

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Journal of Hydrology: Regional Studies

journal homepage: www.elsevier.com/locate/ejrh

The Genevese transboundary aquifer (Switzerland-France): The secret of 40 years of successful management[☆]



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ARTICLE INFO

Keywords:

Transboundary aquifer
Aquifer management
Geneva
Shared water resource
MAR

ABSTRACT

The Genevese aquifer is used for the supply of drinking water harnessed from ten wells on the Swiss side and four on the French side. During the 1960s and 1970s, overpumping lowered the groundwater level by more than 7 m, thereby depleting about one third of total groundwater storage over a period of 20 years. While technical and scientific studies were being undertaken to resolve the problem of over exploitation, including possible artificial recharge of the aquifer, negotiations were being conducted with various local and national authorities in France. The aim was to engage in a collaborative effort to fund the work and to establish a joint water management system.

This paper will focus on a 40-year assessment of a cross border committee, the identification of the roles and responsibilities of each side and the financial modalities governing the use of the resource. The agreements signed in 1978 and in 2007 attest to the success of the joint management plan.

1. Introduction

Lake Geneva and Genevese groundwater provide drinking water to nearly 700,000 inhabitants of Geneva and the neighbouring French region. The groundwater, which is shared by the commune of Geneva, Switzerland, and the department of Haute-Savoie (Upper Savoy), in France, is exploited on both sides of the border thanks to ten water catchment wells in Switzerland and four in France. In the 1960s and 70s, the groundwater level fell drastically because of the vast amount of pumping that was being done in an uncoordinated fashion by distribution and user entities in Geneva and across the border in France. Wells that had gone dry had to be closed. This was when the first technical discussions took place both in France and in the canton of Geneva to find solutions that would curb the over exploitation of Genevese groundwater. In an effort to preserve this shared resource, political leaders, as of then, began to consider artificial groundwater recharge. The idea was to regain exploitable levels of groundwater, in the first instance, and then use the common resource as a large seasonal reservoir to be used in the summer months when demand was highest, from reserves built up during the winter by artificial recharge from the Arve River.

Although artificial recharge of the Genevese transboundary aquifer has proven its usefulness since 1980, alongside the technical research and development, negotiations on the organisational, administrative, financial, legal and political aspects have also been developed within the cross-border context so as to achieve consensus and jointly manage and protect the transboundary aquifer in an efficient and pragmatic manner. The various stages of this endeavour are outlined here and explain why the Franco-Swiss Genevese aquifer is still a rare example of bilateral agreement on the management of a transboundary aquifer system.

[☆] Special Issue on transboundary aquifers to the Journal of Hydrology: Regional Studies

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<https://doi.org/10.1016/j.ejrh.2018.02.003>

Received 12 July 2017; Received in revised form 5 February 2018; Accepted 11 February 2018

Available online 08 March 2018

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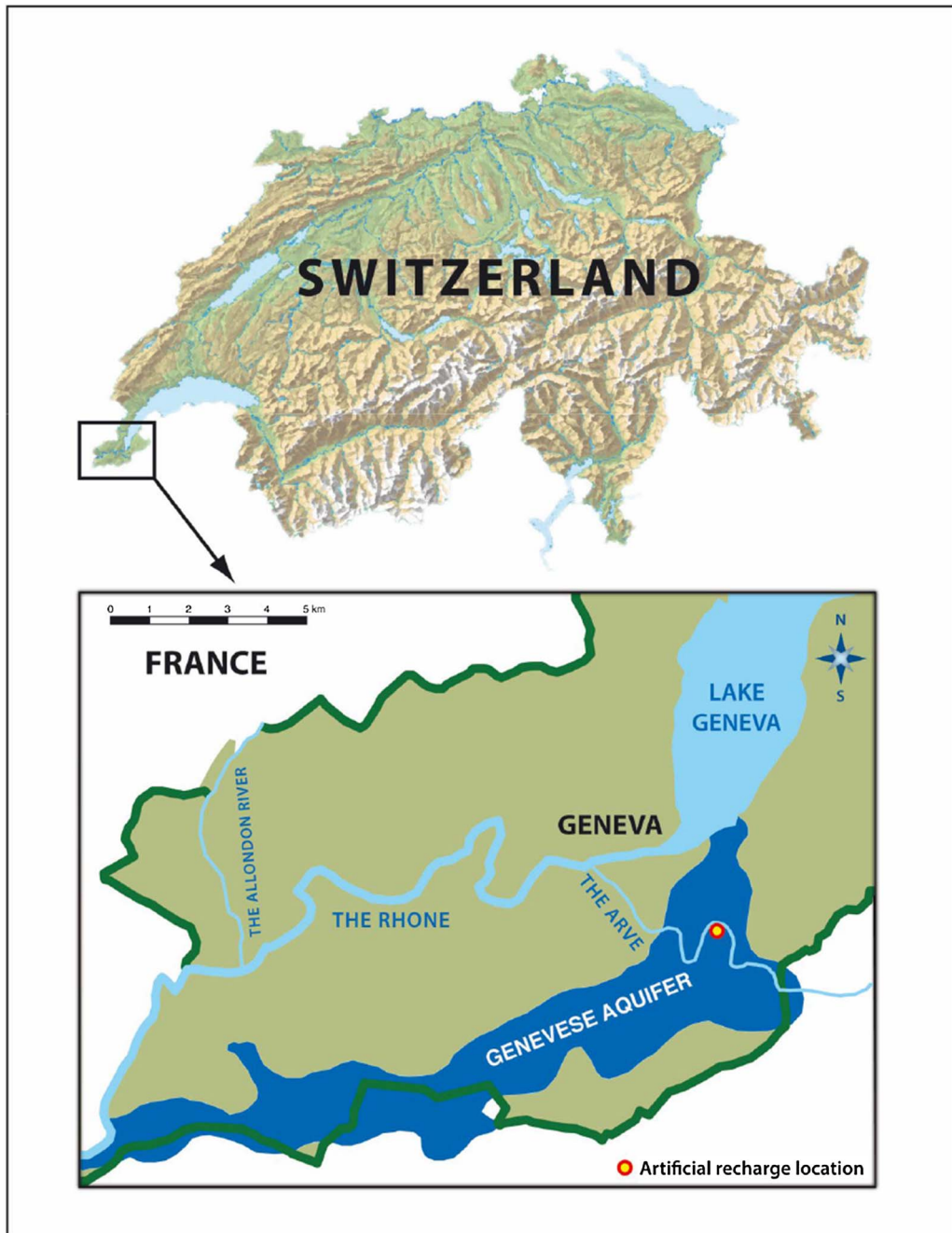


Fig. 1. Location of the Genevese aquifer.

2. Location of the Genevese aquifer & geology

The Genevese aquifer extends over 19 km, between the Lake of Geneva and the Rhône River on the western side of the canton of Geneva (Fig. 1). Its width varies between 1 and 3.5 km. The aquifer lies partly across the French border. Waterlogged gravel may reach up to 50 m. Depending on topographic conditions, the average water level may range between 15 m and 80 m deep.

The aquifer is made up of silty-sandy gravel of glacial and fluvio-glacial origin (Wurm), lying directly on the molasse formation, which is considered to be the impermeable substratum.

This aquifer formation is overlaid by a clayish Wurmian moraine which reduces meteoric water infiltration, but which has the advantage of providing natural protection. The Darcy permeability of the aquifer is around $1\text{--}2 \cdot 10^{-3}$ m/s, but it could reach up to $5 \cdot 10^{-7}\text{--}3 \cdot 10^{-2}$ m/s.



Fig. 2. Location of the wells (drinking water supply) in the Genevese aquifer (water flow directions are from river Arve to the lake and to the west part of the canton).

As a transboundary aquifer, the Genevese aquifer is used for supplying drinking water from 10 wells on the Swiss side and 4 wells on the French side (Fig. 2).

3. Historical background

Between 1940 and 1960, groundwater management of the Genevese aquifer was very close to the average sustained yield ($7.5 \text{ M m}^3/\text{year}$). The groundwater level slowly fell without serious effect. Between 1960 and 1980 the aquifer became overused with withdrawal rates of up to $14 \text{ million m}^3/\text{year}$ in 1971; almost twice its potential yield. This over pumping lowered the groundwater level by more than 7 m in 20 years, depleting total groundwater storage by about one third (Fig. 3).

Consequently, an urgent hydraulic management became necessary in order 1) to consider a decrease in withdrawal rates by using another water resource, which required the construction of a new water filtration and treatment plant in the lake; and 2) to reinforce the natural capacity of the groundwater through artificial recharge.

The choice between the two possibilities was difficult; on the one hand, a well-known and controlled technology, on the other, artificial aquifer recharge, which was still a considerable technical and political challenge at the time. The choice was governed by two criteria: water supply security and economics. Water security would require diversifying the water resources to maintain water distribution in case of a mechanical breakdown or serious contamination of the resource. The cost of a new water treatment plant in the lake, with the necessary modifications to the water supply system, was approximately 150 million Swiss francs (as at 1975). The cost of a groundwater aquifer recharge (MAR) system, including an automatic laboratory system for pollution detection in the Arve River, was around 20 million Swiss francs.

The decision was then taken to set up an artificial aquifer recharge plant to recover use of the wells and take advantage of the large volumes of water that could be stocked from the Genevese water table. An artificial recharge system was, therefore, inaugurated in 1980 to abstract water from the Arve River – which is the aquifer's main natural recharge source – and channel it into the aquifer. This operation, effected via drains that are laid underground above the aquifer, ensures the maintenance of high groundwater levels as well as seasonal stockpiling of the drinking water resource (Fig. 4). The system has been described in previous articles on artificial recharge (de los Cobos, 2002, 2009)

4. Administrative management and policy

4.1. The cross-border approach

Although the artificial recharge plant has been functioning satisfactorily since 1980 and rapidly proved the efficiency of

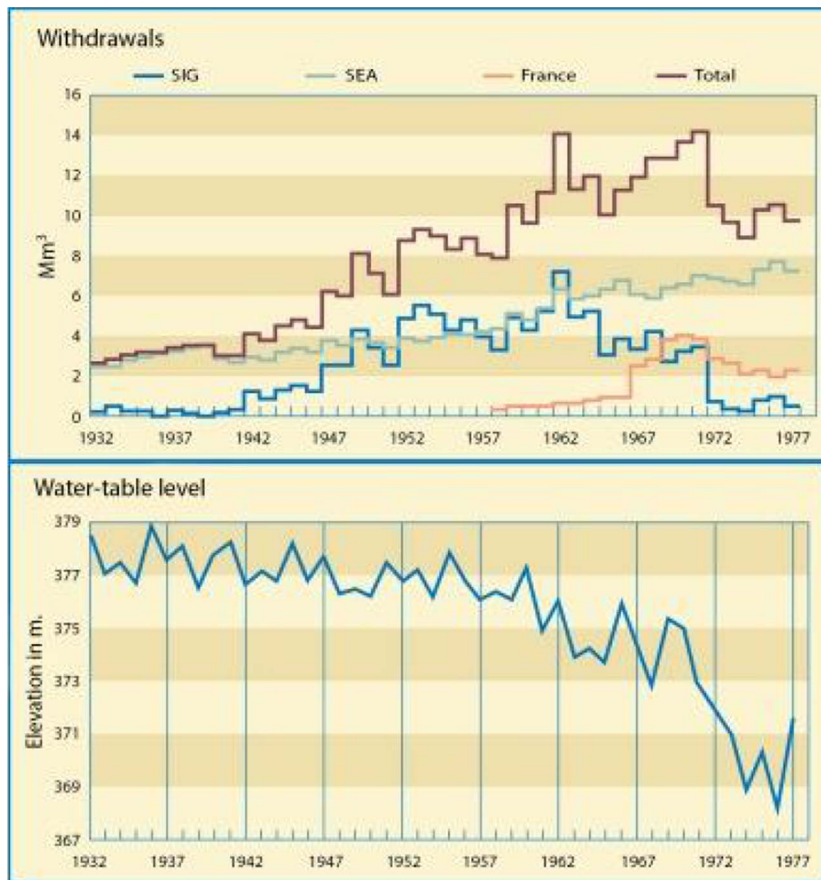


Fig. 3. Impact of the withdrawals on the groundwater table from 1932 to 1977.

seasonally storing water in the aquifer, it was only after many years of careful thought, tests and experiments on the ground to come up with appropriate techniques and systems that a successful artificial recharge system was established (de los Cobos, 2012).

The political will to develop a cross-border project emerged naturally in parallel with the studies and tests that were carried out on the experimental plant. Indeed, although roughly 90% of Genevese groundwater is located in the canton of Geneva, the remaining 10% is to be found across the border in France. In the 1970s, water distribution in Geneva was in the hands of two water companies (Société des Eaux de l'Arve (SEA), and Services Industriels de Genève (SIG)), whereas on the French side a number of wells were exploited by various communities or syndicates.

On the Geneva side, there are two different water sources: the lake (SIG) and the aquifer (Société des Eaux de l'Arve) which use the same network.

Several meetings and discussions were held alongside the studies and drafting of agreements in order to:

- Impose restrictions on use for as long as the diminishing groundwater, threatened with total depletion, was not recharged artificially;
- Establish equitable cost sharing once the recharge plant was completed and operational and would then be of mutual benefit to users on both sides of the border.

From the time the first Franco-Swiss meetings were held in 1972, it was noted that groundwater resources had shrunk dramatically and continued to do so. The problem not only affected Geneva but the entire adjoining French region as well.

Between 1973 and 1974, efforts were focused on drawing up an inventory of drinking water resources in the region as well as on hydrogeological issues, such as losses, natural recharge, future pumping and fees, and a whole range of factors that needed to be considered in laying the bases of a future Franco-Swiss agreement.

On the French side, the authorities were faced with various scenarios:

- The aquifer is left to deplete itself

Geneva centres its approach on lake water. The French base their approach on their own resources or purchasing water from the

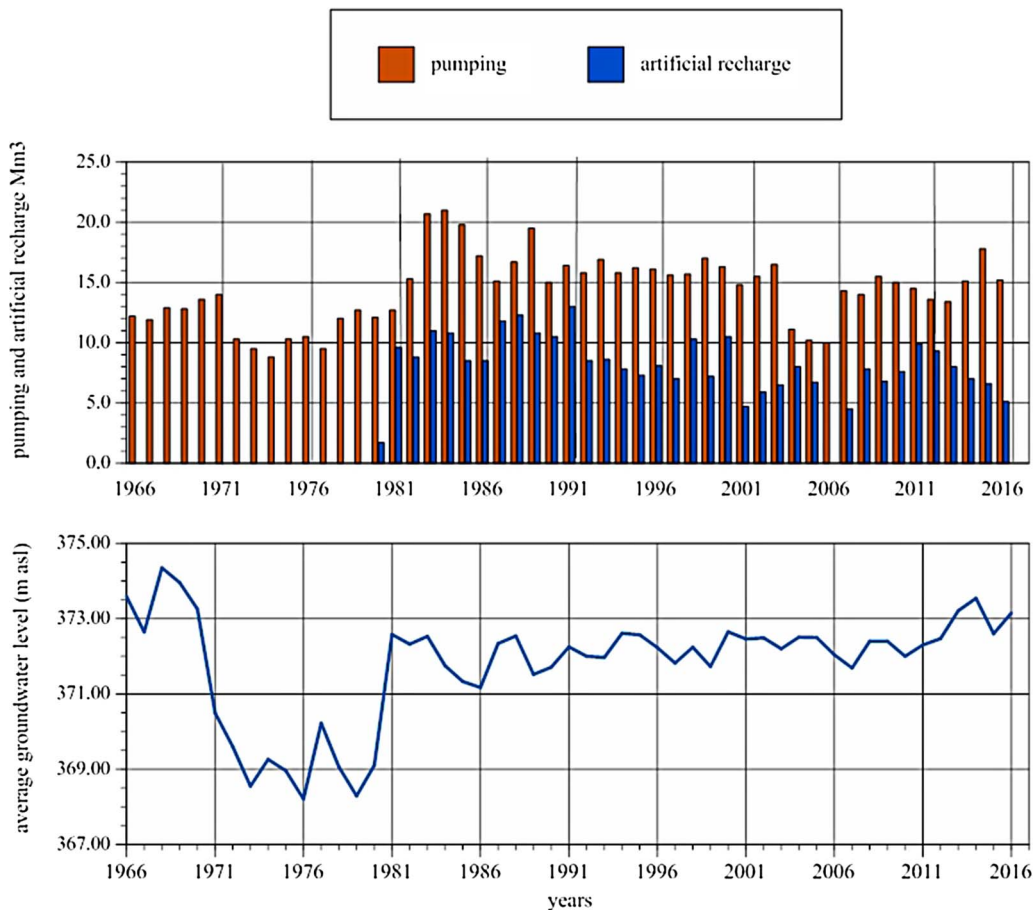


Fig. 4. Impact of the artificial recharge (MAR) on the Genevese water-table.

Swiss. This is an acceptable solution for the French if the resource which has recently been discovered in the region of Nangy (Upper Savoy) is usable (Arthaz aquifer).

- Recharge of the aquifer only by Geneva

- a) The French do not participate. The aquifer management is carried out primarily as a function of Swiss wells with the risk that the French wells run dry. Studies on the Arthaz aquifer have become a top priority for the French.
- b) France participates through a concession tax which compensates for the cost of the water. Aquifer management then focuses on a return to original levels. The cost of the water is attractive for the French as long as it does not exceed operating costs for pumping at Arthaz.

In 1975, the French declared that they would no longer use Genevese groundwater and would be turning to other French resources but wished to retain the possibility of later participating in and benefiting from artificial recharge. This decision certainly had an impact on cost coverage because, although SIG pursued their minimum extraction policy, the financial burden fell onto the shoulders of Société des Eaux de l'Arve, which pumped exclusively from Genevese groundwater. It was envisaged that the cost of artificial recharge (depreciation, interest, usage and renovation costs) would be spread among all groundwater users, irrespective of the origin of the water; whether natural or artificial recharge. The artificial recharge fee per cubic metre of water extracted could be less than 0.07 Swiss francs when the annual volume of water pumped was in excess of 20 million m³. However, the fee could rise to 0.12 Swiss francs or more if the volume of water pumped was less than 10 million m³.

As of 1977, artificial recharge benefits for users were decided as follows:

- *Société des Eaux de l'Arve (SEA)*: The company could continue to expand its network without having to seek out other resources (purchase of water from SIG or construction of a water pumping station to extract water from the lake).
- *SIG*: The company could exploit all the existing pumping wells (100,000 m³/day) and not have to build a new plant for treating lake water (100 million Swiss francs) that would only be used for a few weeks of the year.

- *French communities*: If necessary, the French communities could extract supplementary amounts of water and pay their share of the costs beyond the annual minimum allowance of 2 million m³, which corresponded to the volumes they extracted before artificial recharge was introduced.
- *All users*: Reserves of 15 million m³ of drinking water would be stored in the best possible conditions (underground) to be constantly available in the case of acute shortage in one of their other plants.

Finally, a 30-year arrangement between the State of Geneva and the department of Haute-Savoie (Upper Savoy) in France was signed on June 19, 1978.

4.2. Description of the 1978 arrangement

The main reason for the agreement reached between the State Council of the Republic and the canton of Geneva, on the one hand, and the Prefecture of Haute Savoie (Upper Savoy), on the other, was “the need to establish a system for joint use of Genevese groundwater so as to protect that natural resource and preserve its water quality” – a rationale that proved to be justified from the very start of the arrangement.

The arrangement covered the following aspects:

- The exploitation committee

With articles on its composition, mission and functioning. The main characteristics of the committee are outlined below.

- The annual aquifer management programme

The mandate of the committee is to propose the yearly management programme of the Genevese aquifer, taking into account the needs of all the various users, and to formulate any proposal required to ensure the protection of the resource.

- The groundwater recharge installation

The arrangement provides for the canton of Geneva to construct and operate the required groundwater recharge installation, for which it remains the sole owner. The State of Geneva may delegate the operation of the plant to a third party.

- Water rights

Water pumping is limited to a certain volume for the purpose of obtaining a satisfactory average groundwater level. The French authorities and communities undertook to ensure that total abstraction by users on their territory would not exceed five million m³ per year (exceptions to this limit could be granted by the Exploitation Committee upon the request by the user in question). In order to ensure proper use of the plant, each user must, at the start of the year, declare to the committee the amount of water it expected to abstract from the groundwater for the following twelve months. The water thus drawn would be analysed on both sides of the border using standardized qualitative analysis criteria established by the committee.

- Water costs

The cost of the water is related to the cost of building the plant (in Swiss francs); this includes fees and honorariums pertaining to the construction of the plant, the total construction costs (civil engineering costs, equipment, buildings and external construction) and the cost of operating electromechanical equipment.

The French authorities obtained an annual allowance of 2 million m³. Once this quota was surpassed, the price per m³ would be calculated on the basis of an equation comprising the following factors:

- the costs of operating the plant (SIG expense): *E*
- depreciation: *A*
- total pumping (Swiss + French): *VE*
- share in natural recharge (7.5 Mm³/yr): *AN*
- volume pumped by the French authorities minus the quota: *Vefp*

French participation: $Pf = (A + E) * Vefp / VE - AN$

- Miscellaneous provisions

Unless it can be demonstrated that pollution would have occurred even in the absence of a recharge installation, the canton of Geneva would be liable for damage to the water quality resulting from failure to maintain the recharge installation or from defects in its operation, in particular of its treatment plant. However, the French and Swiss collectivities and third parties remain liable for

pollution of the aquifer occurring within their national territories.

The arrangement was agreed for a period of 30 years and would be tacitly renewed for periods of 5 years unless terminated by either party with a year's advance notice. Either party may propose negotiations to amend or supplement the arrangement, in which case such negotiations are to be initiated within the following six months.

Any differences arising out of the implementation of the arrangement are to be referred to the Regional Franco-Genevise Committee, failing which, the matter is to be decided by the Mixed Consultative Committee.

Following approval of the arrangement between the canton of Geneva and the prefecture of Haute Savoie, an advisory committee was set up to oversee the management of Genevise groundwater recharge which would also be responsible for dealing with problems relating to the use, maintenance and monitoring of the system as a whole.

In 1988, the water company Société des Eaux de l'Arve was bought out by SIG, as of which point, Geneva had one single water supplier.

4.3. Comments on the 1978 arrangement

In accordance with the arrangement signed in 1978 between the State of Geneva and the Prefecture of Haute Savoie, the signatory parties pointed out that it was of the utmost importance to protect the common groundwater resource for drinking water purposes, over and above the purely political aspects of state sovereignty. In order to adopt a strategy for common use of the transboundary resource, the parties agreed to limiting abstractions of water from the Genevise groundwater until the Exploitation Committee considered that satisfactory groundwater levels had been regained (art. 12).

This provision testifies to the desire to tackle a common problem through pragmatic measures mainly relating to the technical and hydrogeological management of the groundwater (groundwater levels, pumping limits and optimization of artificial recharge). The committee is fully involved in the operational management and monitoring of the groundwater. The functions of the committee are clearly spelt out in Article 2 of the arrangement.

The 1978 arrangement analysis has been developed in a specific publication on the international law and freshwater (de los Cobos, 2013). We can hereafter recall the aspects related to the sovereignty issue because it is indeed surprising that the arrangement is silent on aspects that are typically connected to transboundary resources (namely, the sovereignty of the States involved). This question of sovereignty was the subject of lengthy debate by the ILC in the preparation of the draft articles for the management of transboundary aquifers (Stephan, 2015).

In the case of Genevise groundwater, 20% of it is to be found in France (four pumping wells) and the rest in Geneva, whereas it is acknowledged that the majority of its natural recharge comes, not from precipitation, but from permeation from the Arve River, which originates in the Mont Blanc mountain range and flows, for the most part, through French territory (about 90% of its course).

The principle of sovereignty is reflected in the principle of State responsibility, according to which each party makes decisions, for example on projects presented for the installation of new equipment (art. 5). States are also free to institute an abstraction margin of 20% in relation to the annual volume of reserved water (art. 10) or to make decisions concerning water levels or pumping quantities. An examination by another delegation can be requested at any time (art. 11), thus demonstrating that, notwithstanding the element of trust and confidence, examinations by opposing parties could be required by the committee.

Considering the water costs, after the French had finally decided not to contribute financially to the building of the station, yet sharing the hydraulic benefits of recharge, the Genevise took the decision to shoulder the entire financial and technical responsibility of building the plant and of the artificial recharge operations. The negotiations centred on the right of the French to use the volumes of water they had pumped thus far. A free share of two million metric cubes per year was accorded to them. Any amounts exceeding that would be calculated on the basis of a complex formula based on total pumping and recharge costs.

Looking back over the first 30 years and with the experience gained from having to design the project as well as implement it, we can honestly say that the key to the success of this arrangement arises from tackling a problem relating to international water resources at the local level, rather than at the level of sovereign states. In the case of the Genevise area, the parties involved were the canton of Geneva and the department of Haute Savoie. In Switzerland, cantons are sovereign and are allowed to handle transboundary matters directly (under the supervision of the Confederation). In France, since local authorities could not deal with transboundary issues directly in an autonomous fashion, it was the Prefecture of Haute Savoie that represented the sovereignty of the French State in the department. Besides, it should be recalled that all the technical aspects (hydrogeological studies, management of pumping stations, local hydraulic assessments) have always been known and dealt with by local actors who would then relay the information to decision makers at the local level, since the latter are themselves very closely acquainted with specific regional and cross-border issues. That, no doubt, was the secret to the success of the 1978 arrangement.

5. The extension of the 1978 arrangement for 30 additional years

Between 2007 and 2008, the groundwater committee found itself facing new challenges (namely, the extension of the 1978 arrangement, after almost 30 years of being in force). Particularly challenging issues on the Swiss side included the transfer of Geneva state assets to SIG and, thus, the sale of the recharge plant to SIG. In view of these important events, a sub-working group of the committee was formed and met several times during 2007. This Franco-Swiss working group, composed of technical experts and political representatives of the French State and equipped with the necessary legal support, produced a basic document outlining the management of Genevise groundwater for the next 30 years. It was to be ensured, in particular, that the technical specificities on which the parties agreed would be placed within a global context that was recognized at administrative and political levels (de los

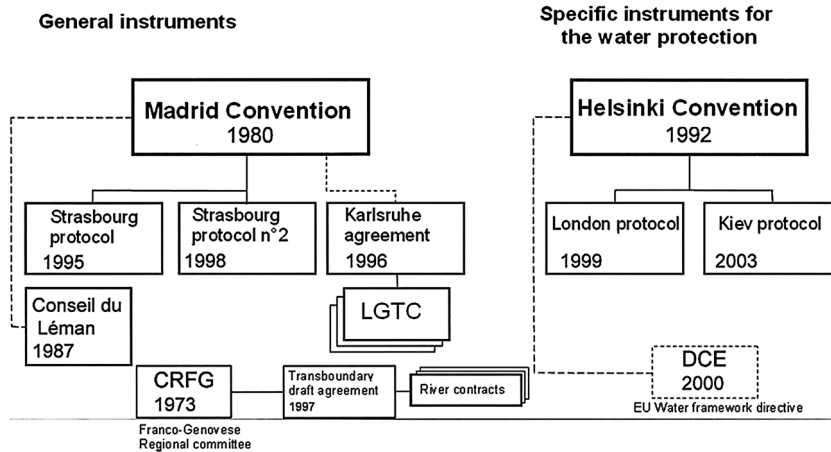


Fig. 5. Transboundary cooperation instruments.

Cobos, 2010). The Franco-Swiss Committee endorsed the draft of the new agreement proposed by the working group.

5.1. The new agreement

The first steps consisted of setting up the cross-border legal bases for the new agreement. The 1978 arrangement did not have a legal premise that was grounded in cross-border cooperation instruments, for the simple reason that there were no such instruments in existence at the time. Several instruments of this type appeared as of 1980 and were ratified by both Switzerland and France (Fig. 5). There were three conventions on which a new agreement governing Genevise groundwater usage could be based, namely:

- the European Outline Convention on Transfrontier Co-operation Between Territorial Communities or Authorities (hereinafter the Madrid convention) of 21 May 1980 (entry into force 21 December 1981);
- the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (hereinafter the Helsinki convention) of 17 March 1992;
- The Karlsruhe agreement on transboundary cooperation between local communities and local state entities of 23 January 1996.

These three international legal instruments do not pursue the same objectives:

- the Madrid convention contains a standard inter-state agreement on transboundary cooperation among local authorities and a standard contract for service supply among “public law” cross-border local communities.
- the Helsinki convention lays down the obligations of States parties to cooperate without directly creating institutions or operational structures. The transboundary river contracts, to which Geneva associated itself after signing the transboundary memorandum of understanding in 1997 to revitalize Franco-Genevise rivers, might have had its origins in this convention.
- the Karlsruhe agreement, for its part, provides for the establishment of operational structures between local communities and/or local public authorities with legal personality.

Before choosing a transboundary cooperation instrument, therefore, it was necessary to decide on the objective to be achieved. If the aim was to replace the 1978 arrangement, a Local Grouping of Transboundary Cooperation (LGTC) (bringing together the local communities of Geneva, the State of Geneva and SIG) seemed to be the way forward. However, when it came to water management, the French entities and the State of Geneva would be the main interlocutors, with SIG’s role being restricted to artificial recharge exploitation. In fact, a simple solution, which was limited to groundwater use and recharge, was advanced in the form of a transboundary agreement among the local communities concerned. On the basis of the Karlsruhe agreement, particularly the possibility stipulated in its article 5 of delegating a mission to one of the local communities, an agreement was subsequently reached between the State of Geneva and the three French communities involved (the greater Annemasse region, the Community of Genevise communes and the commune of Viry). This option was less burdensome and more appropriate than setting up an LGTC. Furthermore, in accordance with the Swiss federal constitution, cantons could sign treaties with foreign bodies within the areas of their competence. Cantons were thus free to act autonomously and themselves conclude international agreements of this type.

Consequently, an agreement relating to the use, recharge and monitoring of Franco-Swiss Genevise groundwater was signed between, on the one hand, the communes of the greater Annemasse region, the Genevise communes and the commune of Viry and, on the other hand, the State Council of the Republic and the canton of Geneva, on December 18, 2007. This new agreement succeeded the 1978 arrangement and entered into force on January 1, 2008 for 30 years. The agreement is a rare example of an aquifer management transboundary agreement between a Swiss canton and European Union communities.

5.2. Comments on the 2008 agreement

Over the years following the 1978 arrangement, European countries introduced several reforms to decentralize their administrative structures so as to make way for greater regional integration and to give more autonomy to local authorities. In France, the political and administrative system underwent major reform between 1982 and 1987; the central government devolved a portion of its powers to subsidiary authorities at the regional and departmental levels. France's water legislation also reflects European directives, decisions from the river basin authorities and those from local government.

In Switzerland, because of the administrative structure of the country's political system, influenced by differences in language, religion and economic interests, cantons have been invested with the power to exercise political authority.

This is the backdrop against which the revision of the 1978 arrangement was developed. New legal instruments had since come into force internationally and so the new agreement was able to be established on new transboundary legal bases. It was more or less natural for the new agreement to be inspired by the Karlsruhe agreement, which allows for the creation of operational systems among local communities.

Because of the successful management of the Genevese aquifer during the first 30 years of the 1978 arrangement, the renewal of the agreement focused on the legal and technical aspects derived from international law rather than potential fallout of a political or operational type. Actually, one could have expected that the French would have taken advantage of the new agreement to reconsider some aspects of the 1978 agreement, such as the quota of 2 Mm³, the financial aspects related to calculation of the water taxes or the method of payment between the French communities, the State of Geneva and SIG. But the basic provisions of the original agreement that specified the mechanisms for managing the aquifer were retained. Some aspects of applicable law and dispute settlement provisions were added (Art. 20), indicating notably that problems relating to the interpretation of the agreement should be resolved in accordance with Swiss law. Each country carries out its own water quality assessments (chap. 16), as the French and Swiss standards are relatively similar. In both cases, these standards have been aligned to European directives.

Amendments centred more on the specification of the legal instruments legitimizing the arrangement and the direct inclusion of French communities whose authority had formally and officially increased. Indeed, it was the French communes (and their communities) which were the signatories of the new arrangement, thereafter referred to as an agreement. The preamble of the agreement lists the international agreements and national laws (both French and Swiss) that validate its legitimacy. This is the result of what could be considered the legal validation of a pragmatic approach. The role of the committee, thanks to the work of the working group, was fundamental in the implementation of this new agreement.

6. The role of the committee

As the main stakeholder, the committee, being at the centre of all discussions and all meetings, was crucial to this success.

The committee would regularly assess the status of the resource in terms of pumping and artificial recharge. Stocked volumes of water (the amount of water each user was expected to use for the coming year) were discussed and accepted on the basis of conditions pertaining to water quantity and quality and the operation of the artificial recharge plant.

Initially, from the Swiss side, the committee was comprised of two State Council-designated representatives, one representative from the cantonal committee for water conservation and one representative for each water company (SIG and Société des Eaux de l'Arve). Committee members could be accompanied by experts. One of the State Council-designated representatives would chair the committee.

The committee would be mainly responsible for reviewing the annual artificial recharge programme (drawn up on the basis of groundwater levels and forecasts of water user needs), the budget that was prepared in line with the recharge programme, the operating costs and water quality control test results. Provisions governing quantities reserved for each party for the coming year, water quality and the warning system in the event of accidental pollution were also matters that would be discussed and adopted by the committee. The committee would meet once to twice per year, alternatively in France and in Switzerland. It could also meet more frequently, if necessary. In practice, the head of the French delegation holds the chair when meetings are held in France and the head of the Swiss delegation holds the chair when meetings are held in Switzerland.

The committee, which is defined in general terms as being purely consultative, plays nonetheless a primary role in groundwater management as it is fully involved in the operational management and monitoring of the groundwater, laid down in the annual management programme of the arrangement (chapter 4). The functions of the committee are clearly spelt out in Article 2 of the arrangement.

It is evident that the committee, which initially had a purely advisory role, has gradually become more involved in the management of Genevese groundwater and the protection of its aquifer. Whereas, at the start, the committee issued warnings on all matters submitted to it, notably as concerned groundwater management (pumping and artificial recharge), it has become increasingly more involved in the protection of the Genevese aquifer in respect of the various Swiss or French water protection and management plans.

The committee thus dealt with various problems which arose in 2011 such as the Fukushima accident and the extreme drought experienced in the spring of 2011. The drought was considered exceptional because it was the worst drought that had been recorded since meteorological measurements were first taken in Switzerland 150 years previously. Transboundary action plans were instituted by the committee as preventive measures to counter all risks of pollution or water scarcity in the transboundary basin (de los Cobos, 2015).

7. Keys of success

From a review of the last 40 years or so, we wish to highlight some key elements which have contributed to the success of the 1978 arrangement and the drafting of its successor agreement.

- Focus on the common water resource.

It was absolutely necessary to safeguard the water resource in the face of the danger posed by over exploitation. The excellent geological and hydrogeological knowledge that emerged from the accumulation of technical data and monitoring of the groundwater helped to undergird the efforts to protect the aquifer. The specific geological characteristics of the Geneveve region allowed for the establishment of an efficient recharge system, setting it apart from other aquifer systems in the world. Moreover, without the serious and specific problems that occurred during the 1960s and 70s in Geneva, the question could be asked whether there might have been a need for this cross-border collaboration.

- The handling of the administrative and policy aspects of aquifer management at the local level.

It was noted that between the negotiations conducted in the 1970s to finalize the arrangement politically and administratively and the in-depth work that was required to draft the new agreement, this agreement was easily concluded to the satisfaction of the French communes and communities, thanks, in particular, to the existing international legal provisions. The latter felt more involved in the groundwater management because they were now directly accountable to their own citizens and could act with more autonomy and with greater ease as signatories. The sub-Prefect of St. Julien-en-Genevois, as co-chairperson of the committee, guarantees the legitimacy of local bodies to the central authority of the French State.

- The ability of the canton of Geneva to handle transboundary matters directly.

The fact that the canton led the recharge project and the management of the various players, in addition to the general authority accorded to cantons to handle cross-border matters, certainly contributed positively to the crafting of the 1978 document. In addition, the canton demonstrated its ability to guarantee optimal groundwater management over the first thirty years. Experience has shown that, whereas it might be necessary to deal with ten different interlocutors in a project with the French neighbours, in the State of Geneva there is usually only one entity with which to contend. This is clearly a benefit to be derived from typical Swiss organisation.

Although the success of the Franco-Geneveve agreement was described as a dream accord at a recent presentation to an Israeli-Palestinian delegation, it must not be forgotten that it was not easy to set up everything and that the work on the first arrangement required long years of negotiation which were not always smooth. A number of thorny and complicated issues remain in terms of organisation and governance, in accordance with how governance is defined on either side of the border.

8. Challenges

Although water is increasingly considered in Europe as a resource which is a common heritage, regardless of ownership, groundwater remains subject to private ownership in France (Dionnet-Grivet, 2014). On the Geneva side, as for the rest of Switzerland, groundwater is the property of the cantons.

In France, however, groundwater usage is a shared right; it is not free. Pumping in excess of 8 m³/hour has to be authorised by the Prefect of the department. Since the 2000 EU Water Framework Directive was passed, management has passed into the hands of water basin committees, closer to participatory democracy and decentralisation methods.

As a result, the organisation of administrative structures involved in water management is highly fragmented and diversified in France (Fig. 6). In France, the community body responsible for water management must deal with the ARS (Health Regional Agency) when it comes to water quality, the water basin agency for management, the Prefect for legal aspects and the Region for

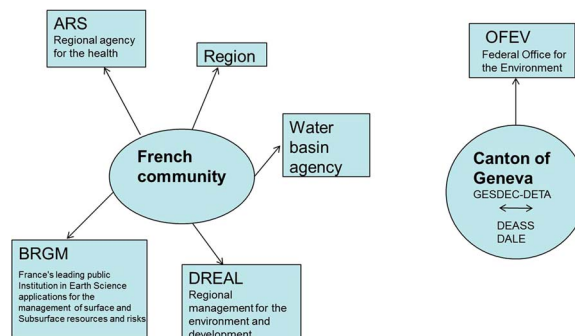


Fig. 6. Administrative management differences between the canton of Geneva and the French communities.

organisational matters. Although issues relating to road or urban development may pose risks for water protection, communities cannot manage or interfere directly in aspects for which they do not have the competency and must go through various stages and bodies to communicate their position. This somewhat complicates their ability to react and communities faced with a real risk to their resources have very few available options.

In Geneva, the canton is organised administratively in such a way that the authorities involved in groundwater management and protection can authorise or deny drilling or pumping. Everything happens within the same department of the canton or in collaboration with other departments involved. The same department that is involved in the groundwater management committee also deals with the management of authorisations for using and protecting the water, which is a clear advantage to ensure proper supervision and protection of the Genevese aquifer.

Another marked difference lies in the tools used by the French to monitor the groundwater which, unfortunately, are still very basic and do not help to develop geological and hydrogeological knowledge about the Genevese aquifer.

Before the signing of the 1978 agreement between the State of Geneva and Haute Savoie (Upper Savoy), many years of hydrogeological study and work (pilot tests and plant) were carried out to gain a better understanding of the functioning of the Genevese aquifer and to assess the groundwater for the purpose of calibrating the future Genevese artificial recharge plant. The plant was supposed to be the solution to considerable groundwater overuse in the 1960s and 70s which had jeopardized continued use of the water for the wells on both the French and Swiss sides of the border.

Now, thirty years later, with a clearer view of the hydraulic situation of the aquifer (more control points and a few decades of piezometric and hydraulic measurement), we realize that there are still many unknowns, especially in the southern part of the aquifer (the French section), since estimates done on the lateral inflows were proven incorrect by a number of drillings which revealed that there were no gravel or sand saturated levels. This is an important point of consideration in the transboundary management of the aquifer because when it came to discussing the pumping quota attributed to the French, in the framework of the 1978 agreement, and even when the agreement was to be renewed in 2007, many said that this quota should be calculated against the inflows from the French zone. However, in assessments done then and more recently and from checks made along the full length of the border, estimated inflows do not exceed 600,000 m³ per year. The quota of 2 million m³ per year, accorded on the basis of the volumes that were being pumped by the French between 1974 and 1977, is therefore favorable to the French side but unsubstantiated from a hydrogeological point of view.

This example is a perfect illustration of the type of geological and hydrogeological detail which must be factored into the study of an aquifer and which is indispensable for analysis purposes. Each party to a transboundary agreement is, thus, able to negotiate on a recognized scientific basis and, most importantly, no party ends up being disadvantaged due to a lack of scientific knowledge on the aquifer.

9. Evaluations and conclusions

In 37 years of operation, the Genevese artificial recharge system contributed over 300 million m³ of water filtered from Genevese groundwater. The choice made in the 1970s between a new plant for treating lake water and the creation of a recharge plant proved to be a judicious one, not only from a financial point of view, but also in terms of water resources management. Transboundary groundwater management, coupled with the technical success of the aquifer recharge system, has guaranteed safe drinking water for Geneva and the surrounding region by diversifying and optimizing the quantitative and qualitative potential of existing water resources.

Due to the radical change in demographics over the past five years and the economic attractiveness of the Genevese region, there is an ever greater trend towards establishing a cross-border approach. A committee on a “transboundary water community” was formed in 2007. This water community will be included in the Franco-Valdo-Genevese regional project, which will serve to create a common, strategic environmental vision across the territory and will include patrimonial, social and economic aspects.

The successful management of Genevese groundwater was the basis for the establishment of this transboundary water community which was made official with the signing of a memorandum of understanding for cross border cooperation on water on December 12, 2012. This demonstrates the recognition accorded to the committee’s almost 40 years of work. Notwithstanding the difficulties and efforts required to make it even more effective, the committee seeks to create efficient, beneficial and dynamic cross border relations.

The Genevese groundwater agreement is an unusual example of a transboundary agreement on aquifer management between communities belonging to the European Union and a Swiss canton. It is the result of what could be considered the legal validation of a pragmatic approach.

Conflict of interest

None

Acknowledgements

The author would like to acknowledge the great opportunity provided by UNESCO-IHP in 2005 to present the Geneva transboundary aquifer agreement which became through the years a unique source to share internationally this very exciting issue around the world.

Appendix A. . Supplementary data (agreements)

The 1978 agreement can be found at:

<http://www.internationalwaterlaw.org/documents/regionaldocs/franko-swiss-aquifer.html>

The 2008 convention can be found at: <http://www.internationalwaterlaw.org/documents/regionaldocs/2008Franko-Swiss-Aquifer-English.pdf>

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