



**United Nations
Economic and Social Commission
for Western Asia**



**The German Technical
Cooperation**

Workshop On Harmonization of Diverging Interests in the Use of Shared Water Resources

17-19 December 2002

Beirut, Lebanon

AN OVERVIEW OF GROUNDWATER IN INTERNATIONAL LAW

A CASE STUDY :

THE FRANCO-SWISS GENEVESE AQUIFER

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Abstract

If, since 1966, the principle of equitable utilization issued from the concept of the international drainage basin developed at international law doctrine can be said to have become a principle of international water resources law. However, its applicability to shared groundwater resources and to confined aquifers in particular, it is still far from general recognition in State practice. In this context, the essentially pragmatic approach followed in the case of the 1978 Arrangement² relating to the Franco-Swiss Genevese Aquifer and more than 20 years of practical success deserve particular analysis. Problems encountered at the time in respect of this ground water resource shared between France and Switzerland have been apprehended on an essentially technical basis and, once an agreed solution was found, it was reduced to a simple regional arrangement between the competent local authorities. A joint commission, purely consultative, was established, each State maintaining its own sovereign prerogatives. Lying across the national border, the aquifer is not given any particular legal status but is apprehended in practice, technically, as a joint resource which the contracting parties undertake to protect quantitatively and qualitatively and to manage for the benefit of the whole of their users irrespectively of nationality and geographical location. Based on the concept of recharging this ground water resource with surface waters, use is made of a recharge installation comprising a treatment plant, both located within Switzerland and remaining wholly under Swiss ownership. A yearly aquifer management plan ensures that authorized extractions are matched by an equivalent volume of treated surface water recharge. Investment and operational costs are shared by the contracting parties in proportion to the volume of water effectively extracted from within their territory while individual users or groups of users pay water charges to their respective local water supply authorities.

¹ The opinions expressed are those of the author and do not necessarily reflect the views of the Swiss and French authorities concerned, nor those of ESCWA. Documents of the author cited herein may be downloaded, among others, in *.pdf format from the following Web Site : www.bjwconsult.com at pages Biography/Main Publications.

² For text of the 1978 Arrangement, see the Annex

I. INTRODUCTION³

The Franco-Swiss transboundary Genevese Aquifer (See : Figure 1) extends over 19 km between the southern extremity of Lake Geneva and its effluent, the Rhône river which crosses the Canton of Geneva westwards. The width of the aquifer varies between 1 km and 3.5 km. It is located partly on the southern border of the Canton of Geneva with the French Department of Haute-Savoie.

The extension of the aquifer is linked to the top of the bedrock morphology and is controlled by the geometry of SW/NE furrows almost completely filled by quaternary glacial formations; past channel lines can reach 300 m height. The aquifer formation is overlapped by a clayed Wurmian moraine which reduces meteoric water infiltration but has the advantage of providing a natural protection. The aquifer composition is silt-sand gravel from glacial and fluvio-glacial origin (Wurm) lying directly on the molasses formation which constitutes the impermeable substratum. Locally, the thickness of saturated gravel reaches 50 m and the average water level is between 15 and 80 m deep. Darcy's permeability of the aquifer is of about $1-2 \cdot 10^{-3}$ m/s but can reach $5 \cdot 10^{-7}$ and up to $3 \cdot 10^{-2}$ m/s.

The Genevese Aquifer is exploited for drinking water supply by 10 wells on the Swiss side and 5 wells on the French side. Of a total extracted volume of water averaging 15-17 million cubic meters per annum, French withdrawals amount only to some 2 million cubic meters per year. On the Swiss side, withdrawals from the aquifer represent 20% of the total drinking water supply, the 80% balance originating from 3 pumping stations on Lake Geneva, i.e., exactly in opposite proportion compared with national water resources use which is 80% from springs and groundwaters and 20% from lakes and rivers. The aquifer is crossed over from East to West by the Arve river, a tributary of the Rhône originating in France, and thus benefits from natural recharges averaging 7.5 million cubic meters per annum.

Between 1940 and 1960, water extractions from the Genevese Aquifer were very close to the average natural recharge. The groundwater table was slowly lowering, but without serious effects. Between 1960 and 1980, the Aquifer was over-drafted with extractions reaching up to 14 million cubic meters in 1971, almost twice its potential yield. Such an over-pumping lowered the water table by more than 7 m in 20 years reducing the total groundwater storage by about one third.

It therefore became urgent to consider appropriate measures to correct such a situation and, at the same time, secure alternative sources of supply in the case of pollution. Two alternatives were investigated : a) to reduce withdrawals by supplementing the groundwater supply from Lake Geneva by constructing an apposite pumping, treatment and water conveyance plant or b) to supplement the natural recharge of the Aquifer from an artificial surface water recharge plant. A test trial with Lake Geneva waters was made in 1972 which resulted in total failure due to the fact that once obscured from daylight, the injected waters developed heavy clogging characteristics thereby endangering the quality of the waters in the aquifer.

³ Taken from "*The aquifer recharge system of Geneva (Switzerland) : a 20 year successful experience*" by G. de los Cobos, *Service cantonal de géologie* (Geological Survey of Geneva), DIAE, Geneva, Switzerland, September 2001.

Furthermore, considering that the cost of a new plant in Lake Geneva and the necessary modifications of the water supply system was estimated at some 150 million Swiss Francs (in 1975) while that of a groundwater recharge installation, including an automatic laboratory for pollution detection in the Arve, was estimated at only some 20 million Swiss Francs, it is this second alternative coupled with an injection-drain system that was selected.

The State of Geneva then initiated negotiations with the French Department of Haute-Savoie with a view to the implementation of such a recharge installation for the joint management of this transboundary Aquifer.

II. THE LAW OF TRANSBOUNDARY GROUNDWATER RESOURCES

As McCaffrey⁴ puts it : “In fact, internationally shared groundwater is, if anything, even more vulnerable than that which is not shared by two or more states. The reasons for this have to do both with lack of full understanding or awareness of the characteristics and extent of groundwater, and with the rather embryonic nature of the law in this area, which is in part a consequence of the first reason”.

State practice⁵ evidences a number of treaties dealing with shared groundwater resources. Teclaff⁶ reports not less than 35 bilateral and multilateral treaties dating back to 1824, and Wohlwend⁷ quotes 11 treaties of interest to 11 international aquifers in the ESCWA Region. If some of these arrangements deal specifically with the management of springs and wells located in border areas, most of them regulate surface waters and only incidentally related groundwaters.

⁴ See : Stephen C. McCaffrey, *International Groundwater Law*, in : *Groundwater: Legal and Policy Perspectives*, Proceedings of a World Bank Seminar, World Bank Technical Paper No. 456, pp. 139-161, Washington DC, 1999.

⁵ For a treaties on International Groundwater Resources Law, see in addition : L. Teclaff and A. Utton, eds., *International Groundwater Law*, Oceana Publications, London – Rome – New-York, 1981; J. Barberis, *International Groundwater Resources Law*, Food and Agriculture Organization of the United Nations, FAO Legislative Study No. 40, Rome, Italy, 1986; and Stefano Burchi, *Legal Aspects of Shared Groundwater Systems Management*, in : *Proceedings of the International Conference on Regional Aquifer Systems in Arid Zones - Managing non-renewable resources (Tripoli 20-24 November 1999)*, IHP, Technical Documents in Hydrology No.42, p. 451-457, UNESCO, Paris, 2001.

⁶ See : Teclaff, op. cit., Note 4, p. 189 & ff.

⁷ See : Bernard J. Wohlwend, *Integrated Water Resources Management, National and International Legal and Institutional Requirements - A New Vision*, Annex 2, Economic Commission for Western Asia, Expert Group Meeting on Legal Aspects of the Management of Shared Water Resources, Sharm El-Sheikh, Egypt, 8-11 June 2000, Doc. E/ESCWA/ENR/2000/WG.1/6.

A few others, as in the ESCWA Region for instance, deal essentially with groundwaters and only incidentally with related surface waters, where applicable.

As from the mid-1960s, under the impulse of the concept of the ‘conjunctive use’ of surface and groundwater resources developed as part of the US-Mexico Colorado Basin experience however, the doctrine of international water resources law has promoted the concept of the ‘international drainage basin’ integrating the whole of surface and underground waters flowing into a common terminus as the object of shared water resources law. This concept, formulated by the International Law Association in its 1966 Helsinki Rules⁸ and as further developed in respect of ground waters in its 1986 Seoul Rules⁹ has now gained worldwide recognition even if only partly restated in the 1997 UN Convention.¹⁰

If, with a few exceptions, States sharing international drainage basins are in practice still hesitant to regulate surface and ground waters as an integrated whole, some recent regional conventions such as the 1968 African Convention on the Conservation of Nature and Natural Resources, the 1995 Protocol on Shared Watercourse Systems in the Southern African Development Community (SADC) Region or the 1992 UN/ECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes¹¹ in Europe for instance have clearly adopted the international drainage basin concept.

⁸ *The Helsinki Rules on the Uses of the Waters of International Rivers*, International Law Association, Report of the Fifty-Second Conference, Helsinki, 1966, p. 484.

⁹ International Law Association, Report of the Committee on International Water Resources Law, Seoul Conference (1986), in : ILA, Report of the Sixty-Second Conference, Seoul, 1986, p. 15.

¹⁰ Convention on the Law of the Non-Navigational Uses of International Watercourses, 21 May 1997, U.N. Doc. A/RES/51/229, 8 July 1997. For a discussion of the Helsinki Rules versus the UN Convention, see : *The Teaching of the Most Highly Qualified Publicists as a Subsidiary Source of International Water Resources Law*, by Bernard J. Wohlwend, Consultant, March 2001, 30 pp., published in : Nile Basin Water Resources, Regional Training Workshop on International Water Law, Negotiation Skills and Conflict Resolution held in Cairo, Egypt, 25 April - 1 May 2001, FAO Workshop Report, GCP/INT/752/UTA, Rome, June 2001.

¹¹ See : Burchi, op. cit., Note 4, p. 2.

As regards more particularly the legal regime of international groundwater resources, the 1978 Bellagio Draft Treaty¹² constitutes an interesting exercise. Based on the need to resolve problems of underground water use in the US-Mexico border area, a US-Mexico Transboundary Resources Study Group was convened in Mexico in 1977 to prepare 'black letter' rules in the form of a Draft Treaty that would serve as a model for States wishing to enter into shared water resources agreements. A first draft was prepared in 1985 and submitted for discussion at an international conference of experienced practitioners and scientists convened in Bellagio, Italy, in the spring of 1987. The final Draft Treaty, known as the Bellagio Draft, was then adopted at the Sixth Congress of the International Water Resources Association in Ottawa in May 1988.¹³

Considering that its two original authors have been active members of the ILA Rivers Committee which produced the Helsinki Rules, this effort could have been expected to yield most rewarding results. Unfortunately, if the Draft Treaty can no doubt serve as a useful tool in the specific field of transboundary underground waters, and although earnest attempts have been made in the commentary to try and make it applicable to both surface and underground waters, this effort, as stated by the authors themselves, will have fallen short of expectations due to the same situation as was later to be faced by the ILC Draft Convention: after it was submitted to a large political debate, the original draft suffered a complete revision. As the authors themselves report: 'Some of the substantive changes made do not meet fully the expectations and suggestions of our several contributors and advisers. Remaining inaccuracies and errors of judgment can be attributed only to the final revisers'.¹⁴ The Bellagio Draft Treaty has nevertheless the merit of addressing such matters as Enforcement and Oversight Responsibilities (Article IV), Comprehensive Management Plans (Article VII), Planned Depletion (Article X) and Inquiry in the Public Interest (XIII) which constitute appreciable novelties.

As a result, and except for the Helsinki Rules as supplemented by the Seoul Resolution which do make its rules applicable to fossil waters, or waters contained in so-called unconnected, confined or captured aquifers, it may be considered that such ground waters still generally escape treatment under agreed rules of international water resources law.¹⁵

¹² Text in : *Transboundary Groundwaters: The Bellagio Draft Treaty*, by Robert D. Hayton and Albert E. Utton, International Transboundary Resources Center, School of Law, University of New Mexico, Albuquerque, NM, USA, November 1992, a bilingual publication, 59 pp. [29, Nat. Res. J., Summer 1989, p. 663-722].

¹³ For a discussion of the Bellagio Draft Treaty, see : Bernard J. Wohlwend, op. cit., Note 9, pp. 10-11.

¹⁴ See : op. cit., Note 11, p. 666.

¹⁵ See : MacCaffrey, op. cit., Note 4, pp. 27-28.

III. THE 1978 ARRANGEMENT BETWEEN THE COUNCIL OF STATE OF THE REPUBLIC AND CANTON OF GENEVA AND THE PREFECT OF HAUTE-SAVOIE ON THE PROTECTION, UTILISATION AND RECHARGE OF THE FRANCO-SWISS GENEVESE AQUIFER¹⁶

The Arrangement was signed on 9 June 1977 and entered into force on 1 January 1978.

This Arrangement is remarkable in many ways. If one considers that, 20 years ago, international water law was still upholding such contradictory concepts as absolute territorial sovereignty and absolute territorial integrity, that international relations in water matters were dominated by upper riparian versus lower riparian rivalries and that underground and surface waters were still apprehended in isolation, the Arrangement simply ignores such concepts and rivalries to follow a purely pragmatic approach based on a yearly technical water extraction and recharge programme aiming at the rational management of this common resource.

The essential provisions of the Arrangement cover the following matters :

a) The Commission

The Arrangement establishes a Management Commission of the Genevese Aquifer composed of three Swiss and three French members designated by the contracting parties and of which two each are to be specialists in water matters (Article 1).

The Commission is purely consultative. The Commission convenes periodically, in practice twice a year, alternatively in France and in Switzerland. Each national delegation, which may be accompanied by any number of consultants and advisers, covers its own operational costs (Article 3). The conclusions reached by the Commission are recorded jointly and submitted to the consideration of the contracting parties which make sovereign decisions on the implementation thereof within their respective territory (Article 5.2).

While the Arrangement is silent on the chairmanship of the Commission, 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.

b) The Annual Aquifer Management Programme

The mandate of the Commission (Article 2) is to propose the yearly management programme of the Genevese Aquifer taking into account as far as possible the needs of all the various users, and to formulate any proposal required in order to ensure the protection of the resource and to remedy possible causes of pollution.

The Commission gives its technical opinion on new water extraction works and utilizations as well as on the modification of existing ones and audits the construction and operation costs of the groundwater recharge installation. Each delegation reports to its parent authority.

¹⁶ See : Annex

A detailed Technical Regulation for the operation of the groundwater recharge system has been drafted jointly and adopted following the commissioning of the installation (Article 21).

c) The Groundwater Recharge Installation¹⁷

The Arrangement provides (Article 8) for the Republic and Canton of Geneva to construct and operate the required groundwater recharge installation of which it is and remains the sole owner.

This installation was commissioned in 1980. It is located at Vessy, on Swiss territory, and consists of a water-intake on the Arve River, 300 m upstream of the recharge plant, of a conveyance pipe (700 mm in diameter and 340 m in length) to a treatment plant equipped with sedimentation and chlorination units with a total capacity of 630 l/s, and of a treated water conveyance pipe (800 mm in diameter and 700 m in length) to an underground infiltration area. This infiltration area of about 3 ha comprises 5'000 m of perforated drains (200 mm in diameter) buried 2 m in depth in the glacial gravel, 7 m above the groundwater table level, in the unsaturated zone. An automatic laboratory with on-line water quality monitoring facilities is located 1 km upstream of the treatment plant. The whole installation is operated by a two-men crew.

The theoretical capacity of the installation is of about 17 million cubic meters per annum. Due to the high turbidity of the Arve which causes the installation to close down at certain times (when turbidity exceeds 120 NTU, i.e., around 65 days/year) and to occasional automatic stops due to pollution of the river, the effective capacity of the installation is of about 11 million cubic meters per annum. Coupled with the natural recharge (7.5 M cubic meters per annum), the total yield of the aquifer is of about 18.5 million cubic meters per annum.

The first five years of operation (1980-1986) had for objective the restoration of the groundwater storage. Since 1990, total water extractions have averaged 15 to 17 million cubic meters per annum while the water level in the aquifer has been kept more or less constant. Quantitatively, the groundwater recharge system has basically doubled the natural recharge of the aquifer (See: Figure 2). In addition, the global quality of the water resource, especially its hardness and nitrate contents, has been greatly improved.

As provided for in the Arrangement (Article 8.2), the operation of the installation has been entrusted to a third-party, namely the 'Services industriels de Genève (SIG)', a concessionaire corporation in charge of the gas, electricity and drinking water supply for the Canton of Geneva, under a Convention entered into on 5 August 1981 between the Council of State and

¹⁷ For technical specifications, see : "*Réalimentation artificielle de la nappe souterraine de l'Arve*", an extract from the booklet published by the Geological Survey of Geneva on the occasion of the inauguration of the installation in the fall of 1979.

the SIG.¹⁸ The Convention has a fifteen year term, automatically renewable for five year periods.

According to the Convention (Article 5), the mandate of the SIG is to exercise the permanent electronic and telemetric operation of the installation in the best technical and financial return conditions and to ensure the maintenance of its equipment. The remuneration of the SIG is at cost (Article 6).

d) Water Rights

Considering the state of the Aquifer at the time when the Arrangement was negotiated, a first, transitory, measure (Article 22) provided for a general limitation of water extractions until the level of the aquifer was to be restored to an acceptable mean, i.e., from a low 368.5 m back to some 372.5 m above sea level.

To this end, the Arrangement provides (Article 9.1) that, until the commissioning of the groundwater recharge installation, and subject to possible derogations by the Commission, the French authorities and local communities would see to it that the total annual volume of water extractions within their territory would not exceed 5 million cubic meters, of which 2 million cubic meters corresponding to existing uses were recognized as a free allocation in favour of the French users.

In the meantime, the Commission was charged (Article 4) to cause the inventory of existing public and private waterworks and extractions to be taken and the terms and conditions of each authorized use such as, in particular, the volume extracted, the installed power and the protected area, to be recorded.

As to new waterworks and extractions and to the modification of existing ones (Article 5), these are to be submitted to the technical opinion of the Commission before the competent national authorities decide thereon subject to the terms and conditions of the Arrangement. The Commission supervises the construction of such new, and the modification of existing, waterworks and their equipment until these are set into operation, at which time the related inventory is up-dated.

All water extraction works are to be equipped with a metering device periodically gauged and sealed by the competent local authorities; regular readings are made and recorded jointly into a register kept in two originals (Article 6), one for the Swiss authorities and one for the French authorities (Article 11.2). In addition (Article 7), all water extraction works are to be equipped with a standard device to register water level variations in the Aquifer. Readings are exchanged and recorded into that same register which may be inspected at any time upon request to the Commission by either of the two national delegations (Article 11.3). Copy of the

¹⁸ “*Convention entre l’Etat de Genève et les Services industriels de Genève pour l’exploitation et l’entretien des ouvrages et installations de réalimentation de la nappe souterraine de l’Arve à Vessy*”, 5 August 1981 (unpublished).

tapes is submitted periodically to the operator of the groundwater recharge installation who reports thereon to the Commission at least once a year.

All authorized users are granted a water extraction authorization, permit or concession by their respective national authorities depending on the volume of the extraction. Such authorizations, permits and concessions contain terms and conditions of use which, if contravened, may be suspended or cancelled.

Every hydrologic year, starting on 1st October, each user or group of users is to present the Commission with an estimate of the volume of water planned to be extracted within the next 12 months (Article 10). The operator of the groundwater recharge installation is then to plan and effect recharges on the basis of the aggregate of such water volumes, it being understood that each user is to be entitled to a priority use in the volume of water allocated to him. Each user is further allowed a 20% additional water extraction margin, the Commission having to be solicited if this margin is to be exceeded.

As regards water quality (Article 16), analyses are regularly conducted on each side of the aquifer on the basis of standard criteria established by the Commission. Water quality data are exchanged and recorded. Treated water for recharge is similarly analyzed and recorded at the treatment plant by the operator of the groundwater recharge installation.

Finally, provision is made (Article 17) for the contracting parties to dispose of a network of surveyors designated by the competent local authorities to issue warnings in the event of accidental pollution likely to affect the quality of the Aquifer water resources.

e) Water Pricing

One year following the commissioning of the groundwater recharge installation (Article 12), the State of Geneva has proceeded with the computation of corresponding construction costs in Swiss Francs (study costs and fees, civil engineering, electromechanical equipment, buildings, drainage network, landscape works, electromechanical equipment start-up costs). Amortization of these costs is by fixed annuity, including interest, over a period of 30 years.

Operational costs are reconciled yearly, in Swiss Francs. Included are the replacement costs of the electromechanical equipment when recognized technically indispensable by the Commission, insurance premiums and the rental of the land supporting the installation (Article 13).

The French share in these costs is computed yearly (Article 14) according to a rather complex formula : the amount of the amortization annuity plus total operational costs multiplied by the effective total volume of water extractions by the French users, minus their 2 million cubic meters free allocation, divided by the total volume of water extracted minus the volume of the natural recharge. If, however, the total volume of water extracted by the French users amounts to less than 70% of their total water allocation in any one year, then for the purpose of this computation the value of their effective total volume of water extractions is to be reduced to 70% of their total water allocation in that particular year.

At the beginning of each operational year (Article 15), an advance payment corresponding to the volume of planned water extractions is paid, which advance payment has for purpose to guarantee the maintenance of the water level in the Aquifer for the coming year. At the end of the operational year, the State of Geneva proceeds with a reconciliation statement of both the French and Swiss shares on which the technical opinion of the Commission is sought. Payment of any balance due is then to be made within sixty (60) days.

f) Miscellaneous Provisions

Unless it can be demonstrated that pollution would have occurred even in the absence of a recharge installation, the Republic and Canton of Geneva is liable (Article 18) for water quality damages resulting from failure to maintain the recharge installation or from defects in its operation, in particular of its treatment plant. The French and Swiss collectivities and third parties remain however liable for acts of pollution of the aquifer occurring within their national territories.

The Arrangement has been concluded for a period of 30 years (Article 19), automatically renewable for periods of 5 years unless terminated by either party serving the other a one year prior notice. Either party may propose negotiations with a view to amending or supplementing 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 (Article 20) are to be referred to the conciliation of the Regional Franco-Genevese Committee,¹⁹ failing which, the matter is to be decided by the Mixed Consultative Commission for problems of neighbourliness.²⁰

IV. CONCLUSION

The Franco-Swiss transboundary Genevese Aquifer is one of several ground water resources, phreatic and deep, comprised within the region south of Lake Geneva, itself part of the Rhône drainage basin. If no international agreement as such has been resorted to by France and Switzerland, the two drainage basin States have entered into one boundary delimitation treaty and several *ad hoc* arrangements governing transboundary surface water matters and pollution control in particular.

¹⁹ The “*Comité régional franco-genevois*” was established in 1974 as one of the permanent committees of the Mixed Consultative Commission (See : Note 20 below).

²⁰ The “*Commission mixte consultative pour les problèmes de voisinage entre Genève et les Départements de l’Ain et de la Haute-Savoie*” was established by an Exchange of Letters dated 12 July 1973 (unpublished) which provides in its paragraph 6 that the Commission entrusts the study of such problems to a Committee which regularly reports to it. The Arrangement itself was submitted to the Regional Committee (Article 23).

Neither does the 1978 Arrangement refer to the concept of ‘limited territorial sovereignty’ on which the principle of ‘equitable utilization’ is based. It simply upholds the legal principles of ‘State Sovereignty’ which, together with its corollary principle of ‘State Responsibility’, allows for the so-called and purely moral principle of ‘no-harm’ to be dispensed with.

At the same time, no need was felt for the establishment of more than a mere consultative, but fully operational and controlling, institution deriving its powers from the yearly water recharge and management programme which constitutes the backbone of the Arrangement and the focal point of such a jointly formulated and agreed management.

The 1978 Arrangement is also silent on the harmonization of national legislations. The water recharge and water uses have to abide by the criteria and specifications of the annual recharge and management programme for the implementation of which the contracting parties are both individually competent and responsible. It is thus evident that the harmonization of national legislations, if any, results simply in practice from this joint management effort.

While the 1978 Arrangement makes no reference to France as the upstream State and sole contributor of water into the Aquifer, and if the text of the Arrangement may seem exceedingly favouring Swiss interests, a balance is provided by the fact that Switzerland has assumed full responsibility for the construction and operation of the water recharge and treatment installation while consenting to the French users 2 million cubic meters of free water per year, which quantity corresponds in fact to total annual French extractions effected so far.

The lesson to be derived from the Genevese Aquifer management experience is therefore that a purely technical water resources management plan adapted yearly to the quantitative and qualitative inventory of available waters and to the corresponding water demand, if formulated jointly and implemented under the sovereignty and responsibility of the States concerned, offers a better vehicle for achieving the equitable utilization of shared water resources than any legalistic attempt at limiting, or substituting externalities to, State sovereignty.

Acknowledgements

The author is much indebted to Mr. Michel Agassiz, Chief, *Service cantonal de géologie* (Geological Survey), *Département de l’intérieur, de l’agriculture et de l’environnement*, Republic and Canton of Geneva, Switzerland, for the technical documentation furnished and for his valuable explanations on the actual management of the Genevese Aquifer, and to Dr. Stefano Burchi, Senior Legal Officer, Natural Resources Law Service, Legal Office, FAO, Rome, Italy, for his much appreciated reference documentation on the Law of Shared Groundwater Resources.

BJW/December 2002

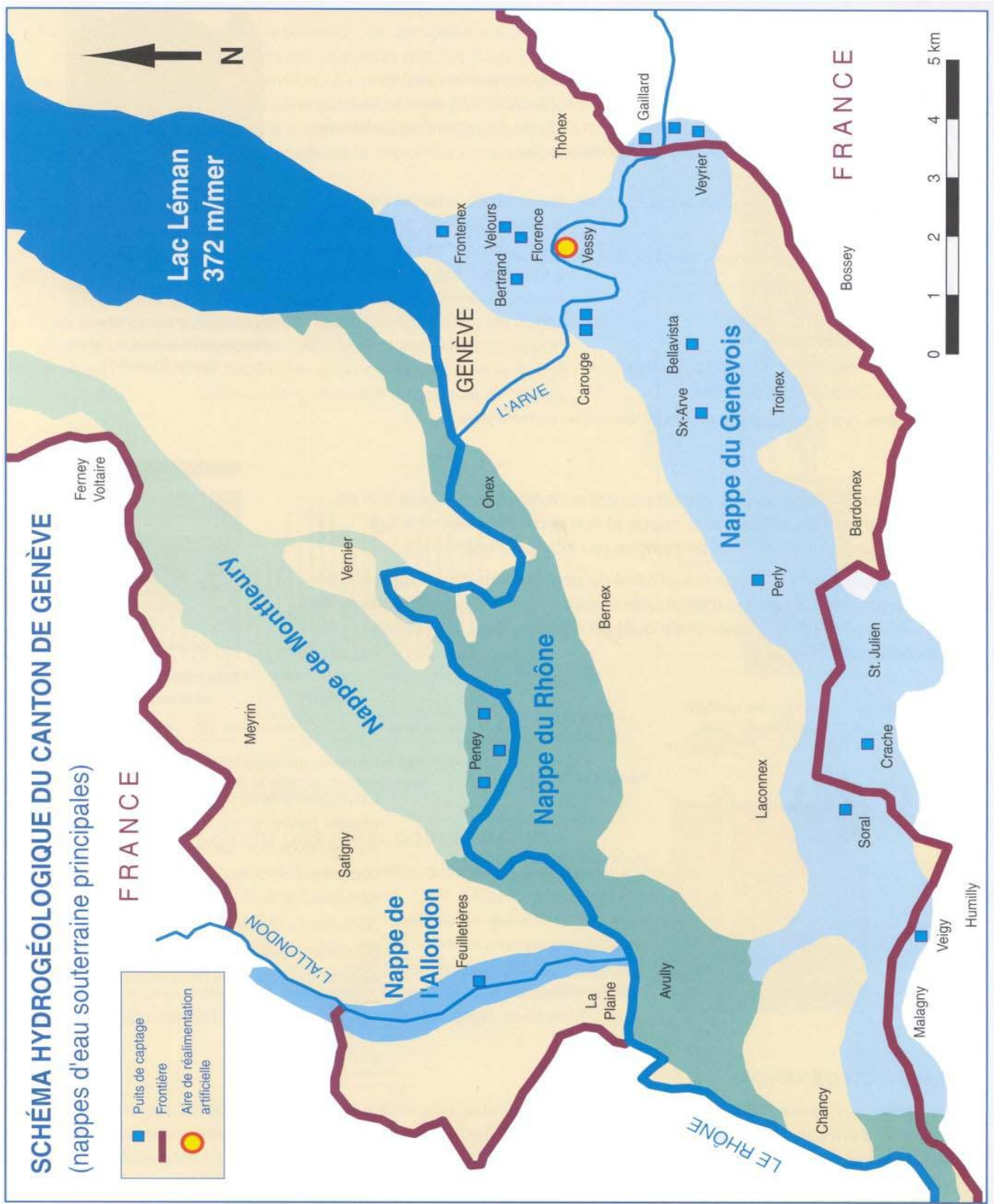


Figure 1. Sketch-plan of the hydrogeology of the Canton of Geneva

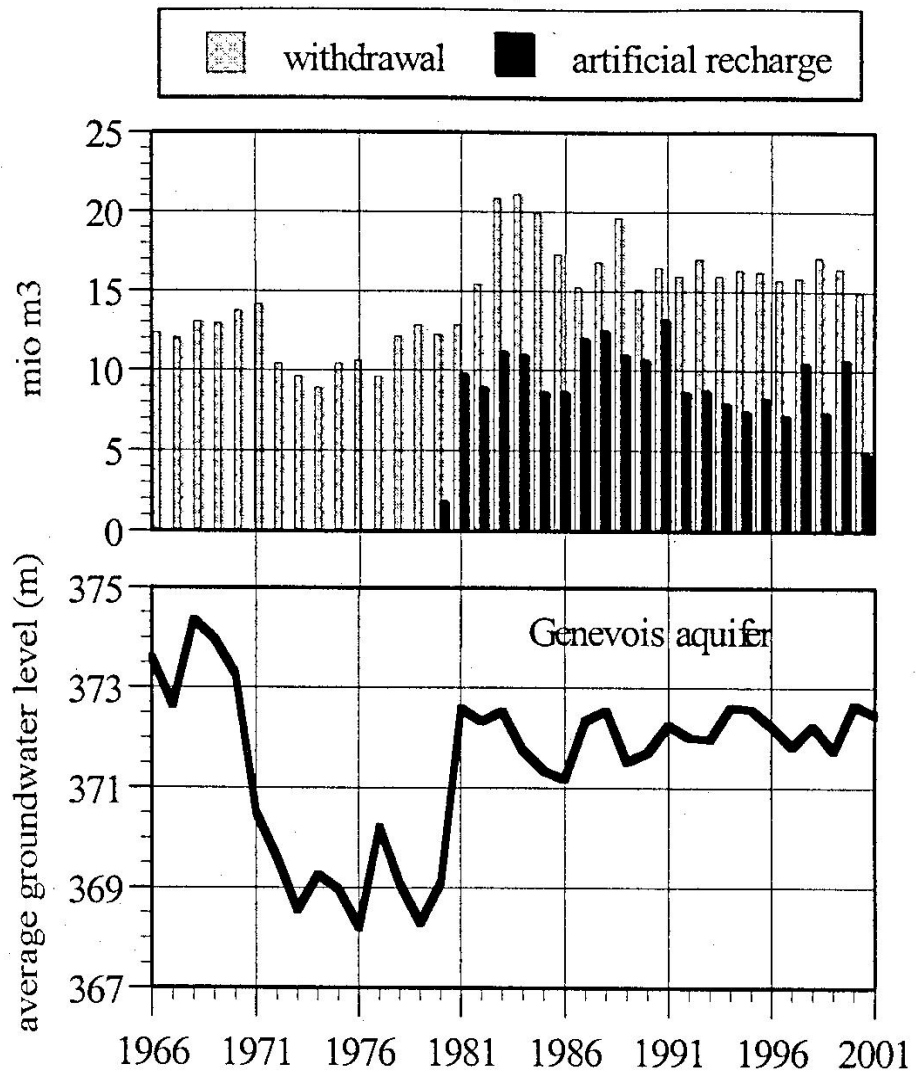


Figure 2. Impact of withdrawals and artificial recharge on the aquifer level.

ARRANGEMENT
ON
THE PROTECTION, UTILISATION AND RECHARGE OF THE
FRANCO-SWISS GENEVESE AQUIFER¹

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The State Council of the Republic and Canton of Geneva

and

The Prefect of Haute-Savoie,

Recognizing the need of establishing an agreed management for the Genevese aquifer in order to protect this natural resource and to preserve the quality of its waters,

Covenant and agree as follows :

FIRST CHAPTER – Management Commission

Article 1 – The Commission

1. A Genevese Aquifer Management Commission (the “Commission”) is hereby created which shall comprise three Swiss and three French members designated respectively by the Council of State of the Canton of Geneva and by the Prefect of Haute-Savoie.
2. At least two members in each of the two delegations forming the Commission shall be selected among technicians specialized in water matters.

¹Free translation

Article 2 – Mandate

1. The mandate of the Commission shall be to propose a yearly aquifer utilization programme which, as far as possible, takes into account the needs of the various users. To this effect, the Commission shall be entitled to formulate any useful proposal on the measures to be taken in order to ensure the protection of the waters in the aquifer and to remedy possible causes of pollution thereof.
2. The Commission shall in particular give its technical opinion on the construction of new extraction works on the aquifer and on the modification of existing equipment.
3. The Commission shall proceed with the audit of the construction and operational costs of the recharge installation as further specified in Articles 12 and 13 of the present Arrangement.
4. Each delegation shall report to its parent authority.

Article 3 – Organization

1. Each party shall assume for itself the running costs of the Commission.
2. The Commission, as necessary and on an equal basis, shall designate representatives entrusted with the control of the volume of water extracted by the various users.
3. The Commission shall convene periodically, as well as whenever so requested by either of its member delegations.
4. The meetings of the Commission shall be held alternatively in Geneva and in the Sub-Prefecture of St- Julien-en-Genevois.
5. The conclusions of the Commission's meetings shall be recorded in a joint report.

SECOND CHAPTER – Waterworks and Equipment

Article 4 – Inventory

1. All existing waterworks and their equipment, whether public or private, allowing for the utilization of the resources of the Genevese aquifer shall be inventoried jointly at the initiative of the Commission.
2. This inventory shall detail all the specific terms and conditions currently governing such waterworks, such as the authorized water extraction volume, the installed power and protected areas.

Article 5 – New Waterworks and Equipment

1. Every new waterwork or equipment, as well as any modification to existing waterworks and equipment, shall be subject to the prior technical opinion of the Commission as provided for in Article 2.2 above.
2. Subject to the provisions of the present Arrangement, the respective parent authorities of the parties hereto shall make sovereign decisions in respect of the projects submitted to them.
3. The inventory provided for at Article 4 above shall be up-dated every time new waterworks and equipment are set into operation.
4. The Commission shall oversee the construction of the waterworks and equipment referred to at paragraph 1., above, until the same are set into operation.

Article 6 – Recording of Water Extractions

All waterworks shall be equipped with a device for the recording of the volume of water extracted from the aquifer. Such a device shall be periodically gauged and sealed at the initiative of the Commission, each of the parties hereto having its own seal. Readings shall be effected periodically and recorded in a register kept in two originals.

Article 7 – Recording of Water Levels

1. All waterworks shall be equipped with a standard device for the recording of the variations in the water-level of the aquifer.
2. Copies of the recording tapes shall be remitted periodically to the operator of the recharge installation who shall be designated by the State of Geneva and who shall present his report at least once a year to the Commission.

THIRD CHAPTER - Construction and Operation of the Recharge Installation

Article 8 – Construction – Operation – Ownership

1. The Republic and Canton of Geneva shall be responsible for the construction and operation of the artificial recharge installation which shall be and remain in its sole ownership.
2. It may entrust the operation of this installation to a third party, hereinafter designated as the “operator”.

FOURTH CHAPTER – Extraction Forecast – Limitations

Article 9 – Limitations

1. Based on the dimensions and capacity of the artificial recharge installation to be constructed, the French authorities and public collectivities shall ensure that the aggregate of water extractions by the users located within their territory shall not exceed 5'000'000 cubic meters per annum, inclusive of a free allocation of 2'000'000 cubic meters. In case of necessity, derogations to this 5'000'000 cubic meters limit may be agreed to by the Commission upon consultation with the operator.
2. In exceptional circumstances and in order to be able to satisfy their own needs, the Swiss users may request the French users, through the Commission, to forfeit part or whole of their free allocation in their favour. Upon acceptance by the French users, the effective water volumes allocations shall be paid for by the Swiss users at the cubic meter

production cost obtained from similar French waterworks, payment conditions being specified at the time of the request.

Article 10 – Forecasts – Reserved Water Volumes

1. In order to ensure the rational management of the recharge installation, at the beginning of the year each user or group of users shall announce to the Commission their estimated volume of extractions from the aquifer for the next twelve months. Such forecasts are designated as “reserved water volume”, or :

$$r_v$$

2. The “total reserved water volume” equals the total of the reserved water volumes by all users, or

$$R_v = r_{v1} + r_{v2} + \dots + r_{vn}$$

3. The operator shall take R_v into consideration in order to best manage recharge operations, each user being entitled to dispose with priority of the reserved water volume (r_v) allocated to him.
4. Each user or group of users shall be entitled to a 20% extraction margin with respect to his reserved water volume (r_v). Extractions in excess of 20% over and above r_v shall be subject to the approval of the Commission based on the technical opinion of the operator.

CHAPTER FIVE – Recording and Control of Extractions and Water Levels

Article 11 – Definitions

1. (E_v) shall mean the volume of water effectively extracted in one year by the aggregate of French and Swiss users.
2. The recording of water extractions from the aquifer shall be effected jointly and entered into two registers, one for the Swiss authorities and one for the French authorities.

3. Water level data from the aquifer shall be exchanged and recorded into those same registers. These may be inspected at any time upon request by either of the two delegations comprising the Commission.

CHAPTER SIX – Artificial Recharge Cost Sharing

Article 12 – Definition of Construction Costs

1. Within one year at the latest from the setting into operation of the recharge installation, the State of Geneva shall compute corresponding construction costs in Swiss Francs. Such construction costs shall include in particular :
 - study costs and fees directly related to the construction of the installation and ancillary works;
 - the total cost of the construction works as such (civil engineering, electro-mechanical equipment, buildings, drainage network, landscape works);
 - electro-mechanical equipment start-up charges.
2. The parties hereto covenant and agree that investment costs shall be amortized in constant yearly instalments (A), computed interest included, over a period of thirty years taking into account the subsequent variations in the money market rates. In this connection, the interest rate shall be fixed every year based on the borrowing conditions obtained by the Genevese public collectivities from the ‘Banque hypothécaire du canton de Genève’ (Mortgage Bank of the Canton of Geneva).

Article 13 – Definition of Operating Costs

Operating costs (O), computed yearly, shall include the following items expressed in Swiss Francs :

- power supply;
- chemicals;
- treatment, elimination and disposal of sediments;

- labour;
- spare-parts and various materials;
- maintenance of buildings and access ways;
- transport and related costs;
- management and insurance costs;
- replacement of part or all of the electro-mechanical equipment as considered technically indispensable by the Commission;
- rental cost of the land supporting the recharge installation.

Article 14 – French Participation

1. The French participation (Fp) to the artificial recharge costs shall be computed yearly as follows :

$$Fp = (A + O) \frac{Evepf}{Vr}$$

in which :

Evef = Effective volume of water extracted by the French users;

Evepf = Effective volume of water extracted and payable by the French Users = Evef – 2'000'000 cubic meters (free allocation);

Vr = Volume of recharge water extracted, i.e., Ev less natural recharges currently estimated at 7'500'000 cubic meters per annum, which estimate may possibly be revised by the Commission based on observations made in the course of operations.

It is nevertheless expressly agreed that, in order to compute the French participation, a reduction in water extractions from the aquifer occurring for whatever reason on the Swiss side shall in no instance lead to a value of Evfp : Vr higher than the said natural recharges, i.e., 2 : 7.5, unless allowed by the Commission in accordance with the provisions of Article 9.1., herebelow.

Volumes of water not extracted but paid for to the State of Geneva by Swiss users shall however not be accounted for as a reduction in water extractions from the aquifer on the Swiss side within the meaning of the above paragraph.

2. In the event that the effective volume of water extracted by all French users (Evef) would be lower than 70% of their total reserved water volume (Rvf), the French participation to recharge costs shall nevertheless be computed within the limits established at paragraph 1., above, by adjusting the value of Evef to 70% of Rvf ($Evef = 0.7 Rvf$).

Article 15 – Form of Payment

1. At the beginning of the year, a contribution proportional to the reserved water volumes shall be paid in advance; such a payment shall guarantee a water level in the aquifer sufficient to satisfy the normal operation of all waterworks during the year.
2. At the end of the year, the State of Geneva shall establish the balance of the total French and Swiss participations for consideration by the Commission. Upon notification of the amount of the French participation contemplated at Article 14 above, the balance due after deduction of the advance provided for at paragraph 1., above, shall be paid within sixty days in Swiss Francs to the Treasury of the State of the Republic and Canton of Geneva.

SEVENTH CHAPTER – Quality Control – Pollution Abatement

Article 16 – Water Analysis

1. Water extracted from the aquifer shall be analyzed by both sides on the basis of standard qualitative analysis criteria established by the Commission.
2. Such analyses shall be made at regular intervals, as fixed by the Commission. Results shall be exchanged and recorded.

3. Analyses of the water intended to be injected into the aquifer shall be made under the same conditions.

Article 17 – Warning System

1. The parties hereto shall maintain a monitoring network installed at the initiative of the competent local authorities and intended for the issuance of warnings in the case of accidental pollution likely to affect the water quality of the aquifer.
2. In case of warning, protection measures commensurate with the circumstances shall be taken on both sides without any restriction.

EIGHTH CHAPTER – Liability

Article 18

1. The Republic and Canton of Geneva shall be liable for damages caused to the quality of the waters of the aquifer resulting from failure to maintain the recharge installation or from want in its operation, especially as regards water treatment.
2. Its liability shall however be exonerated in the event it can be evidenced that such a pollution would have occurred even in the absence of a recharge installation.
3. The liability of the French and Swiss public collectivities or of third parties in the case of pollution of the waters of the aquifer resulting from acts or events occurring within the French and Swiss territories is reserved.

NINETH CHAPTER – Term and Termination

Article 19

1. The present Arrangement is concluded for a period of thirty years.

2. Unless either party hereto serves a notice of termination to the other party at least one year prior to expiry, the present Arrangement shall automatically renew for five year periods.
3. Either party hereto shall be entitled at any time to request the opening of negotiations with a view to modifying or supplementing the present Arrangement. Such negotiations shall initiate within six month from the date of the request at the latest.

TENTH CHAPTER – Disputes

Article 20

1. Any dispute relating to the implementation of the present Arrangement shall be submitted for conciliation to the Franco-Genevese Regional Committee.
2. Failing settlement, the matter shall be referred to the Franco-Swiss Consultative Commission for Problems of Neighbourliness.

ELEVENTH CHAPTER – Final Provisions

Article 21 – Detailed Management Rules

Within one year from the commissioning of the recharge installation, the Commission shall submit a draft Detailed Technical Rules for the Management of the Aquifer for approval by the Working Group entrusted by the Franco-Genevese Regional Committee (hereinafter the “Regional Committee”) with the study of water supply matters within the French border zone.

Article 22 – Transitory Provisions

For the period preceding the commissioning of the recharge installation, the parties signatories hereto agree to a limitation to the water extractions from the Genevese Aquifer until a water level considered satisfactory by the Commission is reached. The Commission shall be entitled to examine

the difficulties which the implementation of this provision may raise and, if need be, may propose solutions to the users.

Article 23

The present Arrangement shall be submitted to the Regional Committee and to the Franco-Swiss Consultative Commission for Problems of Neighbourliness.

Article 24

The present Arrangement shall take effect on the 1st of January 1978.

Done, this 9th of June 1997 in Geneva, Switzerland, and in St-Julien-en-Genevois, Haute-Savoie, France, in two originals.

For :

The Council of State of the
Republic and Canton of Geneva

(Signature)

The Prefect of
Haute-Savoie

(Signature)