



A WIDE-AREA PROGRAMME FOR IMPROVING THE  
QUALITY OF SURFACE WATER IN THE AGRO PONTINO  
BY MEANS OF NATURAL PURIFICATION TECHNIQUES

**LAYMAN'S REPORT**



**REWETLAND**



The Water Framework Directive (2000/60/EC) states that the surface water bodies in Europe have to reach a "good" quality state by 22 December 2015.

The project, with a total budget of 3,706,632 euro, has been co-financed by the European Commission for 1,450,566 euro in the framework of the LIFE+ Programme.

The Agro Pontino is a wide coastal plain in southern Lazio, with an extension of about 1,000 sq km, and a dense network of 2,200 km of canals, result of the "Great Land Reclamation" carried out in the 1920s.

The LIFE+ project "Rewetland" (Widespread Introduction of Constructed Wetlands for a Wastewater Treatment of Agro Pontino) has entailed a set of activities aimed at improving the quality of the surface waters of Agro Pontino, which, following detailed studies, has been proved to be under "poor" and "very bad" conditions in most canals and watercourses, according to the parameters established by the Water Framework Directive (2000/60/EC).

The final result of the project activities, carried out between January 2010 and June 2014, has been the

drafting of an "Integrated Environmental Restoration Programme of Agro Pontino", and the implementation of four pilot projects intending to demonstrate how a **diffuse natural water purification system** can be effective in the reduction of pollutant loads originating from urban and agricultural discharges.

Such initiative, launched by the Province of Latina, has entailed the collaboration of different partners: Municipality of Latina, Circeo National Park, Land Reclamation Consortium of Agro Pontino, and U-Space s.r.l.



# THE ENVIRONMENTAL CONSEQUENCES OF THE GREAT LAND RECLAMATION

The Pontine Plain – or Agro Pontino – is the result of the “Great Land Reclamation” of the 1920s, a drastic work of mechanical draining of wetlands, which has deeply modified not only the Pontine hydrography, but also its topography, biodiversity, urbanisation, economy and, therefore, landscape. With the land reclamation, the Pontine hydraulic system has been reshaped by separating the natural network into “high”, “medium” and “low” waters. The most impressive work was the construction of the great “Canale delle Acque Alte” (High Waters Canal), later renamed “Canale Mussolini”. The dense network of the reclamation canals flows across the whole Pontine Plain, through agricultural, industrial and urban areas, and finally into the Tyrrhenian Sea.

The **management of the reclamation canals** (surface waters) is, still today, based on the hydraulic studies carried out before the land reclamation works, no longer compatible with the different climate conditions and with the transformations undergone by the area, responsible for the problems related to quality and availability of water. Due to the very low quality of surface waters, the irrigation water is drawn from the deep aquifers, giving rise, especially along the coast and around the mouths of the watercourses, to salt wedge intrusion and alteration of soils. It is easy to understand how these processes have an influence on a mainly agricultural economy.

The name “Rewetland” has been inspired by historic and environmental circumstances: the idea is to restore the importance of the water resource and its natural equilibrium, strictly connected to the functionality and ecological diversity of the wetlands.

Even if all human activities contribute to the pollution of surface waters, the **discharges of farming and livestock farming activities**, with their high concentrations of nitrates and phosphates, are the most difficult to intercept. The consequences are dire for both the river ecosystem and the sea, where, in case of abundant discharges, there can be phenomena of algal blooms, mucilage, but also sanitary problems caused to the presence of toxins that are harmful to men and animals. From the economic point of view, this has a strong negative impact on the coastal tourism sector.

As regards **landscape**, notwithstanding the heavy transformations occurred after the land reclamation, today it is still possible to recognise three different zones in the Pontine area:

- » the piedmont zone, a very wide and depressed area at the base of the Lepini and Ausoni Mountains, once enclosing the real Pontine marshes, and today hosting agricultural and industrial activities;
- » the central zone, slightly above sea level, which extends from Ardea to the Circeo promontory, geologically defined as the “ancient dune”, previously characterised by a wide lowland forest, and now hosting intensive agricultural activities (greenhouses), urban and industrial settlements, and a dense road network;
- » the coastal zone, characterised by dunes and coastal lakes.

# NATURAL WATER PURIFICATION

Natural water purification is a natural process of absorption of a high quantity of nutrients (carbon, nitrogen, phosphorus, potassium) by aquatic plant species living in lakes and wetlands. By using these plants, it is possible to reproduce the biological and chemico-physical mechanisms typical of the natural wetlands, in order to treat urban and agricultural wastewater, purifying it from polluting substances.

The most renowned water purification techniques are "constructed wetlands", which make use of "rooted" aquatic plants, such as reeds; these plants release, at their root level, a considerable quantity of oxygen, necessary for the development of specific bacterial colonies able to carry out the purification process.

Based on the plants used (submerged, emergent, or floating macrophytes) and the type of wastewater flow, constructed wetlands can be of different types: free water surface (wetlands with helophytes and rhizophytes), or sub-surface horizontal or vertical flow (basins filled with gravel with rooted, emergent plants, where wastewater flows horizontally or vertically).



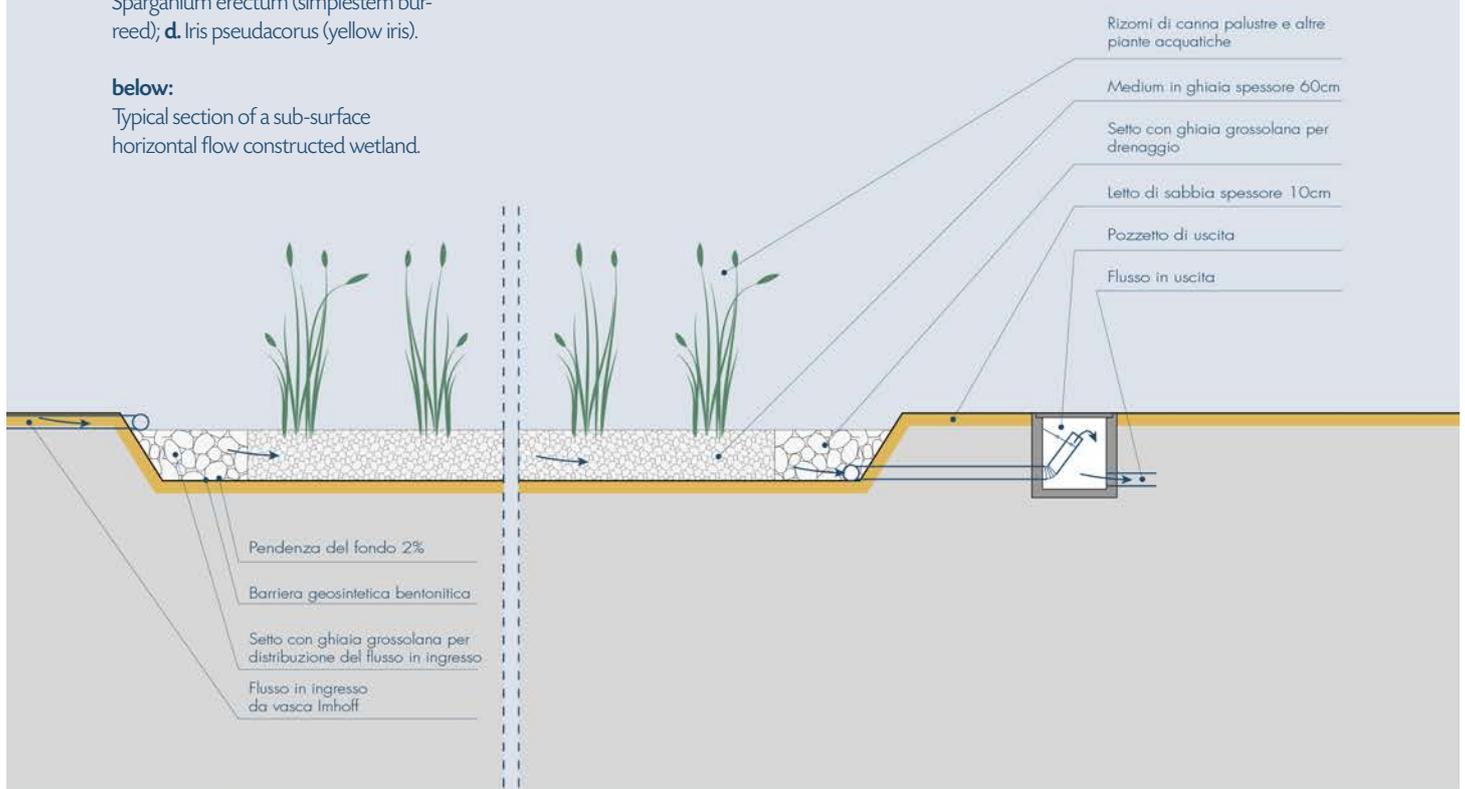
Photos by Bruno Petriglia

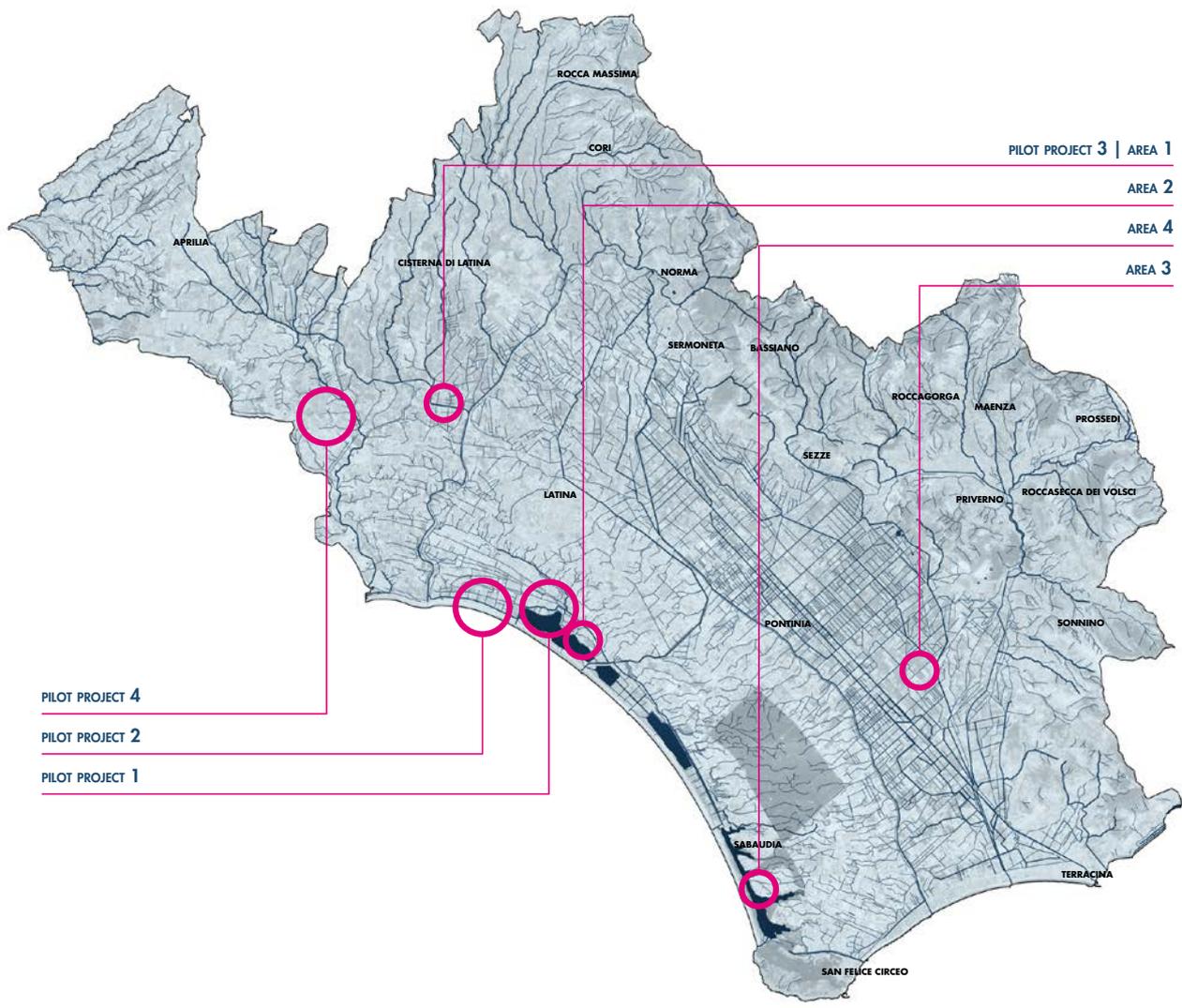
## above:

Main aquatic plants with filtering capacities: **a.** *Typha latifolia* (bulrush); **b.** *Imperata cylindrica* (blady grass); **c.** *Sparganium erectum* (simplestem bur-reed); **d.** *Iris pseudacorus* (yellow iris).

## below:

Typical section of a sub-surface horizontal flow constructed wetland.





# EXPERIMENTING DIFFUSE WATER PURIFICATION SYSTEMS: THE PILOT PROJECTS IN THE AGRO PONTINO

The Pilot Projects implemented within the Rewetland activities have the goal of demonstrating how natural water purification can be effectively applied to different contexts throughout a wide area, contributing to the improvement of water quality and to its sustainable management, with a reduction of pollutant loads.

The four projects have been implemented in typical contexts of the Agro Pontino, in order to verify their replicability: a natural protected area, an urban area, the reclamation canals, and a wine farm.



## PILOT PROJECT 1

### Filter ecosystem in the Circeo National Park

The interventions of Pilot Project 1 have been carried out in the beautiful scenery of the Circeo National Park, along the coast between the Lake of Fogliano and Canale Cicerchia. Objective of these interventions, besides the experimentation of the purification capacities of particular vegetation mixes, is to increase the local biodiversity through the creation of wetlands reproducing marsh ecosystems, once very common in the Pontine Plain. Moreover, an educational path has been designed, in order to foster the presence of visitors and the observation of the abundant resident and migratory bird fauna.

Area 1 – Around Pantano Cicerchia, between the Litoranea road and the Lake of Fogliano, a **“filter ecosystem”** has been created, comprising an existing reed bed, and new “wet meadows” next to the banks of the lake. The area is inhabited by many species of aquatic birds, since it provides a suitable environment for their feeding, nesting and breeding. The design comprises also some bird-watching structures along the borders of the area.

Area 2 – Placed along the right bank of Canale Allacciante, next to the “Casino inglese” of Villa Fogliano, this area borders with intensive greenhouse farming plots; it is composed by three basins with an “L” shape arrangement, fed by both rainwater and groundwater, and is characterised by wet meadows, reed beds and tree rows.

The project has entailed the construction of **Free Water Surface systems** in the basins named A and B, for treating the waters of the Rio Martino-Foce Verde canal (in summer time) and Canale Allacciante (in winter time). A waterproofed reservoir in Basin B is aimed at treating the wastewater coming from Villa Fogliano. The water is then channelled into Basin C, where it undergoes a further refinement through a lagooning system, before flowing back into Canal Allacciante.



## PILOT PROJECT 2

### Urban park in Marina di Latina

Photo by Carlo Perotto

Pilot Project 2 (urban park in Marina di Latina) is an experimental plant designed and built with the aim of integrating water purification functions with leisure facilities, adopting systems, techniques and materials having the lowest environmental impact.

The result is a **peri-urban park** with walking and cycle dirt paths and green areas with trees and shrubs of native species.

The constructed wetland covers an area of about 3,200

sq m. It is composed of two "Sub-Surface Horizontal Flow" basins and two "Free Surface Water" basins collecting the polluted waters of Canale Colmata. All basins have been waterproofed in order to avoid contamination of soils and superficial groundwater. Once treated, the waters are discharged into Canale Mastropietro. The plant species used are: common reed (*Phragmites australis*), bulrush (*Typha latifolia*), rush (*Juncus spp.*), water lily (*Nuphar lutea* and *Nymphaea alba*).



## PILOT PROJECT 3

### Buffer strips along the reclamation canals

Photo by Carlo Perotto

Pilot Project 3 (buffer strips along the reclamation canals) has been carried out along the banks of some of the canals of the Land Reclamation Consortium of Agro Pontino.

The buffer strips are linear vegetated areas able to absorb the polluting substances contained in runoff waters draining from the fields, especially where there is a heavy use of fertilizers and pesticides. In particular, two interventions have been carried out in two different areas.

The intervention named “Reed beds in the floodplain of Canale Allacciante Astura” consists in the creation of habitats where the flowing waters undergo the purifying action of plants such as *Phragmites australis* and *Typha*

*latifolia*. After flowing for a length of approximately 4 km along the reed bed, the purified water coming from Fosso Bottagone is discharged into Canale Allacciante Astura.

The intervention named “Naturalisation of the emissary of the Forcellata water pump (Canale Selcella)” consists in the creation of wetland habitats with dominance of helophytes (marsh reeds) along the bed of the canal, and a tree buffer strip along one of the banks. This intervention, which involves a canal stretch of 1.4 km, has been carried out after remodeling the bed of the canal. The entire system is fed by the Forcellata pumping station.

# PILOT PROJECT 4

## Good practices of water management in a farm

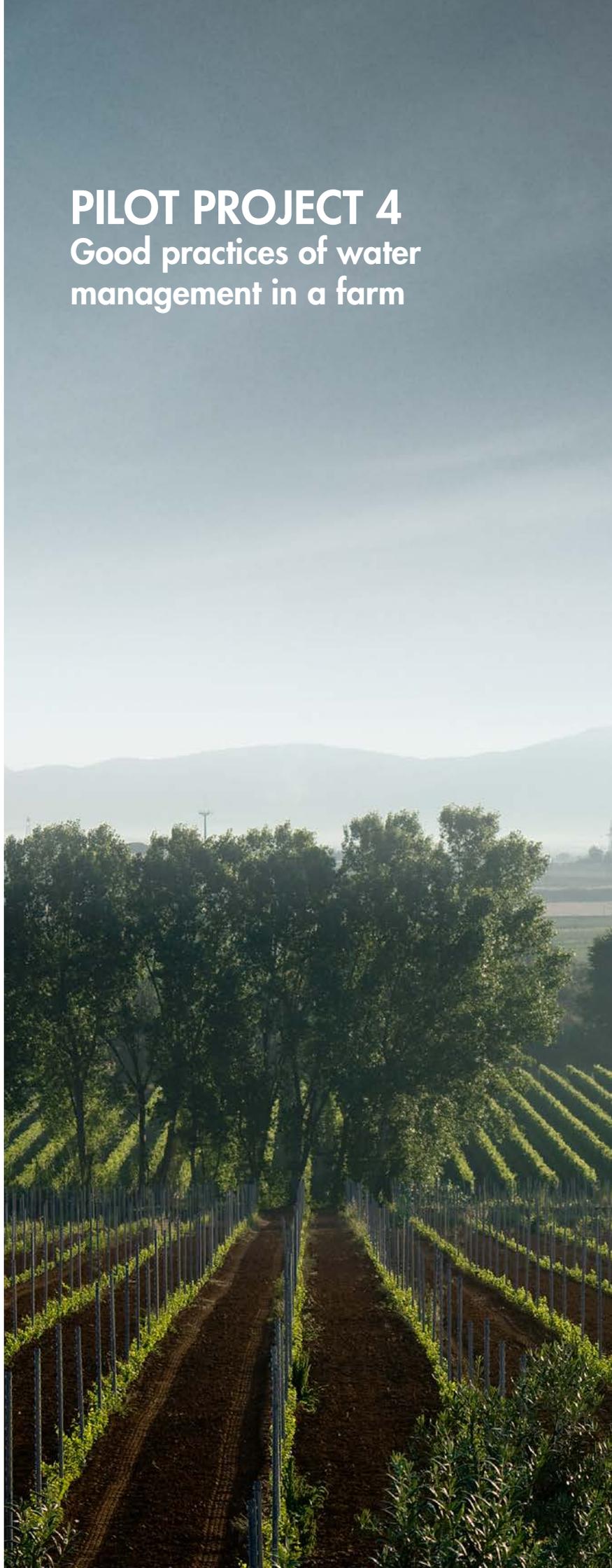
### Good practices and replicable interventions:

- » grassing of the land between the rows of vines, and use of organic fertilizers;
- » setting up a runoff system for the surface waters, in order to enhance the current natural water treatment capacity of Fosso Valle;
- » sustainable management of the banks;
- » achievement of a more detailed knowledge about the farm environment, through biological, chemico-physical and chemical surveys;
- » experimentation of the water treatment efficiency of vegetated floating islands;
- » creation of paths and nature observation points.

### Criticalities in the farm:

during the rainiest periods, the surface runoff of rainwater triggers a diffuse superficial erosion and an accumulation of sediments in one of the most depressed areas of the farm, where the Fosso Valle flows.

Pilot Project 4 has been conceived in order to promote good practices of water management in a farm. The experimentation has been carried out in “Casale del Giglio”, a 150-hectare farm located between Aprilia and Latina. The farm comprises a draining network of watercourses (Fosso Valle, Fosso Piscina Panzesi and Astura River) and an artificial basin next to the wine cellar. Starting from the analysis of the management processes, and the climatic, geological and hydrological aspects, the project activities have led to identify all the actions necessary for a **sustainable management of the resource**, in order to limit the use of water and chemical products. Pilot Project 4 is about the “environmental multifunctionality” of farms, and it proposes the replication of these actions in similar farms of the Agro Pontino, for a future contribution to the improvement of water and soil quality.



# THE DEFINITION OF THE ENVIRONMENTAL RESTORATION PROGRAMME FOR THE AGRO PONTINO

The Environmental Restoration Programme (ERP) for the Agro Pontino has been drafted in parallel with the implementation of the pilot projects.

- » The Programme is composed of three **thematic guidelines** (respectively addressed to agricultural areas, urban and industrial areas, and natural protected areas) containing twenty **project sheets**; these documents have been defined starting from the collection of all the necessary environmental data.
- » Directly connected to the Programme, a specific **Action Plan** is intended as a basis for programming the future strategic choices according to coordinated lines of intervention.

The objective is to improve the surface water quality of the Agro Pontino, in order to achieve the quality levels stated by the European **Water Framework Directive** (2000/60/EC).

The drafting of the ERP for the Agro Pontino has started, in January 2010, at the same moment of the starting of the Rewetland project.

The long and deep phase of debate and negotiation with the institutions and the local community has entailed seven events (meetings and workshops), which have been fundamental for fostering the dialogue and participation of stakeholders and local actors of the Pontine Plain.

Within a specific Action Plan, the proposals have been grouped into 3 axes, 12 measures and 49 actions.

The axes of the ERP concern the following themes:

Axis 1 – Reduction of pollutant loads in residential and industrial wastewater.

Axis 2 – Reduction of pollutant loads in wastewater from farming activities.

Axis 3 – Environmental restoration and increase of the self-purification capacity of watercourses in natural protected areas and Natura 2000 sites.

In order to evaluate the effectiveness of the actions foreseen by the Action Plan of the ERP, specific scenarios have been elaborated based on the estimate of the pollutant loads present in surface waters; in particular, the values of Ntot (total nitrogen), Ptot (total phosphorus), BOD (biochemical oxygen demand), and COD (chemical oxygen demand) have been used as indicators, measured in kilogram per square kilometre per year.

Starting from the current state, this analysis has shown that, in the case that all the actions of the Plan are carried out in the whole Agro Pontino (e.g. in the case of an overall combination of all the interventions envisaged by the Plan), a substantial improvement would take place, with a reduction of 52% of the number of sub-basins under critical conditions as regards COD, 63% as regards BOD, 50% as regards Ptot and 13% as regards Ntot. A diffuse application of buffer strips along the secondary canal network would allow for a high level of abatement of phosphorus and nitrogen generated from farming and livestock farming activities, whereas the creation of artificial wetlands, coupled with an improvement of the current system of wastewater treatment, would lead to an effective containment of the trophic loads of civil and industrial origin.

The ERP, being a wide area planning/programming tool, has undergone the process of Strategic Environmental Assessment (according to art. 6 of Legislative Decree n. 152/2006, and to Regional Council Decree n. 169/2010), entailing also the participation of the environmental authorities.

## Pollutant loads present in the waters of the Agro Pontino:

**Ntot**: nitrogen; **Ptot**: phosphorus;

**BOD**: biochemical oxygen demand;

**COD**: chemical oxygen demand.

The BOD and COD loads are generated exclusively by civil and industrial sources.

# ENVIRONMENTAL AND EDUCATIONAL POLICIES

The success of Rewetland cannot prescind from the involvement of the youngest citizens of the Agro Pontino. The Circeo National Park has implemented an educational campaign involving more than 1,600 pupils of primary and secondary schools. Through lessons and guided tours to the project area, the project staff has shown them this territory, its biodiversity, the natural purification techniques, the good practices for water saving, and much more. Students are bearer of educational needs that have to be satisfied also beyond the limits of

the project. While growing, they will make choices gradually more aware and autonomous: the communication actions have been therefore oriented to the emergence of a critical conscience that should make them active citizens in the future management of this territory. Rewetland has increased the interest of students and teachers on the issues connected to sustainability also through specific labs on landscape and sustainable business management, with a particular focus on water saving.



## THE PONTINE PLAIN “AFTER LIFE”: A SHARED STRATEGY FOR THE BENEFIT OF THE COMMUNITY AND THE ENVIRONMENT

In the course of four intense years, the Rewetland staff, guided by the Province of Latina, has worked with the aim of transforming data, environmental criticalities and territorial needs into experimental plants, sustainable development scenarios and methodological indications at the service of environmental quality. The most relevant result has been the creation of a shared strategy for a wide-area environmental restoration, combining the demands of stakeholders: public administrators, professionals, researchers, but also farmers, entrepreneurs, students, and citizens met in the numerous occasions of debate on the project issues.

Water quality is a cross-sector issue, because it is about the greatest resource of the Pontine area. The ecosystem services supplied by wetlands, the irrigation canal system, the fish and agro-food products, landscape, and coastal tourism, are all strictly related to the water resource, which is part of the local identity.

The problems targeted by Rewetland have entered the day-to-day lives and the normal administrative practices. The strategy set up through the Environmental Restoration Programme will lead to a greater collaboration between public and private actors, with a diffusion of good practices and the implementation of natural water purification interventions, which require little eco-

nomic resources while at the same time ensuring a considerable environmental benefit.

Starting from the results of the project, the Province of Latina will also promote the **River Contract** of the Agro Pontino, which is a modern negotiated programming tool aimed at the environmental restoration of river basins. According to the prescription of the Water Framework Directive, the Province will also be engaged in a continuous monitoring of pollutant loads. This will enable the identification of the most suitable solutions, measures and actions among those defined by the ERP. Other actions will concern the reconversion of the farming sector, according to what provided for by the Community policies, which request a reduction of 20% of pollutant emissions by 2020. Moreover, the Province will foster the sharing of successful experiences and will favour participatory planning, oriented to solving problems rather than imposing constraints.

The Rewetland project will continue also on the web: the portal, accessible at [www.rewetland.eu](http://www.rewetland.eu), provides users with updated information and interactive tools such as the WebGIS, the Geoblog and a Virtual Tour with photos and videos. This last tool is a fascinating aerial tour of some areas of the Circeo National Park that are not easily accessible otherwise.

*"The Pontine Marshes are the wildest  
and most fascinating place in Europe."*

*J. W. Goethe, Italian Journey (1786-1788)*





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**REWETLAND**  
Widespread introduction  
of constructed wetlands  
for a wastewater treatment  
of Agro Pontino

The project, started in 2010 and concluded in 2014, has been co-financed by the European Commission within the LIFE+ Programme

**Gruppo di lavoro**

Province of Latina  
Municipality of Latina  
Circeo National Park  
Land Reclamation Consortium of Agro Pontino  
U-Space s.r.l.

