THE *FUENTE DEL BERRO* (MADRID*)*

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SUMMARY

The Fuente del Berro, situated in one of Madrid's most beautiful parks, is of great historic value due to its renown waters, consumed by the members of the royal family and the inhabitants of Madrid since the times of Phillip IV (c. 1631). The present report analyses historical data, the geological and hydrological features of the area, the underground channels supplying the fountain and the properties and quality of its water. Also described, is the current state of the fountain. The Fuente del Berro is a good example of the many water points which splashed and supplied the city's needs from the time the Royal Court was established (1561) to the end of the XIX century.

1. LOCATION AND HISTORICAL REFERENCES

The origin and peculiar history of the Fuente del Berro is linked to that of its estate, or "Quinta", bearing its name or known as the Quinta de Miraflores. Today, the Quinta de la Fuente del Berro is a beautiful and rare example of a landscape garden in the old quarters of Madrid, whose development has always been conditioned by the presence and use of the fountain's waters.

The fountain is found outside the parks limits and may be accessed via the Calle de Peñascales (fig. 1). The estate is situated between a colony of houses and a stretch of the Avenida de la Paz, or M-30, bordering its east side.

The first historic references denoted it the Quinta de Miraflores or Huerta del Condestable, set in an area of crops and plantations. In 1631, it was purchased by the royal family, and in 1641, His Majesty Phillip IV ordered that the estate be prepared as a residency for Benedictine monks, after their eviction from the Monasterio de Montserrat, a consequence of the war between Catalonia and Castille starting in 1640. Among the assets donated to the monks, "the waters necessary for the royal servants" were reserved. Apart from the royal family, there is no record of any other owner or beneficiary of the fountain, except some mention of the estate and public consumption describing it as a "public fountain".

In 1680, Queen Mary Louise of Orleans dictated that all the water served in her royal household should be from this fountain, and established a special transport service to the palace once or twice a week. Charles II, who was used to the waters of Naples, instructed that the fountain should be housed and its waters be transported even to the Court's summer residence; in glass jars for the court members and crystal ones for the monarchs. The people of Madrid were also addicted to the fountain's water, and could purchase it from vendors in the Calle de Alcalá, the bull ring and the hippodrome or from the stalls of the Prado and Recoletos.

Already in the XX century, the garden or Parque de la Fuente del Berro was protected by the state, under the law of "Artistic Treasure", and was declared an “artistic garden” according to the decree of 31st July 1941. The city council purchased it from Mauritz van Eeghen on 21st June 1948. In 1954, it was opened to the public.

At first, the park had the characteristics of an estate on the outskirts of the city, with orchards and vegetable gardens. Having belonged to numerous owners, in the XIX century it acquired the landscaped appearance that it has today. The ease with which this style could adapt to its setting is attributable to the vegetation maintained over a prolonged period, the abundance of water and its topographical position, protected from the prevailing winds. Its particular microclimate allowed the development of the soil. The slope towards the Abroñigal stream (today the M-30) led to the creation of forms and wavy paths, essential in the development of a landscape garden. The garden also harbours several architectural and faunal motifs, typical of the XIX century's romantic trends.

The garden has suffered some modification over the past decades, including the infilling of a water channel or “Ría Grande” in the eastern zone, which used to bear a jetty. The drying of the “Ría” has upset the ecological balance and accelerated the extinction process of some exotic plant species.

Despite all, the presence of water continues to be an essential part of the garden, and runs from the Fuente del Berro over the park's terrain or via stretches of underground channels. A further modification has been the planting of bushes, defining paths for transit and protecting lawns and woods from massive degradation.

2. MADRID'S WATERWAYS ("Viajes de Agua")

The Fuente del Berro is supplied by means of two underground channels (fig. 1) according to Madrid's traditional waterway system that supplied the entire population until the middle of the XIX century. The system consisted of a complex network of channels or "mines" that penetrating the saturated zone of the subsoil, captured filtration waters and led them towards the city's gates, where the channels which led to the public fountains started their course (López-Camacho et al., 1986).

The fountains of Madrid were a typical sign of urban landscape and included the famous: Fuente de San Isidro, Fuente de la Salud in the Parque del Oeste, Fuente La Mariblanca, Fuente de la Alcachofa in Atocha, Fuente de los Once Caños, Fuente de la Reina, etc. Even the monument fountains of the Salón del Prado such as that of “Cibeles” or “Neptuno” were fed by these waterways, or “viajes de agua”.

The construction technique for these channels was to expose wells until the saturated zone was reached. These were joined such that they approached the city via tunnels which also captured water and were lined or left unlined depending on the consistency of the terrain.

Throughout the XVII and XVIII and first half of the XIX centuries, these waterways were the only supply route for the city, since although there were wells in private estates, these were only used for irrigation purposes. The total length reached by the waterways was some 124 km, of which 70 km were capture tunnels and the rest were transport channels (Gil Clemente, 1911).

The discharge generated was of the order of 3,600 cubic metres per day. This amount diminished over time mainly because of the lack of good conservation practice. Towards

the middle of the XIX, the gauge did not exceed 2.000 m^3/day (Canal de Isabel II, 1954). A further supply limitation stemmed from the fact that only surface penetration was achieved in the saturated zone. This made the system highly vulnerable to the effects of drought.

3. GEOLOGIC AND HYDROGEOLOGIC FEATURES OF THE AREA

The waterway that fed the Fuente del Berro is situated on the hydrologic detritic unit “D” (figs. 2 and 3) and, in some stretches, cuts the transition hydrological unit "T".

The “D” unit is lithologically comprised of arkoses derived from the erosion of the relief at the border of the sedimentary basin (Sierra de Guadarrama), which were deposited and infilled the geological Fosa of Madrid via the mechanism of alluvial fans. Two subunits may be vertically identified in the hydrological unit D:

> The upper D_2 subunit. Lithologically composed of more or less clean arkoses, southwardly increasing in fine grain content.
>
> The lower D_1 subunit. Characterised by monotonous alternating arkoses and brown clays or silt, and a similar decrease in grain size towards the south, accompanied by an increase in the proportion of mud.

The hydrological T unit is mainly formed by clay and carbonated materials. In the area considered here, green clays with carbonates appear, showing a high degree of lateral discontinuity and frequent changes. Its boundary with the detritic unit occurs via a lateral facies change.

The supply route to the Fuente del Berro consisted of two channels; one which commenced in the Las Ventas bull ring (North branch) and was lined with plaster; and the South branch, which ran from the vicinity of the Calle Ibiza, passed close to the Palacio de los Deportes and was not lined. Its cross-section is described as “lomo de caballo”, or "horse back" (fig. 4 and photo 1). Both waterways join together in the area of the Calle Marqués de Zafra, and run south to the Fuente del Berro.

The unique nature and fame of the water from the Fuente de Berro is attributable to its dissolved salts. This property was conditioned by the presence of materials from hydrological unit T, which cut the channels and enrich the waters with magnesium and calcium salts increasing hardness to around 100 ºF (French degrees). The chemical composition of water samples taken from the northern and southern branches is shown below. It is of interest that today’s criteria for quality (e.g., the popular water from Lozoya has a markedly lower salt content and a hardness that does not reach 10 F) differ so much from those defining the water that was so much to the agreement of the people of Madrid for centuries.

CHEMICAL COMPOSITION OF THE WATER FEEDING THE FUENTE DEL BERRO

	North Branch	South Branch
Cl^- mg/l	57	28
$SO_4^=$ mg/l	837	595
COH_3^- mg/l	268	256
NO_3^- mg/l	86	81
Na^+ mg/l	55	49
Mg^{++} mg/l	85	73
Ca^{++} mg/l	261	200
K^+ mg/l	4	4
TSD mg/l	1652	1.278
pH	7.1	7.0
Hardness ºF	100	80

The water supply to the Fuente del Berro, which for centuries quenched the thirst of the people of Madrid, or "Madrileños", was cut off in 1977 due to bacterial contamination. Its water was consequently diverted towards the duck pond within the park. In 1986, the following stretches of its waterways could be accessed: the North branch could be identified from the fountain to the Calle Pedro Heredia; the South one from this point to the Palacio de los Deportes.

On 16th April 1983, after cleaning and repairing the fountain's construction, it was supplied with water from Madrid's main network, the Canal de Isabel II (fig. 5).

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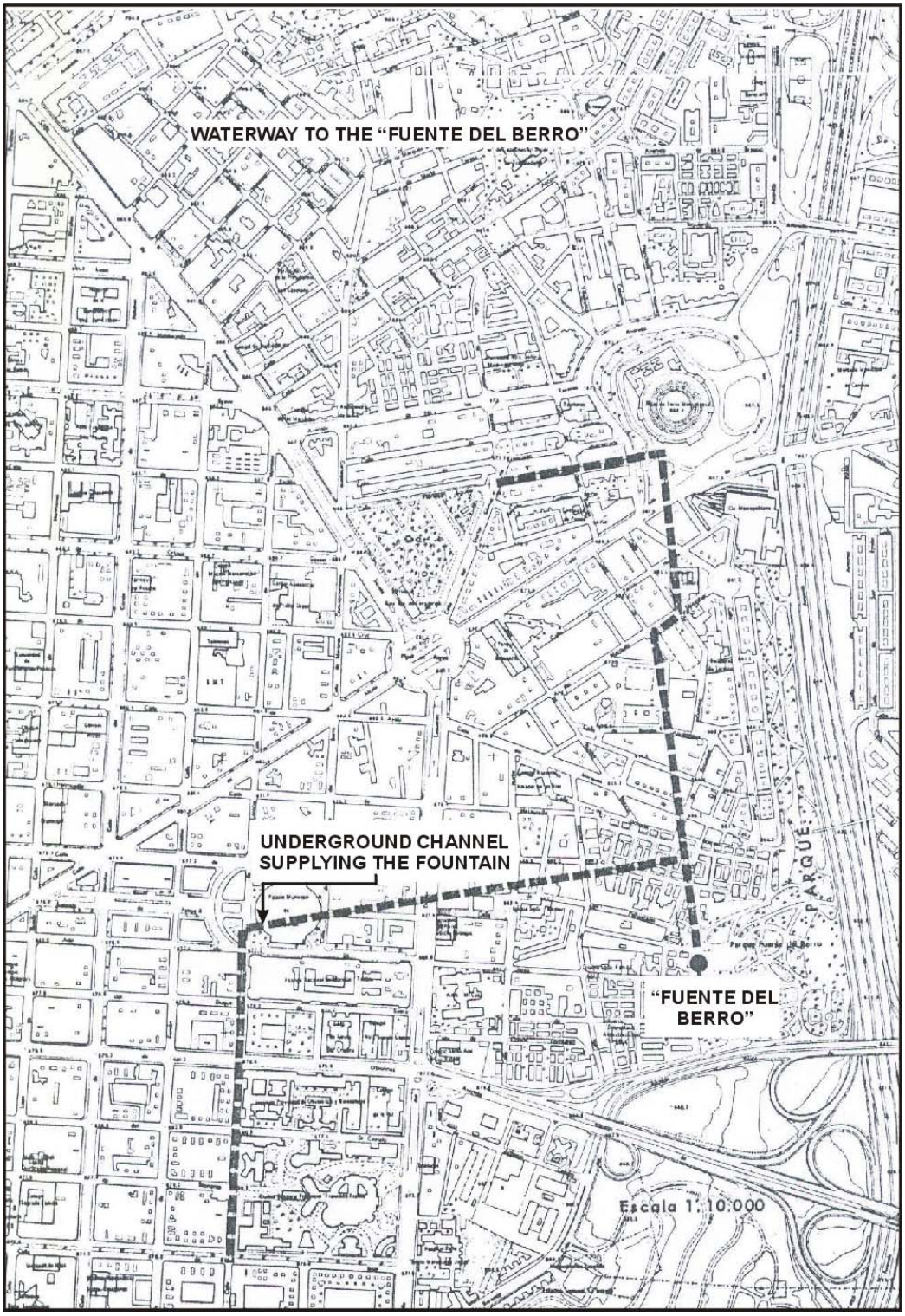

Figure 1. The Fuente del Berro and its supplying waterways.

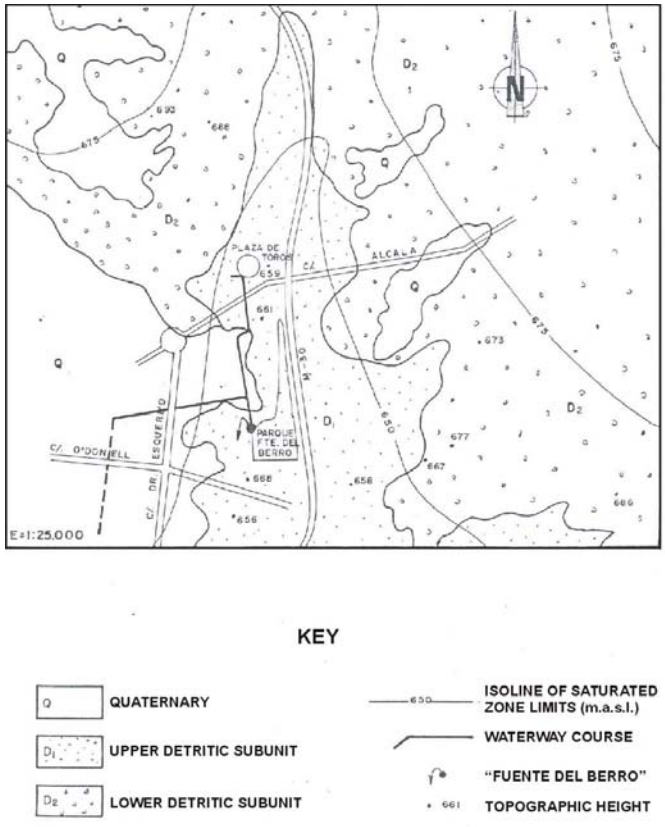

Figure 2. Hydrological setting of the Fuente del Berro.

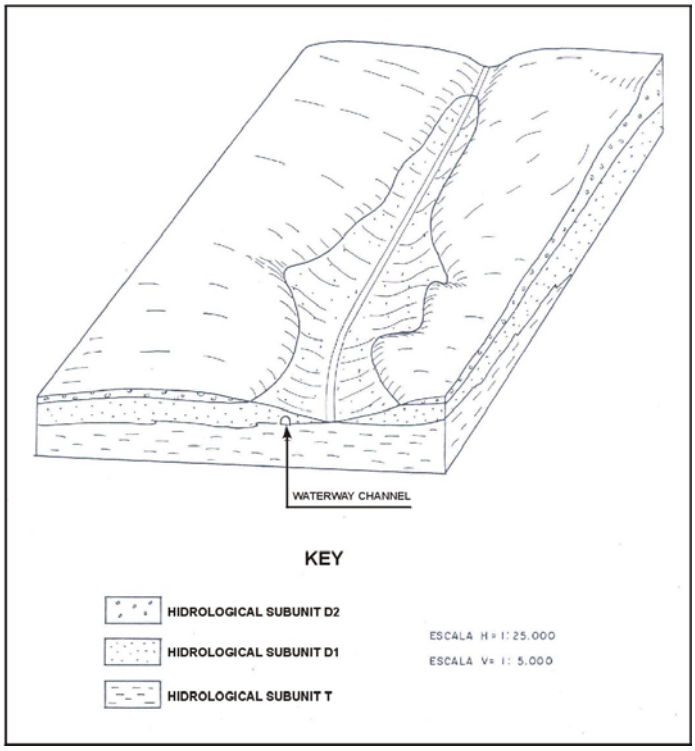

Figure 3. Setting of the Fuente del Berro waterway .

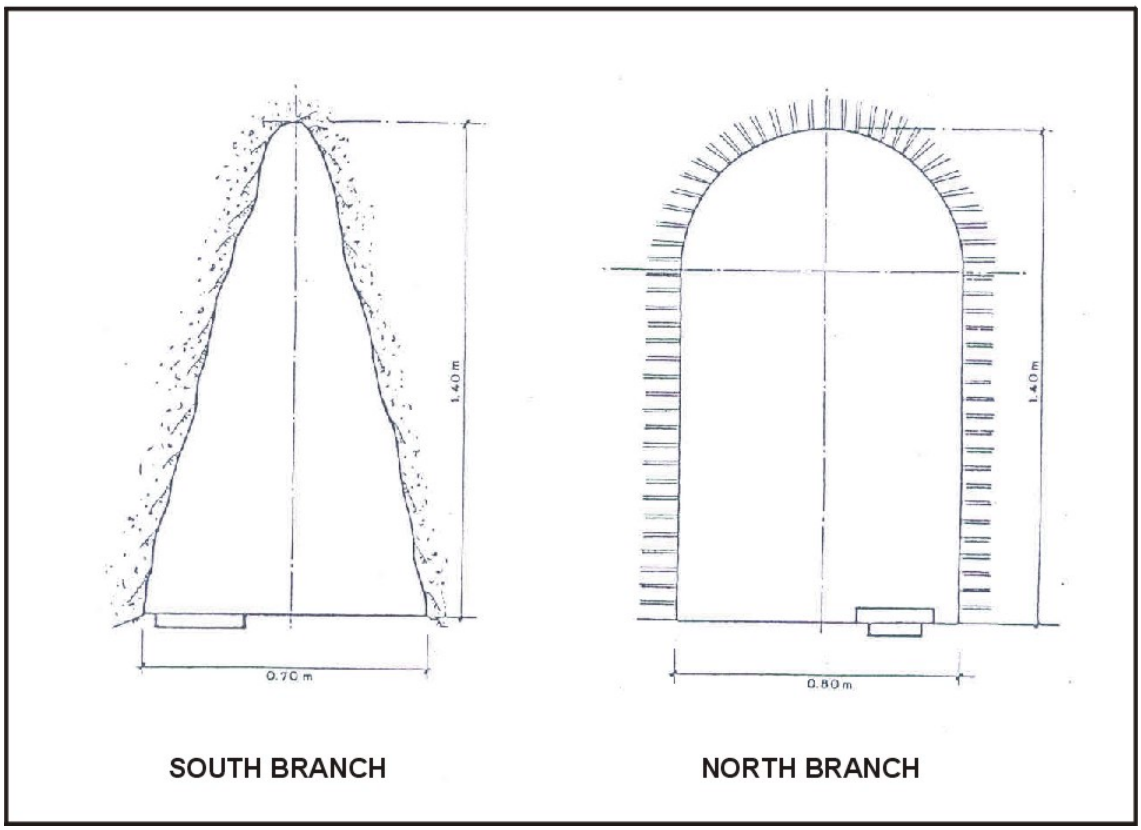

Figure 4. Waterway channels of the Fuente del Berro.

Photo 1. Waterway channels of the Fuente del Berro.

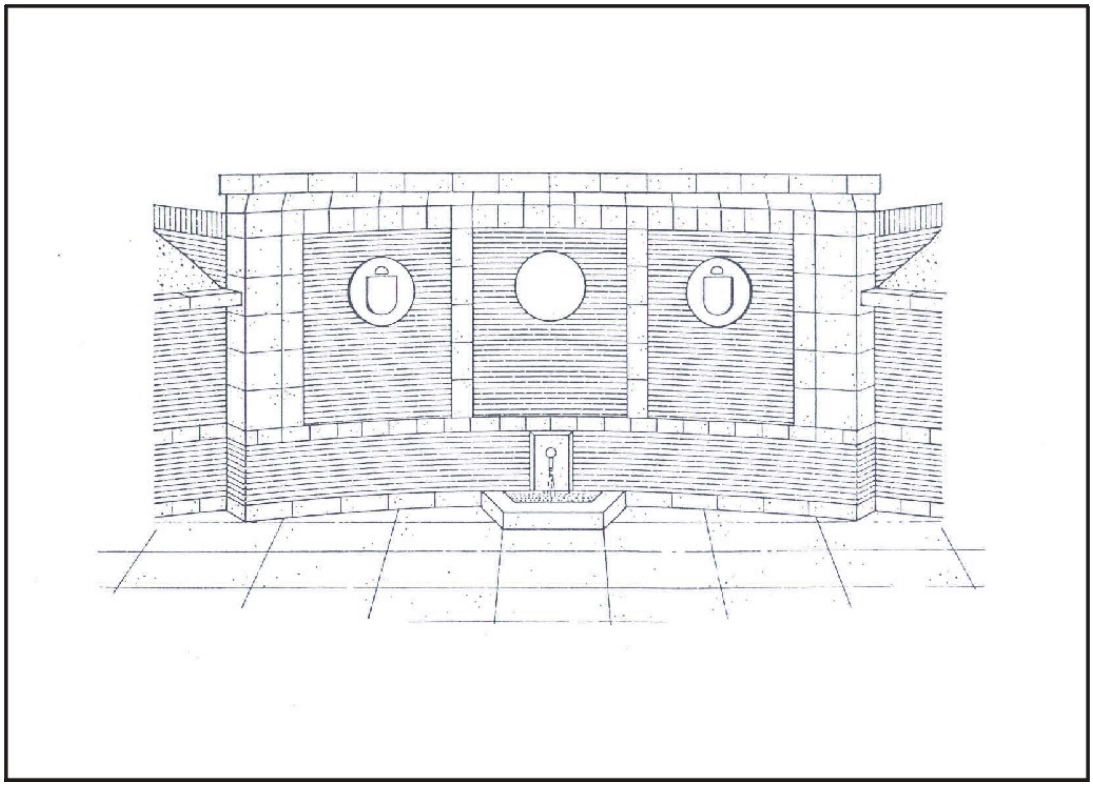

Figure 5. The Fuente del Berro

Photo 2. The Fuente del Berro