Chisone basin

monograph

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Summary

SHORT DESCRIPTION
This document intends to provide a comprehensive description of the mountain areas of the Chisone-Dora Riparia river basins, including the HP plants on which the MCA methodology will be tested. **This monograph is divided into five different sections, each of which explores a specific topic. The first part describes in general the physical, geographical, geological and hydrological characteristics of the basin. The second part is a deepening on present management and monitoring plans, and the third analyzes the main water uses on a basin scale with particular attention to the HP exploitation. Finally the fourth and fifth parts provide a description of the main pressures and impacts related to water uses and their relative restoration and mitigation actions.**

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Introduction

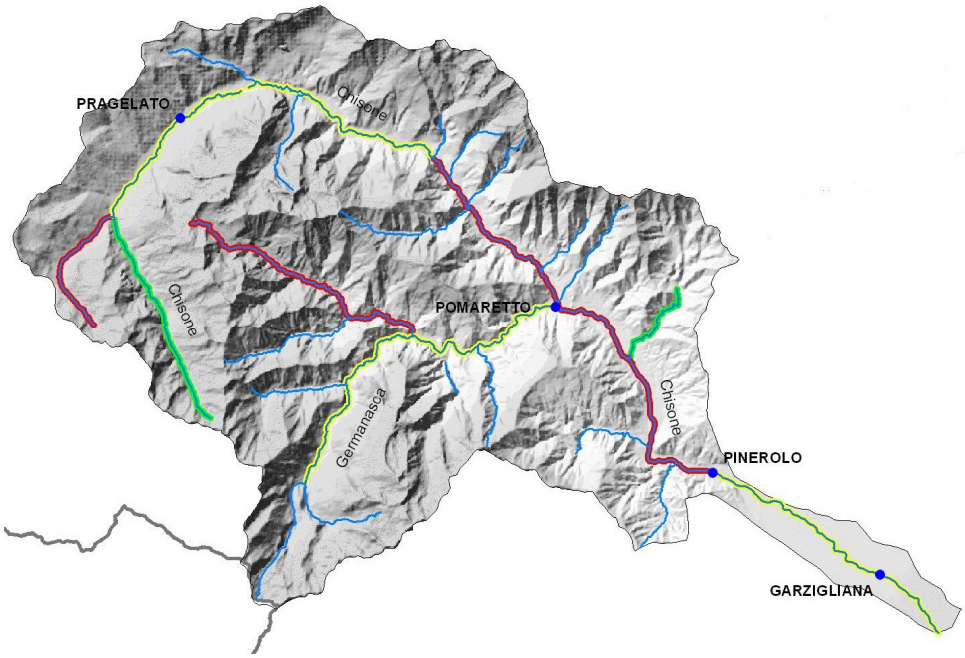
This document intends to provide a comprehensive description of the mountain areas of the Chisone river basin, including the hydropower (HP) plants on which the MCA methodology is being tested.
This monograph is divided into five different sections, each of which explores a specific topic. The first part describes in general the physical, geographical, geological and hydrological characteristics of the basin. The second part is a deepening on present management and monitoring plans and the third analyzes the main water uses on a basin scale with particular attention to the HP exploitation. Finally the fourth and fifth parts provide a description of the main pressures and impacts related to water uses and their relative restoration and mitigation actions.

1. Pilot case study area

1.1 Basin characteristics

The Chisone stream belongs to the Pellice river basin and is the main tributary of the Pellice river. The top of the Chisone valley is connected to the Susa valley which is included in the hydrographic basin of the Dora Riparia river. The Chisone stream originates from the foot of Mount Barifreddo, at 3028 mt a.s.l. and, after a 180° degree turn, in Perosa Argentina it receives the stream Germanasca, its main tributary. In the mountain area the waterflow direction is North-West - South-East; it remains the same also in the plain area, from Pinerolo to the confluence into the Pellice river, close to Cavour. Upstream the Usseaux narrows the stream runs along a valley floor oriented first (Val Troncea) in NNW/SSE direction and then, downstream Pattemouche and the confluence with the Chisonetto stream, in SW/NE direction, until the Usseaux narrows. The river reach situated downstream Usseaux runs with a NW/SE direction with a slight winding trend due to some sills and rocks which are resistant to erosion. The valley floor is constituted by a reduced strip of alluvial level ground, occasionally interrupted by some narrowings.
The Chisone sub-basin (Fig. 1), which includes 19 municipalites, covers an area of 288 km^2 and is not densely populated. Its main tributary, the Germanasca stream, is characterised by a good environmental state.
This highland area has an average altitude of 845 m. a.s.l. and is marked out the presence of many holiday homes and hotels, highlighting the remarkable tourist vocation of the area, which is linked to the nearby skiing resorts in Sestrière and the surrounding protected areas (Natural Park of Orsiera Rocciavré, Val Troncea Natural Park). The tourist sector concerning environmental and landscape features is therefore very important and well established.
In the valley part there are the established industrial estates belonging to the Pinerolo district, which are specialised in the metal and mechanical sector.

Fig. 1. Vew of the Chisone river sub-basin.



1.2 Geolithological and land cover characterization

The mountain basin is located in the rocks of the Piemontese Zone, constituted by calcareous schists with green rocks, and in the metamorphic series of the Dora-Maira Massiccio Cristallino Interno. The plain area is constituted by wurmian alluvial deposits. The mountain basin is marked out by a series of valley gullies due to glacial modeling and strongly molded by river erosion which created many lateral suspended valleys; in the head sectors of the valley there are many landforms due to glacial cirques. The area includes a widespread presence of gravity movements of the mountainside, some of which of big dimensions (deep gravity movements of the mountainside). The area includes a diffused presence of minor tributaries featuring phenomena of strong torrential activity and reopening of alluvial fan sectors.

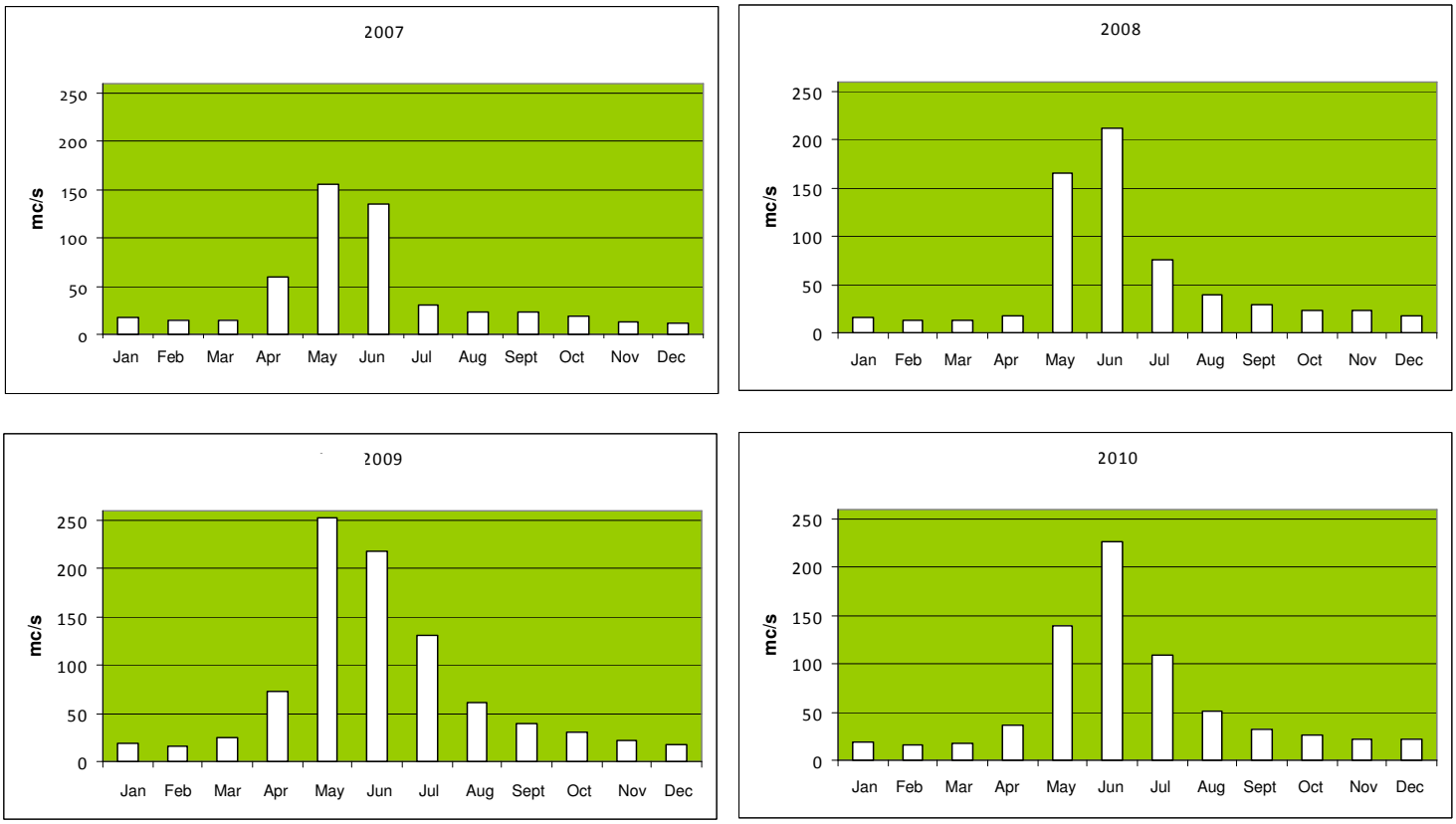
1.3 Hydrological characterization

The Chisone territory upstream the confluence with the Germanasca stream is classified as an alpine internal basin. It is therefore characterized by the protection of the alpine mountain range from the Atlantic and Mediterranean humid currents and by reduced low-intensity rainfalls. Moreover, the presence of wide areas above 2.000 m. a.s.l. implies that meteoric precipitations are predominantly snow for most of the year, and therefore they do not contribute to flooding events. They normally happen in the period between the end of the spring and the beginning of the autumn, when pluviometric contributions and run-off from snow melt merge.
The Chisone reach downstream the confluence with the Germanasca stream is classified as an alpine Piedmont basin. This basin typology is not protected by the alpine range for substantial areas of its territory: rainfalls are more intense, snowfalls are limited and, therefore, specific flows are much higher.
The reference hydrogeological macro-areas of the Chisone sub-basin are: MS07 – Pinerolo Plain, concerning the surface water network; MP3 – Cuneo-South Turin Plain, West Asti, concerning the groundwater network. Part of the basin territory includes areas which are located outside the reference hydrogeological macro-areas. The downflow regime critical state was classified as medium-high with regard to the other regional sub-basins. This is due to local problems on the residual flow stretches of HP plants, especially during winter, and to water depletion on the plain reach, especially during summer, due to the withdrawal caused by the irrigation canals of the Pinerolo territory.
The quality state of the main surface waterbody was defined on the basis of the monthly average flow measured during the period 2007 – 2010 at the hydrometric continuous monitoring station in Soucheres Basses (see Table 1 and Fig. 2). As known, the waterbody flow contributes to the definition of the environmental state as it strongly influences the capacity of auto-depuration from pollutants and it maintains ecosystem functionality and quality.

Table 1. Chisone stream, Soucheres Basses Station. Monthly average flows (mc/sec)

	MONTH											
YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
2007	17,6	14,5	14,1	60,0	155,7	135,3	62,0	23,3	22,7	19,4	13,5	12,3
2008	16,1	12,8	13,8	17,7	165,0	212,4	75,5	38,6	28,6	22,8	23,2	18,1
2009	18,8	16,2	25,3	72,1	252,9	217,7	130,1	60,9	38,7	30,6	21,5	18,1
2010	18,8	15,7	18,1	36,4	139,2	227,0	109,2	51,1	32,0	26,3	22,1	21,3

Fig. 2. Chisone stream, Soucheres Basses Station. Monthly average flows (mc/sec) according to Table 1.

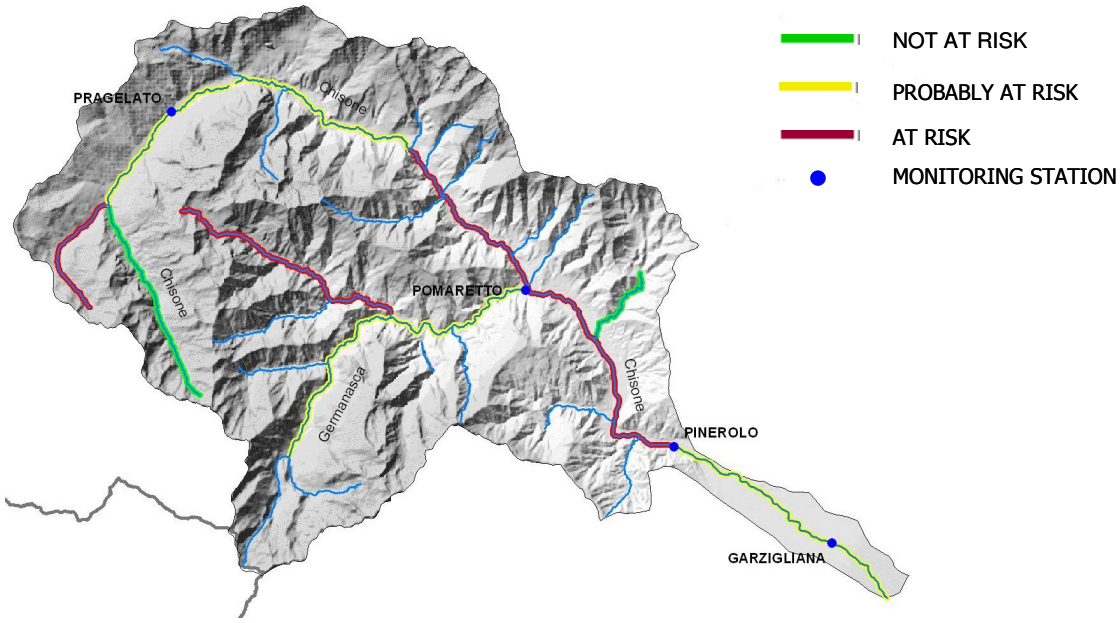


1.4 River quality

1.4.1 WFD quality elements

The probable risk of not reaching the goals of the 2000/60/EC directive for the mountain portion of the Chisone stream (see Fig. 3) is due to the pressures generated by HP withdrawals and by the presence of storage facilities. The heavy artificialization of the riverbanks, due to the presence of hydrogeological risks, is also impacting strongly the stream.The classification of the ecological quality state of the Chisone stream was carried out from 2000 to 2008 according to the national law in force before the implementation of the WFD (D.lgs 152/1999), but already inspired to the WFD principles. As shown in table 2, the ecological state was calculated on the basis of the macrobenthos community (IBE) and of the LIM, a complex index based on the presence and classification into 5 classes of: dissolved O_2, P, nitric N, ammoniac N, BOD5, COD and *Escherichia coli*.

Fig. 3. Assessment of the risk of not reaching the WFD environmental quality goals in the higher part of the Chisone valley.



When the transposition of the WFD and the 3 ministerial decrees for its implementation entered into force (D.lgs 152/2006) the classification system was adapted to the directive requirements and is still in a experimental phase. The following table shows the quality state trend taking into account the whole set of available data.

Table 2. Trend of the ecological quality state at the monitoring station of Pragelato.

Monitoring station	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Pragelato, Soucheres Basses	●	●	●	●	●	●	●	●	●	●
Critical factor	IBE	IBE		IBE					IBE	Star ICMi

● HIGH ● GOOD ● MODERATE ● POOR ● BAD

The water body reference sampling station is located in Soucheres Basses, within the municipality of Pragelato, downstream the urban centre, and subtends a basin characterised by a high level of touristic development as it is situated downhill the Sestrière hill, an internationally known skiing resort, the water of which are collected into two local depurators.
Since 2002, the ecological status of the stream has been classified as *good*, except in 2003 which was an abnormal hydrological year as the whole Europe experienced a situation of drought; on average in 2003 all rivers in Piedmont lowered down their ecological status class by one level.

In 2008 the stream experienced a small and localised flood event which could have altered data sampled about the biological communities. At present it is being clarified if the *sufficient* ecological status recorded in 2009 has been influenced by the methodological change concerning the macrobenthos index.
We foresee to reach the *good* ecological status in 2015, without any further delays.

- Fish fauna

The study area is located in a place where the allochthonous fish fauna is naturally absent due to the conformation of the valley. During the surveys only sea-trout individuals (*Salmo trutta trutta*) of atlantic origin (which are introduced for fishing leisure activities) have been sampled.

- Macrophytes and phytobenthos

In this study area macrophytes and phytobenthos have not been sampled as macrophytes are not necessary in the alpine area according to the WFD requirements and diatoms are not significant to assess the impact typology.

- Chemical and physical-chemical elements supporting the biological elements

In Italy, the general chemical descriptors was merged into an aggregate index, called "LIM – Livello di Inquinamento dei Macrodescrittori" (Pollution Level of the Macro-descriptors) from 2000 to 2008; it was then substituted from 2009 onwards with the LIMeco, which involves a smaller number of parameters and a different calculation method (see full list of the Italian indices). Anyway for the Chisone stream the LIM index is available until 2010.
Based on LIM results, the monitoring station in Soucheres Basses showed from 2000 to 2010 a *good* ecological status while, based on LIMeco, from 2009 to 2010, showed a *high* ecological status.

Table 3. List of the parameters included in the two aggregate indices and qualitative status. Soucheres Basses sampling station.o

LIM		LIMeco	
100-O_2 saturation %		100-O_2 saturation %	
NH_4^+		NH_4^+	
NO_3	From 2000 to 2010	NO_3	From 2009 to 2010
P tot.	*GOOD*	P tot	*HIGH*
BOD_5	Qualitative status		Qualitative status
COD			
Escherichia coli			

- Specific pollutants

In the study area there are no industrial activities which could introduce in the water specific pollutants such as chemical substances which contribute to the determination of the ecological status or dangerous substances.

The chemical status of the water body is *good.*

- Ground waters

Considering the features of the mountain stretch of the Chisone stream, its ground waters are constituted by the water table located under the riverbed and strictly connected to the superficial waterbody, which feeds it. As for the implementation of the WFD and the GWD, the water table located under the riverbed is not monitored in river reach considered. Within the framework of the SHARE project this interconnection is not considered significant.

1.4.2 WFD HER

In Italy we used the methodology developed by CEMAGREF, analyzed and adapted to Italy by CNR-IRSA (Buffagni, 2006) to identify the hydro-ecoregions (HER). The methodology is described in detail in this document.
As showed in Fig. 4, the Val Chisone area which is being studied belongs completely to the 107 HER (Inner Alps-S).
In table 4 we highlighted in yellow the main features of this HER.

Fig. 4 – Representation of the Inner Alps-S hydro-ecoregion. The area considered for the Chisone case study is circled in red.

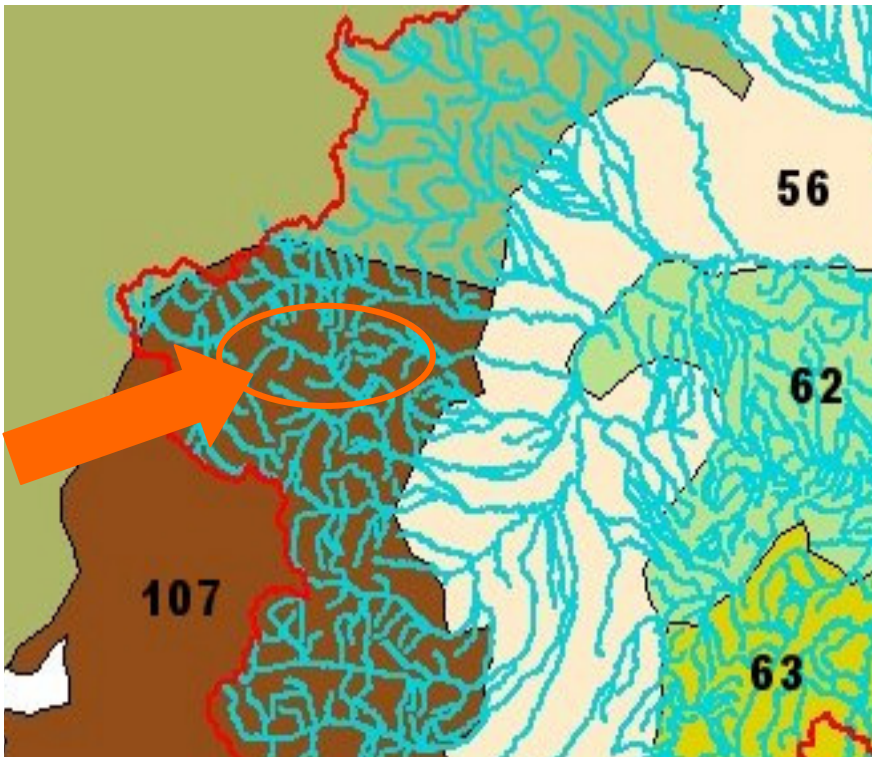


Table 4 – Main features of the 107 HER (Inner Alps – S).

European HER Code	Italian HER Code	HER Name	Description	Orography	Geology	Clime
1	1	Inner Alps	alpine high mountains	high mountains	high mountains	alpine mountain
56	5	Po Plain	temperate warm alluvional plains	plains	alluvional plains	temperate warm
62	6	Monferrato	temperate warm detritic hills	hills	detritic hills	temperate warm
63	8	Piedmontese Apennines	mediterranean heterogeneous mountains	middle mountains	sedimentary middle mountains	mediterranean
64	10	Apennines N	temperate mountains	mountains	carbonated sedimentary mountains	temperate mountain
107	7	Inner Alps - S	alpine high mountains	high mountains	high mountains	alpine mountain
122	9	Ligurian Alps	temperate mountains	mountains	carbonated sedimentary mountains	temperate mountain

1.4.3 WFD river typology

Along the Chisone stream 3 river typologies have been identified. As before, also in this case the methodology used is described in detail in this document.

The river considered originated from surface flowing and it is then divided into different sizes.
The area covered by the case study is highlighted in yellow in the table below and fully belongs to the typology “Surface flowing- Small”.

Table 5 – Chisone stream river typologies.

Typology	Place
107- Surface flowing-Very small	Testa della valle - Pragelato
107- Surface flowing- Small	Pragelato - Villaretto
107- Surface flowing- Medium	Villaretto - Pinerolo

2. Plans and management programs

2.1 Existing management plans and application rules

The WFD identify the “Piano di Gestione” (River Basin Management Plan) as the knowledge, strategic and operative tool to be used by the Member States to apply WFD contents at the local level.

The legislative decree 3/04/2006, n. 152, which transposes the Directive 2000/60/CE, influenced greatly the planning levels existing in Italy for the conservation and management of waters.

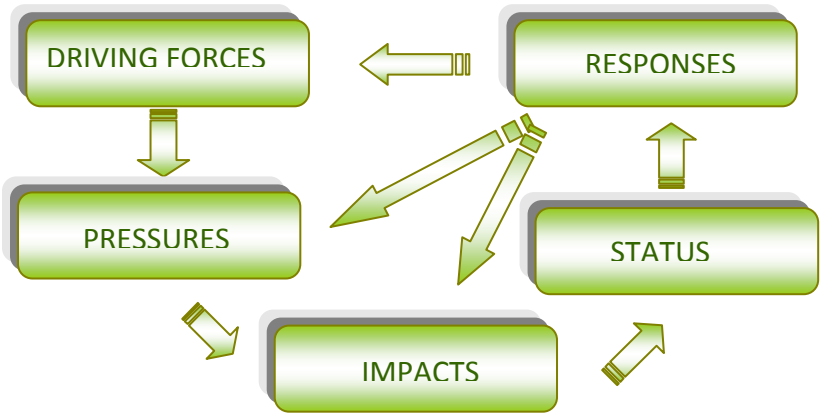
For what concerns the Piedmont Region, the relations between the planning of the whole Po basin and the Regional Planning have been reformulated, introducing, at the supra-regional level, the Management Plan of the Po river hydrographic district, which constitutes the district plan of the whole Po plain. The Water Conservation Plans (PTAs), constitute the regional level as they implement the district planning.

With the law n° 13, 27/02/2009, the Po Basin Authority was recognised as the co-ordinating authority for the elaboration of the Management Plan for the relevant district. The plan was adopted on 24/02/2010 according to the provisions of the WFD.

In the drafting phase of the River Basin Management Plan, the contribution of all the plans and programmes in force on the territory and coherent with the goals of sustainable management and conservation of the aquatic environment was fundamental; of particular importance is the ongoing Water Conservation Plan, the actions of which have been transposed in the District Plan. The resulting Programme includes therefore measures for the conservation and improvement of water quality which had already been planned, together with new specific measures.

2.1.1 Indicators used for environmental monitoring and to assess the effectiveness of the actions

It is nowadays consolidated the use of the DPSIR methodology in planning activities connected with water resources. This methodology is consistent with the WFD and broadly used at the international to identify "casualty correlations" between the different environmental components. The use of indicators is part of this logic scheme as it represents an useful tool to assess the policy implementation level and the degree of fulfillment of the established goals.



The PTA (Water Conservation Plan) includes ways allowing to update, within its period of validity, the whole set of measures foreseen at the elaboration stage to reach the goals relevant to each hydrographic area. It is therefore been foreseen an ongoing assessment structured in a two-way control: verify on the one hand that the measures indicated are actually implemented accorded to the ways and the timeframe provided for, and on the other hand what are the effects of the measures on water quality.
Some examples of significant indicators are:

- % of points in line with the goal of *good* ecological status in 2008 on the total number of monitored stations;
- implementation level of the Minimum Intake Flow (MIF);
- investments of the integrated water services done in 2009;
- progress made by the % of the reduction in nutrients entering urban wastewater plants with regard to the 75% goal set at the Community level.

During 2010, within the framework of the elaboration of the Biannual Report to the Regional Council about the PTA implementation status, an assessment of the plan progress has been done, and a detailed analysis of the implementation of both general and specific measures for each hydrographic area was carried out.

2.2 Monitoring programs

In Piedmont the historical series of waterbody monitoring data started in 2000 and up to 2008 it used the methodologies and the criteria provided for by the legislative decree 152/1999, which constitutes the regional rule for the planning and conservation of the waterbodies. This decree preceded the implementation of the WFD but was already in line with its main principles.
In 2008 the definition of the waterbodies was completed together with the pressure analysis and the assessment of the risk not to reach the quality goals provided for by the WFD. New monitoring networks have been identified for superficial and ground waters trying to maintain as much as possible the sampling stations previously used: 132 stations were maintained on a total of 200, which were considered representative of the main waterbodies identified. An equal number of waterbodies will be classified by considering them similar from the point of view of the environmental typology and the degree of anthropic pressure.
Monitoring activities fully coherent to the WFD have started in Piedmont from 2009.
On all the waterbodies belonging to the new network chemical monitoring follows an analytical protocol fulfilling WFD requirements, which includes the general basic parameters (temperature and oxygenation condition, salinity, acidification, nutrients) sampled at every point, while dangerous substances and other specific pollutants are determined on a sub-group of stations identified through pressure analysis and the assessment of the status data available.
Generally, monthly surveys are foreseen.

2.2.1 Chemical monitoring – Analytcal Protocol

With the implementation of Directive 2000/60/CE monitoring plans for dangerous substances and specific pollutants (including pesticides) had to be made compliant; the process started in 2008 and was consolidated in 2009 with the implementation of the new monitoring station.
The WFD provides for the classification of the superficial waterbodies based on the chemical and ecological status.
The chemical status is assessed based on the European Environmental Quality Standards defined by a list of 33+8 priority substances and dangerous priority substances , out of which 16 are pesticides.
When defining the ecological status, among other components, the specific pollutants discharged and/or introduced in the basin in significant quantities must be evaluated.
The categories of parameters included in the 2009-2010 analytical protocol, identified, as said before, on the basis of existing pressures and previous data, for the Chisone mountain basin (HER 107) are listed in the table below.

Table 6 – List of the metals included in the 2009-2010 analytical protocol.

Parameter	Measure Unit	LCL
Dissolved Cadmium	µg/L	0.5
Dissolved Chromium (iii+vi)	µg/L	2.0
Hexavalent Chromium *	µg/L	5.0
Dissolved Mercury	µg/L	0.02
Dissolved Nickel	µg/L	2.0
Dissolved Lead	µg/L	2.0
Dissolved Copper	µg/L	5.0
Dissolved Zinc	µg/L	50
Dissolved Iron	µg/L	50
Dissolved manganese	µg/L	5.0

Table 7 – List of the Basic Parameters included in the 2009-2010 analytical protocol.

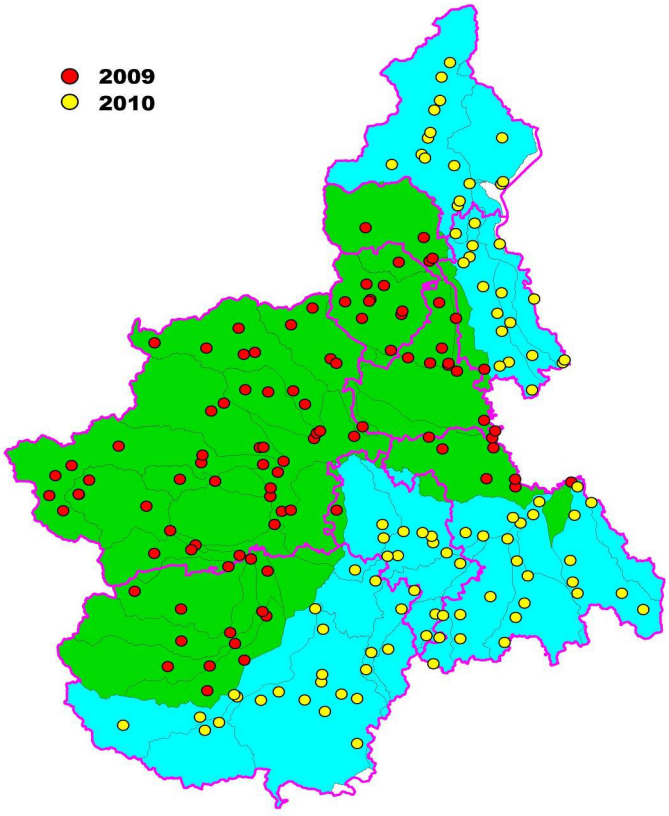
Parameter	Measure Unit	LCL
NH_4^+	mg/L N	0.03
NO_3	mg/L N	0.1
100-O_2 saturation %	%	-
BOD_5	mg/L O_2	2
COD	mg/L O_2	5
Total P	mg/L P	0.05
Escherichia coli	UFC/100 ml	100
Total N	mg/L N	1.0
Chlorides	mg/L	1.0
Conductivity	µS/cm a 20°C	-
Ortho phosphate	mg/L P	0.05
Dissolved O_2	mg/L O_2	0.5
pH	Unità di pH	-
Sulphates	mg/L	1.0
Suspended particles	mg/L	10
Water temperature	°C	-
NO_2	mg/L N	0.003
Calcium	mg/L	1.0
Magnesium	mg/L	1.0
Sodium	mg/L	1.0
Potassium	mg/L	1.0
Alcalinity	mg/L $Ca(HCO_3)_2$	-

2.2.2 Monitoring of the biological components

The biological components considered for the waterbodies are macrobenthos, macrophytes, phytobenthos (diatoms) and fishes. The components to be monitored on the different waterbodies have been selected on the basis of the risk analysis and the sensitivity to specific pressures. As for biological monitoring, the activities are distributed over two years (2009 e 2010) on points chosen based on the 34 hydrographic areas indicated by the PTA (see Fig. 5) and divided into two groups:

1. the Po river and all the hydrographic areas of its tributaries except the Tanaro river (and its tributaries); all the points in this group are monitored for all the biological components foreseen in 2009;
2. the Tanaro river and all the hydrographic areas of its tributaries, plus the hydrographic areas of Northern Piedmont (Agogna, Terdoppio, Toce, Ticino); all the points in this group are monitored for all the biological components foreseen in 2010.

Fig. 5 – Stratification of the biomonitoring activities in 2009 and 2010.



3. Water uses

3.1 Hydropower exploitation

There are medium sized hydropower plants on the whole mountain portion of the Chisone river (where the case study is carried out) and almost all the river channel is affected by authorized water withdrawals (tables 8 and 9). The presence of the Pourrieres reservoir (fig. 4), located in the municipality of Usseaux, is relevant from the point of view of the downflow regime in the mountain part of the river as it closes the water flow of the river by accumulating water for HP uses.

The plant started its activities in 1952 and uses the water coming from the hydrografic basin of the Pellice river. It is constituted by a dam on the Chisone river which forms a small reservoir, allowing daily partial regulation of production according to the water level; by 5 weirs, placed on the lateral streams, which allow the water to go into channels leading to the reservoir, a 4 km long pressure tunnel leading to a piezometric well, from which a 800mt long penstock originates. Two 8,4 MVA alternator groups have been installed in the plant and they are connected to two turbines.

The power station is managed by Energie SpA and includes, beside the plant, a system of withdrawals on the Chisone river and on some lateral tributaries:

- Pourrières dam and reservoir (Chisone river, with a regulation capacity of about 300,000 m3);
- Gorge (Chisone river, flood recovery downstream the dam);
- On the hydrographic left side: Assietta stream, della Rossa brook, Usseaux stream;
- On the hydrographic right side: Laux brook, Crestovo brook.

The following table lists the subtended surface values related to of the hydrographic basins for the withdrawals listed above.

Tab. 8 - Hydrographic basins subtended by the plant withdrawals

WITHDRAWAL	SURFACE (km^2)
Chisone a Pourrieres	116
Assietta	7,6
Della Rossa (*)	*1,9*
Usseaux	7,6
Laux	10
Crestovo	6,1
Total basin	**149,2**

(*) With the authorization renewal in August 2011, the Della Rossabrook withdrawal was disused.

The technical data of the plant shown in Fig. 6, are the following:

Maximum flow : 7250 l/s
Average flow authorised: 2090 l/s
MIF at Gorge: 297 l/s
Head: 301 m
Generators installed power: 16800 kVA (tro generator groups)
Maximum power which can be produced: 13000 kW

Fig. 6 – Orthophoto of the Pourrieres reservoir.

In the mountain part of the Chisone river (with regard especially to the municipality of Pragelato) there have been dramatic changes due to the works done to change the course of the river after the floods. The territory was deeply modified for the establishment of plants and settlements for the 2006 Winter Olympic Games. The river was canalized and its course was rectified and banalized for long stretches; structures were built directly in the river area. The mountain part of the Chisone river is characterised by a strong tourist flow, especially during the winter months which correspond, for the hydrological regime of this river, to the period of maximum water shortage and, therefore, to the period when the auto-depuration capacity is lower.

With regards to the progressive artificialization related to winter sports, water abstraction for artificial snow facilities increased sensibly, with further impacts on the water situation of the area.

Due to the geological conformation of the higher part of the Chisone valley, the basin frequently undergoes important phenomena of sediment filling, with the accumulation, on the riverbed, of fine sediments in the final part of the river and of coarse ones at the beginning.

During the flood in October 2000, it was estimated that ca. 70-80.000 cubic meters of material were deposited in the Pourrieres dam. The theoretic capacity of the basin (ca. 350.000 cubic meters) was therefore reduced by 35%, thus leaving a real capacity of 230.000 cubic meters. In order to remove the sediments, periodic work of flood control were carried out for the management of river sediments.

Table 9 – Details of the water abstractions and the relevant hydropower energy plants located in the Chisone river basin.

Water abstraction authorization data									Energy Plant data							
Water abstraction mapping code	Owner	Type of use by law	Actual water use	Water abstraction type	Authorised from	Authorization expiry date	Maximum flow authorised (l/s)	Annual average flow authorised (l/s)	SIRI (water resources database) code	Plant mapping code	Plant name	Municipality	Plant maximum flow (l/s)	Plant average flow (l/s)	Head (mt)	Average_Theoretical_Power (kW)
T000048	ENERGIE	energy	energy production	Big	30/01/49	31/12/20	6.900,00	2.033,00	CNT0001032	T000048UID001	CENTRALE DI FENESTRELLE	Fenestrelle	6.900,00	2.033,00	297,00	5.919,62
T000049	COMUNE DI PINEROLO	farming	energy production	Big	01/02/17	31/01/02	6.000,00	5.160,00	CNT0036050	T000049UID001		Pinerolo		2.008,00		125,00
T000157	COMUNE DI PINEROLO & SOC. CARTIERA VAL CHISONE SNC	-	energy production	Small	01/02/17	-	1.100,00	855,00	CNT0036051	T000157UID001	CARTIERA VALCHISONE	Porte	855,00	855,00	3,00	80,58
T000243	C.I.O.	energy	energy production	Small	18/07/30	30/04/17	7.150,00	5.600,00	CNT0000749	T000243UID001	CENTRALE MIRADOLO	San Secondo	7.150,00	5.600,00		438,94
T000246	TURATI ENERGIA S.R.L.	energy	energy production	Small	26/10/55	31/03/29	7.000,00	5.500,00	CNT0000891	T000246UID001		Pomaretto	7.000,00	5.500,00	15,00	835,25
T000268	S.I.E.D.	energy	energy production	Small	23/02/52	08/10/32	3.200,00	2.700,00	CNT0000902	T000268UID001	CENTR. IDR. "MEANO"	Pomaretto	3.200,00	2.700,00	90,00	2.395,58
T000274	C.I.O.	energy	energy production	Small	01/02/17	01/01/12	4.000,00	3.400,00	CNT0000905	T000274UID001	CENTRALE MALANAGGIO	Porte	4.000,00	3.400,00	8,10	270,00
T000277	ENERGIE	energy	energy production	Small	08/12/41	30/04/17	6.500,00	4.160,00	CNT0000765	T000277UID001	C.LE VILLAR PEROSA	Villar Perosa	6.500,00	4.160,00	26,00	1.076,30
T000279	ENERGIE	energy	energy production	Small	24/01/29	15/03/17	7.500,00	4.696,00	CNT0000766	T000279UID001	C.LE DI INVERSO PINASCA	Inverso	7.500,00	4.696,00	58,75	2.705,00
T000281	SGPOWER S.R.L.	energy	energy production	Small	01/02/17	31/03/29	6.000,00	3.400,00	CNT0000767	T000281UID001	C.LE S. GERMANO	San Germano	6.000,00	3.400,00	9,50	317,00
T000285	IDROPADANA S.R.L.	energy	energy production	Small	26/04/93	25/04/98	3.200,00	2.300,00	CNT0000769	T000285UID001	IMPIANTO DI ROURE	Roure	3.200,00	2.300,00	80,00	1.804,00
T000288	ENEL PRODUZIONE S.P.A.	energy	energy production	Small	29/04/36	31/03/29	900,00	650,00	CNT0000916	T000288UID001	CENTRALE TESSORE	Perrero	900,00	650,00	10,00	64,00
T000289	RAGGRUPPAMENTO " LE CHIUSE " S.R.L.	energy	energy production	Small	01/01/1893	31/01/97	4.850,00	4.000,00	CNT0000771	T000289UID001	EX COTONIFICIO F.LLI TURATI	Pinerolo	4.850,00	4.000,00	3,00	125,00
T000292	C.I.O.	energy	energy production	Small	16/03/36	30/01/11	2.500,00	2.500,00	CNT0000919	T000292UID002	CENTRALE CHIOTTI INFERIORE	Perrero	1.500,00	1.500,00	16,30	240,00
T000292	C.I.O.	energy	energy production	Small	16/03/36	30/01/11	2.500,00	2.500,00	CNT0000918	T000292UID001	CENTRALE CHIOTTI SUPERIORE	Perrero	1.000,00	1.000,00	66,60	653,00
T000299	ENEL GREEN POWER	energy	energy production	Small	19/08/36	31/12/10	2.700,00	2.200,00	CNT0000772	T000299UID001	IMPIANTO DI RORETO	Roure	2.700,00	2.200,00	53,00	1.134,00
T000304	ENERGHEIA S.R.L.	energy	energy production	Small	04/02/99	03/02/29	1.200,00	800,00	CNT0000925	T000304UID001		Prali	1.200,00	800,00	122,50	961,00
T000318	IDROENERGIA	energy	energy production	Small	30/01/81	31/01/11	2.000,00	1.760,00	CNT0000933	T000318UID001	GERMANASCA	Pomaretto	2.000,00	1.760,00	96,00	1.665,00
T000320	SKIAREA MIARA S.R.L.	energy	energy production	Small	02/11/94	01/11/24	360,00	200,00	CNT0000934	T000320UID001	GIO DAL SAP (PRALY)	Prali	360,00	200,00	182,00	357,00
T000549	ENEL GREEN POWER	energy	energy production	Small	02/05/57	31/03/29	6.300,00	5.500,00	CNT0000804	T000549UID001	IMPIANTO DI PORTE CHISONE	Porte	6.300,00	5.500,00	17,69	954,00
T000563	IDROENERGIA	energy, domestic (surface water)	energy production	Small	01/08/45	31/03/29	3.200,00	2.875,00	CNT0000806	T000563UID001	CHISONE SUPERIORE	Pomaretto	3.200,00	2.007,00	10,00	260,70
T000589	SGPOWER S.R.L.	energy	energy production	Small	01/02/17	31/01/02	350,00	350,00	CNT0000807	T000589UID001		San Germano	350,00	350,00	3,00	10,98
T000622	VIAARET DAMOUNT SRL	energy	energy production	Small	05/07/85	04/07/15	120,00	120,00	CNT0000974	T000622UID001	CENTRALE VILLARETTO SUPERIORE	Roure	120,00	120,00	302,00	355,29
T000624	GAY IRENE	energy	energy production	Small	06/10/87	05/10/17	30,00	30,00	CNT0000975	T000624UID001		Roure	30,00	30,00	81,00	23,77
T000626	GOUCHON RENATO	energy	energy production	Small	27/03/82	26/03/12	28,00	14,00	CNT0000976	T000626UID001		Roure	28,00	13,70	85,00	11,42
T000628	PITON PIERO	energy	energy production	Small	19/11/67	18/11/17	60,00	30,00	CNT0000977	T000628UID001		Roure	60,00	30,00	69,00	20,43
T000670	COMUNE DI GRAVERE	drinkable, energy	energy production	Small	01/08/00	31/07/30	39,00	39,00	CNT0000873	T000670UID001		Gravere	39,00	21,00	367,00	185,20
T000672	TICIESSE S.R.L.	energy	energy production	Small	24/12/20	31/01/02	20,00	15,00	CNT0000874	T000672UID001	EX COTONIFICIO WIDEMAN	San Germano	20,00	15,00		5,00
T000674	MICOL GIANCARLO E COUTENTI	energy	energy production	Small	16/03/96	15/03/26	200,00	150,00	CNT0000978	T000674UID001	CENTRALE 1	Massello	200,00	150,00	10,00	15,15
T000696	CHIADO' FIORIO TIN ANTONIO	energy	energy production	Small	15/12/03	31/05/28	1,00	1,00	CNT0000875	T000696UID001	MICROCENTRALE PER ALPEGGIO	Massello	1,00	0,10	20,00	0,20
T000714	C.I.O.	energy	energy production	Small	25/10/18	31/03/29	1.500,00	1.000,00	CNT0000980	T000714UID001	CENTRALE RIBBE	Perrero	1.500,00	1.000,00	10,00	98,00
T000716	TOYE FIORE	energy	energy production	Small	15/06/87	14/06/17	120,00	95,00	CNT0000981	T000716UID001	OFFICINA MECCANICA	Roure	120,00	95,00	435,00	405,00
T000896	CENTRALE IDROELETTRICA DI SALZA DI PINEROLO S.R.L.	energy	energy production	Small	26/05/04	26/05/34	600,00	146,00	CNT0000997	T000896UID001	CENTRALE DI SALZA PINEROLO	Salza di Pinerolo	600,00	146,00	235,00	336,37
T000960	REGIONE PIEMONTE	energy	energy production	Small	12/06/03	11/06/33	35,00	25,00	CNT0000876	T000960UID001	CENTRALINA PER RIFUGIO	Roure	35,00	25,00	180,00	44,10
T000983	C.I.O.	energy	energy production	Small	09/03/05	09/03/35	4.000,00	2.750,00	CNT0000826	T000983UID001		Roure	4.000,00	2.750,00	30,00	808,91
T001019	ASSOCIAZIONE ALPE SELEIRAUT	energy	energy production	Small	18/05/04	18/05/34	8,00	6,00	CNT0000839	T001019UID001		Roure	8,00	6,00	150,00	8,82
T005530	ACEA PINEROLESE INDUSTRIALE	energy	energy production	Small	07/02/07	-	110,00	90,00	CNT0302407	T005530CNT001	ACEA PINEROLESE INDUSTRIALE SPA	Fenestrelle	110,00	90,00	201,98	178,22
T005545	COMUNE DI USSEAUX	energy	energy production	Small	13/09/07	09/08/29	40,00	25,00	CNT0323686	T005545CNT001	CENTRALINA SORG. CEROGNE (ACQUEDOTTO POURRIERES)	Usseaux	40,00	25,00	360,00	88,00
T005916	COMUNE DI ROURE	-	energy production	Small	-	-	-	-	CNT0324339	T005916CNT004		Roure		2,50		19,00
T006052	ACEA PINEROLESE INDUSTRIALE	drinkable, energy	energy production	Small	10/08/99	-	236,00	170,00	CNT0324704	T006052CNT001	CENTRALE INVERSO PINASCA	Roure	236,00	160,00	311,00	487,80
T006061	COSTANTINO RINA	-	energy production	Small	-	-	-	-	CNT0324726	T006061CNT001		Pomaretto		9,89		7,00
T006326	CHARRIER FRANCA	-	energy production	Small	10/08/99	10/08/29	-	-	CNT0325247	T006326CNT001		Roure		1,27		2,96
T006736	BONINO IGOR ALESSANDRO	-	energy production	Small	10/08/99	-	1,30	0,53	CNT0326057	T006736CNT001		Pinasca	1,30	0,53		0,89
T006833	REY GIUSEPPE	farming, energy	energy production	Small	10/08/99	10/08/29	2,00	0,09	CNT0326229	T006833CNT001		Salbertrand	2,00	0,08	20,00	0,30
T006882	DITTA GILETTA MARIO	-	energy production	Small	10/08/99	-	8,00	1,84	CNT0326327	T006882CNT001		Pragelato	8,00	1,84		6,60
T007073	IDROENERGIA	energy	energy production	Big	10/08/99	-	500,00	55,02	CNT0326675	T007073CNT001	CENTRALE IDR. DI GERMANASCA	Perrero	500,00	55,02		52,00
T010028	COMUNE DI SAN SECONDO DI PINEROLO	farming, energy	energy production	Small	31/01/22	31/01/02	1.200,00	1.050,00	CNT0332871	T010028CNT001		Pinerolo	1.200,00	1.050,00		21,10
T010029	JOURDAN ROBERTO	energy	energy production	Small	30/05/06	29/05/36	4,00	3,80	CNT0332875	T010029CNT001	CENTRALE INTERRATA	Fenestrelle	4,00	3,80		9,50
T010030	COMUNE DI ROURE	energy	energy production	Small	07/09/06	06/09/36	15,00	10,00	CNT0332879	T010030CNT001	CENTRALINA VILLARETTO	Roure	15,00	10,00	380,00	37,00
T010033	VERDENERGY S.R.L.	energy	energy production	Small	31/03/09	31/03/39	4,00	1,00	CNT0332891	T010033CNT001	CENTR. IDROEL. VERDENERGY SRL	Pramollo	4,00	1,00	150,00	1,50
T010216	PITON PIERO UGO CARLO E BARRAL ADA DALIA	energy	energy production	Small	22/01/08	21/01/38	260,00	84,35	CNT0333523	T010216CNT001	CENTRALE IDROELETTRICA	Roure	260,00	84,35	258,00	213,35

Table 10 – Details of the water abstractions and the relevant hydropower energy plants located in the higher part of the Chisone basin.

Water abstraction authorization data									Energy Plant data							
Water abstraction mapping code	Owner	Type of use by law	Actual water use	Water abstraction type	Authorised from	Authorization expiry date	Maximum flow authorised (l/s)	Annual average flow authorised (l/s)	SIRI (water resources database) code	Plant mapping code	Plant name	Municipality	Plant maximum flow (l/s)	Plant average flow (l/s)	Head (mt)	Average_Theoretical_Power (kW)
TO00048	ENERGIE	energy	energy production	Big	30/01/49	31/12/20	6.900,00	2.033,00	CNT0001032	TO00048UID001	CENTRALE DI FENESTRELLE	Fenestrelle	6.900,00	2.033,00	297,00	5.919,62
TO00246	TURATI ENERGIA S.R.L.	energy	energy production	Small	26/10/55	31/03/29	7.000,00	5.500,00	CNT0000891	TO00246UID001		Pomaretto	7.000,00	5.500,00	15,00	835,25
TO00268	S.I.E.D.	energy	energy production	Small	23/02/52	08/10/32	3.200,00	2.700,00	CNT0000902	TO00268UID001	CENTR. IDR. "MEANO"	Pomaretto	3.200,00	2.700,00	90,00	2.395,58
TO00277	ENERGIE	energy	energy production	Small	08/12/41	30/04/17	6.500,00	4.160,00	CNT0000765	TO00277UID001	C.LE VILLAR PEROSA	Villar Perosa	6.500,00	4.160,00	26,00	1.076,30
TO00279	ENERGIE	energy	energy production	Small	24/01/29	15/03/17	7.500,00	4.696,00	CNT0000766	TO00279UID001	C.LE DI INVERSO PINASCA	Inverso Pinasca	7.500,00	4.696,00	58,75	2.705,00
TO00281	SGPOWER S.R.L.	energy	energy production	Small	01/02/17	31/03/29	6.000,00	3.400,00	CNT0000767	TO00281UID001	C.LE S. GERMANO	Villar Perosa	6.000,00	3.400,00	9,50	317,00
TO00285	IDROPADANA S.R.L.	energy	energy production	Small	26/04/93	25/04/98	3.200,00	2.300,00	CNT0000769	TO00285UID001	IMPIANTO DI ROURE	Roure	3.200,00	2.300,00	80,00	1.804,00
TO00299	ENEL GREEN POWER	energy	energy production	Small	19/08/36	31/12/10	2.700,00	2.200,00	CNT0000772	TO00299UID001	IMPIANTO DI RORETO	Roure	2.700,00	2.200,00	53,00	1.134,00
TO00563	IDROENERGIA	energy, domestic (surface water)	energy production	Small	01/08/45	31/03/29	3.200,00	2.875,00	CNT0000806	TO00563UID001	CHISONE SUPERIORE	Pomaretto	3.200,00	2.007,00	10,00	260,70
TO00589	SGPOWER S.R.L.	energy	energy production	Small	01/02/17	31/01/02	350,00	350,00	CNT0000807	TO00589UID001		Villar Perosa	350,00	350,00	3,00	10,98
TO00622	VIAARET DAMOUNT SRL	energy	energy production	Small	05/07/85	04/07/15	120,00	120,00	CNT0000974	TO00622UID001	CENTRALE VILLARETTO SUPERIORE	Roure	120,00	120,00	302,00	355,29
TO00624	GAY IRENE	energy	energy production	Small	06/10/87	05/10/17	30,00	30,00	CNT0000975	TO00624UID001		Roure	30,00	30,00	81,00	23,77
TO00626	GOUCHON RENATO	energy	energy production	Small	27/03/82	26/03/12	28,00	14,00	CNT0000976	TO00626UID001		Roure	28,00	13,70	85,00	11,42
TO00628	PITON PIERO	energy	energy production	Small	19/11/87	18/11/17	60,00	30,00	CNT0000977	TO00628UID001		Roure	60,00	30,00	69,00	20,43
TO00983	C.I.O.	energy	energy production	Small	09/03/05	09/03/35	4.000,00	2.750,00	CNT0000826	TO00983UID001		Roure	4.000,00	2.750,00	30,00	808,91
TO05530	ACEA PINEROLESE INDUSTRIALE	energy	energy production	Small	07/02/07	-	110,00	90,00	CNT0302407	TO05530CNT001	ACEA PINEROLESE INDUSTRIALE SPA	Fenestrelle	110,00	90,00	201,98	178,22
TO05545	COMUNE DI USSEAUX	energy	energy production	Small	13/09/07	09/08/29	40,00	25,00	CNT0323686	TO05545CNT001	CENTRALINA SORG. CEROGNE (ACQUEDOTTO POURRIERES)	Usseaux	40,00	25,00	360,00	88,00
TO05916	COMUNE DI ROURE	-	energy production	Small	-	-	-	-	CNT0324339	TO05916CNT004		Roure		2,50		19,00
TO06052	ACEA PINEROLESE INDUSTRIALE	drinkable, energy	energy production	Small	10/08/99	-	236,00	170,00	CNT0324704	TO06052CNT001	CENTRALE INVERSO PINASCA	Roure	236,00	160,00	311,00	487,80
TO06326	CHARRIER FRANCA	-	energy production	Small	10/08/99	10/08/29	-	-	CNT0325247	TO06326CNT001		Roure		1,27		2,98
TO06736	BONINO IGOR ALESSANDRO	-	energy production	Small	10/08/99	-	1,30	0,53	CNT0326057	TO06736CNT001		Pinasca	1,30	0,53		0,89
TO06882	DITTA GILETTA MARIO	-	energy production	Small	10/08/99	-	8,00	1,84	CNT0326327	TO06882CNT001		Pragelato	8,00	1,84		6,60
TO10029	JOURDAN ROBERTO	energy	energy production	Small	30/05/06	29/05/36	4,00	3,80	CNT0332675	TO10029CNT001	CENTRALE INTERRATA	Fenestrelle	4,00	3,80		9,50
TO10216	PITON PIERO UGO CARLO E BARRAL ADA DALIA	energy	energy production	Small	22/01/08	21/01/38	260,00	84,35	CNT0333523	TO10216CNT001	CENTRALE IDROELETTRICA	Roure	260,00	84,35	258,00	213,35

3.2 Farming

Agriculture and zootechny, intended as significant productive activities, are present only in the lower part of the Chisone valley and do not concern the mountain area which is more affected by issues concerning tourism and hydropower production. Our SHARE case study is located in the mountain area of the Chisone valley.

In the Chisone valley agriculture is strictly related to the morphology of the territory, which includes mostly mountain areas with steep slopes, some strips having a moderate gradient and very few fat areas.

The rationalization process of farms resulted in a strong reduction of their number. The mountain nature of Val Chisone allows a type of agriculture which is mostly based on zootechny on extended areas, as the productive features of mountain meadows are much lower than those of the plain meadows.

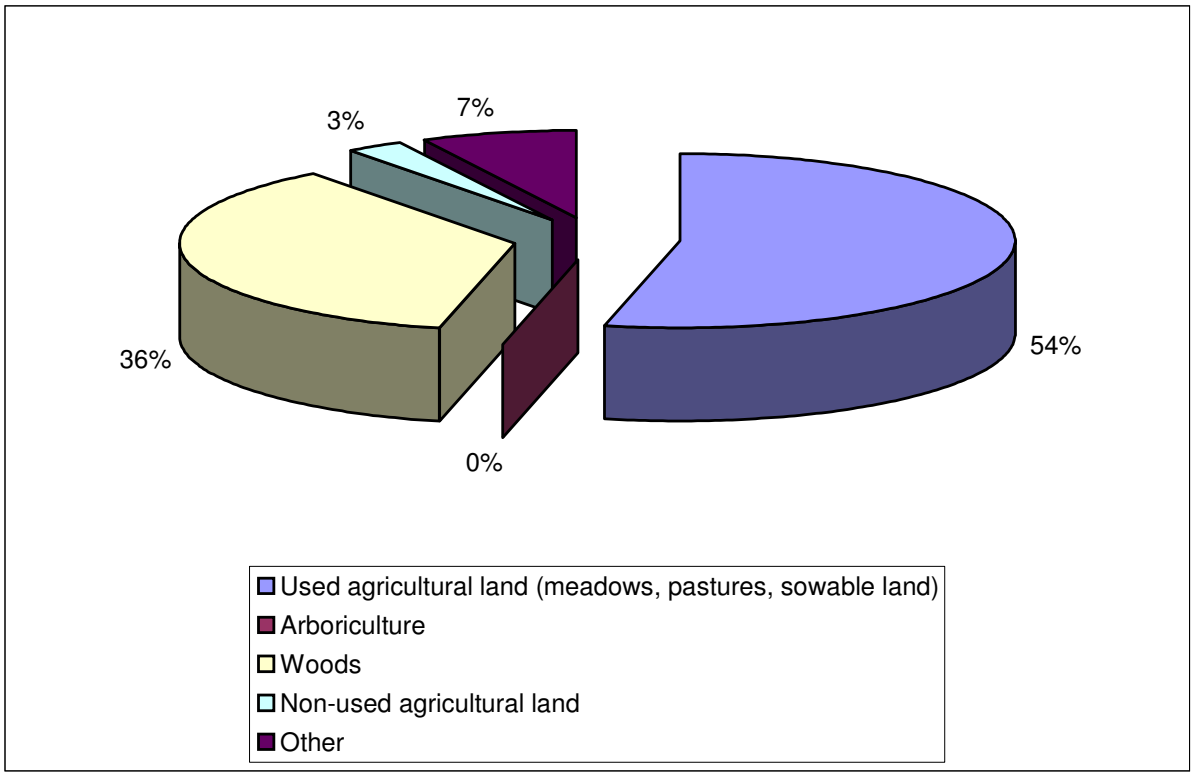
In the higher part of Val Chisone, where some areas are partially unproductive and characterised by phenomena of hydrogeological instability, agricultural activities are declining.

In those areas which are less steep and in the plain ones, agricultural activities are marginal and the product are used up by the producers.

In the last two decades, the agricultural sector underwent a concentration and rationalization process, resulting in a progressive reduction of the number of active farms and workers; in the mountain areas, this has often implied the abandonment of marginal areas and/or productions.

The majority of farms in Val Chisone grow cereals, followed by fruit, fodder plants and vegetables. Most of the farms in the higher part of Val Chisone, which are not many, grow cereals (see Fig. 7).

Fig. 7 – Higher part of the Chisone Valley – Surface (ha) by the different agricultural uses, according to the census done in 2000.



3.3 Factory

The higher part of the Chisone river basin is characterized by little and local industrial activities. No relevant water withdrawals for industrial activities are present in the area, with the exception of the two whithdrawals listed below which are located on the water supply pipeline leading to a plant located in Villar Perosa and belonging to Energie S.p.A.:

Table 11 – Water withdrawals for industrial activities in the higher part of the Chisone river basin.

Land Register Code	Waterbody	Municipality	Type of factory	Water use	Q max (l/sec)	Average Q used (l/sec)	Authorization expiry date
TO00607PRC001	CHISONE	Villar Perosa	SKF - Electric motor manifacture	forge shop cooling	190	178	31/12/2023
TO00607PRC002	CHISONE	Villar Perosa	SKF - Electric motor manifacture	plant cooling	190	178	01/01/2023

The industrial activities listed above are located downhill the area chosen for the case study and therefore they do not have any influence on it.

3.4 Waste discharges

According to the SIRI (Water Resources Informative System) database of the Piedmont Region, on the higher part of the Chisone valley there are the following three industrial waste discharge sites, the location of which is showed in Fig. 8 and 9:

Table 12 – Industrial waste discharge sites in the higher part of the Chisone river basin.

Land Register Code	Waterbody	Municipality	Type of factory	Discharge annual volume (m3)	Discharge frequency	Authorizaton expiry date	Discharge type
TO1506006	CHISONE	Pomaretto	cotton weaving	65000	continuous	21/02/2015	not specified
TO1506009	CHISONE	Pomaretto	cotton weaving	-	-	21/02/2015	industrial
TO1506008	GORA CHISONETTO	Perosa Argentina	fish-breeding	1261440	-	01/09/2013	assimilable to domenstic

As showed, the presence of industrial activities in the Chisone valley is limited and firms are located downhill the study area.

Fig. 8 – Map 1:10.000 showing in red the three industrial waste discharge sites located in the higher part of the Chisone river basin.

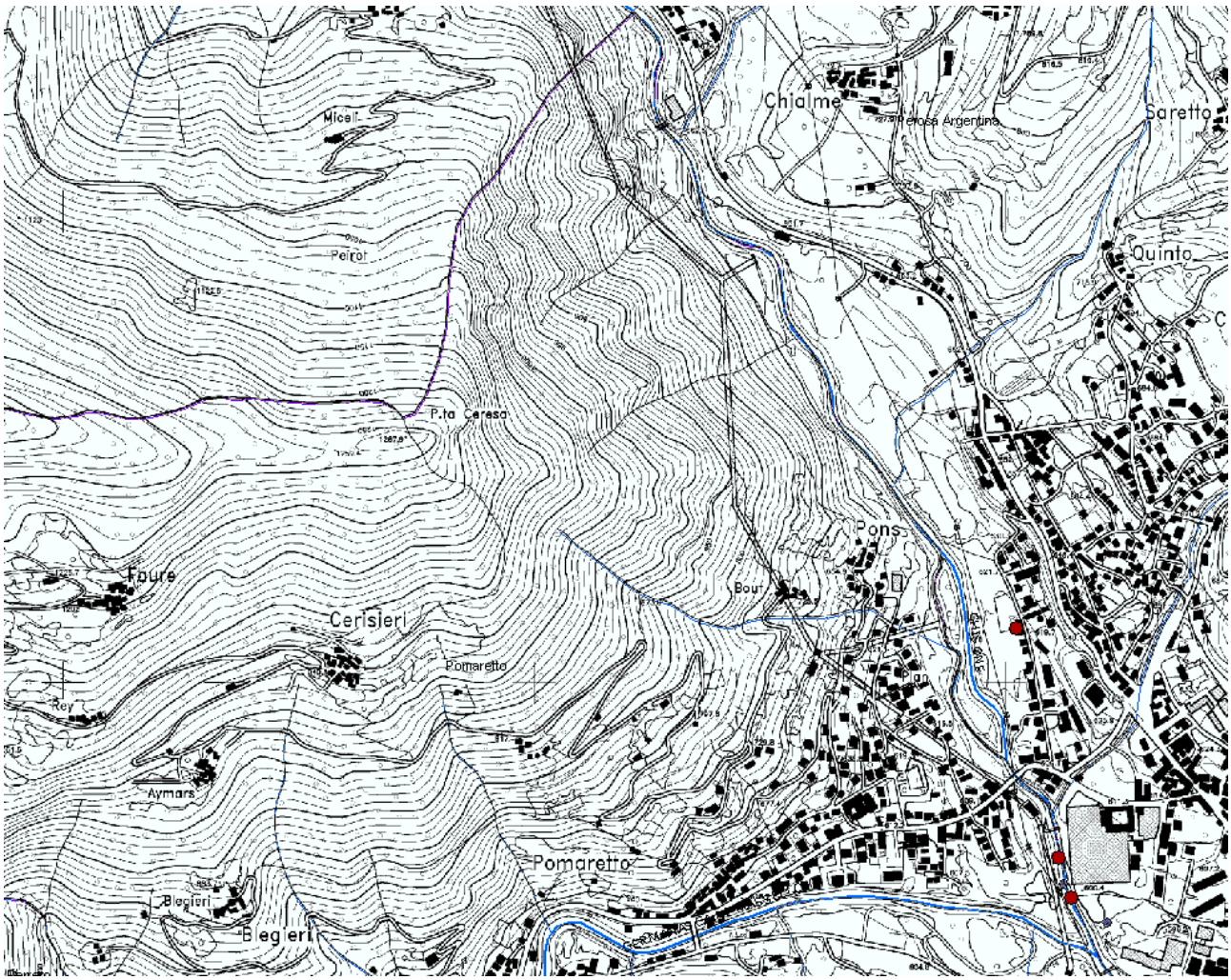
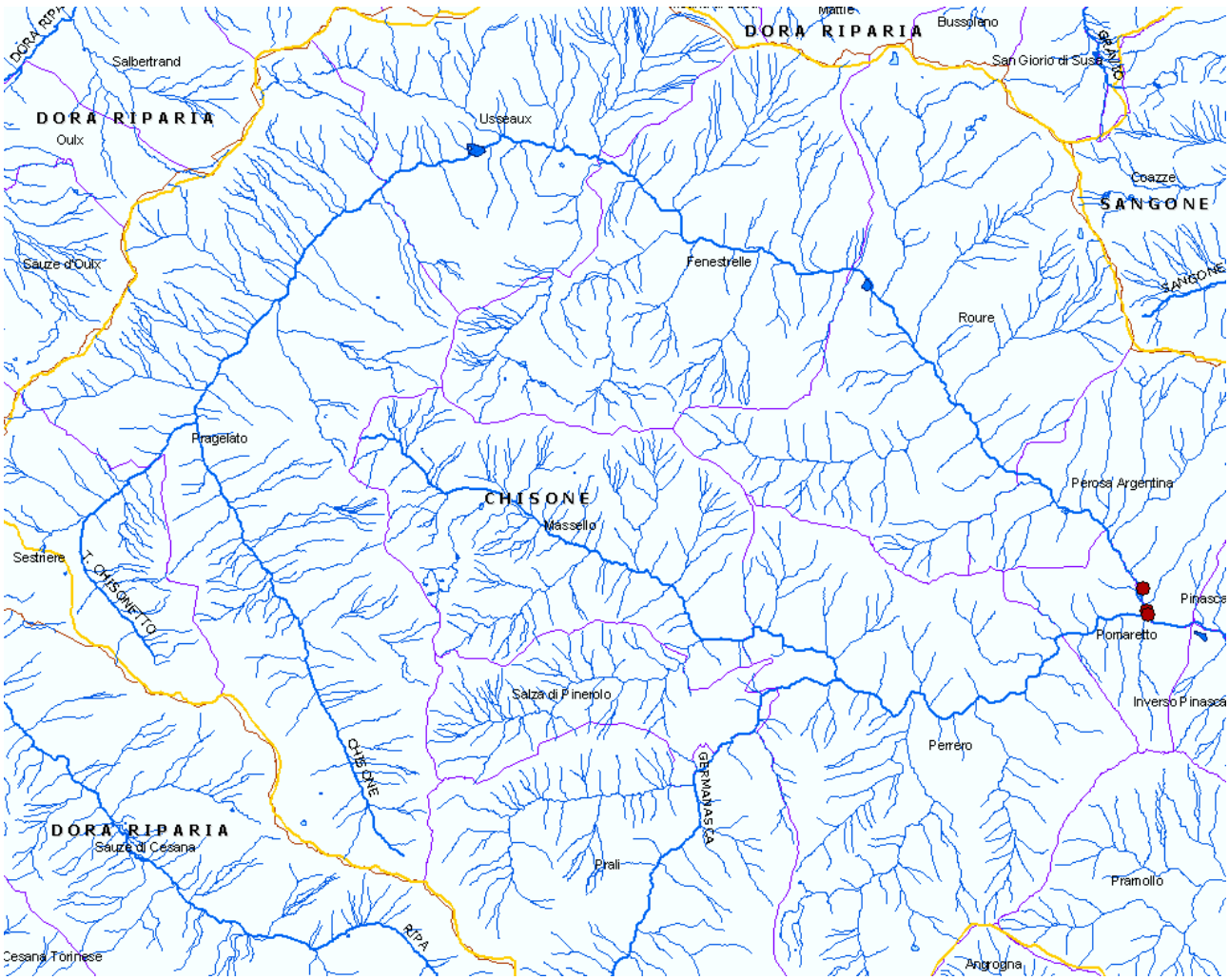
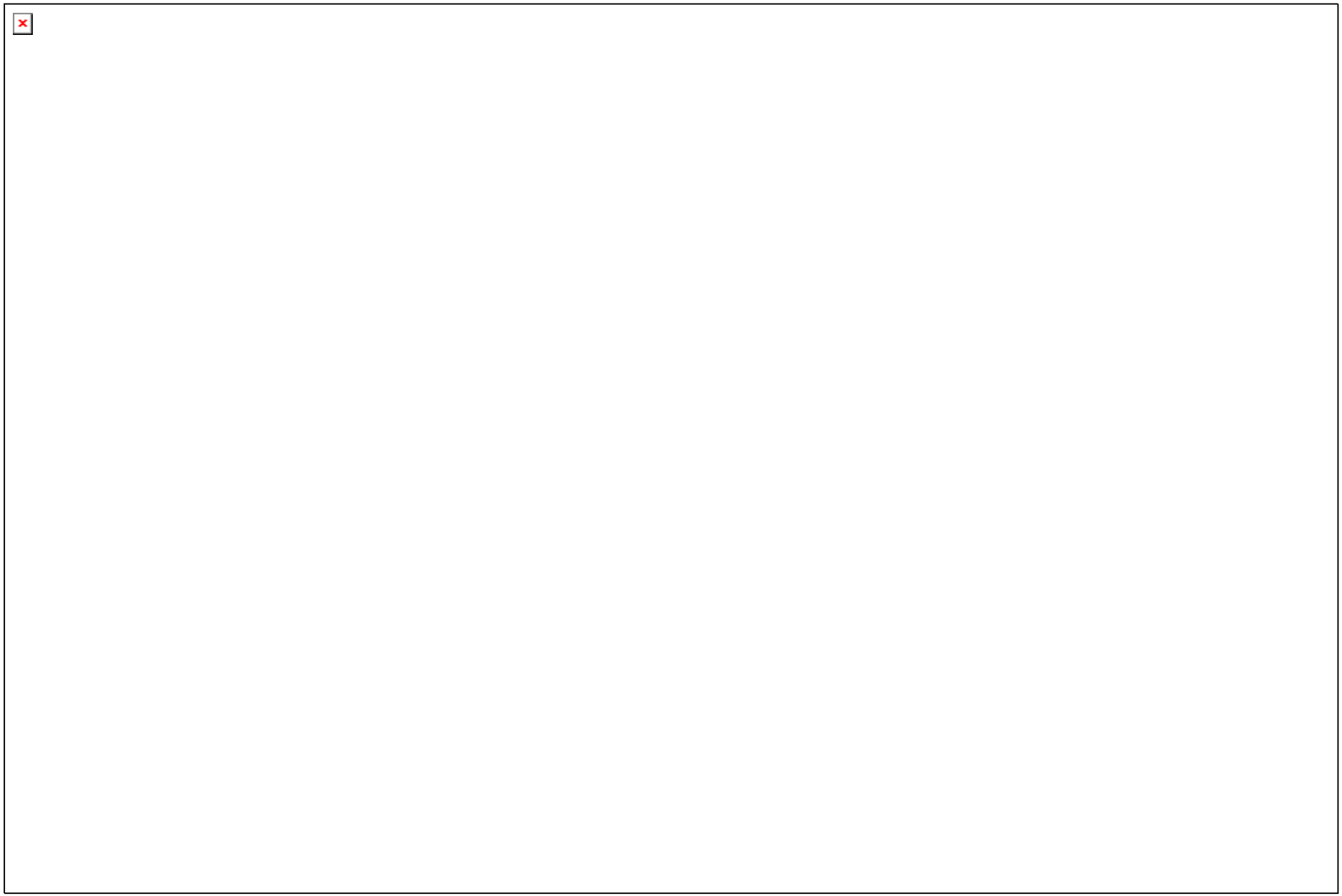


Fig. 9 – View of the higher part of the Chisone river basin. The three industrial waste discharge sites are highlighted in red.



As for the sewer system of the higher part of the Chisone valley, the SIRI database includes records of 20 draining points (with depurator) into the waterbody. They are highlighted in the following figure.
It is currently being built a comprehensive collecting system for the valley; it will allow to discard small and therefore less efficient plants and to bring sewage to the plant located in Pinerolo, the biggest town in the area located at the end of the valley.

Fig. 10 – View of the sewer system and the relevant depurators of the Chisone valley.



3.5 Drinking water

The part of the valley we describe is located in the alpine and mountain area, where the quality of drinkable water is excellent from the source and it is mostly extracted directly from the spring. The SIRI database includes records of 15 wells and 59 springs placed in the higher part of the Chisone valley (with only 3 withdrawals from the waterbody). They are listed below:
Water distribution on the territory is managed by one public waterwork company (SMAT S.p.A.) and, being the higher part of the Chisone valley an area particularly rich in water, water supply takes place mostly through local distribution systems.

Table 13 – List of the wells located in the higher part of the Chisone river basin.

Name	Place
POZZO AMGA	SELVAGGIO
POZZO 1 INVERSO PINASCA	FLECCIA
CHAMBONS	CHAMBONS
POZZO SELVAGGIO	SELVAGGIO
BORGATA	BORGATA
POZZO VILLAR PEROSA	B.TA SOULLIERS
POZZO 3 INVERSO PINASCA	FLECCIA
POZZO 2 INVERSO PINASCA	FLECCIA
POZZO 3 TABONA	TABONA
POZZO 4	TABONA
BOUTAL	VIA BAUDENASCA
POZZO 5 TABONA	TABONA
POZZO 2 TABONA	TABONA
SAN SECONDO P2	MIRADOLO - VIA CARDONATA
P1	MIRADOLO

Table 14 – List of the springs located in the higher part of the Chisone river basin.

Name	Place
LAUX	LAUX
GENEBRE	GENEBRE
INVERS (BABY)	SOUCHERES AUTES
BANCHETTA 2	LA PLA'
COMBA MIAN	COMBA MIAN
SELVAGGIO 3	SELVAGGIO
ENFOUS NUOVA	ENFOUS
GATAUDIA DX	GATAUDIA
FONTANA DEGLI UCCELLI	VALLONE DEL CRISTOVE
GRAN FONTANA	GRAN FAETTO
FONTANIE	FONTANIE
COMBA VILLA BASSA	COMBA VILLA
GIAGIAN	VALLONE DEL CRISTOVE
BANCHETTA 3	LA PLA'
FORNACE	FORNACE
CRUSE'	GRANGIE
SELVAGGIO	SELVAGGIO
RUINA INFERIORE (SERRE)	RUINA
GRAND PUY 4	GRAND PUY
SISES SUPERIORE	GARANELLE

BANCHETTA 4	LA PLA'
GRAND PUY 7	GRAND PUY
PRATO LUPO	COMBA VILLA
PEZZOTTIN 1	PEZZOTTIN
AIGUILLES 2	AIGUILLES
VAUTE DI CHEREUGN 1	CHEREUGN
SELVAGGIO 2	SELVAGGIO
SORGENTE CHEZAL	CHEZAL
GRANGES	GRANGES
ENFOUX DX	ENFOUS
TRONCEA 1 (CROCE ROSSA)	TRONCEA
SINQUET	MOUFLIERES
CHAMBONS	CHAMBONS
PEYROT	PEYROT
BALMA	BALMA
AIGUILLES	AIGUILLES
VALLONE LAUX	VALLONE LAUX
BANCHETTA 5	LA PLA'
PEZZOTTIN 2	PEZZOTTIN
ENFOUS SX	ENFOUS
AREA ATTREZZATA	SELVAGGIO
VAUTE DI CHEREUGN 2	CHEREUGN
GATAUDIA DX	GATAUDIA
BANCHETTA 1	LA PLA'
MERCOURION	MERCOURION
LA ROGNOSA	ROGNOSA
RUINA	RUINA
GRAND PUY 2	GRAND PUY
TRONCEA ALTA	TRONCEA
ALLEVE'	ALLEVE'
CARABASSA	VAL TRONCEA
FOURNETTA	FOURNETTA
TRONCEA BASSA	TRONCEA SUD
LA VAL 1	SEYTE
SEYTE DX	SEYTE
GRAND PUY 1	GRAND PUY
SEYTE SX	SEYTE
BOCCAC DA BON INF.	SOUCHERES BASSES
BOCCA DA BON SUP	SOUCHERES BASSES

Three water withdrawals are used to provide drinking water:

Table 15 – List of the water withdrawals located in the higher part of the Chisone river basin.

Name	Place
LA LOSA 1	MONTE ROGNOSA
LA LOSA 2	MONTE ROGNOSA
FORNETTA LENDINIER	FORNETTA

Details of the waterworks locations with the relevant water treatment plants are shown in the figure below.

Fig. 11 – View of the waterworks system with the relevant water treatment plants in the Chisone valley (use the zoom function to see in more detail).

3.5 Touristic fruition

The presence of important tourist resorts such as Sestriere and Pragelato make the Chisone valley an important place for winter tourism. In February 2006 Pinerolo, Pragelato e Sestriere hosted many competitions of the XX edition of the Winter Olympic Games.
Many fairs and markets take place in Val Chisone to promote typical local products, many of which are from the cheese food chain.

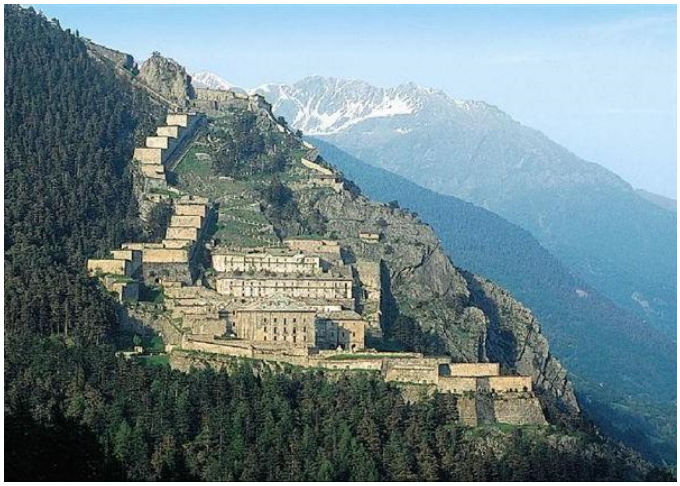
One fifth of the Chisone Valley belongs to regional natural parks. The main ones are:

- Orsiera Rocciavrè Park: its area of about 11,000 ha is located in the Chisone, Susa and Sangone valleys, and its altitude varies between 1,000 mt and 2,880 mt a.s.l.(Monte Orsiera). This territory was only marginally involved in mass development activities and today it represents a place where nature is almost untouched and where human presence is defined by pastoral activities, extensive mountain agriculture , many villages, ancient historical handmade buildings (e.g. Forte di Fenestrelle) and archaeological sites. Local fauna is very interesting as it includes chamois, roe deers, deers, wild boars, mouflon, steinbocks and wolves.
- Val Troncea Natural Park: it is included in the Troncea valley and it covers an area of 3,280 ha with unblemished mountain territorier where the Chisone river originates. The park has specific geological features as it is constituted by rock formations which summarise the genesis of the Alps: coral formations first, than clay and carbonates sedimentations which were transformed in calcschists, marls and dolomites, alternated by green schists; they were then pushed up to 2,000 mt a.s.l., by the African and Eurasiatic plates moving closer. By the Bet col, there are ancient mines of chalcopyrite, used at the end of the XIX century to extract cupric minerals.

The high quality alpine and mountain setting of the Chisone valley promotes sustainable tourism in both winter and summer. However, in the higher part of the valley, the Sestriere skiing resort is an important feature creating tourism pressure on the territory, especially in the winter periods.
Pressures are not linked to pollution, but to the use of water for artificial snow cover and especially for hydropower production.

The Chisone valley hosts the Fortress of Fenestrelle (Fig. 12), supreme example of a mountain fortress. Less than a third of its extent visible is from below, majestically embracing the Pinaia mountainside with a breathtaking series of titanic steps, batteries and bastions. Conceived by the eclectic genius of Antonio and Ignazio Bertola not merely as a barrier, but essentially as a symbol of resolute Savoyan determination in a time when borders were considered to be inviolable, its cost was justified by the need to defend the newly-established Kingdom of Sardinia from its mighty gallic neighbour following the conclusion, largely in favour of France, of the Wars of the Spanish Succession. With respect for the environment and for its historic roots, the ancient fortress now offers an unforeseen prospect for development, being a cultural setting as well as a multi-faceted precious treasure chest of opportunities.
Other prized areas within the zone are the Pra Catinat holiday centre and the Mentoulles Priory.

Fig. 12 – View of the Forte di Fenestrelle, in the Chisone valley.



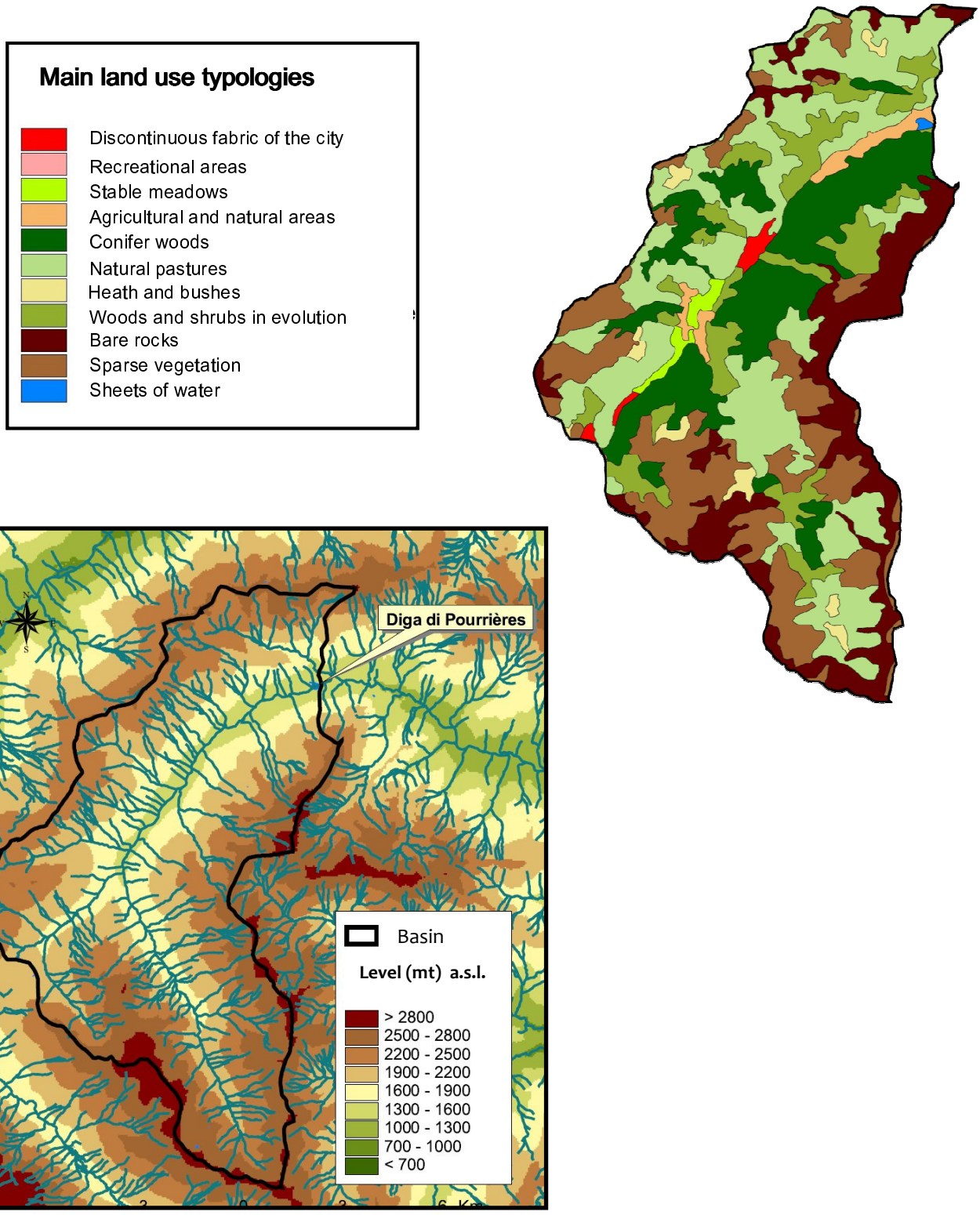
Other important touristic feature of the Chisone valley are the Assietta Road SP173 and the neighbouring Colle delle Finestre Road SP172, witch form the main structure of a road network which is longer than 60 km, often over 2000 meters of altitude and almost completely excavated. It is passed through by cyclists, bikers, on foot and on horseback excursionists, motorized vehicle users (when allowed), from June 1st to October 31st. A careful use and conservation of the road contributes not only to preserve the invaluable environmental landscape resources of Orsiera-Rocciavré and Gran Bosco of Salbertrand protected areas. It also offers the chance to understand a territory and the signs left by its people over the years. In order to enable a proper and sensitive fruition of the users' different needs, each person may promote a "smooth", slow and respectful circulation.

4. Pressures and impacts related to water uses

4.1 Land use

In the alpine and mountain area of the Chisone basin, pressures are not linked to pollution even if there are some anthropic activities which can potentially have an impact, such as the use of water for artificial snow cover and especially for hydropower production. In the area uphill the study site and in the study area itself soil is therefore mostly used for woodlands, pastures, with high presence of abandoned areas which are getting colonized by woods as shown by the land use map (from Corine Land Cover) below.

Fig. 13 – Land use map of the higher part of the Chisone valley with indication of the Pourrieres dam localization.



4.2 Waste discharges

This topic is not particularly important in the area and it was completely dealt with in section 3.4.

5. Restoration and mitigation actions

The activities for the protection, mitigation and restoration of the Piedmontese rivers are in line with the directions of the Water Framework Directive which are included in the Regional plan for Water Conservation (Piano regionale di Tutela delle Acque - PTA), in the Management Plan of the Po River Hydrographyc District (PdG Po) and in its Operative Programme which has to be implemented in order to make the effects of the actions evident by 2015. A summary of the actions which are being implemented in the Chisone Valley are listed in the table below.

Table 16 – Management actions which are being implemented in the Chisone Valley.

THEMES	MEASURES
AGRICOLTURE In the flat part of the basin	Agricultural management aiming at reducing the intake of pesticides/P/N and the livestock load as the area is considered to be vulnerable to nitrates and pesticides according to the laws in force.
	More rational use of N fertilizers. Agricultural soils having high natural value, managed without the use of fertilizers and pesticides. Organic and integrated crop production. Extensive cattle-breeding, soil management practices. Field edges and perennial riparian strips, creation of biotopes/habitat, soil use change, establishment and conservation of orchard meadows.
	In the areas with high water criticality, management of the information deriving from agricultural plans in order to specifically quantify the water requirements of the agricultural year.
HYDROLOGY & MORPHOLOGY	Implementation of the Minimum Intake flow (MIF) and of corrective factors which are positive for the environment. Integration and development of the network for hydrometric monitoring to make it suitable to verify the MIF efficacy.
	General programme for the management of sediments included in the Po Basin Plan.
	Measures for the morphological restoration, to be defined within the framework of the General Programmes for the management of sediments.
	Updating and analysing information about river hydromorphological types and processes (river mobility strips, solid transport balance, detailed topography of the river area and the riverbed, ….)
	Implementation of the Morphological Quality Index (IQM) for the definition of the morphological state.

	Elaboration and implementation of the Programmes for the ordinary maintenance of the mountain and hill areas to guarantee the environmental quality of rivers and basins.
CHEMICAL POLLUTION	Integration and/or acceleration of sewer infrastructures, depurators and waterworks included in planning documents.
	Operative programmes for the development, conservation and selective restoration of water sources collected for drinkable uses.
GROUNDWATER	Re-conditioning (with selective closure of the filters) or closure of those wells connecting groundwaters with deep waters.
PROTECTED AREAS	Operational projects for the conservation of reserve areas and their possible exclusive use for drinkable water.
BIODIVERSITY & LANDSCAPE	Operational projects for the restoration and the protection of rivers.
WATER SCARCITY	Revision of the authorizations, based on the actual irrigation needs.
	Promotion of irrigation management tools, based on climatic and plant parameters, aiming at estimating real crop needs and preparation of the "irrigation criteria" according to EU provisions.
	Infrastructural actions on production techniques and on crop rotation, aiming at rationalising and updating facilities for water delivery and at reducing water use in agriculture.
	Improving checks on water withdrawals during the control and reduction phases of flows which can be withdrawn.
	Improving the efficiency of existing hydropower plants and mitigation of environmental impacts, to be done when the authorization is renewed.