscany in a coastal plain at the end of the Pecora River valley. This area belongs to the “Colline Metallifere” pyrite-base metals district and since Etruscan-Roman times to present days it was exploited for various mining and metallurgical activities.

The Follonica-Scarlino **aquifer system** is one of the groundwater reservoir characterized and defined by the Region of Tuscany under the EU Water Framework Directive 2000/60/EC. The study area is affected by various issues but the numerical model created with FREEWAT platform was focused to study the aquifer over-exploitation problem, according to the Programme of Measures of the River Basin Management Plan compiled by Northern Apennines District Authority, in compliance with the EU WFD 2000/60/EC.

The deficit in **quantity** of the resource is mainly caused by the huge industrial and agricultural withdrawals, but drinking water supply during the summer season is also notable as the population of the area grows up to ten times more, due to seaside tourism.

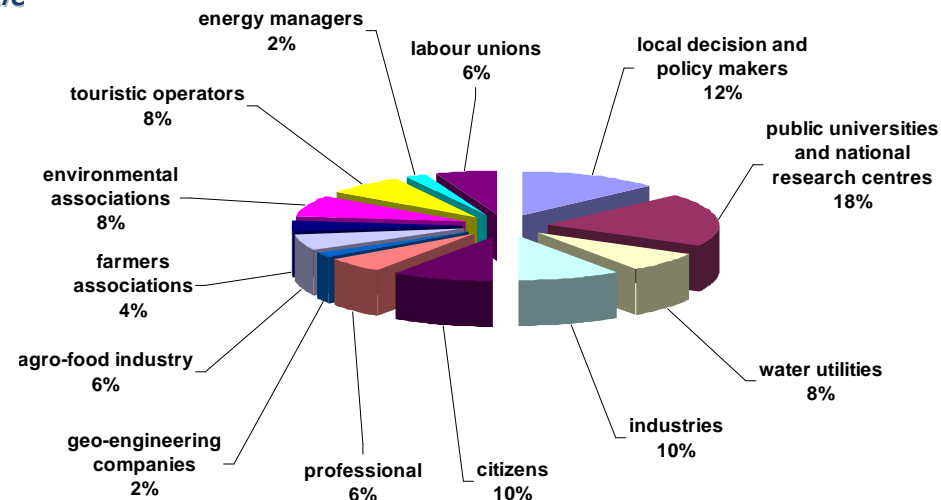


THE H2020 FREEWAT PARTICIPATORY APPROACH

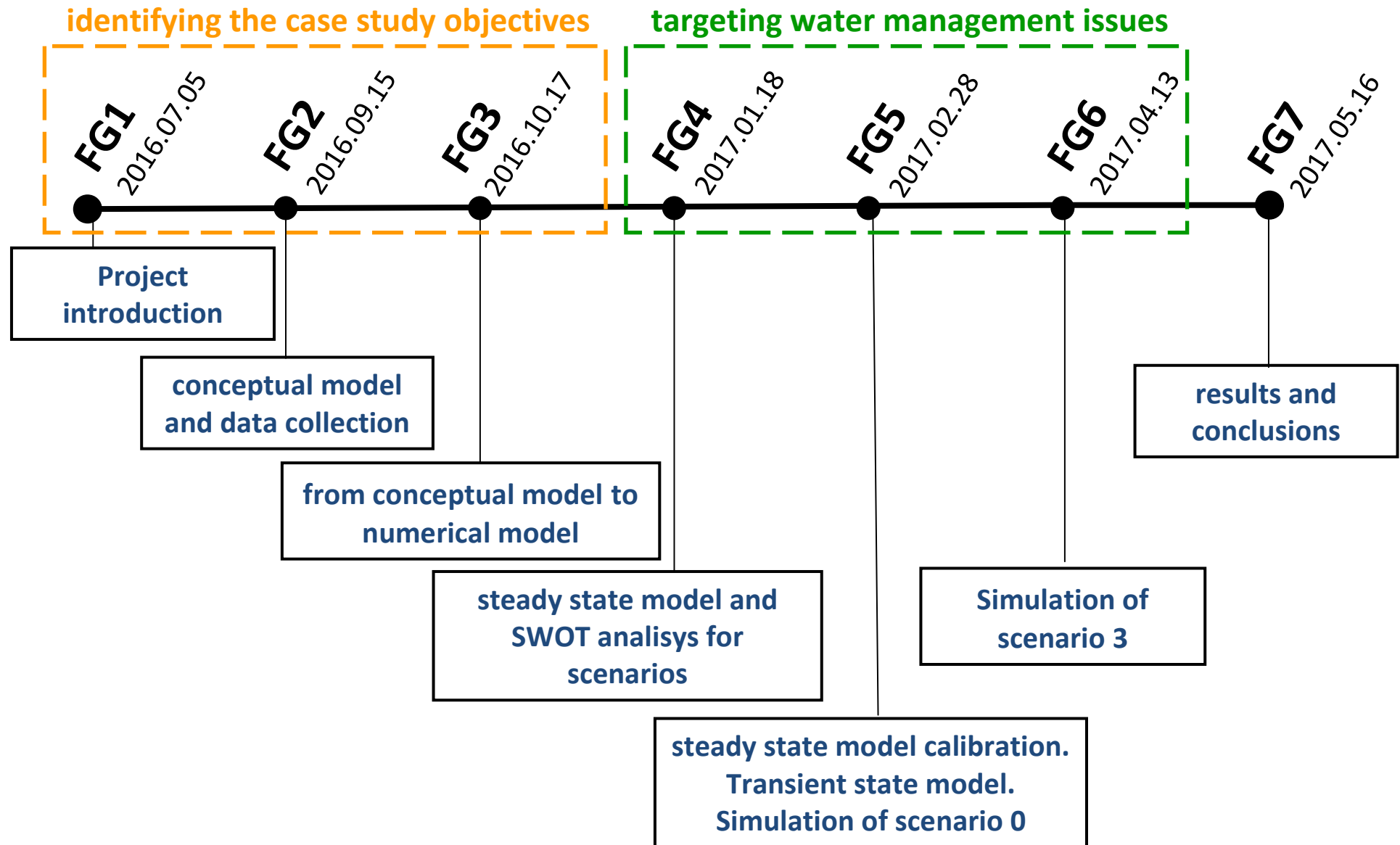
The participatory approach carried on through ***seven focus groups***, led the stakeholders to reach an agreement about scenarios to be explored with FREEWAT software platform.

Main components of the Focus Group

- *local decision makers and policy implementers*
- *public universities and national research centres*
- *water utilities and industries*
- *citizens, geo-engineering companies and professional*
- *agro-food industry*
- *farmers associations*
- *environmental associations*
- *touristic operators*
- *energy managers*
- *labour unions*



THE H2020 FREEWAT PARTICIPATORY APPROACH



Focus Groups 1-3: identifying the case study objectives

1. understanding *how water management issue was perceived* in the study area and how much the stakeholders believe that new technologies could improve water management;
2. clearing the air of *any possible misunderstanding* about commitment of the work project team as members of a public institution already engaged in this area in remediation works. This was very useful to create a collaborative climate within the working group;
3. aiming to reach a *shared awareness* of the available *data set* in order to build the numerical model. The missing data set were supplied by the stakeholders involved.

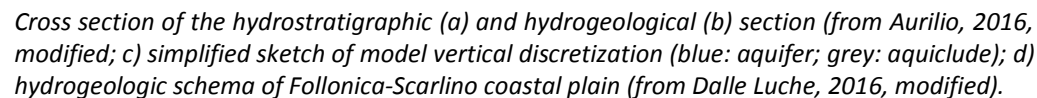


Focus Groups 1-3: identifying the case study objectives

- the important ***gap in quantity*** of the water resource emerged in very clear way during the focus group, matching the main water management problem identified by the *River Basin Management Plan* for this area;
- the objective of the case study was so identified in finding an alternative source for the huge amount of water withdrawals for the industrial activities, agriculture and tourism. The problem under this objective is: ***how to grant a constant and sustainable development of the economic activities*** in the coastal plain of Follonica and Scarlino. For this reason even the social representatives of the local stakeholders took part to the focus group through some of the labour unions.

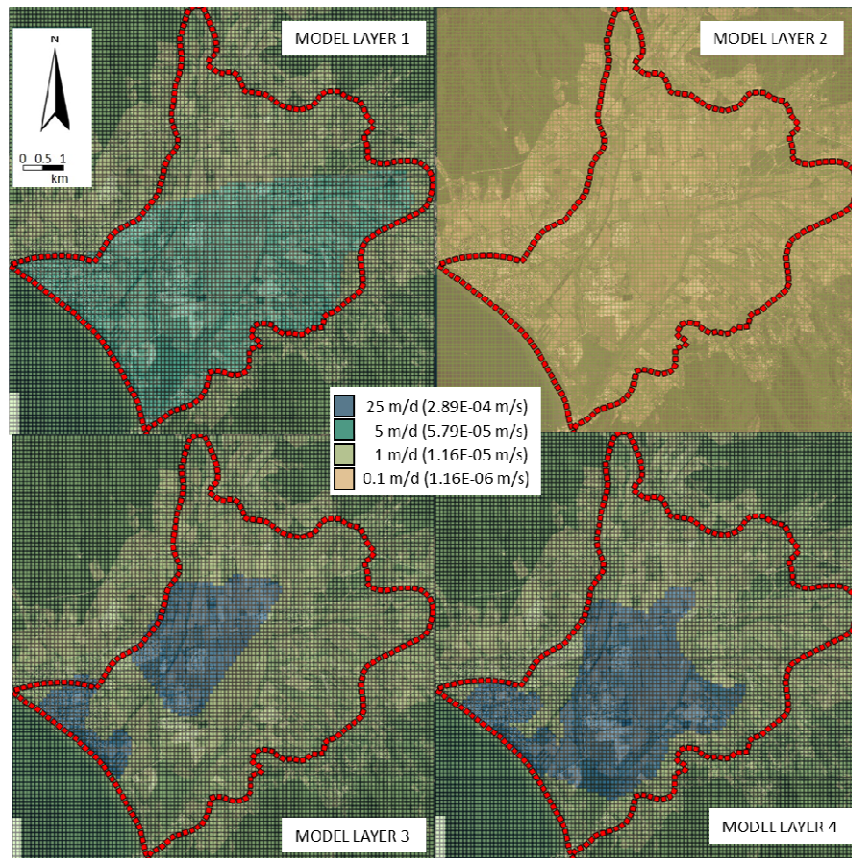


The application of the FREEWAT platform to the Follonica-Scarlino aquifer obtained a groundwater flow numerical model based on a solid conceptual model of the aquifer system.

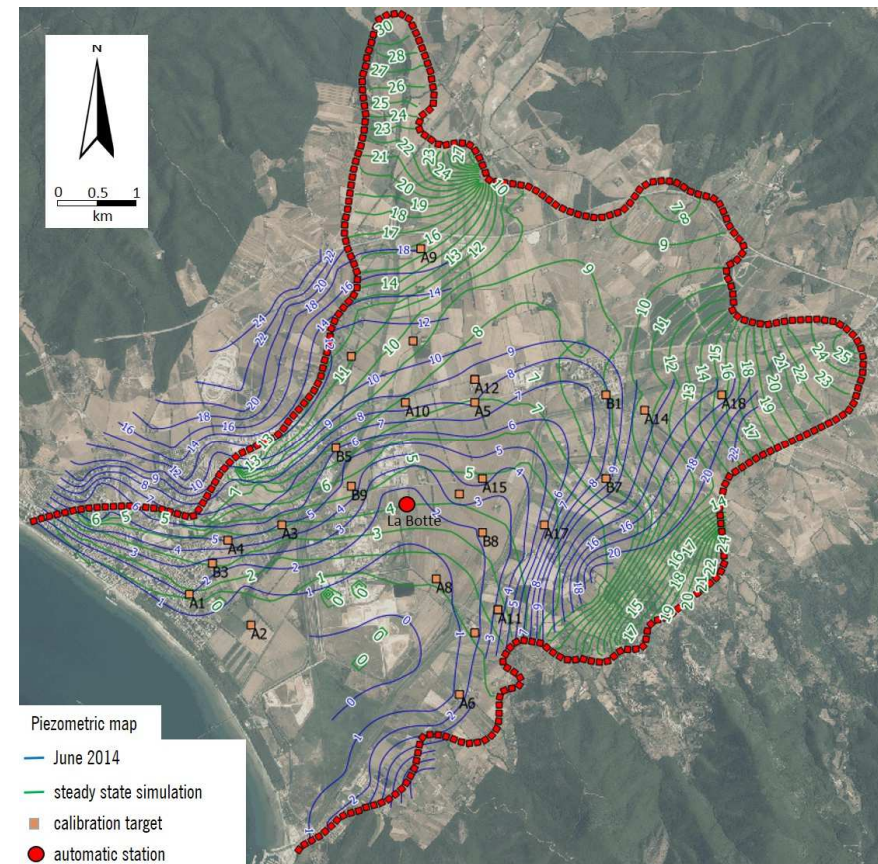


THE NUMERICAL MODEL

The numerical model, conveniently tuned, is able to forecast the response of the aquifer system to different solicitations and changes in the water balance simulating different scenarios. According to the problem and to the *water policy* to target, the case study was useful to investigate various design *solutions to increase the quantity* of the water resource and to provide a reliable support to decision makers.

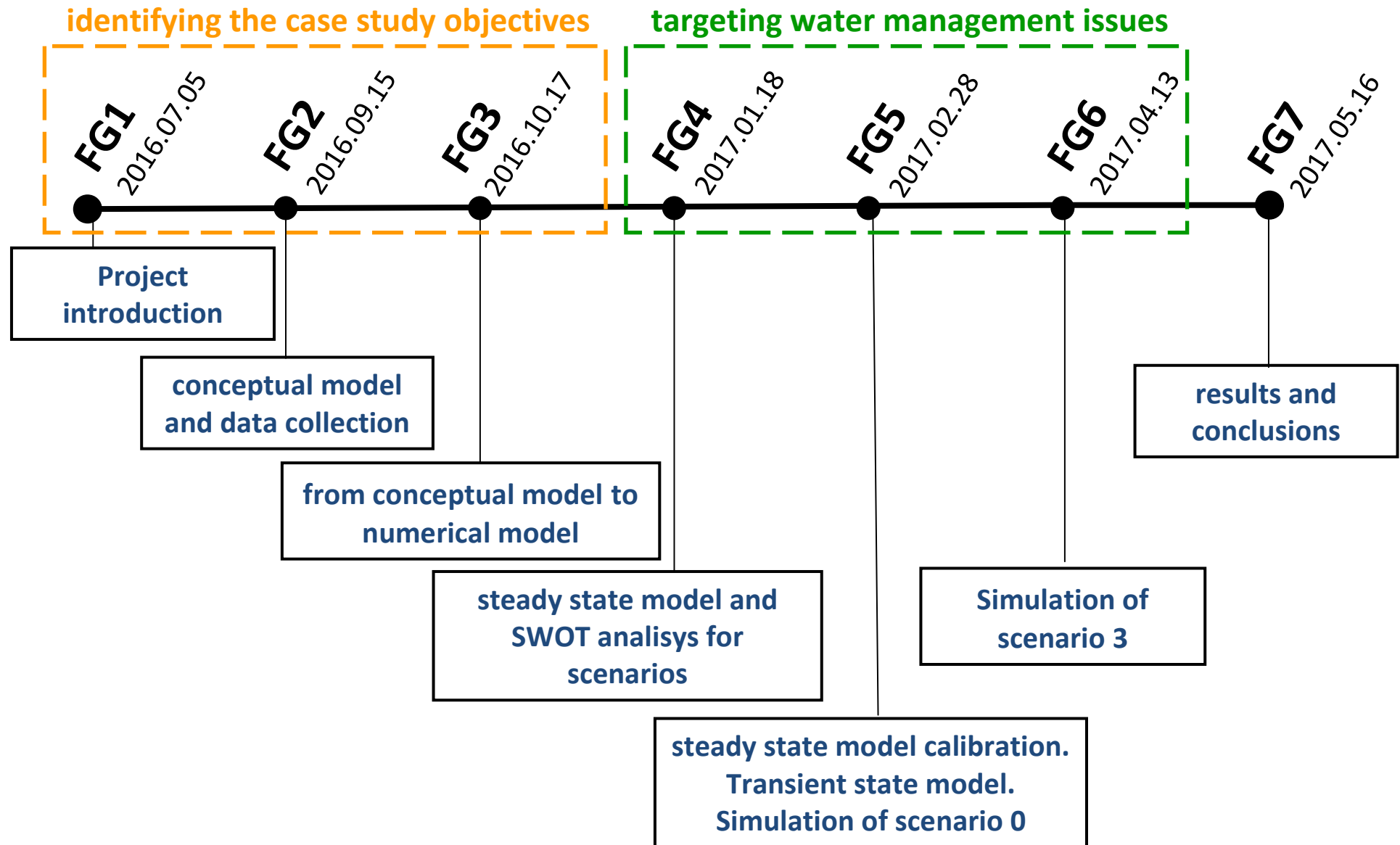


Hydraulic conductivity of each model layer assigned post calibration.



Piezometric map (June 2014) and groundwater head in steady-state condition

THE H2020 FREEWAT PARTICIPATORY APPROACH



Focus Groups 4-6: targeting water management issues

a) *identifying the measures to target* among those foreseen by the River Basin Management Plan in the *Programme of Measures*.

Northern Apennines District :: River Basin Management Plan

Waterbody sheet

| | | |
|---------------------|--------------------|--|
| General Information | Codice WISE | IT0932CT040 |
| | Nome | Corpo idrico della Pianura di Follonica |
| Location | Regione | TOSCANA |
| Characteristics | Category | Acquiferi |
| | Type | DQ |
| | Basin area [sq.km] | 76,9 kmq |
| Links | Aree protette | 09ATO602516 (APOT_GW), 09ATO601793 (APOT_GW), 09ATO601950 (APOT_GW), 09ATO601440 (APOT_GW), 09ATO602558 (APOT_GW), 09ATO602678 (APOT_GW), 09ATO601339 (APOT_GW), 09ATO602494 (APOT_GW), 09ATO602602 (APOT_GW) (+ 7...) |
| | Connected SW | [IT09CI_R000TC171f] FOSSO CERRETELLA [IT09CI_R000TC202f] FOSSO DELL'ACQUA NERA (3) [IT09CI_R000TC041ca] CANALE ALLACCIANTE DI SCARLINO [IT09CI_R000TC300ca] FOSSO PETRAIA [IT09R000TC007AC] Costa di Piombino [IT09CI_R000TC343ca] GORA DELLE FERRIERE [IT09CI_R000TC120f] FIUME PECORA MONTE [IT09CI_R000TC148ca] FOSSO ALL'OPRA [IT09CI_R000TC344ca] GORA DELLE FERRIERE (2) [IT09CI_R000TC121f] FIUME PECORA VALLI |



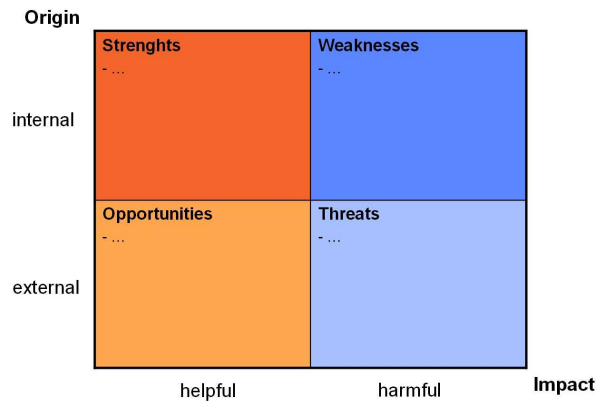
Nota: la mappa sopra riportata ha una funzione solamente indicativa. Per ogni esigenza di precisione geografica nella localizzazione del corpo idrico, si rimanda alla cartografia web-gis dedicata.

Programme of Measures

| Direct | Agriculture | Climate change | Energy - hydr | Energy - non- | Fisheries and aqu | Flood protection | MIN | MAX |
|---------------------------------------|------------------------|------------------------|-------------------|---|--------------------------|--------------------------|----------------------------|-----|
| | Forestry | Industry | Tourism & recreat | Transport | Urban development | Unknown/Other | | |
| Direct measures - Planned | | | | Upstream measures - Planned | | | | |
| [01] POINT | [03] NUTR 1 interv. | [03] PEST | [04] CONTAM | [01] POINT 2 interv. | [02] NUTR 1 interv. | [03] PEST | [04] CONTAM 27 interv. | |
| [05] LONG | [06] HYDROM | [07] FLOW 1 interv. | [08] IRRIG | [05] LONG | [06] HYDROM 1 interv. | [07] FLOW 1 interv. | [08] IRRIG 1 interv. | |
| [09] PRIC.HH | [10] PRIC.INC | [11] PRIC.AGR | [12] ADV.AGR | [09] PRIC.HH | [10] PRIC.INC | [11] PRIC.AGR | [12] ADV.AGR | |
| [13] WAT.PROT | [14] KNOW | [15] EMISS | [16] IND.WWT | [13] WAT.PROT | [14] KNOW 1 interv. | [15] EMISS | [16] IND.WWT | |
| [17] SOIL | [18] ALIEN | [19] RECREAT | [20] FISHING | [17] SOIL | [18] ALIEN | [19] RECREAT | [20] FISHING | |
| [21] POLLUT | [22] FOREST | [23] RETENT | [24] CLIM.CHG | [21] POLLUT | [22] FOREST | [23] RETENT | [24] CLIM.CHG | |
| Extended list of measures | | | | Extended list of measures | | | | |
| Direct measures - Additional measures | | | | Upstream measures - Additional measures | | | | |
| [01] POINT | [03] NUTR 1 interv. | [03] PEST | [04] CONTAM | [01] POINT | [02] NUTR 4 interv. | [03] PEST 2 interv. | [04] CONTAM | |
| [05] LONG | [06] HYDROM | [07] FLOW 1 interv. | [08] IRRIG | [05] LONG | [06] HYDROM 1 interv. | [07] FLOW 1 interv. | [08] IRRIG 2 interv. | |
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| [13] WAT.PROT | [14] KNOW | [15] EMISS | [16] IND.WWT | [13] WAT.PROT | [14] KNOW 11 interv. | [15] EMISS | [16] IND.WWT | |
| [17] SOIL | [18] ALIEN | [19] RECREAT | [20] FISHING | [17] SOIL | [18] ALIEN | [19] RECREAT | [20] FISHING | |
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Focus Groups 4-6: targeting water management issues

b) selecting scenarios to be addressed by FREEWAT platform through some workgroup techniques: for this case study **SWOT Analysis** and **brainstorming** were adopted.



THE SCENARIOS

The scenarios number

- 0** desalination plant
- * **1** well field displacement
- 3** mine water drainage reuse

were focused on the *comparison of alternative water management strategies*

The scenario number

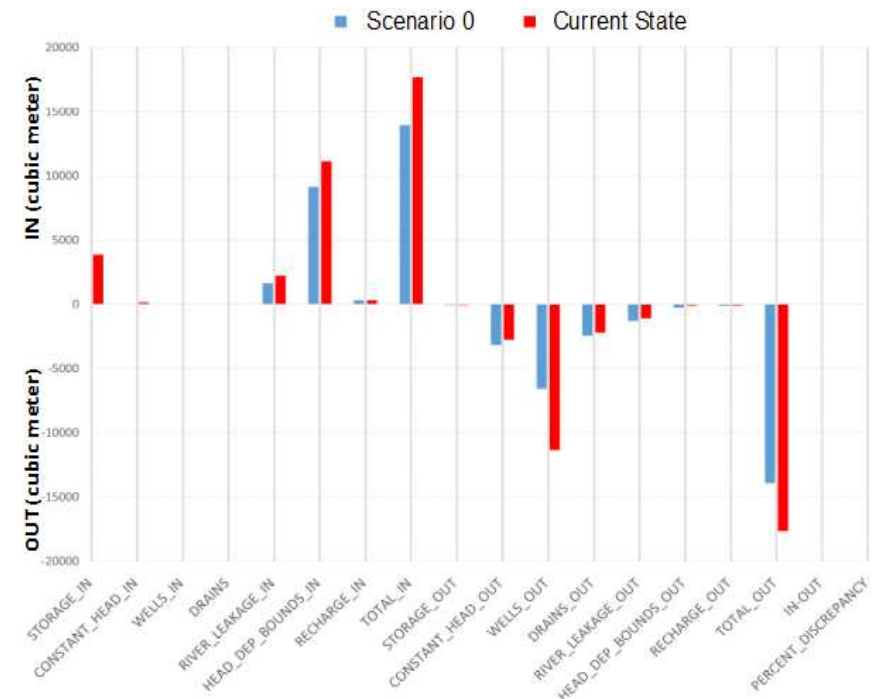
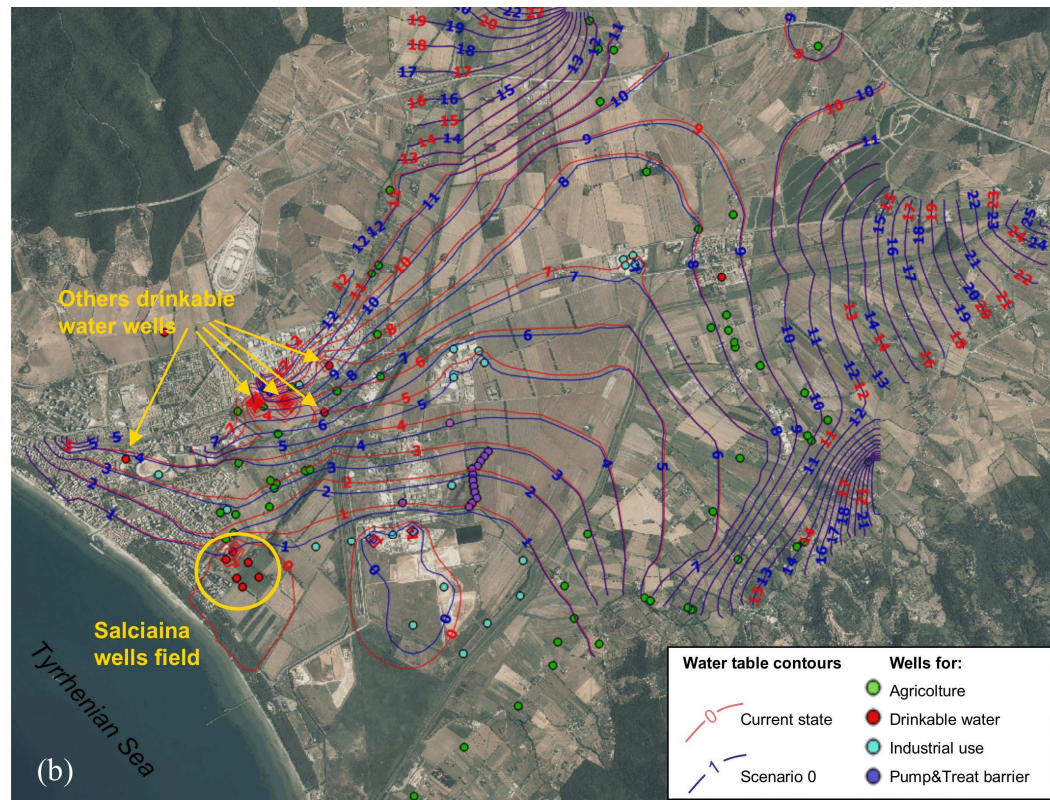
- * **2** very hard summer drought conditions

was centred on *possible future changes to the system*

* These scenarios were not chosen by focus group participants, so they were not implemented in FREEWAT model

Scenario 0: the construction of a *desalination plant* in order to improve the quantity of the resource.

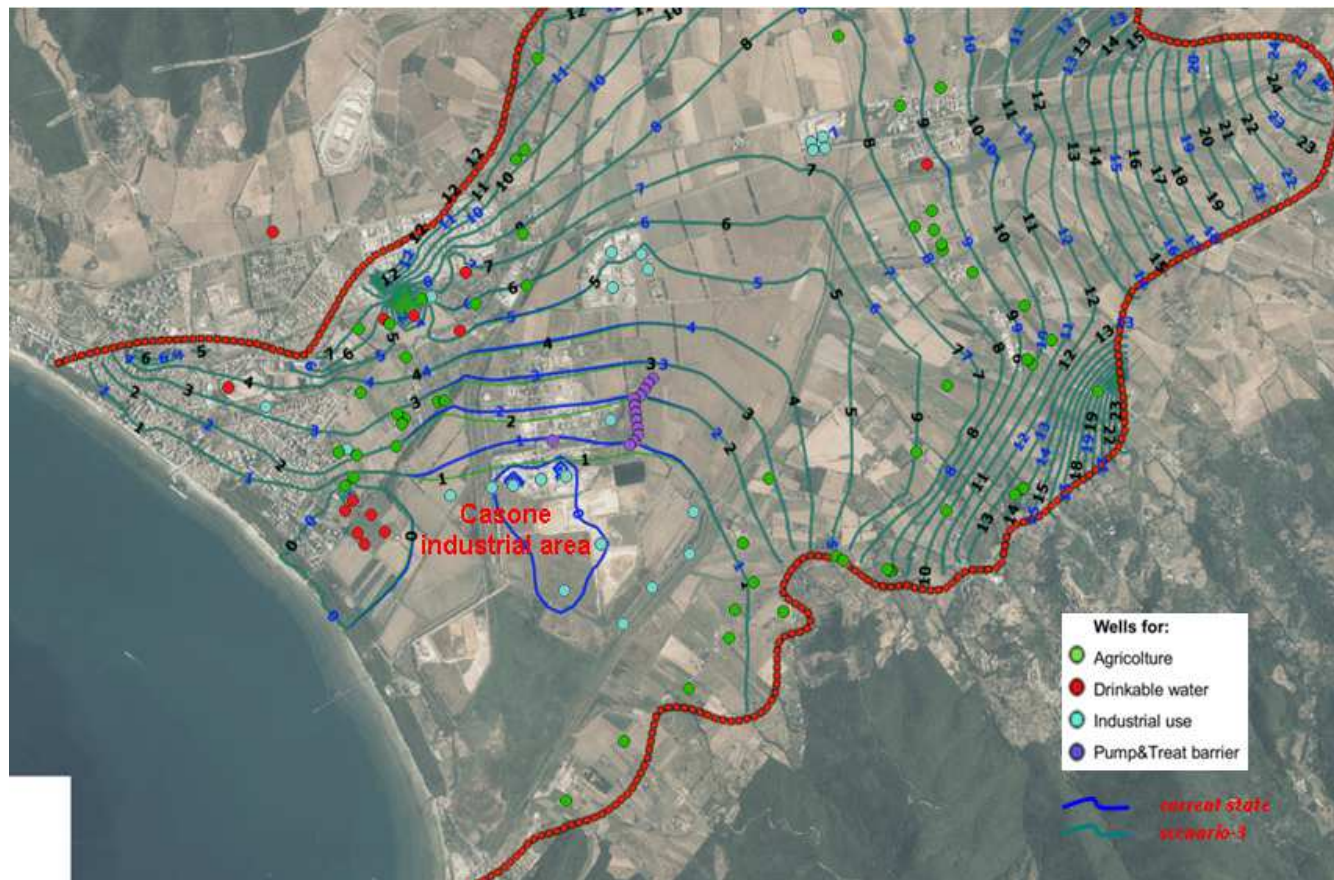
This scenario was based on the fulfilment of a part of the measures foreseen by the PoM of the RBMP for the Northern Apennines District. The result of this scenario shows that a desalination plant replacing the well field for drinkable water supply has positive effects on the water table exploitation just around the well field, so the measure proposed by the PoM it is not enough to improve significantly the quantity of basin water resource.



Water budget and comparison between two hydraulic heads simulated with FREEWAT in transient condition (low level condition sp12: July-September 2012). Constant-Head-In represents seawater intrusion.

Scenario 3 : the *reuse of Gavorrano Mine drainage water* for industrial purpose.

In this scenario the withdrawals from wells located in the central industrial area of the plain are canceled and the result shows that, even using an amount of 50% of the water drained from the mine, the aquifer budget is not negatively influenced and the minimum in water table surface at “Casone” disappears (green contour lines in figure). The analyzed measure could improve the quantity of basin water resource and could be useful to reduce the seawater intrusion problem.



Comparison between two water tables simulated with FREEWAT in transient conditions (low level condition sp24 - July-September 2015) using 50% of the mine drainage water for industrial purpose (total amount of the industrial area needs = 3524 m³/day)

Focus Groups 7

Feedback from the stakeholders

- FREEWAT is an important tool in order *to improve the knowledge* of a study area or of a problem and *to organize and share data*;
- *no software licenses costs*;
- FREEWAT project gave the opportunity *to organize the big amount of data collected* for the Follonica-Scarlinò aquifer basin;



Results of the project

- the scenario of the reuse of mine drainage water instead of industrial withdrawals is a very useful starting point *to increase opportunities for productive activities* in a very responsible manner for society and environment and also capable to generate new "decent work *" and *long-lasting jobs*;
- tools like FREEWAT are important to produce new work that is not only "decent" but also "green " because this is the most successful way to make *work sustainable* and long-lasting;
- relevance of the results of FREEWAT for the management of water resources in *touristic season planning*;
- some engineers of local industries are interested in *using FREEWAT platform as a modeling tool* for their work starting from the numerical model produced by this case study *for new model implementations*.

* definition of the United Nations Economic and Social Council and of the International Labour Organization

Conclusions

The H2020 FREEWAT approach was able to:

- get more *awareness* about benefits in using *numerical modeling*
- use the power of *participatory approach*
- get *Policy Briefs* for decision makers
- enhance *quality* and *quantity of data* to improve the numerical model;
- grow up *water resource monitoring*;

and ...

...new challenges for the future

- to pass *from the case study to a concrete application* in the study area
- to *get more involved decision makers* who have now to receive FREEWAT suggestions for a new kind of water management
- to *get more involved the agriculture world* of local stakeholders, even if they are not so used to employ and understand tools for numerical modeling like FREEWAT

Thank you for your attention





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EIP Water Online Market Place
Matchmaking for water irrigation
MWR solutions - Managed Aquifer
Recharge Strategies and ACTIONS
(MAR3)

