Analysis and Typology Studies on Aqueducts in Historical Kırkçeşme Water System*

Filiz KARAKUŞ
General Directorate of Foundations, Ankara, Turkey
For correspondence, ferdemir06@gmail.com

Z. Gediz URAK
Gazi University, Department of Architecture, Ankara, Turkey

Zühal ÖZCAN
Çankaya University, Faculty of Interior Architecture, Ankara, Turkey

ABSTRACT
Historic water systems in Istanbul, a world city and on the World Cultural Heritage List, are in danger of extinction due to improper construction, public works and unconscious repairs.In this study, the Kırkçeşme Water System, one of the historical water systems from the Ottoman Period in Istanbul, has been discussed.The article provides information about the Kırkçeşme Water System and its water structures and emphasizes the characteristics of aqueducts.After obtaining information from various sources about the water structures in the Kırkçeşme Water System, these structures have been determined by on-site inspection.Conservation of water-related waterways, which are vital for humanity, is neglected as a cultural asset. In this study, it has been aimed to draw attention to these water systems and to give general information about the Kırkçeşme Water System, and to provide an analysis and typology study on the aqueducts in the system.

Keywords: Historical water ways, Istanbul, Kırkçeşme, preservation, typology, analysis

1. INTRODUCTION

In order to deliver water, an important need for living things, to humans, systems have been established from the past to the present and facilities belonging to these systems have been built. These facilities are important cultural assets that have existed in every period as a part of water systems.

Throughout history, when a settlement was established or an existing settlement was expanded, it was necessary to find new sources to meet the water requirement and to bring water from the settlement to the settlement at very long distances.In order to meet this need of the people, where the water will be collected, how it will be collected, how this water will be brought from rough terrain, how the distribution and usage stages will be done and such phases have been realizedby means of important planning and construction of a number of facilities.Weirs / dams, reservoirs / wells, cisterns, ponds for water collection; waterways, canals, aqueducts and spirit levels for transporting water; maxims and masks for water distribution; fountains, waterfalls, floodplains and baths were built for the use of water.

There are historical water systems in Istanbul that were built during the Byzantine, Roman and Ottoman periods. The aim of this article is to draw attention to the historical water systems in Istanbul and to give general information about the Kırkçeşme Water System, to examine the water structures in the system and to make an analysis on the aqueducts and to determine the typological characteristics of the aqueducts.Despite all the problems of the Kırkçeşme Water System, a large part of it has survived to the present day, a certain part is still in operation, it supplies water to Alibeyköy Dam and it contains important works of Architect Sinan. All these factors have been influential in

selecting this field fort he study.Water structures constructed for the collection, transportation and distribution of water in the Kırkçeşme Water System have been discussed in the scope of the study.Since the number of structures built for the use of water such as fountains, waterfalls, floodplains and baths for the use of water is high and the area where these structures are located is wide, they have been excluded from the scope of the study.

2. KIRKÇEŞME WATER SYSTEM

There are many types of water structures in Anatolia dating back thousands of years and almost every period.Among these, Istanbul, which had been the capital of the Ottoman Empire for hundreds of years, undoubtedly has the most valuable water systems.

The water problem in Istanbul continued in the Ottoman Empire period as it did in every period of history.As the population increased, the need for water increased, and the old water systems were repaired and used and new water systems were built.Thanks to the new lines, hundreds of kilometers of waterways and water facilities were built in Istanbul and new water systems were established [6]. Throuhout15-19th century; water was brought to other cities, especially Istanbul [11]. Water systems built by Architect Sinan in Istanbul and Edirne by the order of Suleyman the Magnificent (1520-1566) led to the emergence of the most important water facilities of the Ottoman period [11].Water systems used in Istanbul during the Ottoman Period; Kırkçeşme, Halkalı, Taksim, Üsküdar, Terkos and Hamidiye Water Systems (Figure 1) [6].

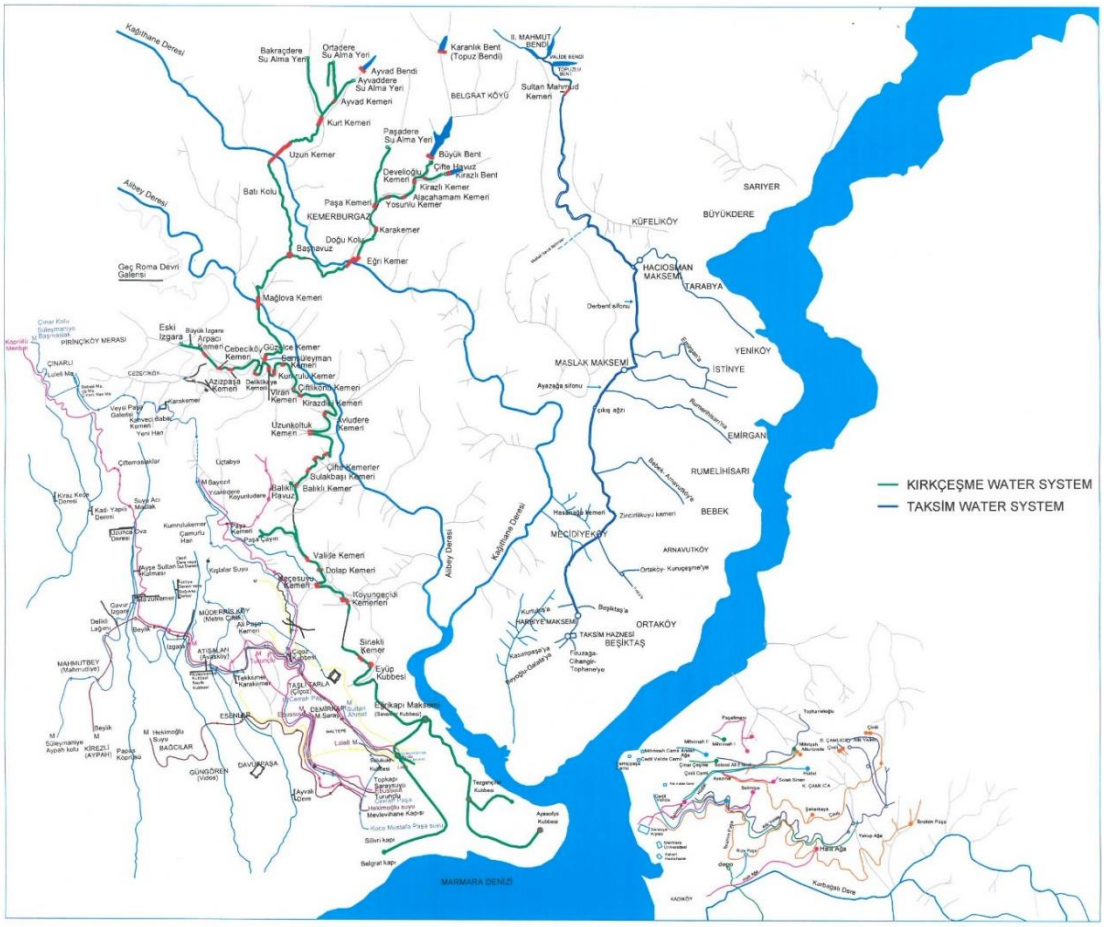

Figure1. Istanbul Water Systems map [9]

2.1. Definition of Kırkçeşme Water System Area and Water Structures in the Area

The Kırkçeşme Water System starts at the Belgrad Forest within the borders of Eyüp and Sarıyer Districts in the north of Istanbul and ends at the boundaries of Fatih District through Sultangazi, Gaziosmanpaşa and Bayrampaşa Districts (Figure 2).

The construction of the Kırkçeşme Water System, which was built by Sultan Süleyman the Magnificent by Mimar Sinan, began in 1554 and was completed before 1563. After the flood disaster in 1563, the destroyed aqueducts were repaired and the facility reopened in 1564 [6, 3, 7].

Kırkçeşme Water System, which is the largest monument by Mimar Sinan, is 55.274 meters. This system collects the surface waters around the Belgrade Forests in the north of Istanbul and the system consists of two branches [6, 3].The water from these two branches joins in Başhavuz, southwest of Kemerburgaz, then passes through the Alibey Stream with the help of the Maglova Aqueduct, and then continues to the south by taking a branch from the Cebeciköy Stream.Transmission line passes through numerous aqueducts and perforations from the beginning to reach Eğrikapı Maksim [6].

The removal of water from the two branches of the Kağıthane Creek, which extends to the places of the embankments in the Belgrade Forests, was completely considered by the Architect Sinan himself and constitutes the most important part of this facility.Instead of the water facilities which were previously built by the Emperor Justinianus in the northern part of the Alibey Stream and had become devastated, Sinan preferred to collect the waters from the southern parts of the Alibey Stream and thus implemented a project that was more economical and could easily participate in the main medium [10].

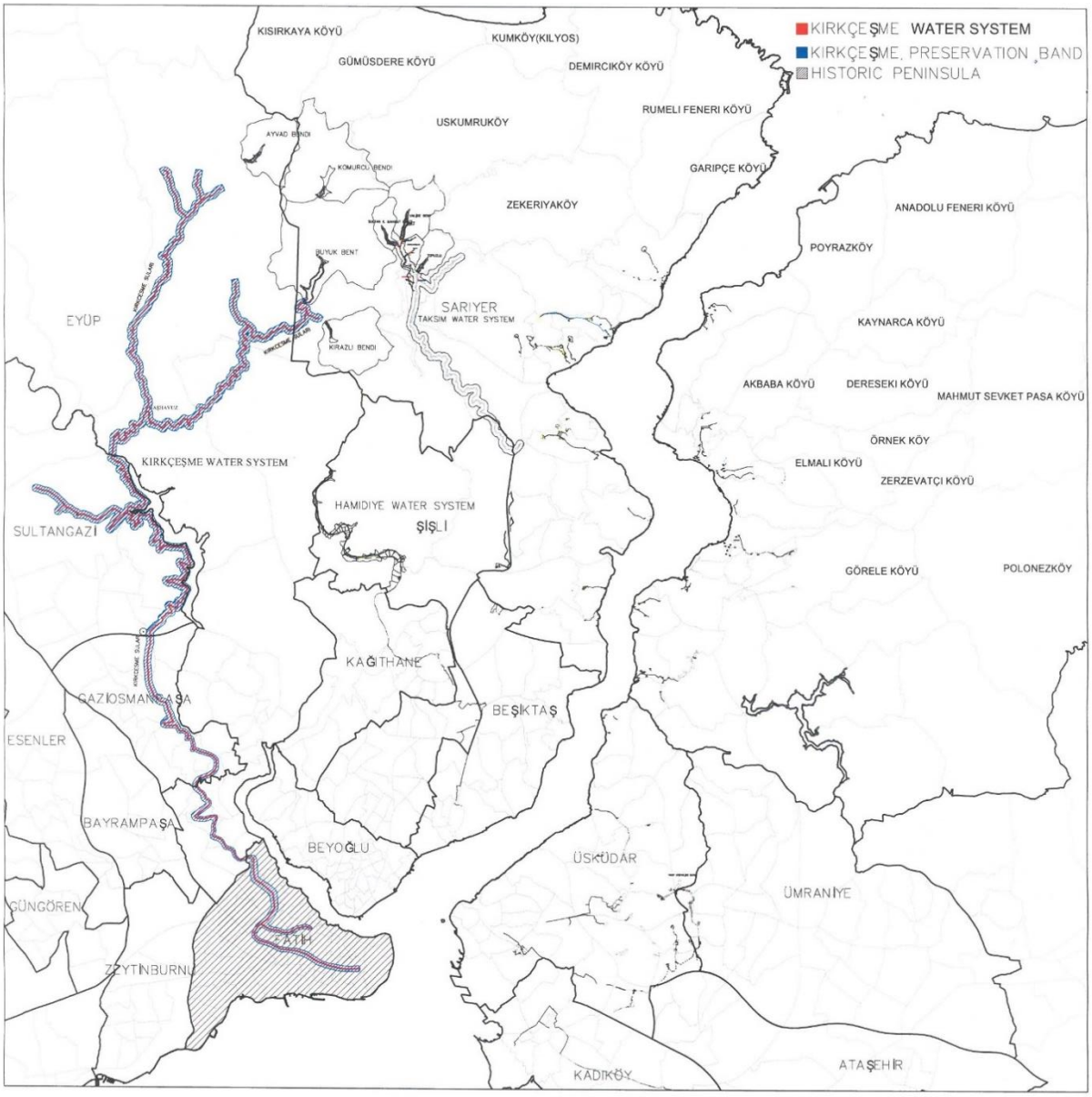

Figure2. The location of Kırkçeşme Water System in Istanbul [9]

The universal value of the Kırkçeşme Water System lies in the unique combination of architectural masterpieces on the 55374 m long pipeline and in the unique imagery and engineering solutions created by the creative geniuses of the architects of the Ottoman period, especially Architect Sinan.

The total number of fountains, mosques, fountains and imarets fed from Kırkçeşme Water in the Foundation Book is 561 and the total flow allocated to them is 333 pipes with 7 tubes, so 17423 m³ / day [3].The structures in the Kırkçeşme Water System are the urban distribution network consisting of aqueducts, dams, water intake and pools, weirs and domes, and spirit levels and small distribution points. These structures are examined and given below.

2.1.1.Aqueducts in Kırkçeşme Water System

In this system, although Aysel stated that there are 32 aqueducts, Ceçen gives this number as 33 [2, 4].

Table 1. Aqueducts in Kırkçeşme Water System [5]

No	Name of Aqueduct	Number of openings	Aperture (m)	Height (m)	Lenght (m)	Branch
1	Kirazlı Aqueduct	1	2	4,5	34	Kirazlıbent branch
2	Develioğlu Aqueduct	2	6,65-2,60	7,5	62,60	Topuz-Kirazlı branch
3	Alacahamam Aqueduct	1	2,55	7,5	32,50	Topuz-Kirazlı brancg
4	Çeşnigir (Yosunlu) Aqueduct	1	2,65	7,30	44,70	Topuz-Kirazlı branch
5	Paşa Aqueduct	Upper 7 Lower 5 1 middle-high	5	On the road 12,40 Creek 16,40	102	Topuz-Kirazlı branch
6	Kara Aqueduct	1	4,20	12,50	61,20	Paşa deresi branch
7	Kovuk Aqueduct (Eğri Aqueduct)	Upper 21 Lower 10 Bottom 4 Side 12	4-5,27	35	408	Eastbranch
8	Ayvad ve Ortadere Aqueduct	5	4,20	8,30	195,15	Westbranch
9	Kurt Aqueduct	1	5,25	14,21	305,40	West branch
10	Uzun Aqueduct	Upper 50 Lower 47	4,5-5,5	25	711	Westbranch
11	Mağlova Aqueduct	8 big 8 small	Upper 13,45 Lower 16,75	36	258	Main branch
12	Gözlüce (Güzelce) Aqueduct	Upper 11 Lower 8	5,90 m	29,5 m (34,5) temelden	165	Main branch
13	Arpacı Aqueduct	1	2,5	4,40	13 (to the barrier)	Cebeciköy branch
14	Cebeciköy Aqueduct	1	1,5	5	10,5 (to the barrier)	Cebeciköy branch
15	Azizpaşa Aqueduct	1	1,5	16,5	17 (to the barrier)	Cebeciköy branch
16	Deliklikaya Aqueduct	1	4,30	5,90	22,25 (to the barrier)	Cebeciköy branch
17	Viran Aqueduct	1	(3,45) 1,9	7	20 (to the barrier)	
18	Kumrulu Aqueduct	1	1,90	7,85	24 (to the barrier)	Main branch

19	Sarısüleyman Aqueduct	1	1,5	5,2	16,10 (to the barrier)	Main branch
20	Çiftlikönü Aqueduct	1	6	5,30	18,00 (to the barrier)	Main branch
21	Kirazdibi Aqueduct	1	1,0	4	17,80 (to the barrier)	Main branch
22	Avludere Aqueduct	1	3	5	17 (to the barrier)	Main branch
23	Uzunkoltuk Aqueduct	1	3,5	5	16,5 (to the barrier)	Main branch
24	Bulakbaşı Aqueduct	1	3,5	5	16,50 (to the barrier)	Main branch
25	Çifte Aqueduct 1	1	2	3,80	17,70 (to the barrier)	Main branch
26	Çifte Aqueduct2	1	3,40	3,86	15,50(to the barrier)	Main branch
27	Balıklı Aqueduct	9	3,70-3,70 3,70-3 3-2,90 3-3-3	9,50	125 (to the barrier)	Main branch
28	Valide Aqueduct	4	2,80-3,20	5,10	28,80(to the barrier)	Main branch
29	Dolap Aqueduct	1	3,70	5,10	28,80 (to the barrier)	Main branch
30	Keçesuyu Aqueduct	1	3,50	3,80	22,5 (to the barrier)	Main branch
31	Koyungeçidi Aqueduct 1	1	2	4,5	18	Main branch
32	Koyungeçidi Aqueduct 2	1	2	6	14	Main branch
33	Sinekli Aqueduct	1	2,0	5,6	16,10(to the barrier)	Main branch

The most important of the aqueducts in the Kırkçeşme Water System in terms of engineering and architecture are the Mağlova Aqueduct(MuallakAqueduct) (Figure 3), Uzun Aqueduct, Gözlüce Aqueduct (Güzelce Aqueduct) and Kovukkemer Aqueduct (Eğri Aqueduct), it is thought that one part of the latter is from the Roman Period due to the different arches used.Apart from these aqueducts, one-storey important aqueducts cannot be considered as monuments; 195 m long Ayvad Aqueduct, 305 m long Kurt Aqueduct, 62,60 m long Karakemer Aqueduct, 125 m long Balıklıkemer Aqueduct and 38,80 m long Valide Aqueduct [5].


Figure 3. Mağlova Aqueduct [9]


Figure 4. Ayvad Aqueduct[9]

2.1.2.Dams in Kırkçeşme Water System

When the Kırkçeşme Water System was built in 1563, there were no present dams. Since water is not stored in the facilities,the water was very low in August and September.In order to store the water in times of abundant water and use it during periods of water shortage, a total of four dams were made, Topuz Bendi (Karanlıkbent), Büyükbent, Kirazlıbent and Ayvad Bendi (Figure 4)[6].

Table 2.Dams in Kırkçeşme Water System [1]

Name of Water System	Name of Dam	Construction Date	Volume of Resorvoir (thousand m^3)	Area of Resorvoir (thousand m^2)	Body length (m)	Body height (m)	Body Thickness (m)		Water amount (pipe bowl)
							At the bottom	At the top	
Kırkçeşme water System	Karanlıkbent	1620	70	28	64,5	8,6	5,9-7,4	5,2	200/250 mm pipe
	Büyükbent	1723	1318	264	84,5	12,15	9,7	2,3	250
	Ayvad Bendi	1765	156	50	65,8	13,45	8,42	5,6-6,90	46
	Kirazlıbent	1818	104	27	59,45	11,25	9	7,15	56

2.1.3. Water intake and pools in Kırkçeşme Water System

During the construction of the Kırkçeşme Water System, it was envisaged that the water would be taken from the creek and after it was raised with the help of a binding, it would be taken from the side with a grilled water intake.Just behind these water intake points called gratings, sedimentation ponds were build to precipitate solid materials such as sand and gravel [6, 3]. In this system, there are Çiftehavuz (Figure 5), Kirazlıdere Water Intake Site, Ayvad Water Intake Site, Ortadere Water Intake Site, Bakraçdere Water Intake Site and Kurt Kemer Pool and Başhavuz.


Figure 5. Çifte Havuz [9]

2.1.4. Kırkçeşme Water System urban distribution network

After coming to the main gallery of the Kırkçeşme Water System, Eğrikapı Maksim, called Savaklar, water is distributed to the city from two main branches.The water distribution system is divided into zones called Service, which means the operation of the entire network that supplies water to that area. The distribution network consists of two main elements: galleries and pipes [6].

The main distribution locations of the Kırkçeşme Water System in the city are the Savaklar and TezgahçılarDomes and the Eyüp, Azaplar, Sulukule and Ayasofya Domes.

*1.Savaklar Dome (Eğrikapı Maksim) (Figure 6):*Eğrikapı Maksim is a square planned building with an external dimensions of 8.26x8.25 m built by Sultan Süleyman the Magnificent.This maxim, which distributes the water of the Kırkçeşme Water System to the Tezgahçılar and Sulukule Domes, provided water to low-rise areasof the city [8].

Figure 6. Eğrikapı Maksim [12]

2. *Tezgahçılar dome (Figure 7):*The Tezgahçılar Dome is opposite the Tezgahçılar Mosque at the top of Kovacılar Street where Gazanferağa Madrasa is located under the Bozdoğan Aqueduct. The door sill is approximately 2,5 m below the pavement level.The walls were built of cut stone and the rectangular dome was built with bricks.The dimensions of the wallson which the dome rests are 5,60x7,30 metre.The gallery from which the water comes (70x110 cm) enters into the maxim from the direction of the main door and the exit galleries are located on the wall opposite it.Incoming water is filled into a measuring box. A total of 47 nozzles were placed on a 580 cm long and 20 cm thick marble slab made 110 cm apart parallel to the entrance wall.Since all of these nozzles are stolen, their diameter cannot be obtained [6].

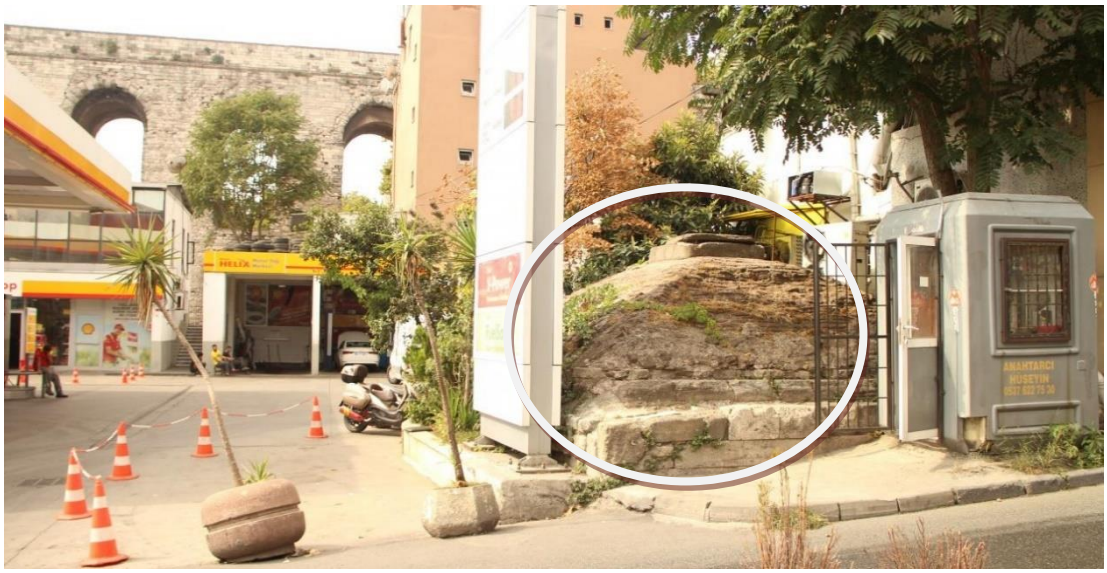

Figure 7.The Tezgahçılar Dome is under the road elevation [13]

*3. Eyüp, Azaplar, Sulukule, Ayasofya Domes:*The function of the Eyüp Dome has changed completely, and the Dooms and Sulukule Domes have been completely destroyed.The Ayasofya Dome is under the road.

2.1.5. Small distribution areas and water scales in Kırkçeşme Water System
While water was taken from main gallery or small distribution points, flow measurement was made with the help of nozzles placed on the edge of a measuring box.For this purpose, the water was taken to a higher measuring box.This crate, which was provided with nozzles whose axis was 96 mm below the water surface, was usually placed on top of a tower.This pyramid-shaped tower is called a "water scales".The water scales has two functions, such as adjusting the water pressure and distributing the water by measuring it. Sometimes water scales with function of storage tasks were also made [6].

Numerous water scales had been built within the city network of the Kırkçeşme Water System.Water scales in Yenikapı, Çatladıkapı, Sultanahmet and Tahtakale are examples of this. But, few of these scales survived today [6].

2.2. Analysis and Typology of Aqueducts in Kırkçeşme Water System
In this part of the study; as a result of the evaluation of the analyzes carried out on the aqueducts in Istanbul Kırkçeşme Water System by making use of on-site determinations, historical information, documents and related resources, the period in which they were made, their arm, general characteristics, architectural features, structural system properties and building material typological characteristics were determined.

Of the aqueducts examined, 31 (93.94%) were built by Sultan Süleyman the Magnificent in the sixteenth century.It is known that the Paşa Aqueduct (Figure 8) was built after the sixteenth century [6].Among the aqueducts in the Kırkçeşme Water System, the onlyaqueduct that has difficulty in determining the origin is the Eğri Aqueduct (Kovukkemer) (Figure 9).Although all the buildings in the Kırkçeşme Water System are Ottoman structures, it is difficult to say that Kovukkemer is completely Ottoman.According to Çeçen, it is most likely that the 2nd floor of Kovukkemer was demolished down to the lower part and that half of the 2nd floor, the whole of the third floor and a belt on the lowest floor were rebuilt by Architect Sinan [6].

Table 3. Construction Periods of Kırkçeşme Water System Aqueducts

Typology of Kırkçeşme Water System Aqueducts according to construction periods

Period	Number	Percent
XVI. century	31	93,94
After XVI. century	1	3,03
XVI. yy- IV. century	1	3,03
TOTAL	33	100,00

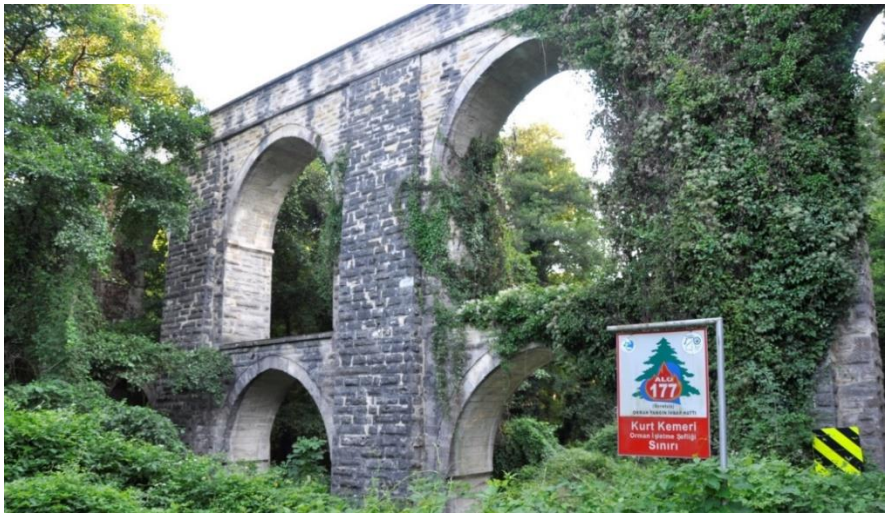

Figure 8. View of Paşa Aqueduct [9]


Figure 9. View of Eğri Aqueduct [9]

Eastern branch of Kırkçeşme Water System which collects water of Büyükbent, Karanlıkbent, Kirazlıbent and the Paşa Stream layer and passing through Kovukkemer Aqueduct merges with western branch which collects water of Ayvad Bendi, Orta Dere Stream, Bakraç Dere Stream and passing through Uzunkemer aqueduct in Başhavuz. Then continues as the main branch and Cebeciköy branch also merges to the main branch after Güzelcekemer Aqueduct. Başhavuz is located 2,5 km south-west of Kemerburgaz, on the top of the road from Kovukkemer Aqueduct and on the road leading to the Maglova Aqueduct (Figure 10).19 (57.58%) of the aqueducts on the Kırkçeşme Water System are located on the main branch, 7 (21.21%) on the eastern branch, 3 (9,09%) on the western branch and 4 (12.12%) on the Cebeciköy branch (Table 4).

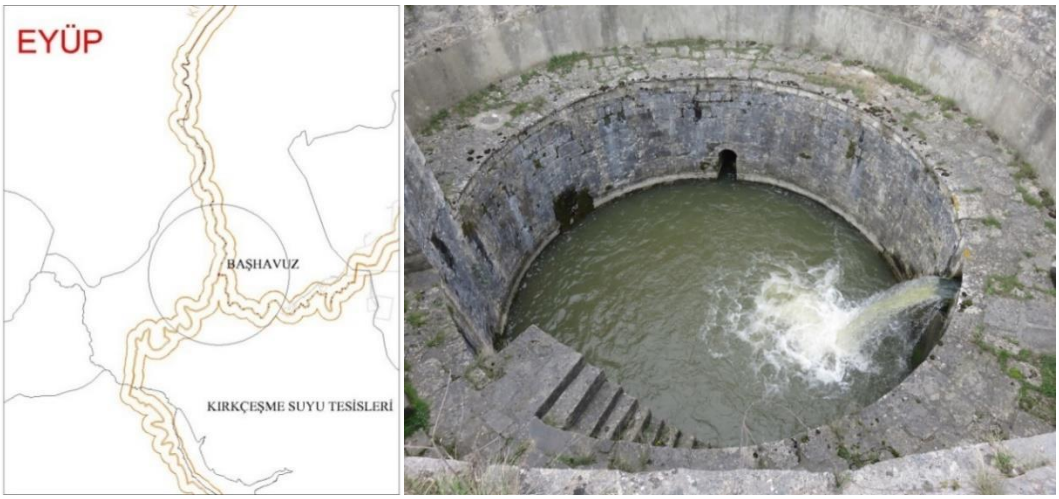

Figure 10. Location and view of Başhavuz [9]

Table 4.Branch and the scope within wholeof Kırkçeşme Water System Aqueducts

Branch and the scope within the whole of Kırkçeşme Water System Aqueducts		
Branch	Number	Percent
Main branch	19	57,58
Eastern branch	7	21,21
Western branch	3	9,09
Cebeciköy branch	4	12,12
TOTAL	33	100,00

When these aqueducts were examined in terms of plan type, it was found that 29 (87.88%) were in the form of a straight line and 4 (12.12%) were in the form of a broken line. In terms of the number of storeys, it was found that the number of single storeys was 28 (84.85%) and the number of two storeys was 4 (12.12%).The only three-storey aqueduct is the Eğri Aqueduct (Kovukkemer).In terms of the number of arch opening, it was found that 24 (72.73%) had one opening, one (3.03%) had two openings and 8 (24.24%) had multiple openings (Table 5).

Table 5.Typology of Kırkçeşme Water System Aqueducts according to plan, floor numberand number of arch opening

Typology of Kırkçeşme Water System Aqueducts according to plan, floor number and number of arch opening		
Plan Type	Number	Percent
Straight line	29	87,88
Broken line	4	12,12
TOTAL	33	100
Floor Number	Number	Percent
Single storey	28	84,85
2 storey	4	12,12
3 storey	1	3,03
TOTAL	33	100,00
Number of arch opening	Number	Percent
Single opening	24	72,73

Double opening	1	3,03
Multi opening	8	24,24
TOTAL	33	100,00

The aqueducts in the Kırkçeşme Water System have been examined in terms of their architectural features, arch shape, gallery dimensions, form of gallery roof, and whether they have barrier walls, pedestrian crossings or ornamental features.Of the 33 aqueducts examined, 23 (69.70%) were pointed arches, 9 (27.27%) were semicircular arches, and both the pointed arch and the flattened arch were used in the Eğrikemer Aqueduct (Figure 11).The galleries in the aqueducts; 23 of them (69,70%) are 60x175 cm and 10 of them (30,30%) are 55x175 cm in size.The top covers of these galleries; 14 (42.42%) were flat roofed and 19 (57.58%) were gable roofs.Although all of these roofs were originally covered with raft stones, today most of them are covered with concrete (Table 6).

Barrier walls were built to prevent people and animals from passing over the aqueducts.Of the aqueducts in the Kırkçeşme Water System, 28 (84.85%) had barrier walls and 5 (15.15%) had no barrier walls; 2 (6,06%) had pedestrian crossings and 31 (93.94%) had no pedestrian crossings.The Develioğlu Aqueduct, Uzun Kemer Aqueduct and Mağlova Aqueduct have decorative elements on the stone (mukarnas, medallions, etc.) and 30 (90.91%) do not have any decorative elements (Table 6).

Table6. Typology of Kırkçeşme Water System Aqueducts according toArch Shape, Gallery Size and Cover, Obstacle Wall, Pedestrian Crossing and Adornment Characteristics

Typology of Kırkçeşme Water System Aqueducts according to Arch Shape, Gallery Size and Cover, Obstacle Wall, Pedestrian Crossing and Adornment Characteristics		
Arch Shape	Number	Percent
Pointed Arch	14	42,42
Semicircular arches	18	54,55
Pointed Arch+ Flat Arch	1	3,03
Flat Arch	0	0,00
TOTAL	33	100,00
Gallery Size	Number	Percent
60x175	23	69,70
55x175	10	30,30
TOTAL	33	100,00
Gallery Cover	Number	Percent
Flar Roof	14	42,42
Gable Roof	19	57,58
TOTAL	33	100,00
Obstacle (Barrier) Wall	Number	Percent
Existent	28	84,85
Non existent	5	15,15
TOTAL	33	100,00
Pedestrian Crossing	Number	Percent
Existent	2	6,06
Non existent	31	93,94

TOTAL	33	100,00
Adornment	Number	Percent
Existent	3	9,09
Non existent	30	90,91
TOTAL	33	100,00

Figure 11. In Eğrikemer, the 14th belt is flat, and the 13th and 12th arches are pointed arches [5].

In some of the aqueducts examined, the arch legs are reinforced with buttress (Figure 13).Some have been equipped with flood splitterto facilitate hydraulic flow and prevent water damage to the feet (Figure 12).Seven of these aqueducts (21.21%) have buttresses and 26 of them (78.79%) do not have buttresses.The number of aqueducts withflood splitter is 4 (12.12%) and 29 of them (87.88%) do not have flood splitter (Table 7).

Table 7.Typology of Kırkçeşme Water System Aqueducts According to Buttress and Flood splitterProperties

Typology of Kırkçeşme Water System Aqueducts According to Buttress and Flood splitter Properties		
Buttress	Number	Percent
Existent	7	21,21
Non existent	26	78,79
TOTAL	33	100,00
Flood splitter	Number	Percent
Existent	4	12,12
Non existent	29	87,88
TOTAL	33	100,00

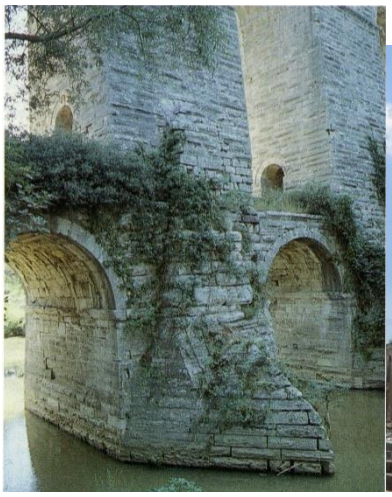

Figure 12.Lower arches andFigure 13. Buttresses in Uzun Kemer Aqueduct [9]
Selyaran in Kovukkemer [5]

In the aqueducts built during the Roman and Hellenistic periods, the thickness of the arch was kept constant from top to bottom and therefore, except for the ones with a very high thickness, they were destroyed.On the other hand, Mimar Sinan made the foot thicknesses in Uzun Kemer, Kovukkemer and Güzelkemer to decrease from the foundation to the top, thus forming a structure resistant to horizontal forces.In the Maglova Aqueduct, he found a much more interesting solution, reducing the belt thickness by keeping it very small, increasing the stability by extending the feet in a pyramidal direction perpendicular to the arches in order to withstand horizontal forces.In order to reduce the weight of these legs, he made three lightening belts on each of them and made the triangular ends of the pyramid-shaped legs next to them in order to pass the flood flow in case of a flood-shaped flood (Figure 14) [1, 7].

Figure 14. Mağlova Aqueduct lightening belts and buttresses [9]

Rubble stone was used in 22 (66.67%) of the aqueducts examined, rubble stone and cut stone were used together in 10 (30.30%).Only the cut stone was used in the Paşa Kemeri Aqueduct (Figure 15) (Table 8).

Figure 15. Paşa Kemeri Aqueduct [9]

Table 8. Typology of Kırkçeşme Water System Aqueducts According to Building Materials

Typology of Kırkçeşme Water System Aqueducts According to Building Materials		
Building Materials	Number	Percent
Rubble Stone	19	57,58
Cut Stone	1	3,03
Rubble+ CutStone	13	39,39
TOPLAM	33	100,00

As a result of the typological analysis, it was determined that most of the aqueducts which constitute the most important building group in the Kırkçeşme Water System were built in the sixteenth century, and those other than the monument aqueducts were single span and single storey.Also; the use of pointed arches and half arches, which were used extensively in Ottoman architecture, has been observed to be predominant and most of the aqueducts walls were found to have barrier walls, cut stone and rubble were used as building materials and no ornamental elements were used other than the monumental aqueducts.

3. CONCLUSION

Historic water systems in Istanbul, a world city and on the World Cultural Heritage List, are in danger of being destroyed due to improper construction, public works and unconscious repairs. It is very important to protect and document these valuable assets as well as those at risk.In this scope of work; located within the Kırkçeşme WaterSystem; water structures that have lost their functions and are in danger of extinction in the near future with increasing wear and tear rates are identified and documented.Afterwards, a catalog study on aqueducts in the Kırkçeşme Water System has been conducted. The information documented in these catalogs has been evaluated and typological analysis has been made in aqueducts.Of these aqueducts, the Arch of Maglova is said to be "If the Architect Sinan had only built the Arch of Maglova and hadn't made another work, he

would have been the Architect Sinan.It is very important to make the necessary protection applications in order to identify these systems and structures in the system and transfer them to future generations.Similar studies should be applied in other water systems and other water structures. In this context, the research is thought to be a guide for future studies.

REFERENCES

[1] Acar, Ş. (2010). "Bentler ve Sinan'ın Suyolu". 1st edition, Biryıl Culture and Art Limited Publications, İstanbul, 34.
[2] Aysel, N.,R. (2008). "İstanbul'un Tarihi Su Sistemleri:Kırkçeşme Tesisleri", General Directorate of State Hydraulic Works Historical Water Reformation Congress,İzmir.
[3] Çeçen, K. (1984). "İstanbul'da Osmanlı Devrindeki Su Tesisleri", 1st edition, İTÜ Civil Engineering Faculty Publications, İstanbul, 1-8, 55-68, 100-200.
[4] Çeçen, K. (1996). Sinan's Water Supply System in İstanbul, 1st edition, İSKİPublications.
[5] Çeçen, K. (1998). "Mimar Sinan ve Kırkçeşme Tesisleri", 1st edition, İSKİ Publications, İstanbul, 90-123.
[6] Çeçen, K. (1999). "İstanbul'un Osmanlı Dönemi Suyolları", 1st edition, İSKİ Publications, İstanbul, 19-122, 198-254.
[7] Esmer, K. (1983). "Tarih Boyunca İstanbul Suları ve İstanbul ve Kanalizasyon Sorunu", 1st edition, İSKİ Publicetions, İstanbul, 19-29.
[8] Gülmez, F., G., Aysel, N., R. (2008). "Tarihi Bir Su Yapısı: Eğrikapı Maksemi", General Directorate of State Hydraulic Works Historical Water Reformation Congress,İzmir.
[9] Karakuş, F. (2015). "Project and Photo Archive", Ankara.
[10] Özand, E. (1968). Koca Sinan'ın En büyük Mühendislik Eserlerinden Biri Olan İstanbul'un Kırkçeşme Tesisleri. Ankara: *Türkiye Mühendislik Haberleri*, 8-10.
[11] Öziş, Ü., Arısoy, Y. (2008). "Edirne Taşlımüsellim Suyolları", General Directorate of State Hydraulic Works Historical Water Reformation Congress,İzmir, 241-244.
[12] URL1: Eğrikapı Maksemi. http://www.mustafacambaz.com/details.php?image_id=36689, (accessed 11 May 2017).
[13] URL2: Tezahçılar Kubbesi.http://wikimapia.org/24067652/tr/Tezgah%C3%A7%C4%B1lar-Kubbesi, (accessed 11 May 2017).