IMPROWARE PROJECT

MODULE 1:
SCIENTIFIC AND TECHNICAL ASPECTS OF GROUNDWATER RESOURCE MANAGEMENT

PREFACE

PREFACE (1/2)

Groundwater constitutes an important component of many water resource systems. Groundwater can be **extracted** from deep geological formations (called aquifers) through pumping wells, and supplied for domestic use, for industry, and for agriculture. Water can be **injected** through specially designed wells or surficial basins into aquifers for storage and/or quality control purposes (aquifer recharge). Thus, management of a groundwater system means making such decisions as:

- the **total volume** that may be withdrawn annually from an aquifer system;
- the location of pumping wells and artificial recharge systems, and their **rates**;
- the **quality aspects** connected with groundwater overdraft (e.g., increased salinity) or contaminant releases on the land surface; once reaching an aquifer, contaminants are transported with the moving groundwater, eventually reaching wells that pump water for domestic or industrial use.

In all cases, whether of aquifer management, or of aquifer remediation, various decisions have to be made within a management framework. **Management** means making decisions to achieve goals without violating specified constraints.

.

PREFACE (2/2)

IMPROWARE PROJECT

Management requires **information** on the response of the managed system to the proposed activities. This information enables the planner, or the decision-maker, to compare alternative actions and to ensure that constraints are not violated. **Tools** are needed that will provide this information, in particular **geophysical techniques** and **numerical models**. The formers are used to **characterize** the aquifer system, the latter to **make prediction** of the expected behavior of the system.

With the main focus on the aquifer recharge, this course is composed by the following five lessons:

- **lesson 1**: Porous media, aquifers and groundwater balance (Representation of porous media; From porous to aquifer system scales ; Groundwater balance ; Estimating aquifer properties ; Darcy's law)
- **lesson 2**: Managing artificial recharge of aquifer systems (Artificial recharge systems; Design and management; Quantitative and quality issues ; Aquifer recharge with treated wastewater: challenges)
- **lesson 3**: Geophysical methodologies for the characterization of subsurface systems (An introduction to hydro-geophysical techniques; The Transient EM (TEM) technique; The MRS technique; Case studies)
- **lesson 4**: Numerical modeling to manage subsurface water resources: guidelines (Basic concepts of modelling; Discretization, boundary and initial conditions, calibration; Input data and model outcomes; Basic numerical issues)
- **lesson 5**: Case studies in the Mediterranean and arid/semiarid countries