







# Water NEEDs, Availability, Quality and Sustainability

# WE-NEED



Monica Riva  
Brian Berkowitz  
Susana Loureiro  
Daniel Fernandez-Garcia

# CONSORTIUM DESCRIPTION

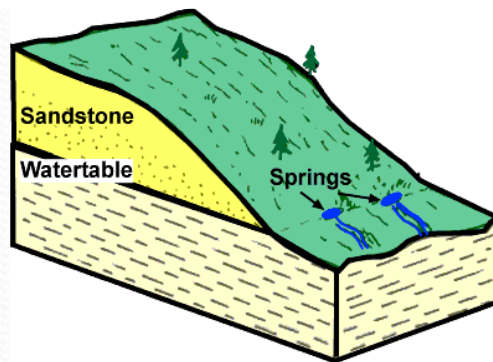
ACRONYM	TOPIC	Coordination	Partners
<b>WE-NEED</b>	<b>2</b>		  
<b>Water Needs, Availability, Quality and Sustainability</b>		water management; risk assessment; emerging contaminants; surface and groundwater interaction; multiscale characterization; ecotoxicity	

PRINCIPAL INVESTIGATOR	INSTITUTION		COUNTRY
<b>Monica Riva</b>	<b>Politecnico di Milano</b>	- <b>Polimi</b>	<b>Italy</b>
Brian Berkowitz	Weizmann Institute of Science	- Weizmann	Israel
Susana Loureiro	Universidade de Aveiro	- UAVR	Portugal
Daniel Fernandez-Garcia	Universitat Politecnica de Catalunya	- UPC	Spain

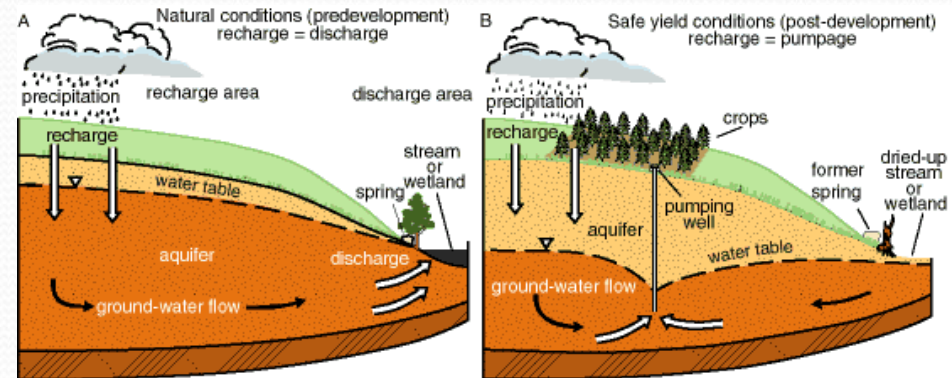
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## Scope and State of the art

**GOAL:** Develop innovative management strategies to assist the use/protection of groundwater resources (springs – wells)



<http://imnh.isu.edu/digitalatlas/hydr/concepts/gwater/gwfr.htm>



[http://www.kgs.ku.edu/Publications/pic9/pic9\\_2.html](http://www.kgs.ku.edu/Publications/pic9/pic9_2.html)

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## Scope and State of the art

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**GOAL:** Develop **innovative** management strategies to assist the use/protection of groundwater resources (**springs – wells**)

### **Problems/Failure of classical approaches/Challenges of WE-NEED:**

- **Heterogeneity** of natural systems. Strategy: proper quantification
- **Complex dynamics** of processes involved. Strategy: process quantification for modeling and decision-making
- **Scaling/Statistical Scaling:** Transfer knowledge across scales. How to use available information from a range of observational scales to characterize/describe the subsurface at a desired scale (in space and time)? Strategy: increase certainty of predictions

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## Scope and State of the art

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**GOAL:** Develop **innovative** management strategies to assist the use/protection of groundwater resources (**springs – wells**)

**WATER QUANTITY** : Over-exploitation of groundwater resources

**WATER QUALITY** : Regulated and emerging contaminants  
(pharmaceuticals, ...)

**KEYWORDS:** Management/Protection of Groundwater Resources –  
Sustainability – Uncertainty Quantification - Risk Assessment -  
Multiscale Statistical Analysis  
Relevant **Study Cases** (real scenarios)

## Objectives and relation to the scope of the call

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### Scientific/Application-oriented objectives are:

- Develop methods/models **to include uncertainty quantification and its propagation across scales** (as grounded on direct observations/experiments at diverse scales of interest) **in risk assessment** (under uncertainty).
- Provide quantitative understanding and **process-based models** of the hydrogeological system and geochemical behavior of reactive chemical species **in relevant scenarios**.
- Include these results within a **decision making** framework for the **sustainable use of water**, preserving historical heritage, and with acceptable risk to existing ecosystems.
- Assessment of the contaminant-specific **vulnerability** of the aquifer systems.
- Physically-based **risk assessment** and water management protocols.

## Objectives and relation to the scope of the call

### Scientific/**Application-oriented** objectives are:

- Develop methods/models to include **uncertainty quantification** and its **propagation across scales** (as grounded on direct observations/experiments at diverse scales of interest) in risk assessment under uncertainty.
- Provide quantitative understanding and **process-based models** of the hydrogeological system and geochemical behavior of reactive chemical species **in relevant scenarios**.
- Include these results within a **decision making** framework for the **sustainable use of water**, preserving historical heritage, and with acceptable risk to existing ecosystems.
- Assess the **contaminant-specific vulnerability** of the aquifer systems.
- Provide physically-based **risk assessment** and water management protocols.

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## Objectives and relation to the scope of the call

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**Topic 2** of the WaterWorks 2014 Cofunded Call: "Research and innovation for developing technological solutions and services **for Water Resources Management**". Within this topic *WE-NEED* deals with (**subtopics 2.3 and 2.4**) "uncertainty/risk assessment, relevant study cases and innovative decision making tools".



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## Objectives and relation to the scope of the call

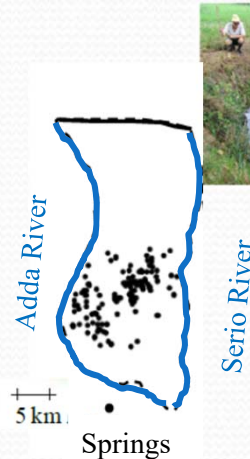
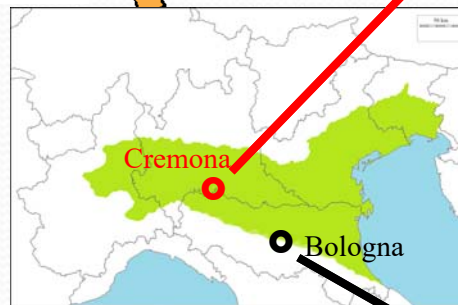
**Topic 2** of the WaterWorks 2014 Cofunded Call: "Research and innovation for developing technological solutions and services for **Water Resources Management**". Within this topic *WE-NEED* deals with (subtopics 2.3 and 2.4) "uncertainty/risk assessment, **relevant study cases** and innovative decision making tools".

Two field sites representing different but complementary realities.

The *Bologna Aquifer* is a key source of water for the metropolitan area of Bologna.

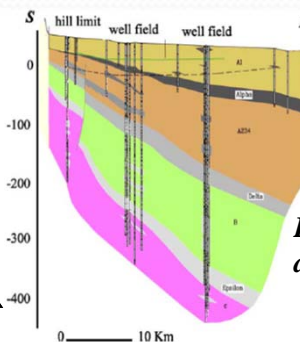


*Springs location in the Cremona-Bergamo area*



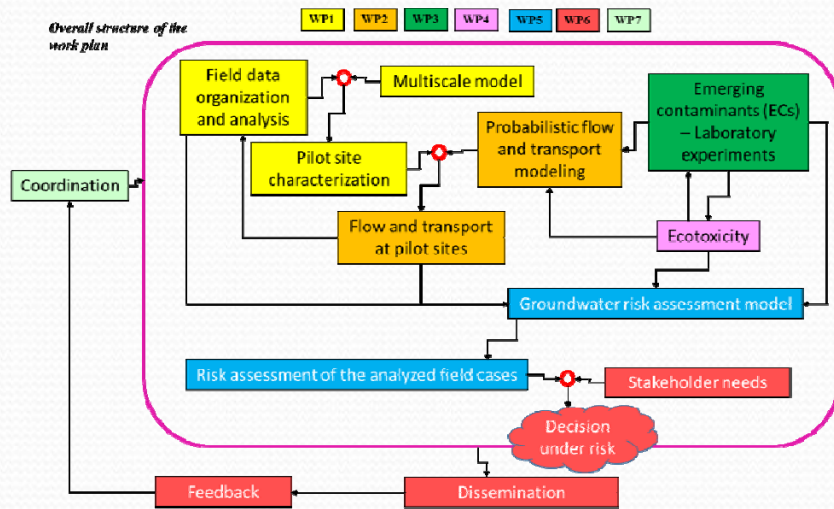
The *Cremona Aquifer* located in the so-called *Springs Belt*.

Natural high-quality water springs are the main supply to agriculture and a key environmental driver.



*Bologna aquifer system*

## Work Package (WP) description / distribution of tasks



		Lead Partner	Participating Partner
WP1	Data collection and multiscale characterization	Polimi	UPC, UAVR, Weizmann
WP2	Probabilistic flow and transport modeling	UPC	Polimi, Weizmann
WP3	Fate of Emerging Eontaminats (Ecs) - laboratory experiments and modeling	Weizmann	UAVR
WP4	Ecotoxicology	UAVR	Weizmann
WP5	Multidisciplinary risk assessment and decision making	Polimi	UPC, UAVR, Weizmann
WP6	Dissemination of results, communication with stakeholders/general public	Polimi	UPC, UAVR, Weizmann
WP7	Project management	Polimi	UPC, UAVR, Weizmann

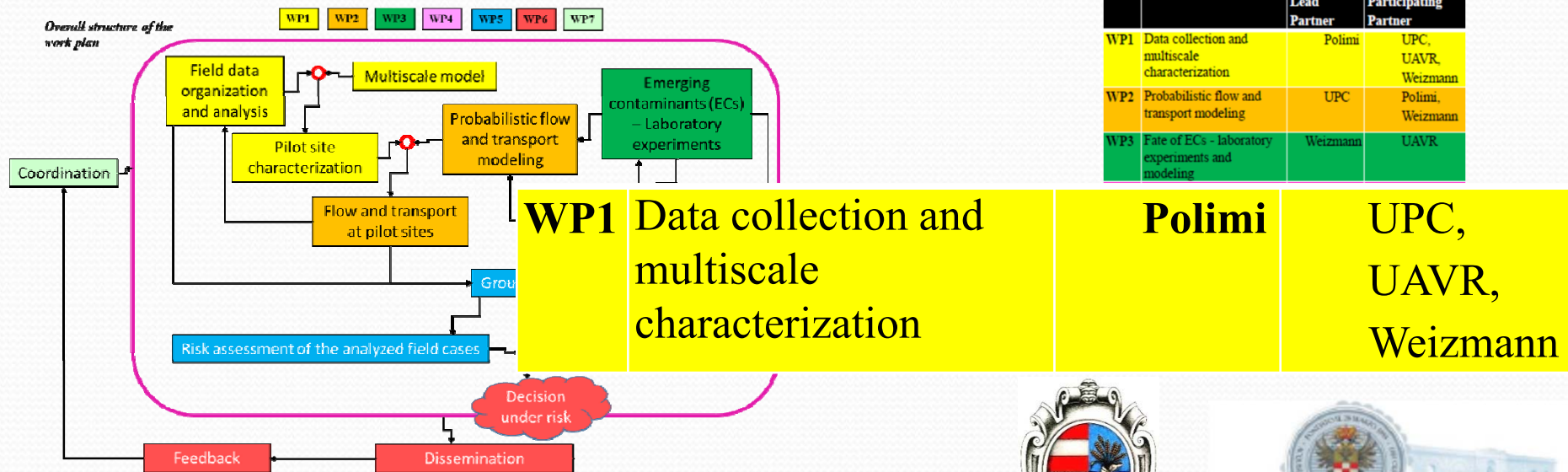
All partners participate in several WPs

- Shared international experience, state-of-the-art process understanding and modeling techniques
- Mobility of researchers
- Multidisciplinary work

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## Work Package (WP) description / distribution of tasks

Overall structure of the work plan



		Lead Partner	Participating Partner
WP1	Data collection and multiscale characterization	Polimi	UPC, UAVR, Weizmann
WP2	Probabilistic flow and transport modeling	UPC	Polimi, Weizmann
WP3	Fate of ECs - laboratory experiments and modeling	Weizmann	UAVR

**WP1** Data collection and multiscale characterization

**Polimi**

UPC,  
UAVR,  
Weizmann

- Develop a new model for scaling of statistics.
- Develop conceptual models of pilot sites.
- Reconstruction of spatial distributions of hydrogeological parameters.

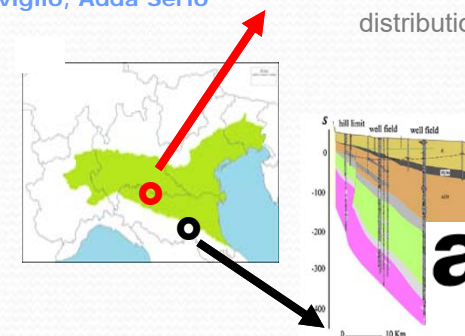


Consorzio di Bonifica Dugali, Naviglio, Adda Serio



CONSORZIO IRRIGAZIONI CREMONESI  
(ente consorzio)  
www.consorzioirrigazioni.it

Water derivation and distribution for irrigation



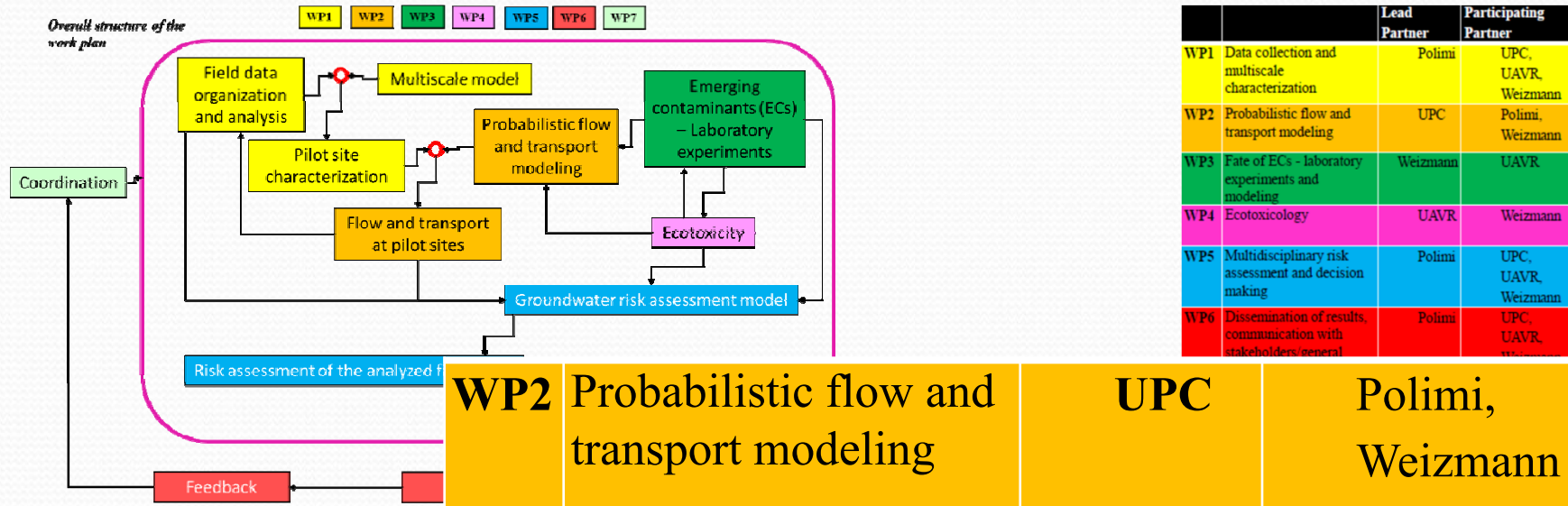
Regional Agency for Environmental Protection

**arpae**  
agenzia prevenzione ambiente energia emilia-romagna

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## Work Package (WP) description / distribution of tasks

Overall structure of the work plan

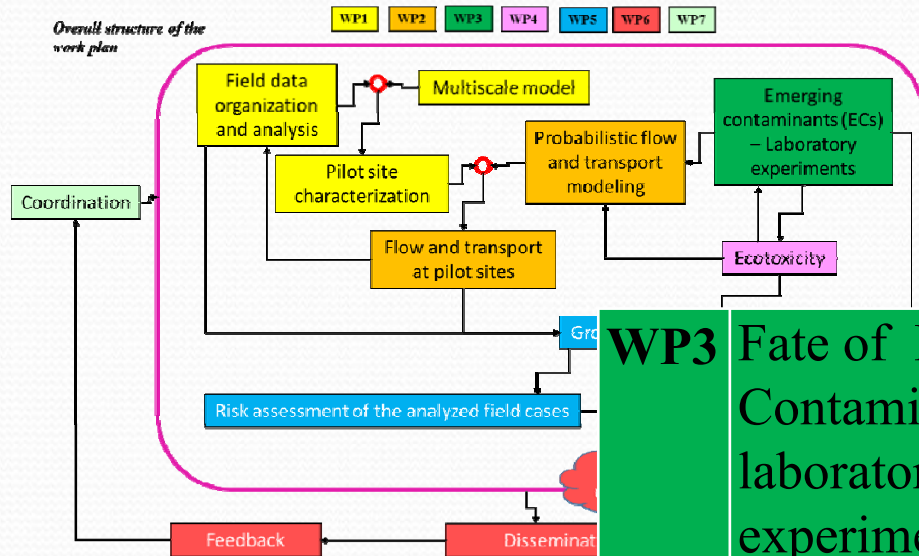


- Develop methods for complex reactive transport problems.
- Reconstruct groundwater circulation within the field cases.
- Assess probabilistic time-related protection zones.

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WP2	Probabilistic flow and transport modeling	UPC	Polimi, Weizmann
WP3	Fate of ECs - laboratory experiments and modeling	Weizmann	UAVR
WP4	Ecotoxicology	UAVR	Weizmann
WP5	Multidisciplinary risk assessment and decision	Polimi	UPC, UAVR

<b>WP3</b>	<b>Fate of Emerging Contaminants (ECs) - laboratory experiments and modeling</b>	<b>Weizmann</b>	<b>UAVR</b>
<b>WP4</b>	<b>Ecotoxicology</b>	<b>UAVR</b>	<b>Weizmann</b>

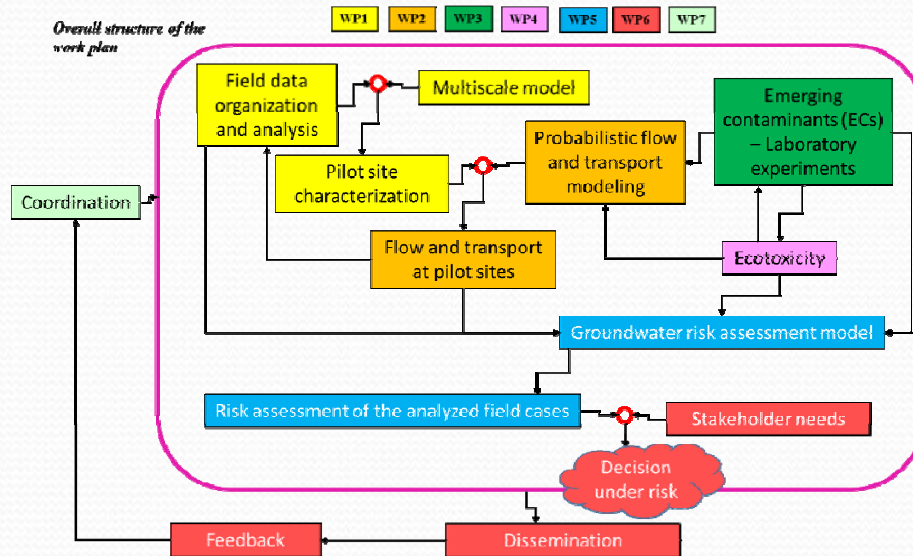
- Examine the transport behavior of representative ECs (laboratory experiments).
- Examine ECs transformation in environmentally-relevant conditions.
- Model fate and transport of ECs.

- Assess toxicity of groundwater samples.
- Infer potential increases in toxicity (synergism) due to multiple chemical exposure.

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**WP5** Multidisciplinary risk assessment and decision making

**WP6** Dissemination of results, communication with stakeholders/general public

**Polimi**

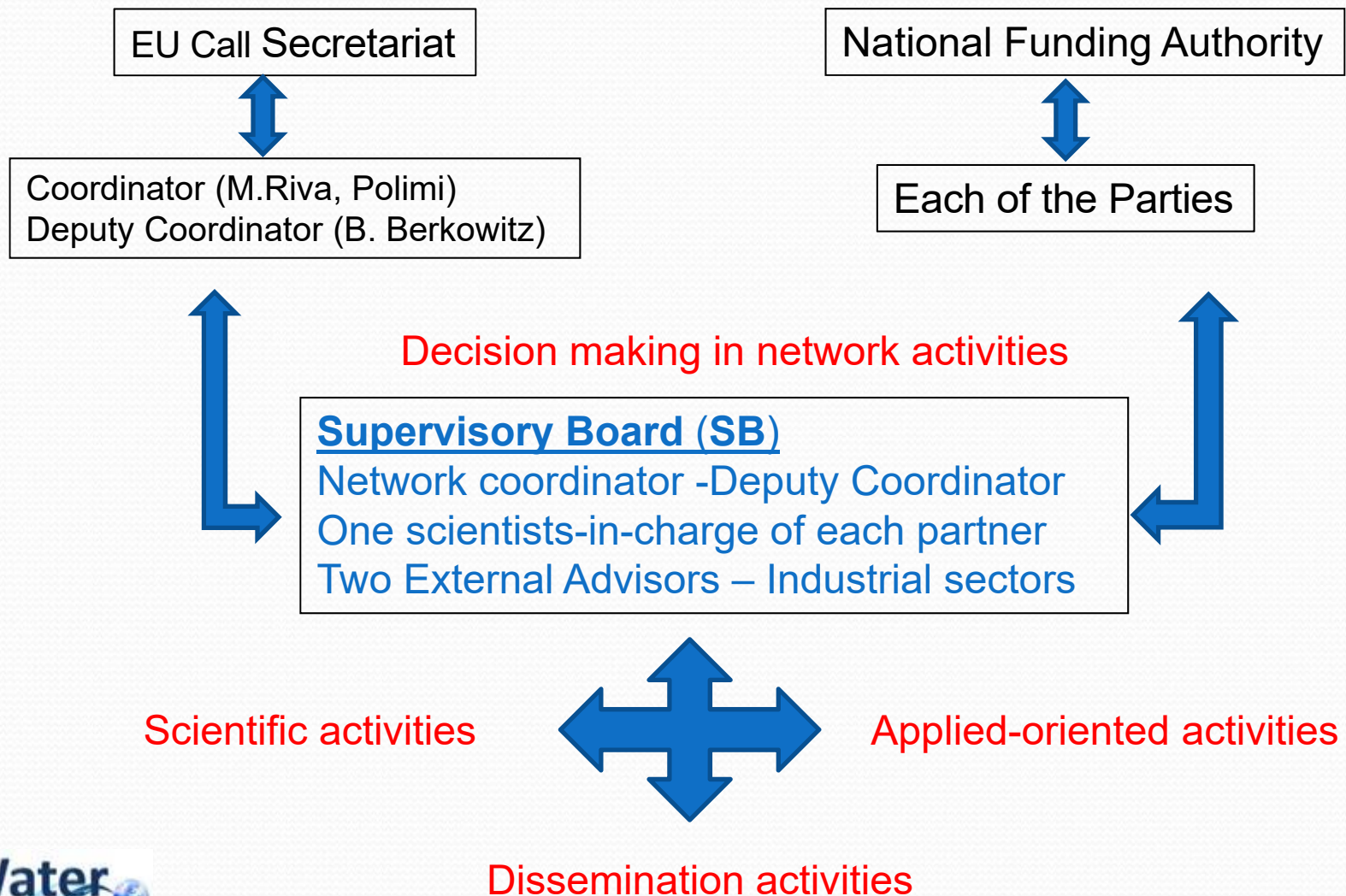
UPC,  
UAVR,  
Weizmann

- Develop a Groundwater Risk Management Model.
- Apply the Risk Model to the field sites.

Convey the scientific information in clear form to stakeholders, general public.

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## Management structure



## Innovative Aspects

**Statistical Scaling.** To describe aquifer functioning under the influence of uncertain parameters and processes defined at diverse scales.

Characterization of the **fate of ECs in aquifers.**

Quantification of the effect of **multiple sources of uncertainty** on sustainable management and protection of the groundwater resources.



## Expected Impact

Increased levels of confidence by **reducing uncertainties.**

**Impacts** of groundwater extractions and contaminant dynamics.

**Reduce future costs** associated with over-exploitation/contamination of groundwater.



## Innovative Aspects

Application of **probabilistic groundwater models in real/relevant hydrogeological studies** (Probabilistic Risk Assessment)

## Expected Impact

Provision of an understandable and **ready-to-use platform for risk analysis and management under uncertainty**

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# Thank you



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OF SCIENCE



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Water NEEDs, Availability, Quality and Sustainability



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Naviglio, Adda Serio



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Work in progress

Thank you



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Naviglio, Adda Serio



# PRESENTATION INSTRUCTIONS

## Please address the following topics:

- state-of-art and the originality and innovative aspects of the project
- objectives of the project and the relation to the scope of the call
- Work package description/ distribution of tasks/ consortium description (management structure)
- Expected impacts (research-related/ innovation-related/ societal-related)
- Address how your project is related to the Call and to the European Research Area objectives (multidisciplinary work; mobility of researchers; knowledge sharing throughout the project lifetime and beyond; effective articulation between Basic Research/Applied Research/Innovation)

## 15 MINUTE PRESENTATION.

Direct it towards a HEALTHY DISCUSSION OF IDEAS and potential NETWORKING with the other projects

# WE-NEED GANTT CHART

► 20 of April 2016

Month/ Description	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
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<b>Deliverable</b>		D6.1									D1.1 D1.2 D4.1							D1.3 D1.4a D2.1 D3.1 D3.2 D4.2					D3.3a	D5.1	D2.2		D1.4b D3.4							D2.3 D3.3b D4.3 D5.2			
<b>Milestone</b>		M6.1 M7.1									M4.1							M1.1 M2.1 M3.1 M7.2 M7.3							M4.2	M5.1			M1.2								M2.2 M3.1 M3.2 M4.3 M5.2 M6.2 M7.4 M7.5
<b>Progress Monitoring</b>																																					
<b>Mobility Schemes</b>		MS1									MS2							MS3							MS4												MS5
<b>Risk Management Consortium meetings<sup>(a)</sup></b>																																					

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## Innovative Aspects

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- (1) **Statistical Scaling.** Models to describe aquifer functioning under the influence of uncertain parameters and processes defined at diverse scales.
- (2) Characterization of the **fate of ECs in aquifers.**
- (3) Quantification of the effect of **multiple sources of uncertainty** (hydrogeological settings, aquifer architecture, abstraction rates, sources and loads of contamination) on sustainable management and protection of the groundwater resources.
- (4) Application of **Probabilistic groundwater models in real/relevant hydrogeological studies** (Probabilistic Risk Assessment)

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## Expected Impacts

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- (1) Quantification of the uncertainty linked to evaluation of environmental **impacts of groundwater extraction and contaminant dynamics** (through modeling and innovative experimental analyses).
- (2) Provision of an understandable and **ready-to-use platform for risk analysis and management under uncertainty** (relying on data acquired and rational use of modeling options and capabilities).
- (3) Increased levels of confidence by **reducing uncertainties** regarding new substances that require regulation.
- (4) Provision of improved risk assessment and management practices with an overall effect of **reducing future costs** associated with over-exploitation/contamination of groundwater.