Riqualificazione e Partecipazione

Lambrovivo

Regione Lombardia

fondazione cariplo

LAYMAN'S REPORT

Lambrovivo is a LIFE + Environment project (LIFE + 11 ENV / IT / 004) born in 2011 and aimed to promote and implement actions for the environmental and ecological requalification and for the rehabilitation of the waters of the Lambro river through actions, paths and initiatives shared with the citizenship.

Lambrovivo birth

Lambro river has always been known as the most polluted river in Italy, or almost one of the most polluted in the northern Italy. Althought important actions for the improvement of the water quality has been put in place until the 80s, it was not able to overcome, in most of his path, the level "scarce" planned by the EU water frame directive n. 2000/60. And this fact not only for the water quality itself but also for some parameters connected more directly to the river environment, habitat and ecology.

For this reason in the 10s of 2000 Regione Lombardia started the

so called "River Contract" for Lambro River, an agreement between parties who have responsibilities in the management and use of water, in land use planning and environmental protection. On March 2012 were 83 the signatories that made official their adherence to the Lambro river contract.

In 2011 the Department of River Restoration of the Regional Park of the Lambro Valley, one of the first signatories of the contract, elaborates a set of actions to be implemented on Lambro and some tributaries in the Inverigo valley aimed to improve water quality and create new river habitats. In 2012 the overall project gets financial support from the European program LIFE + Environment and additional support from the Cariplo Foundation.

Thus it was born "Lambrovivo", an ambitious program of actions to promote citizen participation in river restoration through environmental and ecological restoration actions.

The final structure of the project was defined only at the beginning of 2014 with the merger of "Lambrovivo" projects and "Lamber Risorsa di Brianza".

All the activities of the project officially ended at the end of January 2021.

The programmed actions of the projects were:

- Involve the stakeholders, create and develop a decision-making and participatory planning model;
- Create filter ecosystems for finishing the water leaving the Merone and Nibionno purifiers with constructed wetlands techniques;
- Identificate and possibly reduce polluting sources along some minor tributaries of the Lambro critical for the quality of the waters;
- Create wetland along some minor tributaries of the Lambro critical for the quality of the water;
- Create permanent wetland areas along the Lambro river as habitats for amphibians and odonates;
- Renaturate the final section of the Cavolto river;
- Monitor the stakeholder participation, the water and habitat quality;
- Communicate and disseminate (website, information panels, report for non-professionals, mailing list and newsletter, blog, conferences and seminars, after LIFE + communication, Layman's report);
- Manage the whole project.

The objectives of the project were:

⇒ Develop a participatory decision-making model in accordance with the principles of Agenda 21;

⇒ Improve the quality of the surface waters of the Lambro and its tributaries;

⇒ Improve the quality of the river and suburban habitats of the Lambro and its tributaries;

⇒ Increase the ecological connection between contiguous natural areas;

⇒ Provide scholars, citizens and tourists with specific areas of use.

Fitodepuration

Constructed wetland is a wastewater treatment system that reproduces the self-purification mechanisms typical of wetlands. Purification takes place through the combined action of a permeable substrate, plants, wastewater and microorganisms present according to different processes:

1) physical processes due to mechanical filtration and sedimentation of the particulate (the set of particles dispersed in the liquid);

2) chemical processes which, thanks also to sunlight, take place both in oxygenated and non-oxygenated areas;

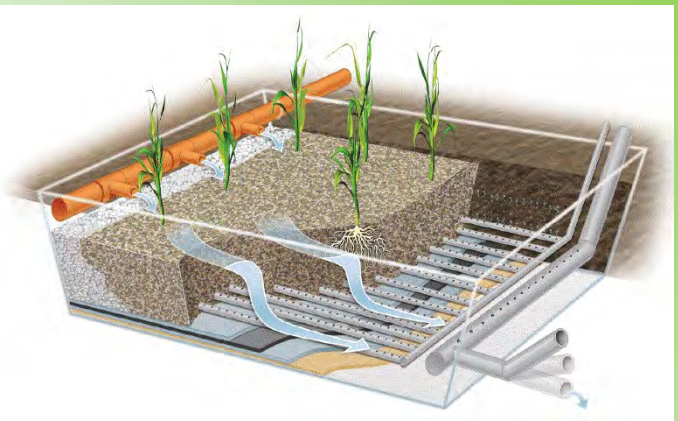
3) biological processes mainly due to the action of microbial flora.

Aquatic plants play a dual role:

- a direct action, assimilating some substances (mainly inorganic nutrients) present in the water to be purified;

- an indirect action, providing part of the oxygen necessary for microorganisms to be able to decompose organic matter.

Through the phytodepuration process, pathogenic



microorganisms and pollutants are partially or completely eliminated. Constructed wetlands systems are therefore based on natural dynamics and can be defined as real eco-technologies.

Surface flow systems, or Free Water Surface (FWS), are shallow basins or channels in which the waste water to be treated is made to flow slowly through a generally sinuous path. The pools of water are colonized by emerging rooted essences with different functions: they slow down the flow rate, create the substrate with the stems and stems for the adhesion of bacterial biomass (biofilm), remove part of the nutrients necessary for metabolic processes of growth.

The substrate for the adhesion of bacterial biomass (biofilm) removes part of the nutrients necessary for the metabolic processes of growth.The two main mechanisms to which the self-purification capacity of an artificial surface flow wet area can be attributed are separation of the solid phase from the liquid phase (sedimentation) and the transformation of the substances present in the water by the bacterial community (bacterial metabolism).

The vertical submerged flow systems consist of tanks containing inert material with a selected particle size in order to ensure adequate hydraulic conductivity (commonly used fillings are sand, gravel, crushed stone).

These inert materials constitute the support on which the roots of the emerging plants develop; the bottom of the tanks must then be suitably waterproofed.

During the passage of wastewater, organic matter is decomposed by microbial action, nitrogen is denitrified, if in the presence of sufficient organic content, phosphorus and heavy metals are fixed by adsorption on the filling material; the contributions of vegetation to the purification process can be traced both to the development of an efficient aerobic microbial population in the rhizosphere and to the pumping action of atmospheric oxygen from the emerged part to the root system and therefore to the surrounding soil portion, with consequent better oxidation of the wastewater and creation of an alternation of aerobic, anoxic and anaerobic zones with consequent development of different families of specialized microorganisms and almost total disappearance of pathogens, particularly sensitive to rapid changes in dissolved oxygen content.

Merone plant

With the aim of contributing to the water rehabilitation plan of the Lambro river, a finishing system was created, with natural techniques, of the first rain runoff water and the purified water of the Merone purification plant.

The finishing system has been designed to be fed through two sources:

1) the overflow waters discharged by the spillway at the head of the purifier which will have to undergo some pre -treatment (screening and sandblasting);

2) the effluent purified water from the last stage of purification which in a dry period will be entirely directed towards the surface flow systems.

The system provides the following scheme:

A) lifting station necessary to carry out the pre-treatments (maximum flow rate 1430 m3 / h);

B) medium-fine screening of rainwater;

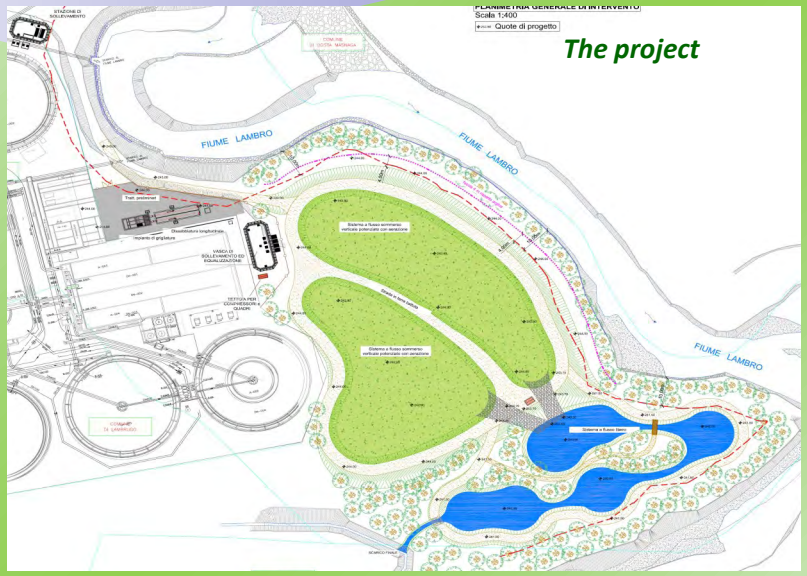
C) Sand removal by means of 2 aerated longitudinal sand traps;

D) first rain water lifting station for feeding the aerated vertical submerged flow constructed wetland system;

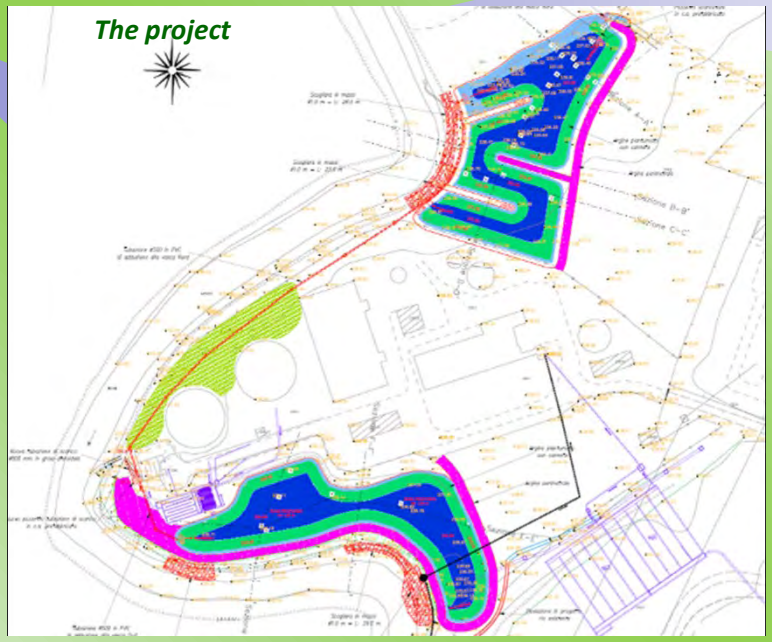
E) constructed wetland system with aerated vertical submerged flow, modified for rainwater, with an extension of 4000 m2 and divided into two basins of 2000 m2, in turn divided into two sectors of 1000 m2;

F) 1500 m2 free-flow constructed wetland purification system also having the function of favoring the inclusion of the landscape and the creation of humid biotopes with high biodiversity, which can be connected to the use paths of the area;

G) cleaning, redevelopment and strengthening of the riparian belt by inserting suitable species, with the aim also of compensating for the forest areas affected by the works.



Nibionno plant



A surface flow refinement filter ecosystem was created consisting of two distinct basins capable of treating the purified wastewater from the conventional purifier.

The water leaving the plant from the purifier is derived through a divider well, equipped with two gates capable of modulating the flow rates entering the refining tanks. The resulting flows are thus conveyed to the refining basins for subsequent treatment. The average flow out of the plant is about 15,500 cubic meters / day. The wastewater is divided equally between the two basins.

The northern basin has been sized to also receive the waters coming from the emergency spillway. These are intercepted and conveyed to a pre-treatment system (screening), consisting of a rectangular underground tank. The pre-treated waters will convey to the north tank for the refinement treatment.

Both refinement basins are characterized by an area with an average depth of the water line not exceeding 1 m and a reed area characterized by about 50 cm of water. The two basins have a natural shape and the wastewater leaving the conventional purifier will have to cross the wet area created, following a defined path in which aquatic macrophytes capable of biofiltrating the pollutants and residues are located along the banks.

The average residence time of the waters for both basins varies from about 5-10 hours in correspondence with meteoric events that determine an increase in the inlet flow to the purifier up to 3 times the flow of dry weather to a maximum of one day (flow of dry weather).

The basins were suitably waterproofed with a bentonite mantle to avoid the percolation of the water into the soil and covered with a layer of natural mixture (about 30 cm thick) to allow the reeds to be planted. Both basins discharge directly into the Lambro river; the embankments created to delimit the basins were stabilized by laying a coir biomat.

Wetlands

By "wet areas" we mean swamps, marshes, peat bogs, or reservoirs, natural or artificial, permanent or temporary, with stagnant or running, fresh, brackish, or salt water.

The sites that possess these requisites therefore constitute ecosystems characterized by a very high biological and naturalistic value, in which there is often a great diversity of animal and plant species.

The conservation, restoration and, ultimately, the new constitution of these areas therefore assumes great importance for improving the current ecosystems, which are too often characterized by trivialization of vegetation and poor biodiversity.

In any case, wetlands are of considerable importance in several respects:

hydrogeological, as they perform the function of attenuation and regulation of phenomena such as floods of rivers. The swamps adjacent to the waterways, for example, create a sponge effect, that is, they collect the water during floods - slowing the flow of water and reducing the risk of floods - then returning it during lean periods. They are also important reservoirs for groundwater;

chemical and physical, in fact, they are traps for nutrients. The rich and diversified vegetation of the wetlands gives these environments the ability to assimilate nutrients, ie compounds of potassium and nitrogen, and the possibility of creating favorable conditions for the microbial decomposition of the organic substance. Therefore, they perform the precious function of natural water "purifiers";

biological, as already mentioned, because they represent, worldwide, one of the most important habitat types for conservation. A particular function of wetlands is, for example, to provide resting places for the biodiversity. feeding and shelter for many species of migratory birds that pass through our region every year in spring and autumn. The presence of such environments along the migration routes is therefore of fundamental importance.

Among the birds threatened with extinction, for example, 146 species depend on wetlands which, after forests and grasslands / savannas, represent the third group of environments for the number of threatened species;

educational and cultural, thanks to the various activities, including birdwatching in particular, linked to these places. In fact, they are elective places for observing aquatic avifauna.

scientific: from the study of pollen profiles in peat bogs, for example, it is possible to reconstruct the ecological, climatic and evolutionary events of the territory in which these environments are located.

Wetland B5

The project on this area proposed the construction of permanent pools of water of good quality within a wooded area that has several clearings due to the death of the tree specimens. The lowered areas are be kept humid by the upstream waters but may also be flooded by the floods of the Lambro, and in these cases, the hygrophilous vegetation can also play a positive role in the self-purification of the river. The same function is constantly carried out by the vegetation that was planned to be planted inside the cliff.

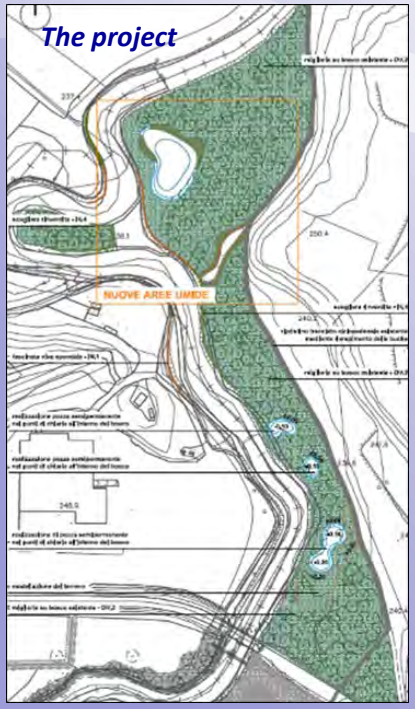
The works envisaged by the project were:

1) Creation of wetlands, fed both by the water coming from the aquifer or by the waters coming from a small stream coming from the east, and by those of the river Lambro.

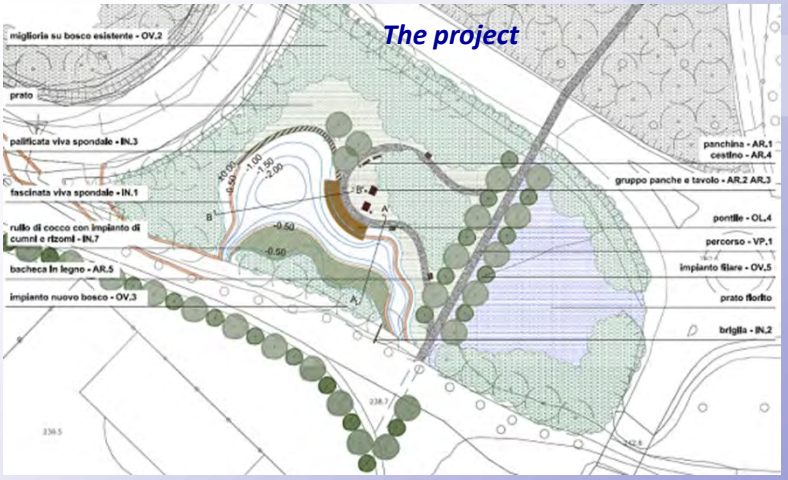
2) Forest improvement through clearing, felling dead trees (of the wooded areas between the cycle and pedestrian path and the Lambro River, as well as those on the island) paying particular attention to the removal of Sicyos angulatus, a rapidly expanding weed, which suffocates the native vegetation. Following the elimination of sick, malformed individuals, supernumerary suckers in case of stumps, the planting of shrub forest plants under cover is foreseen, preferring the species currently lacking to favor biodiversity.

3) Creation of bundles along both banks of the Lambro River, where superficial erosions or emptying of the bank or small landslides are evident, while the cliffs will be enriched with willow cuttings obtained directly on site.

The cycle / pedestrian path, which is in good condition, will only undergo punctual interventions for a total of approximately 100 square meters, ie in the points where there are holes created by the intense passage or due to the runoff of water.



Wetlands B6



The project on this area proposed the construction of a large wetland area for phyto-purification purposes derived from the Tabiago canal which can present mainly urban polluting loads. Being an area with a strong passage of users, the recreational function cannot be disregarded. The planned works were:

1) Excavation of a new wet area with a surface greater than 1000 square meters with 2/3 of the surface for purification purposes.

2) Construction of a recreational area with two-level path and platform and construction of a grove of native species. The environmental and habitat recreation purpose is primary, providing timely disclosure thanks to the presence of educational bulletin boards and facilities for recreational and contemplative activities.

3) Creation of a flowery meadow that has, in addition to the naturalistic value, also an aesthetic value thanks to the blooms and the type of management of the lawn area.

The water is diverted from the Tabiago canal and left to flow into the humid area from where the tank capacity comes out only in case of exuberant flows (the entry into the broadcasting area is favored by the presence of a bridle).

The creation of a rather extensive constructed wetland area allows to refine the quality of the diverted water. It is an ecosystem, colonized by a multitude of plant species and home to various animal species, with a very rich biodiversity.

Wetlands are areas with a high rate of biological activity capable of transforming pollutants into harmless biological products or essential nutrients for plants. They are isolated basins in which the water is slowered and where it undergoes the fundamental processes of sedimentation, filtration, oxidation, reduction, absorption and precipitation of polluting particles.

The plant species most used in constructed wetlands are higher aquatic plants (macrophytes), which live in normal conditions in natural wetlands (lakes, ponds, swamps, etc.).

Wetland B4

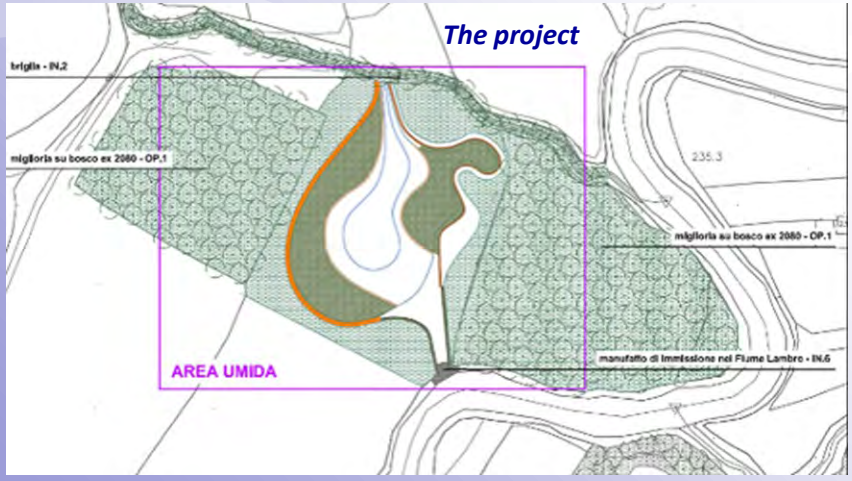
The project sought to enhance the naturalistic heritage of the area in question through the construction of a new wetland which constitutes a filter ecosystem for the waters introduced into the Lambro river. The planned interventions were:

1) Excavation of the wetland fed by diversion from the canal and interception of the aquifer.

2) The diversion of the water takes place through the creation of a small bridle which allows, in idle regimes, the deviation of the entire flow of the canal while in periods of full water it can overcome the bridle and continue its course in the old riverbed.

The entry channel is defined by willow bundles. The outlet channel, on the other hand, comes into operation only in the event of overflow, and the water will be delivered directly into the Lambro River via an inlet in stone to avoid erosion, with the simultaneous construction of piling along the banks. The wet area has an area of about 6,000 square meters and a maximum depth of 1.5 m. The banks are designed to create areas with deeper waters and areas with shallow waters delimited by pre-sown coconut rollers. Along the banks live fascinate and piling are realized for a bank reinforcement. The earth obtained from the excavation was distributed evenly over the entire surface of the plot and over the area south of the new pond available in the Lambro Valley Park, connecting with the slopes of the neighboring lands. The surface free from the wet area was treated as a grove and lawn for an area of about 5,000 square meters. The shrub trees have been concentrated in the area between the wetland and the existing forest, so as to reinforce the existing habitat.

Forest improvement throughout the area; through the elimination of alien species and sick or malformed elements and the planting, mainly shrubs, of new plant essences; The wooded areas on the eastern and western side of the wetland (created about 20 years ago with only tree species and with regular planting) and the wooded belt along the canal were involved.



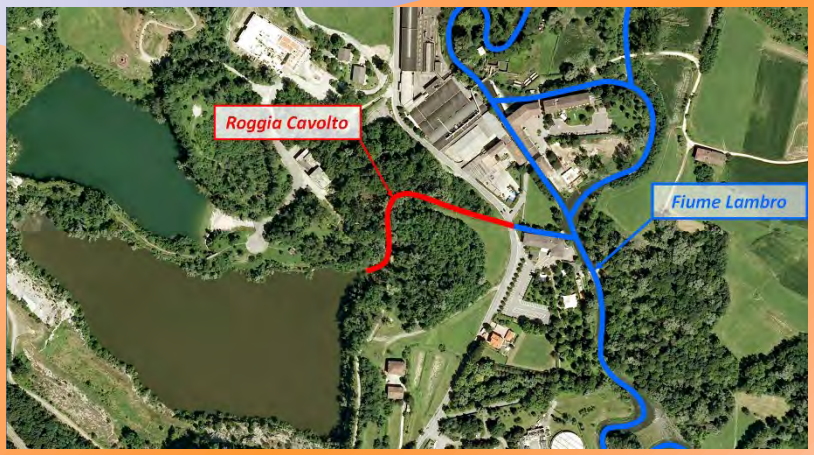
River restoration

The Oasis of Baggero is a protected reserve that extends for 225 thousand square meters and rises between Merone, Monguzzo, Lurago d'Erba and Lambrugo. Within this area (which has been part of the Valle del Lambro Regional Park since 2002) there are two small lakes 5 to 6 meters deep and extending over almost 8 hectares.

The tributary that feeds them is the Roggia Cavolto: called Durini in its initial stretch, it is a watercourse that originates in Fabbrica Durini, in the Municipality of Alzate Brianza; it crosses the municipalities of Alzate Brianza, Anzano al Parco, Lurago d'Erba and Monguzzo, then enters the lakes of Baggero, in the municipalities of Lambrugo and Merone, and finally flows into the Lambro at the mill in the locality of Baggero di Merone.

The origin of the two basins of Baggero is completely artificial: following the extraction of material (marl) for the production of cement (which began in 1928 and ended in 1969 for the southern area and in the 1970s in the north), after 10 years of environmental recovery work, in 1980, with the deviation of the Roggia Cavolto, the lakes of Baggero and the related nature reserve were born, well usable and whose access is completely free.

In the stretch between the Baggero lakes and the mouth of the Lambro river, the Roggia Cavolto (photo August 2014) is heavily artificial; Bank walls and concrete bridles represent significant critical issues from an environmental point of view: here in fact the lack of a suitable habitat for fish fauna generates a scarce if not total absence of fish.



Fish fauna is an important component of biodiversity in aquatic environments, as well as a relevant indicator in the definition of ecological quality. Safeguarding and increasing fish fauna primarily involve the protection of its habitats. The restoration of hydraulic-morphological heterogeneity is essential to ensure the development of an articulated river biocenosis.

Restoration of Cavolto river

The objectives adopted in the definition of the interventions on the Roggia Cavolto were identified with the primary intent of environmental enhancement and improvement of the quality of the habitat, through a process of renaturalization of the bottom and of the banks of the watercourse, and of safeguarding continuity fluvial.

In particular, therefore, the planned interventions consist of:

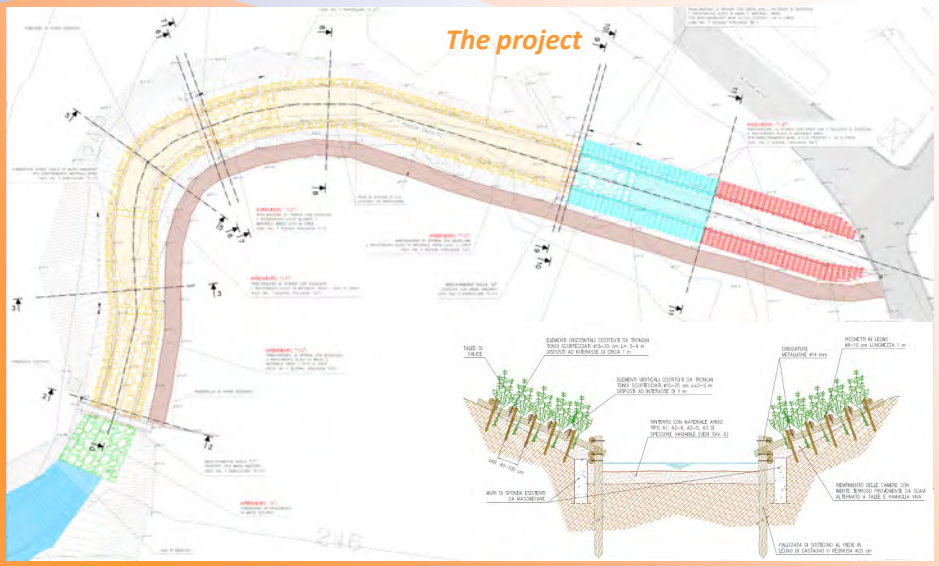
1) RENATURATION and MASKING of the existing thresholds and banks of the canal through the use of two different design solutions of Naturalistic Engineering:

2) COVERING IN Boulders and / or LIVE GRATE with SUPPORT PALISING. Within this framework of interventions, it is planned to build three stone ramps (cyclopean boulders): the existing thresholds represent insurmountable obstacles for the ichthyofauna; it was therefore decided to carry out works capable of restoring the fluvial viability.

3) Formation of a NARROWING IN CYCLOPIC MASSES in the vicinity of the upstream threshold to allow the local elevation of the lake level and the consequent reduction of the flood flows passing downstream along the Canal.

Cleaning of the current hydraulic path on the right, adjacent to the canal, through the elimination of branches and crashed logs.

Upon completion of the works, new tree and shrub plantings were planted along the upstream stretch of the path and near the narrowing in boulders. Furthermore were planted aquatic species such as the STRAW OF PALUDE (PHRAGMITES AUSTRALIS) and the NINFEA COMUNE (NYMPHAEA ALBA) in the section upstream of the narrowing in boulders.



Monitoring

Environmental monitoring activities have been envisaged in the places subject to the interventions to assess their effectiveness in pursuing the objectives of improving the quality of surface waters and aquatic and suburban habitats. Before the start of the works to carry out the works, a campaign was carried out for the characterization of the sites (pre-construction status: 2012-2015); after the end of the works, a second campaign was carried out to assess the first impacts on the environment (post-construction status: 2016-2017).

In particular, the following were monitored:

- Chemical-physical parameters of water and related indicators (LIMeco)
- Microbiological parameters of water (IBE)
- Fish fauna
- Ecological indicators of river function (IFF)
- Avifauna (nesting, wintering and nocturnal birds of prey)
- Bats
- Amphibians
- Odonates

The ante operam monitoring confirmed data collected in recent years that describe a quality of the water in slow improvement in time and however at a sufficient level. The analysis confirmed the spatial deterioration of water quality caused by purifier discharges, while for secondary tributaries has been confirmed the presence of substances introduced by spillways of the sewage system.

The habitat quality monitoring was developed with similar methodology to that of water quality. The investigations were conducted for each area of actions, localized in strategic points for the study and for the knowledge of the current state of the habitat and the subsequent assessment of the effects of the works.

Results of the project

Action B2M carried out at the Merone treatment plant is undoubtedly the one most suited to the theme of water quality and less to that of the quality of the environment and this feature is also enhanced by the level of mechanization and plant engineering that was required to achieve it.

Action B2 carried out at the Nibionno purifier and certainly mainly suited to the quality of the water but it already represents a step towards greater naturalness at the expense of the efficiency of purification performance, obviously.

The combination of actions B3 and B4 represents the attempt to alternatively address a problem of pollution of the secondary water network which ultimately demonstrated its limitations in the part relating to the improvement of water quality but also an exceptional power instead in the diversification of habitats which were previously extremely trivial.

Actions B5 and B6 represented a collection of multi-objective proposals in which the quality of the water was not even considered, although it could receive an indirect minimum benefit, and instead also in this case great potential was discovered and highlighted by ecological point of view and citizenship usability.

Finally, the action of B7 can be considered a valid although perfectible experiment of defragmentation of a water body for the purpose of its functionality for the viability of the fish fauna and in general for the requalification of extremely artificial bodies of water.

If we consider that as a corollary of all this great experiment, a first attempt at participation born within the process of river contracts and upstream a serious plan for monitoring the effects induced on water bodies and fauna by the interventions are placed upstream. Overall judgment that can be given on the project is positive.

AREA / INDICATOR	B2M	B2N	B4	B5	B6	B7
Water quality				-	-	-
Fishes*			-	-	-	
Birds						
Bats**	-	-	-			
Amphibians						-
Odonates						-

Thanks to: Daniele Giuffré, Stefano Minà, Carla Galbiati, Maria Teresa Olmeo, Chiara Perego, Chiara Vellani, Marco Pozzoli, Eugenia Tiscar, Mariella Nicastro, Davide Borin, Elena Savarese, Antonella Anzani, Alessandro Marieni, Eleonora Frigerio, Bernardino Farchi, Leopoldo Motta, Silvia Galli, Francesca Viganò, Sabina Rossi, Saverio D'Ambrosio, Luigi Longhi, Giorgio Citterio, Fausto Lombardo, Elio Anzani, Paolo Lampreda, Giuseppe Erba, Marco Bernasconi, Enzo Calcaterra, Giuseppe Baldo, Marco Lisso, Cristina Passoni, Riccardo Bresciani, Massimo Sartorelli, Maurizio Rosso, Santo La Ferlita, Stefania Meucci, Francesca Oggionni, Diego Curti, Pietro Cerri, Livio Tremari, Ezio Mulini, Leonardo Barri, Stefano Mazzoni, Marco Peverelli, Marco Zamburlini, Lorenzo Verga, Dante De Candido, Michele Pozzoli,

Lots of thanks also to Chiara Spotorno for her technical and financial assistance and monitoring.

Thanks also to all the supporters of this project, especially Paola Bencini that provides us some impressive photographs.