

The Waters of Lake Garda



The Catchment System
and the Condition of the Lake

AZIENDA SPECIALE CONSORZIO GARDA UNO

Since the start of the '70s, the Lake Garda Community, an association made up of the lakeside towns and the provinces concerned (Brescia, Verona, Trent and Mantua), has been responsible for concerns about the state of health of the Lake Garda basin, seen both as a water resource and as environmental heritage, and thus both in terms of tourism and as a drinking water supply. The thorough research which the Irsa-Cnr was commissioned to make showed that although the conditions of Lake Garda are still satisfactory, the first signs of deterioration were nevertheless detected, and so it was advisable to start comprehensive preventive work as soon as possible, also considering that Lake Garda should be considered to be a particularly sensitive and potentially vulnerable ecosystem, as a result of its structural features, connected to a long period of water exchange.

With regard to this, in 1974 the Italconsult company in Rome, commissioned by the Lake Garda Community, drew up and presented their "Basic plan of interventions for depolluting the waters of Lake Garda". This led to the executory plans of two public consortia which had meanwhile been founded, namely "Consorzio Garda Uno" and the "Consorzio della Riviera Veronese del Garda", and their purpose was to start off the constructive implementation of the initiatives.

The part of the Lake Garda shore in Trent province, on the other hand, did not feel it was necessary to form a consortium, both because only two towns were concerned (Riva and Torbole), and because those two towns were already constructing catchment and purification plants on their own.

So it became the responsibility of the Consorzio Garda Uno and the Consorzio della Riviera Veronese del Garda to define the executory plan, search for financing and start off the work, the former for interventions on the Brescian shore and the latter for interventions on the other shore.

The various options were assessed, and the unitary conception of political management was followed at a technical level, too, observing the spirit of an agreement signed in '77 where the two consortia had defined their common aims, to be achieved under the banner of close coordination. The system, serving almost the whole of the Brescian-Veronese catchment basin, bar a few justified exceptions, is essentially based on two collecting subsystems covering the two shores which finally converge

in the large inter-consortium purification plant in Peschiera.

Here it is very important to point out the line of development which the institutions have been taking from the seventies until today, which leads to interesting future prospects.

In the first stage, where the idea was conceived and the political choices were made which have guided us up to today, the main role was played by the Lake Garda Community, a representative body made up of freely associated local organizations. Proposals emerged from this "political laboratory" (such as the constitution of a joint stock company with mainly public capital to manage the sewage and purification service), which widely anticipated today's legislative choices. The lawyer Avventino Frau, a brilliant organizer, distinguished himself in this stage, and he must be given the credit for this important initiative.

The second stage, lasting from the second half of the seventies until today, is characterized by the starting of major contracts, and the reference institution in this case was the Public Authority, which was formed and regulated pursuant to the sole text of the municipal and province law, as the sole structure suitable for the role assigned to it.

But, when the work is completed, it is necessary to manage it, with a more flexible instrument which is less encumbered by bureaucratic superstructures. This new phase is starting today, with law 142 on home rule, which gives precise instructions on the direction to be followed, going through structural alteration (this is today's history) and a profound review of the present consortium structure. The Consorzio Garda Uno was one the first in Italy to follow the instructions of the above-named law and it has been working as Azienda Speciale since 1st July 1994. The very first strategies of the new Azienda were: cutting costs, managing the whole water cycle, using the mud coming from the purifier for farming, energy recovery, also by reactivating disused electricity central units. Moreover, it has been managing the Peschiera del Garda purification plant directly, since 1st January 1995. Just unfeasible plans? Well the big collecting and purification system, too, could have stayed in the "dream book" if concrete initiatives had not followed the initial political debate.

Guido Maruelli

Chairman of the "Azienda Speciale Consorzio Garda Uno"



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The Catchment System and the Condition of the Lake

by Franco Ragni

The uneasiness of the seventies followed two decades of brash optimism, and one of the things we then became aware of was the fact that the energy required by the life processes of an advanced society is not inexhaustible, and could even be costly. It also became clear that water, earth, and air were not invulnerable, and could only tolerate a certain amount of abuse. Environmental damage could be perceived and its effects were already measurable, and it was possible to predict how it would develop. This problem could no longer simply be passed on to future generations.

As far as safeguarding water resources is concerned, this was the period when modern-style legislation was introduced in Italy beginning with law 319 of the 10th of May 1976, the 'Merli' law. Even though this law was imperfect and the result of compromise, it at least had the merit of inaugurating the era when those in power saw water as an asset in itself and no longer as a functional aspect of other processes.

With good timing, the health condition of the largest of the Italian lakes was seen to be a problem at the end of the sixties and was taken on by the 'Garda Community'. This was a voluntary association formed in 1955 by the institutions in the area, the provinces, mountain communities and around fifty of the towns surrounding the lake and in the immediate hinterland, including some along the initial stretches of the river Mincio in the province of Mantova.

Although the 'Community' had no particular powers, it was the ideal body for transforming the stimuli which arose from the initial alarms raised in reaction to the results of local analyses on lake water into an overall view and plan.

The analyses were carried out by hygiene and prophylaxis laboratories in the provinces concerned, because at the time the health services had not yet been reformed and the USSLs (Local State Health Units), which were later to be given a more incisive role as regards environmental problems, did not as yet exist.

The 'Community' commissioned the CNR (National Research Council) to carry out research on the waters of the lake, and the situation according to the ensuing

chemical/physical report was quite good compared with those of other large lakes. However, the report was marked by instances of general malaise and biological pollution that could not be ignored. In 1973 'Italconsult' were asked to produce a feasibility study for the overall cleanup of the catchment basin, and several possible options were defined as a result. Finalizing the project, obtaining the financing required, and starting up the work became the responsibility of the 'Consorzio Garda Uno' for the Brescian shore and of the 'Consorzio della Riviera Veronese del Garda' for the Veronese shore. These consortia were formed in 1974 and 1975, and included the towns, provinces and mountain communities concerned.

The matter was treated differently in the province of Trento, which decided to go it alone for various reasons, including the fact that the geographical area concerned was limited to the two decentralized towns of Riva del Garda and Torbole, the existence of an advanced local purification system, and the fact that the political/administrative bodies concerned had greater powers, autonomy, and financing.

The General Architecture of the System

The solution adopted after the various options were assessed was the most radical one. The unitary conception - with a tendency towards centralization - of political management was followed at a technical level too.

In the agreement which the two consortia signed in 1977, they defined the mutual targets to be achieved through close collaboration.

The system was to serve almost the entire water catchment basin in the provinces of Brescia and Verona, barring a few justified exceptions, and was largely based on two catchment sub-systems running each side of the lake converging on a large inter-consortium purification plant in Peschiera.

The orography of the shores, however, meant that some interruptions were necessary, with fewer of them on the Verona side of the lake, which is more linear, and where they were limited to the obstacle formed by Punta San

Vigilio, and with a more considerable number of them on the Brescian shore, which is more varied in character. This is the reason why the system is isolated in the Limone area, and consists of a small local catchment that is already in operation and of a pre-treatment plant which treats water before releasing it deep in the lake. There will be an autonomous purification plant, but this has neither been financed nor built yet. Tremosine and Tignale also have autonomous systems, although part of the Tremosine area is marginally dependent on Limone on which it borders.

From Gargnano southwards the mid-lake catchment runs along the lakeside, with some sections in underwater pipes, and ends on the south bank of the gulf of Salò. As a matter of fact, waste water from all this area is sent in a pipe under the lake from Toscolano to Punta San Vigilio. Here the waste waters meet the south terminal of the laketop catchment coming from Malcesine on the Verona side. The system, which is now mixed, then runs through another underwater section to Cisano where it connects with the lower lake pipe coming from Garda and running to Peschiera.

The long underwater section from Toscolano was a considerable feat both in technological and economic terms, but the alternative was to construct a waste water pumping system for water from the mid-lake catchment on the Brescia side, which would be situated on the hill of San Felice, which would have been extremely costly in terms of energy. The water could then be put into the Valtenesi catchment system, an isolated system which has various branches into the hinterland before autonomously running down to Desenzano on the lower lake pipe and from there to Peschiera.

In all, there are 134 kilometers of catchment, 19 of which run beneath the lake, and 51 pumping systems set along the route that lift water so that it can then flow by gravity downhill along long stretches. A side view of the system can be imagined as looking like the teeth of a saw. The most important pumping station is unarguably the one at Toscolano, as it is there that waste water is given sufficient impetus to cross the lake for eight kilometers in a double pipe that is up to 250 metres beneath the lake surface and capable of a flow rate of 330 litres per second (it is currently carrying 75 lt/sec). In an emergency, this load can be carried by a single pipe.

Eighteen emergency pipes connected to overflows complete the system, and following pre-treatment, waste water is sent deep into the lake should the main system be out of service for some reason.

The Peschiera Inter-Consortium Purification System

The purification plant was constructed by the Ecotecnica Company in Brescia (work began in 1977) and is spread over 50,000 square metres in Paradiso on the left bank of the river Mincio.

The plant is modular and has several parallel treatment "lines", each of which is capable of covering the needs of 110,000 equivalent inhabitants (a unit of measurement used to define usage needs more accurately beyond the mere number of residents). Three lines are currently operating, and there is a planned total of five lines to cover the needs of 550,000 equivalent inhabitants, which is thought sufficient until the year 2015.

From the very start, the modular basis of the plant gave it the required operating flexibility for two fundamental reasons. Above all, it is able to expand to the ideal size, line after line, as the catchment system evolves. Secondly, it can also respond to seasonal fluctuations, as, although the residential population totals around 150,000, this can swell to half a million during the tourist season. Not to mention the fact that modular construction was virtually the only way of adapting to the predictably gradual way financing is obtained.

The Peschiera plant began operating in July 1981 with a single line at 50% of its nominal capacity of 110,000 equivalent inhabitants, and has gradually gone from treating 3,700,000 cubic metres of waste water in 1982 to the over 25 million/year it treats nowadays. At full capacity, it is estimated that the plant could handle around 35 million cubic metres a year.

The Purification Process

Treatment is carried out in several separate stages. The first or "primary" stage simply consists of the physical removal of any large, heavy or floating objects. The next, or "secondary" stage is biological in nature, and is essential as it reduces the concentration of organic substances in the waste water.

The waste water coming from the primary stage is pumped into "oxidation" vats where it comes into contact with a suitable bacterial flora which can biochemically react with it and neutralize organic substances, resulting in suspended "activated sludge", as it is known. This is then sent to sedimentation vats where the sludge gradually precipitates and is collected.

Part of the sludge is then sent back to the oxidation vats where its bacterial flora keeps the above-mentioned neutralization process going.

Surplus sludge produced during the process is sent to the "stabilizing" vats where it undergoes suitable treatment to make it biologically stable and non-putrescible. The resulting sludge is then dehydrated and sent to a controlled dump. (The possibility of using this stabilized sludge in agriculture is currently being assessed). The purified water, in its turn, undergoes a superior treatment, the "tertiary" stage, where phosphates and nitrates are removed. Dephosphating and denitrification are aimed at limiting "eutrophication", through an excess of nutrients, that the purified waste

waters could cause in the river Mincio, where they are released following a disinfection process.

Energy Recovery and the Flexibility of the Plant

The above description refers to the first section, or “line”, which started operating in 1981 when there was a simultaneous need to achieve quick construction, high performance, and minimum plant expenses. We did not consider the possibility of energy recovery since the size of a single section kept this recovery at an acceptable level. In fact, the process only becomes economically viable on systems guaranteed to have 50,000 to 70,000 equivalent inhabitants using it constantly.

In this case, energy recovery refers to the biological gas, or “biogas”, produced by the anaerobic digestion of the sludge in the absence of air. The process was introduced beginning with the second treatment line, which started operating in 1986. The treatment cycle for this second line is similar to the previously described one, with the exception of the primary stage, which is given greater emphasis, where 25% to 30% of the pollutant content settles out by means of sedimentation before oxidation in order to lighten the load for the successive biological stages.

The resulting sludge, including the “surplus” removed from the liquid at the end of the previously described cycle, is sent to a ‘digester’ where, in the absence of air, it is attacked by micro-organisms which bring about the



The Peschiera purification plant

decomposition of its organic substances. On the one hand, the volume and putrescence of the sludge is reduced, and on the other, the decomposition process produces biogas consisting of 65% to 70% methane and with a heating power of 5,500 to 6,000 kilocalories per cubic metre. It is thus useful for feeding suitable electricity generators, and at present there is a 200 kW/hour generator which contributes towards the needs of the plant and to direct heat production.

A 1,500 cubic metre gasometer acts as a reservoir to the system compensating for and regulating the gas accumulation and distribution stages. Plant productivity is around 15 litres of gas per inhabitant per day, and from 1986 to 1990 around two and a half million cubic metres of gas were produced, in turn enabling the generation of one and half million kilowatt hours of electricity during the same period.

The importance of the system, its ecological nature, and the fact that it is under-used for eight months of the year when it only serves the resident population, have enabled the operators of the plant to offer its services for treating bio-compatible waste water from various other sources. Currently, as well as treating sewage from towns along the banks of the river Mincio, the plant receives and treats waste water arriving on tank trucks from cesspits, percolation from dumps, effluent from food industry processes, and waste water of vegetable origin from olive processing.

The Remote Control System

The centralization process obviously also included a control and supervision plant serving the entire system. Centralization was the only way the quality of the process could be controlled, using an 'intelligent' system, in economically feasible terms.

The system is structured so that all the processes taking place on the network and all the equipment "in the field" can be supervised uninterruptedly. It is based in the control room of the inter-consortium purification plant in Peschiera, where two computers split the work but always dialog with each other.

Each possesses the necessary redundancy for taking complete control of the system, including the purification plant, should the other computer be out of service.

Signals regarding the pumping stations on the Brescia side of the lake are remote controlled.

Work in Progress

"Garda, the poisoned lake", "Garda the bluest of lakes is now bluer than ever". Two very different headlines picked almost at random and both explicitly referring to the same

lake, but, reading between the lines, referring to the purification plant we have been discussing here.

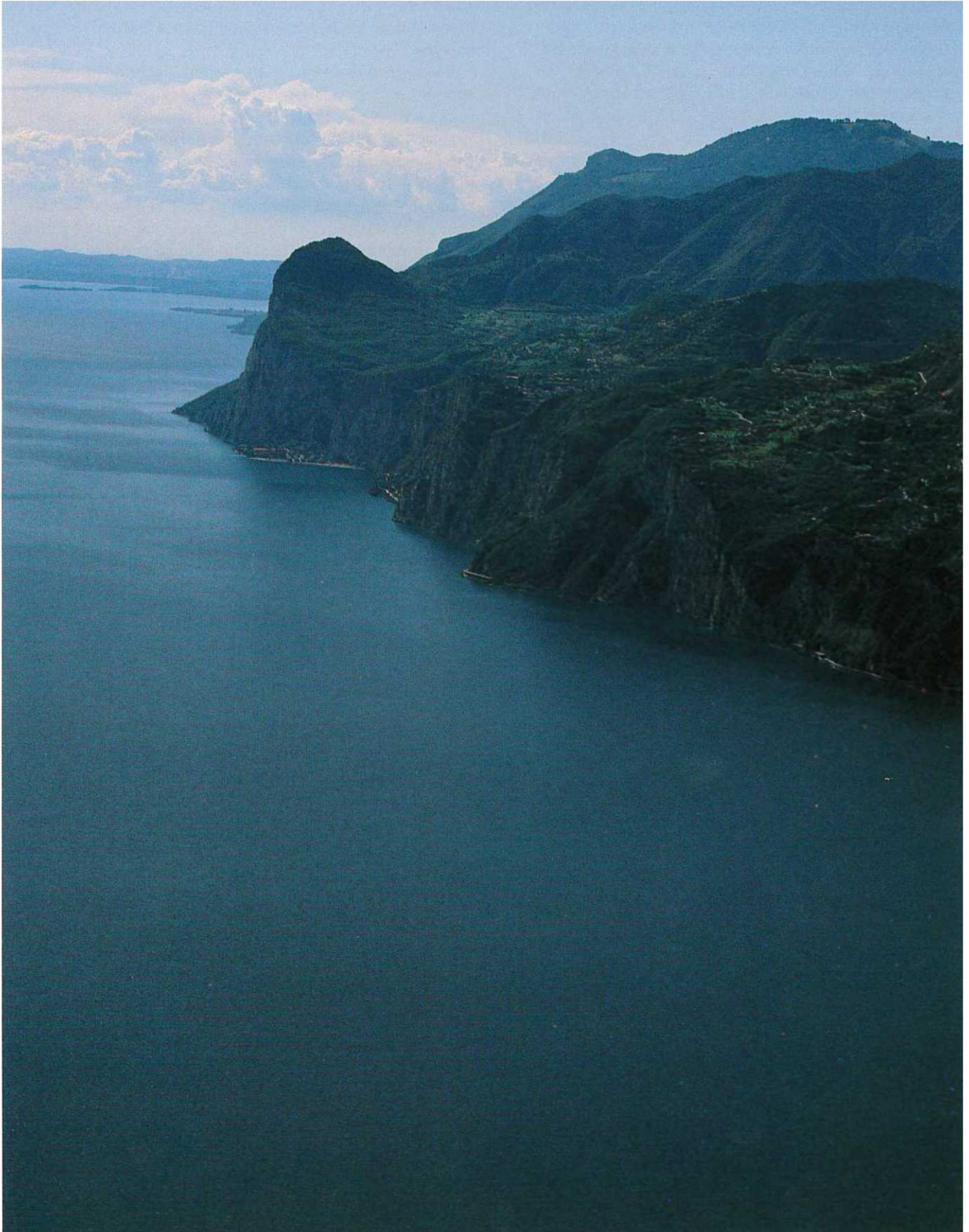
Detractors and critics alike all seem to be able to agree on one point, and namely that the system should be completed. Even the old arguments about the system being too unitary and centralized have died away. The reasoning behind the plant, the possibility of economically supervising the system whilst maintaining high quality standards, only made possible by centralization, the possibility of obtaining considerable energy savings, the possibility of concentrating other ecologically compatible activities in a sole final treatment centre, have stood the test of time.

As regards the effectiveness of the work carried out so far, debate has been heated and at times even virulent. On the one hand, the official results of periodic analyses carried out by Local State Health Units 25 and 40, and investigations into the condition of the lake carried out by the University of Milan in 1988 and 1990, in both cases give reason for comfort and show that the situation is gradually improving. On the other hand, there is a campaign of counter-analyses and counter-information conducted in the main by environmental associations.

However, it is not hard to imagine why a public work of such size should find itself at the centre of a storm of debate, frequently echoed in the press, in a sort of war of press releases and conferences, accusations, condemnations, and absolutions. Public opinion, both national and international, is caught in the middle of the debate. Disorientated and misinformed, partly because of the difficulty in co-ordinating decision-taking and operation levels, public opinion has been subjected to considerable tension and verbiage, particularly on the Verona side of the lake, where local controversies and splits between and inside the political parties seem to have greater weight than on the Brescia side. All this, together with instances revealing a lack of conviction at a local administration level (see below) and insufficient work aimed at improving public awareness, has contributed to the fact that a realistically positive image of the plant and its potential has never been properly constructed.

The works of the consortia have so far totalled 150 billion lire, and by the end of the plan should reach just over 200 billion lire. This figure is closer than it would at first seem to the original 24 billion maximum estimated by Italconsult back in 1973, if the ever changing real value of money is taken into account, along with the fact that no money was actually received until towards the end of the seventies, and the first financing of reasonable size were the FIO funds received in 1982.

Some important works are still to be carried out before the activity of the consortia can be considered complete. First of all there is the complete doubling of the catchment on the Verona side near the lower lake. At present, its capacity is far below that required to treat the joint flow coming from the Malcesine - Torri area at the



top of the lake and from Toscolano (Brescian mid-lake catchment plant) - via underwater pipes. Both these branches are in fact forced to operate at low capacity, especially during peak periods. In particular, when rainfall is heavy, overloading with storm sewage is such a problem that for the moment the entire system north of Punta San Vigilio, situated mid-lake on the Brescia side and at the top of the lake on the Verona, side is isolated and forced to dump water into the lake, albeit in a more protected fashion than in the past, for the duration of the event. Moreover, two more treatment lines at the inter-consortium purification plant in addition to the three existing lines, and the purification plant at Limone still remain to be constructed.

The biggest problem, however, is encountered outside the control of the consortia. On both banks of the lake insufficient efforts are being made to complete and upgrade the internal sewer network, an indispensable requirement for triggering the entire cycle, and in some cases action is simply avoided. One possible justification for this state of things, which all too often becomes a mere excuse, are the undoubtably heavy costs borne by the town councils.

As regards the town drainage networks, there is a virtually confirmed general tendency towards using a mixed system for rainwater and sewage as this is less costly, although it does mean that when rainfall is heavy, great demands are made on the network and pipes must be suitably large. On the other hand, there do not appear to be problems at the purification end as a result of these variations in sewage dilution levels.

Conclusions

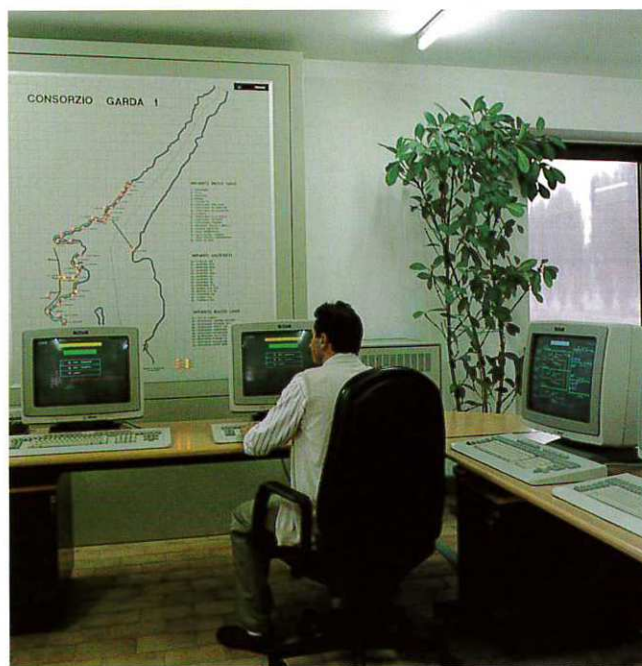
The immediate future will surely see institutional changes of some interest. There has been a debate for some time, for example, about whether to set up an authority for the basin granted with effective powers, and about whether a single managing body should be introduced for the entire colossal system. Similarly, the need that has been felt for some time for a permanent scientific "observatory" to check on the condition of the lake may finally be resolved.

Apparently, a short term inter-regional agreement between the consortia is also on the negotiating table. The agreement is aimed at creating forms of operational and economic support to supplant the up until now insufficient efforts made by many towns with their drainage networks, which by being delayed or not constructed at all, threaten to nullify all other efforts made at a consortium level.

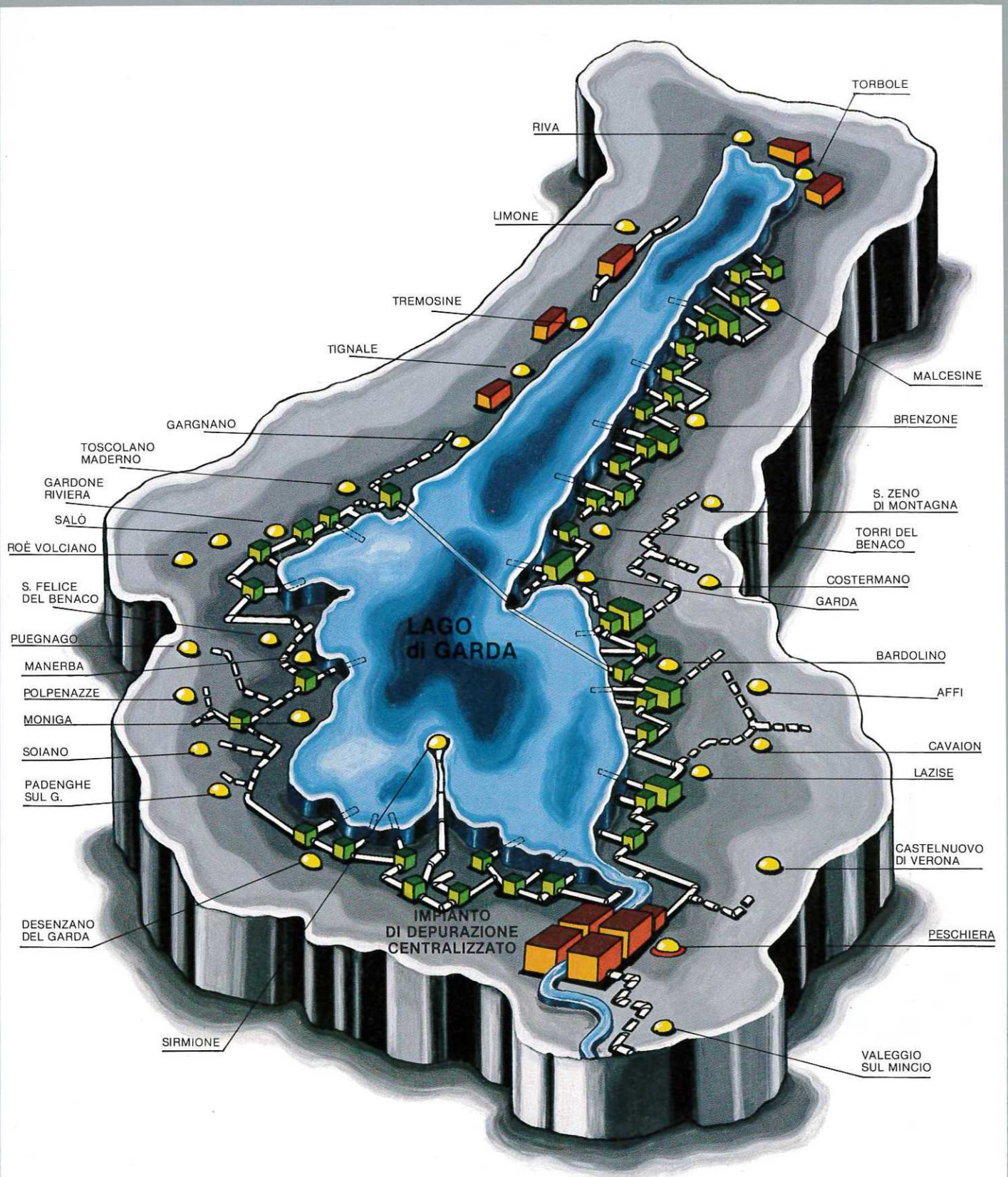
Meanwhile, Sommerservice, an information agency mainly aimed abroad, is operating in the Garda Community, distributing real and unequivocal information concerning the safety of bathing in the lake,

in an attempt to allay the perennial uncertainties of the often and inevitably-bewildered central European tourists.

If it is true that strong unitary management would in theory have co-ordinated the complex stages of the plan more effectively and faster, then it is also true that the real situation to be faced "in the field", as opposed to on the drawing board, is that of a fragmented and non-unitary area, and that it was here that one of the few examples, if not the only one, in Italy of a large public operation was actually started, despite the dizzying array and complexity of political and administrative competences at every level and of every type. The moment has now come to rationalize its management, as the nature of the system itself requires, and to complete it within a short space of time.



The control room at the purification plant



A schematic view of the catchment and purification plant for the waters of Lake Garda