



## Case Report

# From Private Company to Water User Association and Natural Park over a Century: The Case of Riegos de Levante, Izquierda del Segura (Spain)

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**Abstract:** This work examines the transformations occurred with the shift from private company to water user association and natural park, looking at one collective irrigation system located in Alicante province (Spain): Riegos de Levante, Izquierda del Segura, one of the most extensive irrigation areas in Europe. Between 1918 and 2018, a process of change and transformation of both landscape and institutions occurred, considering: infrastructure expansion and its operation, the transfer of irrigation management responsibilities to water user association, after years of financial operations with water, thanks to state intervention, the coexistence of traditional agriculture with the modernisation of the irrigation systems, the history of an irrigation reservoir which was transformed into a natural site in 1988, or the evolution of the composition of water resources, taking into account the arrival of the Tajo-Segura transfer waters from the year 1979. The general objective is to understand key factors driving these changes, by means of a paradigmatic case study, as well as to identify policymaking and context-relevant dynamics that could enable it.

**Keywords:** water user association; irrigation water management; collective action; institutional change; Spain



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## 1. Introduction

Good water governance plays a fundamental role in overcoming key challenges that are facing the water sector, including organisational structuring and the sustainable use of resources. This concept is understood as the implementation of legal, institutional, and economic mechanisms that enable the effective organisation of the activity developed by all of the agents involved in water management [1]. It requires a legal and institutional framework consistent with the challenges, yet there is no single model to articulate the effective governance of water applicable to all contexts. Indeed, to be effective, governance systems should adapt to the social, economic, and cultural characteristics of each context. Nevertheless, there are some principles which are considered as essential for the effective governance of water [2]: transparency, the use of comprehensible language, efficiency (economic, political, social, and environmental), the adoption of a holistic approach, and the development of the appropriate legal, institutional, economic, and technological mechanisms.

Governance, therefore, includes the roles of the private sector and civil society, the character of relationships (and the formal and informal rules and regulations guiding such relationships), as well as the nature of information flow between different social actors and organisations, which is a key feature of good water governance [3]. In this vein, to ensure effectiveness in water governance, which affects the management of water at different levels of society, the public sector needs to establish partnerships with user groups. By strengthening the capabilities of user groups, management responsibility and authority over the infrastructure and the resource itself can be shared, and the participation

of local communities in managing their water can be enabled [4]. Thus, directly affected water user associations and irrigators can be empowered by establishing and formalising a platform that allows all interested water users to present their interests and have ‘voice and choice’ in the decision-making and management process of water services. This enhances transparency and fosters the local sense of ownership, while partially relieving the financial burden on agencies [5]. Delegation of water management responsibility to water user groups also contributes to the potential positive benefits of subsidiarity, whereby local managers can better understand the needs, resources, and demands of their situations, with improved cooperation between stakeholders as well as innovation stimulated through competition between local authorities [6]. Whether such a participatory approach to irrigation management necessarily leads to increased water use efficiency is, however, debated. This is because an appreciation for the sustainability of the resource may require more than just a sense of ownership, but also an appreciation for fair access to the resource between current users and future generations [7,8]. Indeed, this has been a constant issue in the case presented here: the need to sustain the use of the resource for present and future generations has not only led to a continual search for new sources of supply—including exogenous resources—but has required great efforts to improve the rational management of resources, modernisation, and promoting a culture of a sustained efficient irrigation in a territory increasingly pressed to raise their productivity per unit of water [9,10].

Some general features that constitute effective water governance are: the external environment, including underlying political and cultural conditions as well as economic factors, quality of partnerships and distributed governance for engaging civil society and the private sector, internal support driving such a development of such an approach to water governance, degree of adaptive capability to often rapidly changing environmental conditions, simultaneity between the capacity to develop laws and institutions in response to the rapid pace of economic, social, and environmental change, and having institutions built with an eye toward long-term sustainability [3].

It is difficult to make general statements about water governance, but a model of policy, empowerment, and control can illustrate how it should work for any situation, through the combination of the appropriate approaches for different scenarios and levels of development in order to get the right balance [11]. In this theoretical context, the case report of Riegos de Levante, Izquierda del Segura could be seen as a socio-hydrologic qualitative approach [12–15], where the development of the entity is analysed from its origin in 1918 to the present, considering the co-evolution and interactions among natural and human components of the water systems, using historical analysis to explore co-evolution between key stakeholders and the factors influencing them and their activities.

This study synthesises, therefore, the evolution of an entity that was decisive in the socio-economic development of a good part of the province of Alicante and the factors that triggered the changes that have taken place throughout its history. It particularly focuses on the gradual intervention of the state in the management, finally collective, of water and public water works, whose shared vision has contributed to build stakeholders’ capacity to participate in managing natural resources, share benefits, and improve water efficiency in agriculture, all of which are consistent with good water governance principles. By focusing on the history of the entity, the origins of the management, and water uses, discussions sought to understand the influence of collectivisation, land and water rights, government incentives, economic difficulties, and conflicts.

## 2. Case Study and Methods

With a specialisation in the cultivation of fruit and vegetables and an intensification of crops, the agricultural expansion of the twentieth century required an increasing amount of water resources and a greater regularity in their supply. This could only be achieved if surface water was regulated, given that the geographical area of study in the province of Alicante (Spain) is characterised by the intermittent availability and scarcity of water resources. The average annual temperature in the districts of the province of Alicante, called

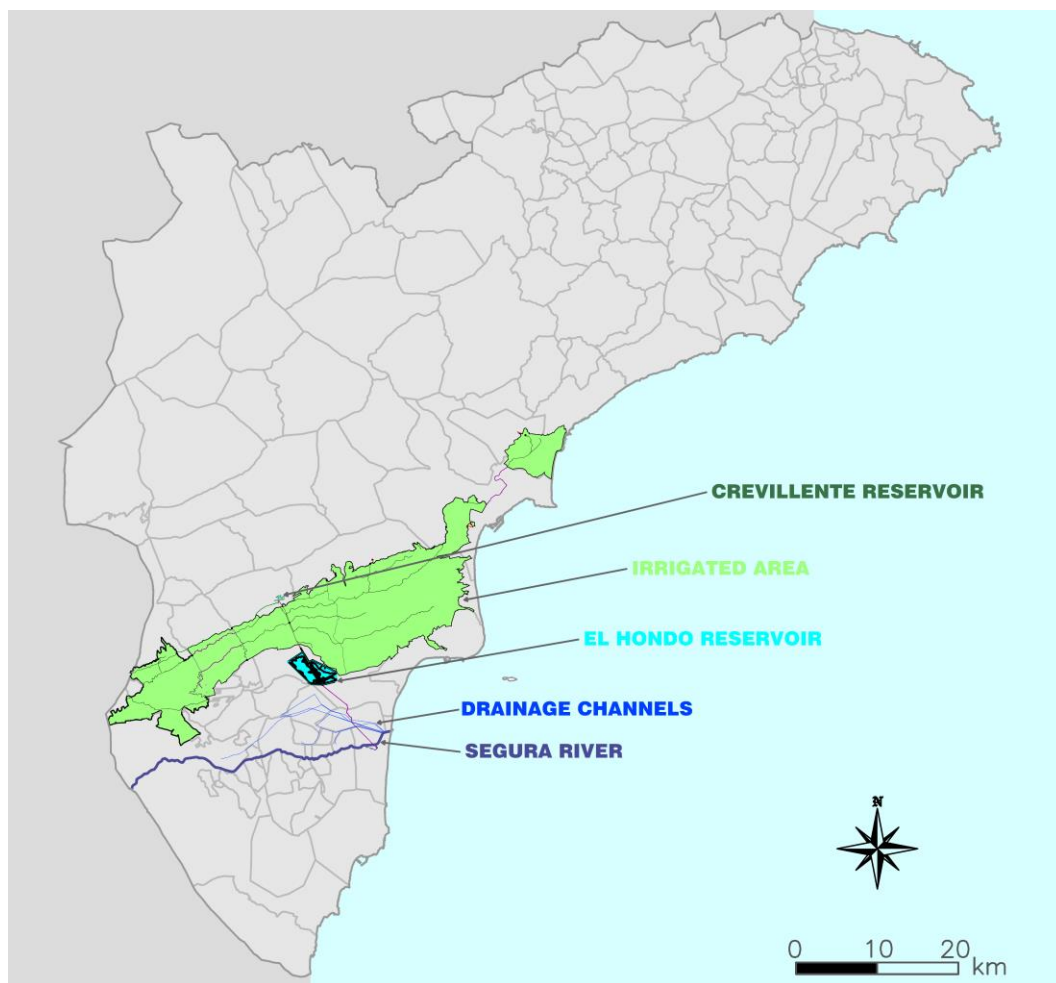
Bajo Vinalopó, Vega Baja del Segura, and Alacantí, is 18 °C and the average annual rainfall is 286 mm, on the whole concentrated in the spring and, most of all, autumn. The climate is typically Mediterranean, with high temperatures in summer and mild temperatures in the winter, with scarce rainfall and a semi-arid climate in the southern part. In general, the zonal balances indicate a process of environmental aridification which affects 75% of the area of the province. This implies a sustained inhibition of biological development in the natural environments and the necessary demand for water resources in the districts of greatest agricultural production [16].

The company Riegos de Levante S.A. was constituted on 5 June 1918 in Madrid (Spain) before a notary. Its objective was to exploit public and private water for irrigation and for industrial, production, and electricity generating uses and to exploit the concessions obtained and any others that could be secured through the issue of shares.

From this moment, the company began an evolutionary process, beginning as a private company in 1918, with the idea of selling water in a geographical area characterised by its scarcity and ending up as one of the most extensive irrigation communities in Europe within an area of a protected national park. Until the present day, many events and transformations have affected the institution: the expansion of the infrastructures in an inflationary process, where there was more land than available water, the implementation of different sources for obtaining resources, with the arrival of the water from the Tajo-Segura transfer in 1979, the operation of the traditional irrigation infrastructures coexisting alongside a modernisation process of the systems, the transfer of the irrigation management responsibilities to the irrigation community, thanks to the intervention of the state, or the conversion of a reservoir aimed at regulating irrigation water to become part of a natural space protected by the government from 1988.

Tradition in Spain for collective water management has spanned for 1000 years, and more than 100 years ago, the 1879 Water Act [17] facilitated the voluntary creation of irrigation communities [18]. On one hand, there are some factors under which these institutions can achieve successful collective action, as is currently the case in Riegos de Levante, Izquierda del Segura, and are exposed in Lopez-Gunn [7], according to the theories of Schlager and Ostrom [19–21]: the major beneficiaries of the advantages that the coalition produces are clearly identified and are members of a coalition, those individuals who benefit from collective action goods provided by the coalition are clearly identified, and, both the boundaries of the service area and the individuals or household with rights to use water from an irrigation system are clearly defined.

On the other hand, the success of the creation of this large irrigated area (Figure 1), with a growing number of users, is due to other context-relevant factors: the guarantee of an electrical supply to power the motors and lifting pumps, the good design of infrastructures and supply networks which have gradually expanded across the territory, the configuration of a distribution system, first based on water auctions and then on regulated and transparent rates, and finally, the guarantee of supply, which was effective during the first years of functioning. Proof of this success is the continued existence of the model until today, as an example of good irrigation water governance, in which the design of conflict-solving mechanisms that ensure social, environmental, and economic factors relevant to governance has been adequately considered when adjudicating conflicts over time [3]. However, over its century-old history, it has not been exempted from difficulties derived from the scarcity of resources or tension between the principal agents who often have conflicting interests.



**Figure 1.** Irrigated area into Alicante province.

The research methodology combined qualitative analysis of literature and archive documents, as meeting minutes and notarial deeds, together with hydrological data and interviews with stakeholders. The most important resource for the paper was a set of meeting minutes from the community and the water user association. Methods are based on institutional analysis underpinnings which link method to synthesis and theory building, through a process of rigorous a posteriori analysis in which those institutions and actors have played an important role in producing local socioeconomic outcomes or environmental changes. Based on a close reading of the internal documents of the institution and the academic literature, the case study will yield insights about the entity and agents that have asserted their influence in shaping its current situation.

This paper aims to discuss a specific case and uses the summary of its history to focus on common attributes that appear through the lens of good water governance. To illustrate how effective water governance is applied in different ways, examples of how Riegos de Levante, Izquierda del Segura evolves in diverse scenarios throughout its history helps to bridge the gap between discussions presented in the introduction and the real-world.

### 3. Institutional History and Context—Relevant Dynamics

After the company was created through three Royal Orders, the water concessions that it was to use were assigned. They corresponded to the excess resources of the Segura River and the drainage channels of the Vega Baja del Segura district, which are regulated in the El Hondo reservoir. The first concession, of 19 September 1918, was for a volume of 2500 L/s from the Segura River when there were excess resources derived from the Guardamar dam, liberating 95 L/s in all seasons for irrigating smaller areas. The Royal Order of 28 March

1919 authorised a new derivation of 2600 L/s of the excess resources of the Señor and Reina drainage channels. When the volume was insufficient, they were complemented with the excess resources of the Culebrina, Enmedio, Acierito, and Mayayo drainage channels, in this order. Both concessions were granted to José María Serra y Alonso del Real, who, for a long time, became the soul of the company and was the representative of the family of the Dreyfus bank which provided financial support to the business. José María Serra y Alonso del Real was also the president of the Sociedad Eléctrica de Los Almadenes (Cieza, Spain), a board member of the Development Commission of the Segura Hydrographic Confederation (CHS), and elected member of the Governing Body of the drylands of the basin. Before the company's infrastructures were completed, in 1923, the third concession was obtained by way of the Royal Order of 26 July 1922. In this case, the company was assigned 2600 L/s from the Segura, transferred to the dam of Molino de San Antonio de Guardamar. The total water assigned was 7.7 m<sup>3</sup>, of which 5.1 m<sup>3</sup> were from the excess resources of the river and 2.6 m<sup>3</sup> from the drainage networks of the Vega Baja del Segura [9].

All of the concessions were governed by Article 188 of the Water Law of 1879 [17]. In other words, these concessions were made to a private company for irrigating land owned by others through the payment of a rate. This concession was granted for a period of 99 years. After this time, the land would no longer be subject to paying the charge for exploiting the water, thereby relating the use of water to the land benefiting from it in the future. It also stipulated that the collective dominance of the works undertaken for irrigation should be transferred to the irrigation community. In this sense, the initial date for enjoying the concessions was 4 April 1923.

### *3.1. The Origin of the Company: From Expansion to the Need to Be Rescued*

Riegos de Levante S.A. was officially inaugurated on 31 January 1923 by king Alfonso XIII. Its infrastructure works were declared as being of public interest and they began operating in the same year. Irrigation and energy constituted an indissoluble equation, as in order to carry out irrigation, the water had to be lifted 85 m above sea level, and the force needed for this process required a consumption of 6000 HP. The intervention of the Dreyfus Bank gave rise to the agreement with the company Brown-Boweri for the equipment to electrically lift the water, giving rise to the Compañía Eléctrica de Los Almadenes, located in Cieza, a municipality in the province of Murcia [22].

Thanks to the technological innovations and the introduction of new motors that were much more powerful than the previous lifting artefacts, it became possible to lift water across considerable distances at the end of the nineteenth century. Thus, the irrigated area grew substantially during the first third of the twentieth century, corresponding to the greater increase in the lands located within the province of Alicante and most of all, the area where Riegos de Levante S.A. implemented irrigation. The total area of the Segura River basin irrigated by lifting motors in 1931 was 22,573.3 ha, with the province of Alicante accounting for 82% of the total. This inflationary process, whereby there was more land than available water, gave rise to the beginning of the idea of selling water at the beginning of the 1940s. The area affected by the irrigation channels of the Sociedad amounted to almost 45,000 ha.

In March 1932, the Sociedad Eléctrica de Los Almadenes merged with Riegos de Levante S.A. under the name of Compañía de Riegos de Levante. At the same time, the concessions granted to the Compañía Riegos de Levante (Compañía, hereinafter) gave rise to an acrimonious reaction from the traditional irrigators of the Segura River basin. The irrigators argued that these concessions undermined their interests as they could affect their pre-emptive rights. The expansion of the networks of the Compañía towards the north of the municipalities of Orihuela and Alicante is highly interesting as these areas were located at a lower altitude than the principal channels, which made the hydraulic connection feasible. Furthermore, the Huerta de Alicante had a long tradition of irrigation and water auctions linked to the Tibi reservoir and the Monnegre river, with a considerable imbalance between the irrigated area (3700 ha) and the available water (1.6 hm<sup>3</sup>/year).



Bringing the water from other basins was always a priority and this was materialised in the transfer from the Alto Vinalopó through the Compañía, available from 1926.

The Compañía auctioned the water, and during the first few years, the business did not flourish because the areas that were actually irrigated were relatively small in comparison with the area that it served with its channels, with the rest used for cereal crops. The divergences between the interests of the irrigators and the purely speculative interests of the Compañía were large even in 1927 before the Segura Hydrographic Confederation (CHS) was constituted, when there was an increase in the auction price of water of 50%, which triggered a long dispute and protests. According to these divergences, societal response to hydrological change may be limited when the costs of action are individual but the benefits collective, and when costs have to be made upstream, but the benefits are downstream [12]. The problem was partially resolved with the beginning of an agreement to reduce the price of water to an intermediate position between the former price and the new one that the Compañía wished to impose. In order to obtain political gains from the agreement, which did not satisfy either of the parties, upon its inauguration by the Ministry of Development, the CHS acted as a mediator in the conflict, with the Ministry taking the credit for having reached a reasonable agreement. These events were important because they generated a climate among the public opinion favouring the interests of the farmers. It was considered that the farmers could not continue in the hands of a private company which could increase the price of water at its whim. Furthermore, the fact that the Compañía was mainly formed by foreign capital considerably influenced this positioning of public opinion. The Compañía used the conflict in order to begin a campaign in which it claimed that the only long-lasting solution that was beneficial for the farmers was for the state to rescue the Compañía, with the CHS intervening as a mediating institution, seeking to put an end to the problems that had arisen from the separation between the ownership of the land (the farmers) and that of the water with which this land was irrigated (of the Compañía). A rescue is an abnormal form of terminating the right of use of a public good that does not exclude compensation and its ultimate goal is to protect the public interest [9].

After obtaining a favourable public opinion, the CHS elaborated an additional budget for 1929 in order to undertake the rescue of the works and concessions belonging to the Real Compañía de Riegos de Levante and the Sociedad Eléctrica de Los Almadenes. The operation was valued at 43 million pesetas, a price that did not require any assistance from the state or the immediate increase of the tariffs paid by the irrigators [22]. However, the Compañía valued its assets at 57 and a half million and included in its conditions the urgency of the acquisition, as it claimed to have received offers from Spanish banks that were interested in purchasing it. The CHS made a counter-offer of 50 million pesetas (which required the assistance of the state). This was also rejected by the Compañía. Nevertheless, in order for the CHS to pay this price, it was necessary to add state assistance to the budget and increase the tariffs of the water users. In view of these two conflicting positions, another journalistic campaign was launched against the rescue. It claimed that the Compañía was over-valuing its properties, reinforcing the suspicions that this was an attempt to commit fraud against an entity that used public funds: the CHS. In light of these difficulties, particularly the serious financial problems afflicting the state in the 1920s, the rescue never took place.

### *3.2. Collective Action to Overcome the Difficulties: The Constitution of the Irrigation Community*

After the Spanish Civil War (1936–1939), the conflict continued between the irrigators and the Compañía Riegos de Levante, leading the Ministry of Public Works to dictate an Order on 21 November 1940 regarding the normalisation of the Sociedad Riegos de Levante, seeking to put an end to the conflict caused by the tariffs of water, its distribution, and the failure to include the users in the decisions made by the Compañía. The Order had five provisions, of which we will highlight two: the Compañía had to present a project to normalise the situation within a month, and in a maximum term of two years, it had to finalise the works that were still to be done, referring to the El Hondo reservoir. The

other provision stipulated the urgent constitution of the irrigation community, which had to be made up of the actual irrigators of the municipalities of Dolores, Elche, San Fulgencio, Albatera, Catral, and Crevillente, with the possibility of adding those of the rest of the municipalities affected by the concessions. While the situation was being normalised, Riegos de Levante was considered as “abusive irrigation” and the water was temporarily distributed by a Water Tribunal which put an end to the anomalies that had been observed.

A further step to regulate the functioning of the entity was the unification of the user rights into a single concession according to the Resolution of the Ministry of Public Works of 17 December 1945. This also included the exploitation of the water from the rivers Monnegre and Jijona, which, since time immemorial and by way of the enforceable judgement of the Royal Audience of Judgements of Valencia of 1552, had been used for irrigating the Huerta de Alicante. On 21 September 1947, the Organising Commission of the irrigation community passed the ordinances of the community and the regulations of its Irrigation Union and Jury. From that time, the intention of obtaining new sources from outside of the basin grew. This is a constant feature throughout the history of the community.

In this process, we should point out the significant delay that took place, even though Article 228 of the Water Law stipulated that the community was to be formed when the number of irrigators exploiting the waters derived from a public source reached 20 and the number of irrigated hectares was not lower than 200, criteria which were amply fulfilled in this case. The irrigation community was not formed until the constitution of the Comunidad de Regantes Riegos de Levante Margen Izquierda was definitively approved by Ministerial Order of 8 March 1949. As a result, the Water Tribunal terminated its activities and auctions ceased to exist, having been replaced with new exploitation rules. This step demonstrates how governance and management must work in tandem with technical approaches to solve water problems [11].

In accordance with the Water Law [17] and the principles of good water governance [2], for the government of the community, an Irrigation Union and Jury were established. The Union was responsible for the administration of the irrigation and constituted a connecting element between the irrigators and the concession-holding company. With respect to both complaints and requests and the payment of the water consumed, it acted in defence of the irrigator as opposed to the Compañía. Meanwhile, the functions of the Irrigation Jury as the depository of the judicial power in the community consisted in mediating in all conflicts arising between the participants of the community in relation to the use and exploitation of the water, examining the reports lodged for violations of the ordinances, and conducting the corresponding trials and passing the judgements in each case. Water management should be based on a participatory approach, involving users, planners, and policymakers at all levels, as a participatory and consultative approach can help to strengthen local government and bring the positive aspects of such arrangements into the formal system and reduce vulnerability [3].

On the other hand, the Compañía Riegos de Levante decided to segregate the electrical business and transfer it to Hidroeléctrica Española in December 1959. The operation was completed in 1961 and the Compañía thereafter was exclusively dedicated to the irrigation water business. The electrical distribution company was transferred to Hidroeléctrica Española, S.A., by Ministerial Order on 27 August 1963.

### *3.3. The Purchase Transaction of the “Compañía Riegos de Levante” by the Irrigation Community*

Another milestone in the history of Riegos de Levante was the Decree of 25 April 1953, which became law on 12 May 1956, enabling the consolidation of all areas irrigated after 1933, without affecting the interests of the traditional irrigators (existing before 1933) [9]. It regulated the water of the Segura River used to complete the insufficient irrigation volumes, given the proximity of the dates for completing the works of the Camarillas-Cenajo reservoirs (1960), which would increase the regulated irrigation water by 70% [23]. However, even though it existed before 1933, Riegos de Levante Margen

Izquierda continued to exploit the excess water, subject to its existence. Until the regulation of the basin and given the river regime, the Compañía was always able to lift large volumes of excess water in spring and autumn. This circumstance led farm owners to construct irrigation ponds to store the water that they bought in these periods and ensure their resources for the whole year. But this situation was aggravated when the reservoirs in the headwater basin came into operation, as the regulation of the basin made the existence of excess resources in the river increasingly difficult. In addition to the lower contribution of water, there was the problem of its poor quality. The excess water of the river was runoff and seepage water from the neighbouring land which contained high levels of chloride, which meant that this water had a high salinity level. In this way, irrigation led to the gradual salinisation of the soil which then was only apt for highly tolerant crops.

This water scarcity led farmers to leave a large part of their lands dry and use the assigned volumes for extensive crops that required little water (such as almonds, olives, and carobs) and only grew grass and tree crops intensively on a small area of their land applying irrigation [23]. The Union of Riegos de Levante lodged an appeal case against the new regulation, as the community understood that it was not included as a beneficiary of the new regulated waters of the Segura. In 1959, the case had still not been formalised and a year later the ruling was passed by the Third Chamber of the Supreme Court on this lawsuit; after the hearing held on 20 May 1960, the Court declared that it had no jurisdiction to hear such a case. Without going into detail, the irrigation community was not entitled to bring any legal actions as the competency to initiate proceedings was held only by the Compañía.

Poor governance leads to increased political and social risk, institutional failure and rigidity, and a deterioration in the capacity to cope with shared problems [3]. Then, governance systems should facilitate action and not create an obstacle to development, which will have important results and serious repercussions on future developments of the community, as can be seen in the evolution of Riegos de Levante, Izquierda del Segura.

In 1965, the Union and community made endless complaints about the Compañía due to the continuous divestment that it made in the systems' installations which led to breakdowns of the lifting machinery, the poor state of many of the channels, and the partial burying of the headwater reservoirs, which caused serious economic damage to the irrigators. In response, the Compañía reacted with the request for new tariff increases so as to be able to execute new investments, seeking profitability. In many developing countries, considering recent decades [5], charges to users did increase, but farmer systems have tended to under-invest, thus necessitating public rescue. In this case, the increase in tariffs by the Compañía was considered due to the increase in wages that was taking place in Spain at the time. Finally, an agreement was reached regarding the increase in tariffs by 26%, which came into force in 1967. From then, the increase in tariffs was constant, although the improvement in infrastructures was not significant.

At that time, the community covered a total area of 39,296 ha which were distributed among more than 20,000 irrigators of the province of Alicante, with estimated water needs of the area of 284 hm<sup>3</sup>. This is a utopian amount that could never be reached with the existing resources at the time in the Segura River basin. Therefore, in view of the imminent arrival of the Tajo-Segura transfer that sought to obtain a water balance, it was essential to construct new installations with the help of the state. Since the Compañía was a limited company, it could not receive official aid which would be received by the irrigation community. In this context, the possibility of the early rescue of the Compañía became relevant.

In reality, we cannot talk about a rescue for two reasons: first, because the concession-holder, the Compañía, did not offer the state the reversion, but opposed a voluntary rescue; second, because the state was not interested in this rescue. It was the irrigation community that sought it so that it could acquire the works and installations of these concessions. Therefore, the advantages to be gained by the community from acquiring the rights of the



Compañía constituted a merely private matter. They did not contemplate the public interest which was necessary in order to carry out an expropriation or rescue of the concession.

The purchase operation was carried out on 10 December 1976 for a price of 70 million pesetas for the concessions and installations of the Compañía Riegos de Levante, S.A., by the irrigation community, with effect from 1 January 1977 by way of a notarised public deed. The state merely played a monitoring and supervisory role, as it sought the autonomy of this irrigation and for the users themselves to resolve their problems. However, it was always in favour of putting an end to the dissociation between the ownership of the water and that of the land, and therefore it supported this operation. Thus, to facilitate the transfer, the Ministries of Public Works and Agriculture committed to making a large investment in a works plan which was carried out between 1978 and 1982 to improve the deteriorated infrastructures, guaranteeing the participation of the Banco de Crédito Agrícola in the financing of the purchase. In order to ensure harmony in the actions to be undertaken in the areas benefiting from the transfer, the Council of Ministers decreed the lines of action of the Ministries of Public Works and Agriculture in the irrigated areas of the transfer, which had been declared as being of national interest in 1972. In this sense, these changes in the organisation of water governance are the outcome of interrelated changes in the determinants of actor-specific perceptions about the costs and benefits of governance [24]. This example illustrates how the governance element of empowerment is required, complete with capacity building and financial assistance to ensure compliance with policy-driven regulations. Later, a heavy hand of control and enforcement would be more appropriate to set the stage for effective governance, with the intervention of the river basin authority [11].

In the meantime, the water from the Tajo-Segura inter-basin transfer (TST) arrived in the community on 15 June 1979, although amidst high tensions with respect to the price of the water as the irrigators complained to the Segura Hydrographic Confederation that the tariffs had been manipulated.

#### *3.4. The Constitution of the “Comunidad General de Regantes Riegos de Levante, Izquierda del Segura”*

Although the area benefiting from the inter-basin transfer in the province of Alicante after it began to operate was estimated at 50,183 ha, in practice, this area has been smaller, as have the water resources applied. The forecast of the water from the transfer necessary for each of the irrigated areas declared as being of national interest was carried out in accordance with the total area to be irrigated in each sector, taking into account the volumes supplying the traditional irrigation, the excess waters existing in each area, and the available underground resources. So, in 1987, the only area that had not fulfilled its expectations was Riegos de Levante Margen Izquierda: of the 38,190 ha forecast, only 65.46% had been transformed, while the rest of the areas benefiting from the transfer in the province of Alicante had completed the transformation of the irrigated area. This is a consequence of the low estimate of the transfer water required due to the gradual reduction in the contribution of water from concessions attributable to two factors: the regulation of the Segura River basin through the construction of reservoirs and the modernisation of the irrigation (drip irrigation and automation) systems which reduced the water returns that could be used as excess resources in El Hondo, increasing its salinity. In short, some of the expectations that were created in the province of Alicante with the transfer waters were frustrated [10]: the water from the Tajo was expensive, it arrived irregularly and with lower volumes that had been initially predicted. Its quality, however, is good and it is undeniable that without the transferred water, the area would not have experienced the significant changes that have taken place.

The water scarcity together with the pressure of demand and the increase in the costs of the service contributed to raising the price of this resource. Furthermore, the operating rules of the community, called ordinances, had been conceived for an entity with no economic obligations, as the management was carried out by the Compañía and the community supervised the distribution of the water. However, after the purchase, it took

on an economic responsibility of a budget of over a billion pesetas for normal operations and another billion in investments for new works and improvements with the assistance of the state. This led to an exponential increase in the community's debt between 1980 and 1983 and it was feared that its assets would be frozen. This triggered the intervention of the government in the operation of the community, and the new ordinances and regulations of the community of 1984 established a binomial tariff to reduce the deficit composed of a variable quota depending on the water consumed and another fixed quota in proportion to the irrigated area, responding to the previously budgeted expenses [25]. The situation improved between 1984 and 1986 and the available funds enabled it to fulfil its most urgent commitments, such as paying for the transfer water, energy consumption, and taxes and creditors, conforming to the debt recognised by an external audit. However, after 1987, the community began to incur losses again as it had not taken into account the real cost of the water from the transfer, which it was using in a greater proportion each year.

This period of serious internal tension on an institutional level revealed the fact that the organisational structures of the community could not assume the new challenges arising from the arrival of the transfer waters, together with the financial consequences of the purchase of the Compañía. The CHS threatened the community due to the debt of previous years: if the community did not present a guarantee, it would be liquidated. Furthermore, the first half of the year 1990 was particularly critical in terms of the situation of the community: the transfer was stopped due to the debt that it had with the CHS, the Hidroeléctrica Española threatened to cut the electricity supply and the banks did not facilitate the availability of liquidity, which prevented it from paying debts and wages. After the many financial imbalances, in May 1990, the Segura Hydrographic Confederation (CHS) ceased to intervene in the community. A series of provisional ordinances were approved as was a Management Commission presided by the then mayor of Elche. By agreement of the CHS on 21 November 1990, the irrigation community was restructured and became known as the Comunidad General de Regantes Riegos de Levante, Izquierda del Segura, and each former irrigation area became a first-degree irrigation community into this water user association or general community.

According to the Spanish water legislation, the user communities are public-law corporations. These corporations are called irrigation communities when they are made up exclusively by this type of user. The Revised Text of the Water Law [26] promotes the collaboration between the holders of the water exploitation rights. When these communities are only made up of final users, they are called first-degree communities. However, it is possible to create entities with a greater scope made up of several first-degree communities or first-degree communities and individual users who do not form part of these communities. In this case, they are second-degree communities which can be general communities if they are made up of only first-degree communities or central boards if they also include individual users [9]. The nature of public-law corporations has traditionally been controversial. In fact, although the user communities often operate as private entities in terms of their relations with third parties, they act as public administrations when they undertake general interest functions within the framework of their organisation and in exercising their public responsibilities. In short, the general communities are corporate entities with an associative base. Their principal function is to organise and defend the common interests of the irrigators and they are the expression of an enhanced cooperation between the state and society and the exercise of powers conferred by public authority to defend the general interest in the distribution of water uses.

From an organisational point of view, the restructuring included the creation of a general community made up of nine first-degree irrigation communities which have full judicial and economic autonomy, currently called: El Canal, Tercero de Levante, Sexta y Séptima de Elche, Cuarto Canal de Levante y Séptima de la Peña, Bacarot, Huerta de Alicante, Crevillente, Albaterra (although segregated from May 2001), and Cuarto Canal de Poniente-Orihuela. From 1994, the economic problems began to be resolved. Agreements were reached to restructure the pending debts, and in February 1996, the

definitive ordinances of the general community were passed, and its General Assembly and Governing Body were constituted according to the current functioning. The studied case shows the importance of human and social capital quality, their local rootedness, and recognition of how valuable collective water management is; these factors, which depend on the tradition, culture, and size of the water user collectives, make irrigation entities more robust vis-à-vis external pressures and disturbances [8]. This evolution of the entity, by means of an adaptive governance to water management, shows the significant role that the new structure may play in resolving underlying differences between stakeholders, contributing to the sustainability of the integrated system [27,28].

#### **4. Traditional Irrigation, Modernisation, and Complementarity of the Sources of Water Resources**

Throughout the second half of the twentieth century, water scarcity in south-east Spain was seen by part of the state as a national problem, defining the Tajo-Segura transfer as a work of national solidarity and social justice. The supply of water through a transfer enabled an intermittently irrigated area to be transformed into an irrigated area with water continuity. Even so, the resources continued to be insufficient. The subsidies from the state and the regional government (through the Departments of Public Works and Agriculture of the Regional Government of Valencia, respectively) enabled the traditional irrigation systems to be modernised and new structures to be built, such as the Crevillente reservoir. This modernisation has been essential for regulating the volumes from the TST, the connections with the community's channels, the installation of the remote control for the lifting equipment, or the installation of the irrigation system on the plot. This allows cost savings to be made and creates sufficient regulation capacity in order to guarantee a continuous supply. Public promotion of modernisation and drip irrigation has been implemented in Spain in a combined top-down, bottom-up process, in which the administration provided subsidies and performed some state-led projects [29].

Subsequently, in view of the water shortage suffered in 1995, obtaining alternative resources became a priority for the managers of the community. These alternatives included the use of urban wastewater, desalination, and the exploitation of aquifers. From 1974, the Town Council of Mutxamel had offered the wastewater generated by the municipality. However, it was not until 1984 when concessions were requested to obtain the wastewater of the municipalities of the catchment area which amounted to 25 hm<sup>3</sup> per year and to use the brackish waters through their desalination. From 2006, the water user association was able to make use of the resources from complementary water sources, defending the use of all the available resources within the framework of a comprehensive hydrological plan, considering: the maintenance of the TST, the transfer agreements with other irrigation communities in times of drought, the resources from the regeneration of urban wastewater, the modernisation of the irrigation systems (drip irrigation and automation), the underground water, either filtered from the Crevillente reservoir or from other hydrogeological formations, and the desalination of seawater and brackish water.

The primitive facilities of the Compañía Riegos de Levante had been operating without hardly any modifications until the 1980s, when they were partially renovated. The distribution of water was carried out through a lifting system from the Guardamar dam along the original course of the Segura River (until the new river mouth of the Segura was constructed during the 1990s) and which consists in staggered underground installations. The lifting system is made up of a principal channel and five transversal channels with a total of seven elevations from Orihuela to San Juan de Alicante, over a 70 km long territorial strip. El Hondo reservoir has an area of 16 million m<sup>2</sup>, of which 1100 ha correspond to the reservoir and the 500 remaining ha to the bordering land, protecting against the adjacent salt marshes which are isolated by mounds of earth with a height of between 2 and 5 m and in some parts by concrete structures. The water pumped from the Segura River and the drainage channels accumulated in this reservoir. This amounted to a volume of around 70 hm<sup>3</sup>/year and is what usually arrived from the Segura in the most favourable times during the first years of operation. However, the average volume of water stored in the

El Hondo reservoir between 1964 and 2017 was only 31.5 hm<sup>3</sup>, as from the arrival of the waters from the transfer, the waters in El Hondo became complementary to the higher quality resources from the TST [9].

Due to the large exposed surface area of the El Hondo reservoir and taking into account the high sunshine indices, the evaporation levels were very high, estimated at 15% of the total reserves of accumulated water. However, this was not the only complication, as the gradual reduction in the volumes of excess water gave rise to a high salt concentration which significantly diminished the quality of the water (over 4000 µS/cm). Therefore, this water had to be used preferably for irrigating horticultural crops, which are more resistant to chlorides. The reservoir currently has a useful capacity of 10 hm<sup>3</sup>. This quantity is far from sufficient to fully exploit the excess water. The current co-existence of traditional waters with transferred waters is explained in the following hydraulic diagram (Figure 2), which shows the principal storage, distribution, and lifting infrastructures of the water user association.

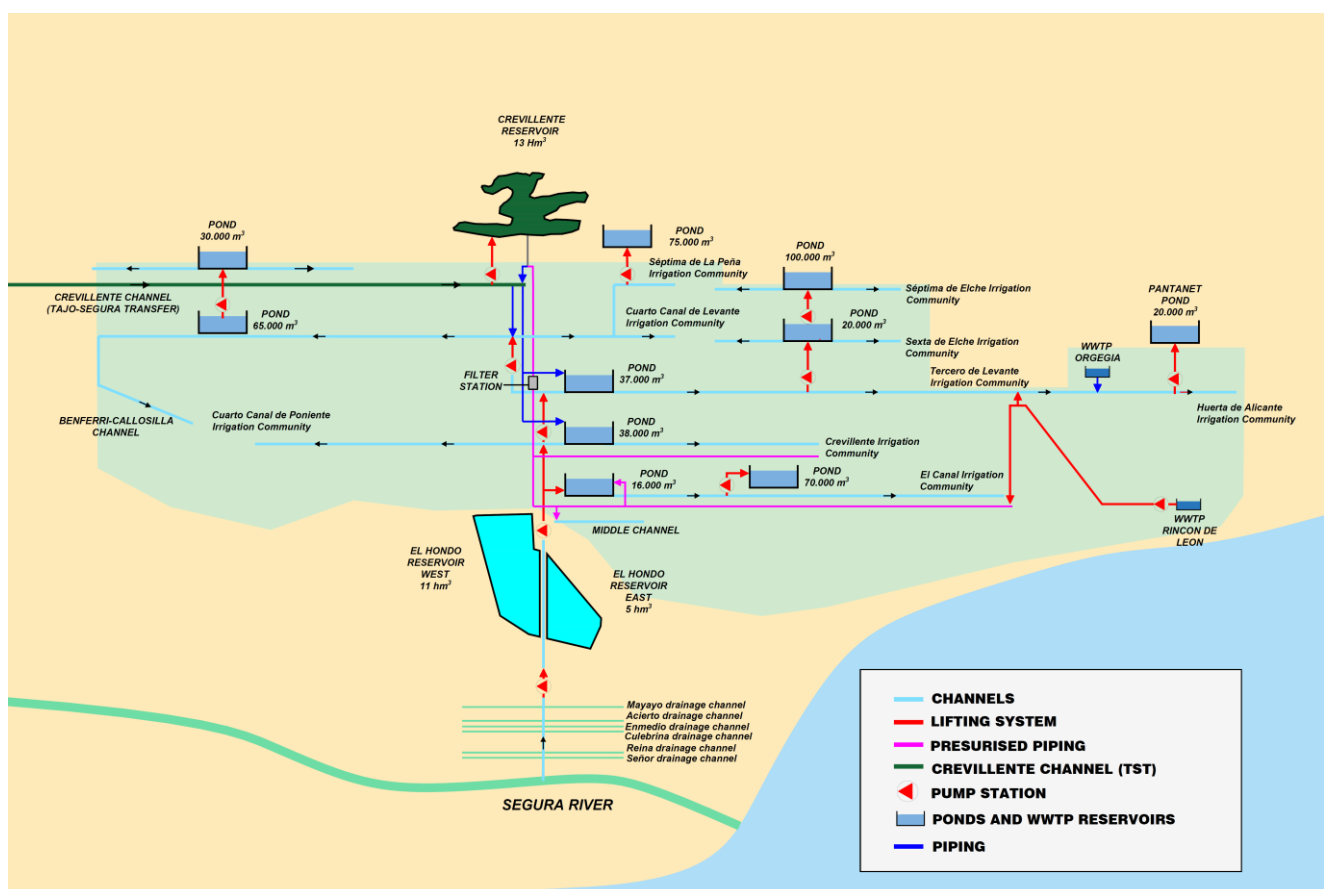


Figure 2. Hydraulic diagram of Riegos de Levante, Izquierda del Segura.

Principally, there are two large types of network: those that distribute the water of the concessions through lifting, using the El Hondo reservoir as a regulating element, and those that are distributed from the Canal del Postravase de la Margen Izquierda or the Crevillente reservoir, from the TST, water markets, drought wells, and other complementary sources. As well as the El Hondo and the Crevillente reservoirs, the irrigation ponds also contribute to regulating the system. With a capacity of 12.78 hm<sup>3</sup>, the Crevillente reservoir has the function of regulating part of the volume transported along the Canal Postravase de la Margen Izquierda. Its small basin and low contributions would never have justified its construction and it acts as a regulating tank at the tail-end of the Canal: practically all of its contributions come from the exploitation of the Tajo-Segura transfer. In 2001, the

CHS granted the general community the use of the Crevillente reservoir. However, the personnel and maintenance costs correspond to the CHS.

As we can observe in the diagrams, the infrastructures constructed to modernise the irrigation systems are the following: a main pipe with its inlet from the Crevillente reservoir running to the filter station, continuing to the origin of the transport channels, a second network of pipes leaving the filter station, where there is a branch for each of the irrigation communities, and the sector headwaters. These are points where the pressure is reduced, and the flow is measured to distribute through the tertiary or distribution network. Due to the large area where the irrigation systems of the general community were modernised, the network was designed based on the division of the irrigated area into 100 ha plots, which coincide to a certain extent with the different irrigation communities and their irrigation channels. In essence, integrated water solutions require effective governance, as well as suitable technical solutions and management instruments [11].

Nowadays, the situation of the TST (the main source of water) is worrying due to the context of uncertainty caused by different factors. These factors include the raising of the reserve thresholds permitted in the headwater reservoirs of the Tajo river so that the transfer of water between basins can be carried out, the constant judicial appeals of the neighbouring autonomous regions, the scarcity of rainfall in headwater systems due to the prolonged droughts (leading to the total closure of the TST between May 2017 and April 2018), or the elevation of the environmental flows in the new hydrological plan of the assignor basin. In the light of this uncertainty, the search for complementary resources is continuous, although it is not yet possible to fulfil its potential. In this respect, in 2018, the community even planned its own desalination plant. Furthermore, water from wastewater treatment plants (WWTP) arrives eventually, since 2013, 1.2 hm<sup>3</sup>/year on average, and is used when legal and operational factors converge. It should be mentioned that the irrigated area is geographically located between two Hydrographic Confederations (Segura and Júcar), but water resources come mainly from CHS, except for wastewater sources approved to date, which come from Júcar Hydrographic Confederation. Finally, we should remember that the water user association, Riegos de Levante, Izquierda del Segura, was granted a theoretical quota of 77.5 hm<sup>3</sup>/year of the TST water, but between 1979 and 2020, only 35.8 hm<sup>3</sup>/year on average arrived, as we can see in the following Figure 3.

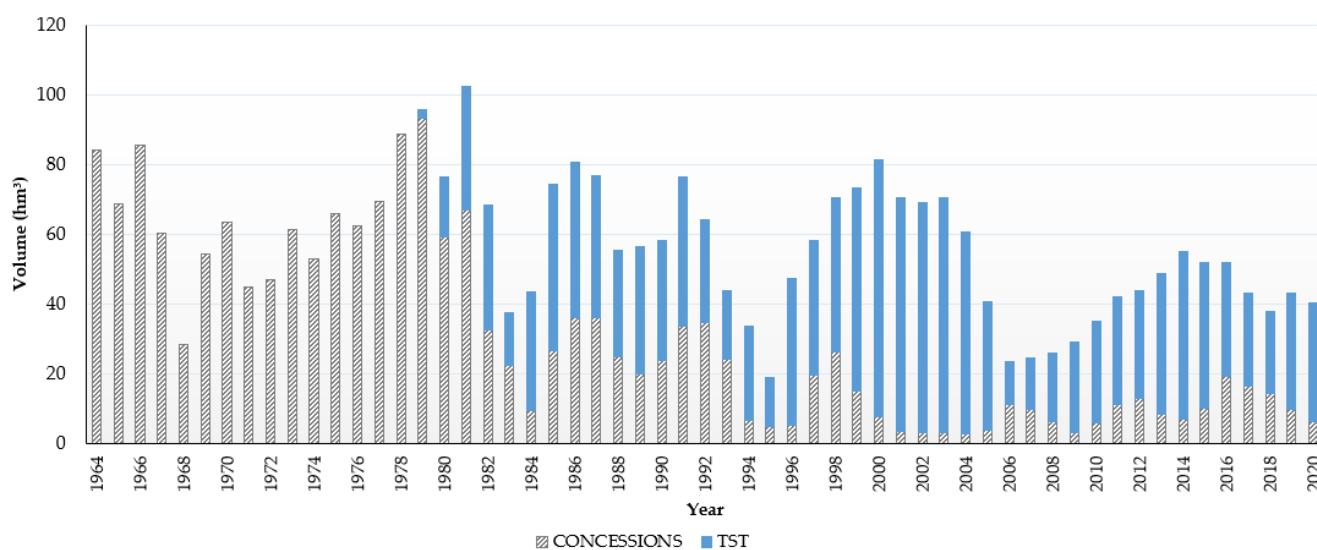


Figure 3. Water distributed by Riegos de Levante, Izquierda del Segura in the last decades.

## 5. The Natural Park

El Hondo is located in a floodplain between the municipalities of Elche and Crevillente, with an area of 2387 ha. It is an artificial wetland emerging from anthropic action as it



was manually constructed by the Compañía Riegos de Levante. El Hondo is made up of two irrigation regulating reservoirs called Poniente (West) and Levante (East), natural pools in the perimeter area of the reservoirs, reedbeds, rushes, salt marshes, and land for orchards and palm groves reclaimed from the wet area. *El Hondo* receives the runoff waters of Crevillente and Abanilla, the excess waters of the Segura River, the irrigation returns via the drainage channels, and also water from the aquifers bordering the area, even though their bottom has been made watertight [30].

Its environmental and landscape value has enabled the generation of a symbiosis between human activity and the preservation of the environment, giving rise to a marvelous ecosystem [31]. Even before the official protection of the space, the respect for the natural characteristics of the environment was achieved due to the need to conserve the quality of the water for irrigation, on one hand, and due to the importance of the activities related to the appropriate maintenance of complementary activities developed there, such as hunting or the sale of canes. The importance of the hunting activity in the history of *El Hondo* can be observed in many references appearing in the Minutes of the Irrigation Union, expressing the will of the community to protect the space to maintain this activity. There was a deep-rooted tradition of putting the sale of the hunting stations up for auction. However, this tradition was stopped in 1977 as it gave the control of the activity to those with the most economic resources. The system changed to the direct sale which enabled the community to better control the assignment and distribution of the stations and the way in which hunting was organised in the space.

The space was declared a natural site by the regional government, by way of Decree 187/1988 of 12 December, of the Consell de la Generalitat Valenciana, concerning the declaration of El Hondo as a Natural Site of the Region of Valencia due to its ecological and landscape interest. Thereafter, the decisions that were made throughout the 1990s in relation to the environmental protection of the space often clashed with the interests of the general community and the traditional activities carried out within it. For the community, the most harmful aspects of these environmental measures, due to their incompatibility with the correct management of irrigation, were the hunting ban, the impossibility of drying out the reservoirs without prior authorisation of the regional ministry, and the limitation of sharp movements of the water levels in the reservoirs during the period between 1 February and 31 August. Moreover, no types of action that implied an alteration for the protected species or the quality of the waters could be carried out without the authorisation of the regional ministry. However, the declaration of *El Hondo* as a natural site gave rise to the contribution of economic resources by the Regional Government of Valencia. Subsequently, it was declared a natural park by the Regional Government of Valencia in 1994, as category IV, Habitat/Species Management Area, to maintain, conserve, and restore species and habitats, according to the definition provided by the International Union for Conservation of Nature (IUCN). It is included in the lists of the Ramsar agreement [32] and is classified as a ZEPA (Area of Special Protection for Birds), due to the relevance and abundance of its birdlife. It also forms part of Natura 2000, a network of nature protection areas in the European Union. Therefore, it is a Site of Community Interest (SCI) according to the Habitat Directive (92/43/EEC).

The ban on hunting in the natural space was one of the most contested measures and was challenged by the community through different appeals, and the first were dismissed by the High Court of Justice of Valencia. However, after the corresponding cassation appeal to the Supreme Court, the High Court acknowledged the right of the community to be compensated by the Regional Government of Valencia. Therefore, the general community received several compensation amounts, which have contributed to improving its financial imbalances [25]. In addition, the formalisation of the agreement with the Regional Government of Valencia regarding the environmental exploitation of El Hondo generated extraordinary annual resources which normalised the functioning of the community. These economic compensations were based on the acknowledgement by the public authorities that the water maintenance of El Hondo corresponded to the

irrigators of the general community. Through this payment, it was understood that they were compensated not only for the cost of acquiring the water, which cannot be withdrawn, but also all of the costs borne by the irrigators to carry out the water management of the reservoir under the terms stipulated by the agreement signed each year.

## 6. Conclusions and Policymaking

As can be seen, the water user association undertakes the comprehensive management of the water, and this management can be considered as being exemplary. It searches for and uses non-conventional resources drawn from desalination and the reuse of urban wastewater, without renouncing its traditional resources such as surface waters of the concession of the Segura River and the waters from the Tajo-Segura transfer. Underground resources also constitute a source of supply as the so-called drought wells are sometimes used, the essential minimum to contribute to overall sustainability of groundwater and avoid over-exploitation. One of the community's main concerns is the constant search for new underground water in the area of the general community or surrounding areas. Even though this water has a high saline content, it seeks to treat it for its subsequent use through its own desalination plant. Besides, the efforts to modernise the irrigation system that the community has been developing for decades should be taken into account.

Particularly noteworthy in this process is the intervention of the state or the regional government in promoting each of the changes that have marked the path of the water user association, such as: enabling the arrival of the water from the transfer, modernising the irrigation systems, creating new infrastructures or a natural park. This case demonstrates that the characteristics and autonomy of the water user association are a result of their interaction with state administration, in permanent dialogue, sometimes marked by conflict, and sometimes by cooperation and shared criteria [33]. This case exemplifies how to pursue the right balance by identifying and progressing actions needed for policy, empowerment, and control, even while other institutional arrangements and context-relevant dynamics continue to evolve [11].

In view of the persistent shortage of resources in the area, we can conclude that the continued existence of this irrigation system has been, above all, an achievement within an extremely hostile environment—a process of territorial transformation and appropriate adaptation to this environment, where hydrological planning has been limited to the confirmation of the existing water deficit [10]. This continuity has been achieved through several complementary mechanisms: the multiplicity of sources of supply, the under-watering of crops, and the application of saving techniques, without losing sight of the long-term sustainability.

Then, a number of factors characterise Riegos de Levante, Izquierda del Segura, in comparison with other case studies—where water user associations have had very mixed results around the world [2]—and in order to meet good water governance assumptions, such as: capacities for adaptation required in a rapidly changing environment over a century, relying on a variety of origins of water resources and adaptable to manage efficiently various water qualities with its own filter station, the integration of first-degree irrigation communities, which often have conflicting interests, but with participation in the decision-making processes, transparently and with a comprehensible language in assemblies and meetings, the exceptional adaption to different institutional frameworks and organisational schemes, considering a holistic approach on the development of the appropriate legal, institutional, economic, and technological mechanisms, the coexistence between two Hydrographic Confederations, and the social integration of different municipalities, but with no formal role in the administrative control of the entity. With regard to financial support, an important issue is the participation of the users according to the full cost recovery principle in the case of the TST water, and partially in the case of concessions water, and the paradigmatic and harmonious coexistence of the protected environment with a traditional, as well as modernised, irrigation system.

Currently, there are serious doubts as to whether the amounts forecast for the TST can be consolidated in the future. For example, between May 2017 and April 2018, no water was transferred from the Tajo. Therefore, even today, the use of the water from the former concessions is still essential even in spite of the high salinity of the water: from 1979 to 2020, the water from the concessions amounted to, on average, 18.9 hm<sup>3</sup>/year, representing 53% of the water received from the transfer in the same period.

All in all, as we can observe, the panorama for the near future for this entity consists in fulfilling a wide range of objectives aimed at maximising the use of a resource as valuable as water.

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