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The Role of Irrigation System in Shaping Urban Planning in Safavid Cities, an Investigation into Ashraf al-Belād, Iran

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Abstract

Due to the water scarcity in Iran, the urban water system mostly followed gardens when royal gardens were set there. This paper sets out to reinvigorate this debate, in a new way that combines the water and the structural connections between the gardens and the urban landscape. In this direction, it pursues that the structural connections between the gardens and the city were planned based on the water system, as one of the designers' purposes. This paper investigates this idea in the case of Ashraf al-Belād City and its Safavid Gardens Complex by studying historical documents and combining them with current field observation. This city is crucial because of its specific climate conditions and originality. The repetition of the Safavid urban ideas in Ashraf indicates to a meaningful concept that was considered on purpose. The study clarified that the main directions designed in the Safavid period remained in today's landscape and kept the traces of original urban planning. This evidence showed the structural relationship between the gardens and the city and their revolution over time, based on the irrigation system. Regarding this study, we can trace the original Safavid urban structure in the current situation by following the different irrigation systems through time and their impacts on the urban structure. The Safavid irrigation system clearly had been designed after their gardens and shows a well-planned modular network against an organic unsymmetrical-shaped structure that developed after the Safavid era.

Keywords: Persian garden; Urban Watering System; Urban structure; Historic Urban Landscape; Urban conservation; Safavid gardens; Behshahr (Ashraf al-Belād).

1. Introduction

Ashraf al-Belād was a city in Māzandarān, northern Iran, which nowadays we call Behshahr. It was built during the period of Shāh Abbās I (1571-1629 AD), the Safavid king, as a place to spend summers. As there was not a city that could be a royal settlement, they started to build one in parallel with building the royal gardens to settle the royal camp at its heart. This city was located in the North of Iran, between the Caspian Sea (in the north) and the Alborz Mountains (in the south) which created a south-to-north slope.

In the case of Ashraf el Belād as well as many other Persian Gardens or Cities, it can be observed that the watering system had been followed in shape and structure. The importance of studying this particular case lies within the fact that there seem to be some major differences concerning it in comparison to most Iranian historical cities especially the ones placed in Central Plateau. Primarily, the city built in the Safavid period was in replacement of some small villages which indicates that there were no traces of a city before that time. Secondly, it was a royal city that contained some royal gardens. These two aspects create the opportunity to uncover a pure relationship between gardens and urban landscape without the effects of other significant structures. And finally, there were some differences in water supplies and irrigation systems according to different weather and geographic situation. Its placement between the sea and mountains with springs and rivers greatly differed greatly from other famous Safavid cities in Iran.

This survey's major focus is on the role of water, its sources, and the circulation system, as a fundamental concept of the urban planning of Ashraf which shaped the structure of the royal gardens and the city. As the process of locating them in the Safavid city is based on the whereabouts of water supplies, the primary structure of the royal Gardens that were based on the irrigation system will be identified at first. In this regard, the study would gradually follow an instructed design to explain Ashraf's urban planning in the Safavid period. After finding the gardens' irrigation system, a demonstration of the urban watering system which has followed the gardens and shaped urban blocks will be conducted along with a speculation water circulation in the gardens' spatial structure and, after that, through the city. In retrospect, the following steps will pursue the results of changes in the gardens and urban irrigation after the Safavid period.

Hence, the Historical Approach applied in this research which included the review and collection of the related historical resources, written and visual data, was to investigate the original irrigation system and its

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transformation over time. Then, a comparison between historical evidence and its contemporary condition was conducted to find the remains of the historical city it once was. Finally, some images and plans have been drawn to present a coherent perspective of the effects of the watering system on shaping the structure of the urban landscape.

2. Research Background

Attention to Iranian gardens as a noteworthy subject to study increased mainly after David Stronach's discoveries through the ancient area of Pasargad and his finding of remains of Achaemenid gardens. Since then, many discussions about the historical gardens of Iran have been started. While in the meantime, a topic that is relatively new and could be considered along the studies of the two main fields of Persian gardens and historical cities began to shape. Studying the relationship between the city and its gardens at their establishment and over time as a new argument which has moved the studies one step forward. The main topic of this research is the relationship between the historical gardens and the landscape of the Safavid city of Ashraf al-Belad, from the point of view of irrigation sources and methods. Therefore, there is more attention to the mentioned research in the literature review. This introduction was necessary to mention that several studies have been done in the field of Persian gardens and more studies on Iranian historical cities so far. While only the studies that have opened an entrance to integrate these two study zones together in the last three decades will be mentioned in this short space.

Mahwash Alemi is one of the first researchers who examined Iranian gardens from a documentary perspective. He, who has studied Safavid gardens in most of his works, has pursued the idea of a meaningful connection between the garden and the city in Safavid cities such as Isfahan, Qazvin, Shiraz, Ashraf-al-Balaad (Baheshahr) and Farah-Abad in Sari. His work method is based on historical documents. Alemi knows the importance of urban elements to understand the original atmosphere of the garden as if the study of Safavid royal gardens would be incomplete without considering them (Alemi 1991, 1997, 2005, 2008, and 2016).

Another view that has taken this issue a step further is the structural correlation of the garden with the city and its surrounding nature as one of the characteristics of the Iranian garden (Irani Behbahani and Khosravi 2015). Hamidreza Jayhani is another researcher who has paid attention to this topic from the filter of restorative interventions. He considered the Western theories of the urban landscape and integrated them with the historical gardens' study. In an article titled "Difficulties facing the restoration of Iranian historical gardens" he critically examined the restoration approach to gardens after looking at the world history of restoration and stating the principles and foundations. On the one hand, he reviewed the existing restoration and the investigation of the Iranian garden and its structure and values. Finally, he expresses the differences between the existing foundations and what can be effective for the restoration of the Persian gardens as the conclusion. To carry out protection measures in Iranian gardens with the current situation, we will face problems that arise from our understanding of the existence and inner nature of the garden. He considered the lack of attention to the relationship between the garden and external spaces, arenas and elements, the nature of the plants used in the garden according to the climate and land of Iran, as well as the process of extraction and use of water, among the shortcomings of the current conservation and restoration point of view. The historical gardens of Iran are listed (Abouei and Jayhani 2011a). In another place, Jayhani, after examining the parameters from the viewpoints of theorists such as Gordon Cullen, Kevin Lynch, and Spray Regan, includes landscape, skyline, and communication routes, extensive changes in the environmental landscape of residential areas. He also studied the surrounding environment of historical gardens based on the case of the Fin (Abouei and Jayhani 2011b).

Attilio Petruccioli also believes in the problems of studying historical gardens as an independent element. He specifically examines the effects of Islamic gardens beyond their defined boundaries. He states that pursuing this type of comprehensive view in research "creates a rich field" in which the agriculture, the garden, the camp, the city, and the territory are separated even though they mutually influence each other " (Petruccioli 2011, 353).

Considering that these researchers have conducted the most principal studies on the relationship between the garden and the city, we can understand how new, necessary, and neglected this topic is. As seen in this section, the studies have focused more on the necessity of raising this debate and its importance in the discussions of restoration and historical interventions so far. This topic has several dimensions that can be considered in various interdisciplinary fields. Therefore, the current research has approached the issue by investigating the influence of watering methods, water supply, and disposal of nuisance water. This study tried to examine the aspects of the subject with a close look at one of the most noticeable historical fields.

3. Research Methodology

This study is a kind of Qualitative research. The methodology of this research is determined based on a precise study of the dimensions of the problem, which is considered the primary premise of the research. In fact, in this research, there is no hypothesis that we seek to confirm or reject. In contrast, there is a problem whose existence is obvious based on the researcher's previous studies and observations, and the proposed research seeks to understand its dimensions and aspects. Therefore, this research is placed in a Descriptive research group instead of experimental, because it seeks to interpret and express thematic dimensions. On the other hand, since this topic belongs to the past, it can be considered historical research. The approach of this study is also a comparative approach because the final results will be obtained from comparing the research findings.

This research will have three separate study phases To achieve the observations. The first phase is related to the documental study of irrigation system in each historical period . The second phase includes the classification of research findings in the first phase, and the result is indicators that can be tracked and compared in each category. Finally, the third phase of the research is analyzing information and approaching the final outputs. Literature review and, in some cases, interviews will be used to carry out the first phase, which is called information gathering or data collection. The primary documents that have directly spoken about the Ashraf al-Belād at the beginning of its establishment and throughout history and the secondary studies that have previously worked on each of these categories will be studied and reviewed in this phase. However, the research method is completely different in the second and third parts. It relies on the researcher's point of view. The final interpretation of the research in the third phase will be causal; Because it is built on the idea that every historical phenomenon (here, the evolution of urban landscape in its lifetime) has a cause (here, the changes that happened in the irrigation system) that its discovery will clarify the dimensions of the historical phenomenon. Although this analysis, just like any other historical research, has been done in a personal way. Its adherence to not moving away from the historical reality is a condition that makes it reliable and referable. Although, due to the existential necessity of historical research, it cannot be repeated or experienced.

4. Results (The Irrigation System in Ashraf al-Belād Through the Time)

The results of this study were achieved from reviewing the literature documents which refer to this city in any kind of information and surveying the current city to simulate the original townscapes and their changings. Therefore, in this part of article a summery of all of these phase would be presented to make a reliable base for the discussion. For this reason all of collected data have been classified in order to be useful for the next part.

4.1 Water sources in Ashraf al-Belād

With a glance at Iran's geological location, it is apparent that most of its area contains dry lands. Dialectically, we can understand why before modern times the urban design in Iran was affected by water sources and its dividing systems. The watering system was at the very base of the concept that had shaped Persian historic cities. For a long time the linear system of urban design its main axis was a line of water in the shape of a stream or Qanat, has been a common method for shaping and extending a city in Iran. In cities such as Ashraf al-Belād, the issue of watering is different yet significant in two aspects: firstly, providing the needed water; secondly, preventing unwanted floodwater.

Expectedly, before the city had been built, water followed its natural flow on the ground from its sources in the southern hills to the sea in the north. In this situation, it was obvious that they took the upstream part of the landscape as the Royal Spot. Considering this, when the city was built, its major water sources were the rivers that flowed from the southern hills that have been used for the villages located there before there was a city. It is now obvious why at the time of building the royal complex the upstream part of the landscape was chosen. *Rabino*, who visits the city and gardens in the early part of the twenty century, before its changes in the Pahlavi I era, clearly writes about the city's numerous rivers and their names (Rabino 1986, 106). As the city had not changed a lot since its establishment in Safavid until Pahlavi I, we can understand that these rivers were also the most accessible water sources of the Safavid city and its royal gardens. *Khanykov*, who visited the city in the middle of the 19th century, pointed out that the river which had been used for irrigation of royal gardens was redirected to these gardens by spending a fortune (Khanykov 1996, 81). A comparison with other documents shows that he probably meant the *Borzū River* which was branched earlier in Safavid period to provide water for royal gardens. The river flowed through the city to its final destination the sea.

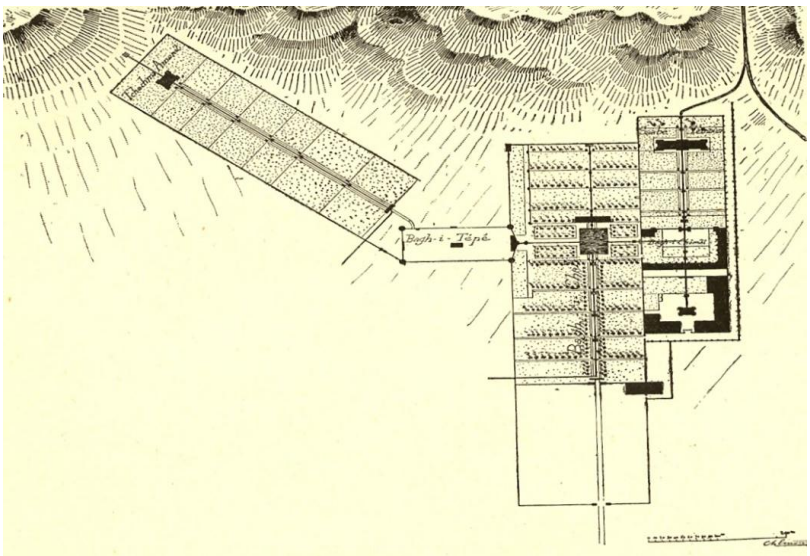

Fig. 1. De Morgan's drawing plan shows both water sources of the royal gardens: the branched river (on the upper right side) and the spring (shown with a cross on the upper left side). (Source: De Morgan 1894, 181)

However, most documents that have mentioned the city of *Ashraf al-Belād* and its royal gardens have also mentioned another water source. The second one was a spring at *Cheshmeh Emārat* garden, the easternmost garden of the royal complex. In a map of the *Ashraf* gardens complex, *De Morgan*[1] clearly identified these two water sources about a century ago (Figure 1). In this map, he shows that the water from the spring in *Cheshmeh Emārat* passes *Bāgh-i Tapeh* and then flows toward the great pool at *Bāgh-i Shāh*. On the other side of the map, the other water source can be observed which produces the water for a river above the garden of *Sahib al-Zamān*, the southern garden among the three western gardens.

By and by, both key water sources of the city have entered the royal gardens directly and then flowed into the city after watering the gardens. From the western side, a branch of the *Borzū* River irrigated the western gardens and From the eastern side, the spring-fed the eastern ones. With such an arrangement, the way in which the water supplies were situated had created a noticeable hierarchy in the city with the Royal complex at its top.

4.2 Challenges concerning the Ground Water

The fundamental principle of traditional irrigation systems' design as pumps had not yet been invented, was to use the shape of the land to its advantage. Creating a system that helped with the flowing of water from highlands to lowlands. However, in addition to its advantages, it created some problems in coastal areas. This was because of the intense surface runoff that weekend the soil by washed it in its path in addition to the lower lands turning swampy by overflowing of floods. In northern Iran, which has a wet climatic characteristic and is considered a coastal region, surface water disposal poses a challenge that even the royal gardens' designers have been involved with. Accordingly, this challenge can clarify the design features of this historic city from two points of view: first, the classification of lands by their valuation, and second, locating the main uses of urban land.

The first step in solving this problem was the decision to set up the royal gardens in a spot that was not in the path of wastewater. Accordingly, by locating the royal gardens in the higher part of the city, they would naturally have prevented flooding during rainy seasons, and the waters would move to lower places where the privet gardens and farms were located there. Furthermore, coastlands that were downstream of the city have not been selected for residential use, especially by the upper-class people. It was caused as the result of the special nature of these lands which were waterlogging and swampy as well as the difficulty in commuting and the existence of some types of annoying insects and animals such as flies, mosquitoes, snakes, and leeches. This issue had created difficulties for living comfortably which naturally made it unsuitable for the establishment of the royal camp. On the positive side, being swampy had made these lands more fertile and consequently, more valuable. In local traditional urban planning, such productive lands were too valuable to be used for housing.

Determining the urban zones also follows the land's type and value which are influenced by water. It can be observed that the urban design in *Ashraf al-Belād*, in such a wet climate, where the surface water created merits and demerits made designers pay more attention to the topography. Hence, the topography in this particular area has had a great impact on the establishment and development of the urban settlement. Fortunately, the urban topography rarely significantly changes over time. Therefore, it can be a link between the current state of the garden and its original state. In other words, the location of urban landmarks such as gardens in the city's topography is one of the ways of showing the continuity of landscape in historical cities that remained relatively unchanged over time. This issue, along with the continuation of the traditional land use in the indigenous parts of the region, has created a way to research what Safavid designers had envisioned at the time of the city's establishment.

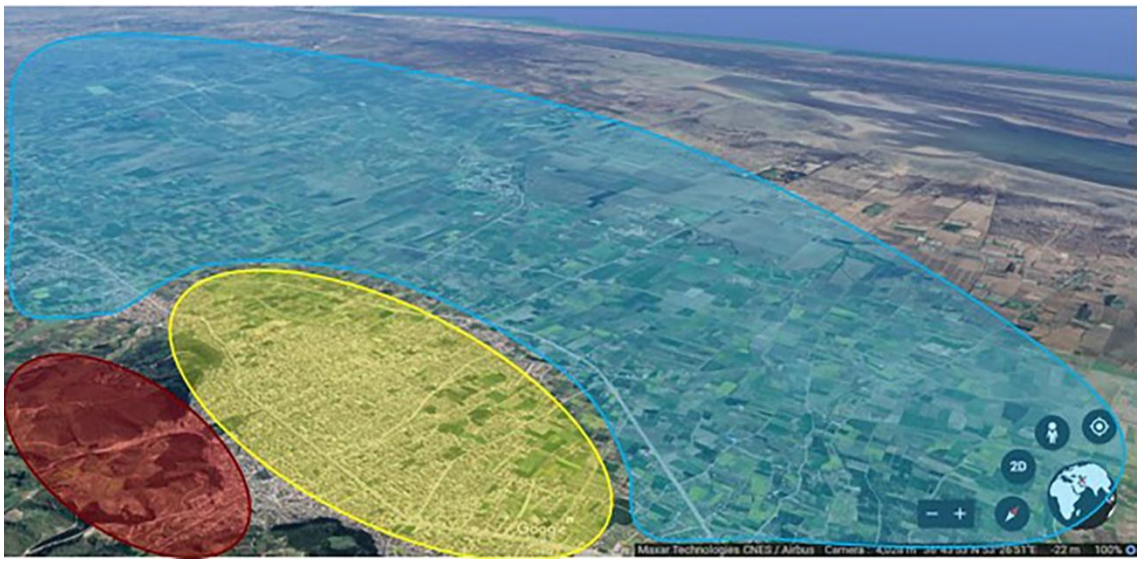

Fig. 2. The three topographic regions of the landscape could be observed even at present. Based on the www.googleEarth.com, 30.10.2019.

The field surveys showed that three topographic areas can be identified in the context of *Ashraf al-Belād*, which have different characteristics by considering how water flows through them. From the south, at first, there was a steep part at the hillside of *Hezār Jarib* and *Abbās Ābād* hills. It was where the intensity of water flow was higher than in other parts of the region and got flooded by heavy rains. After that, there was a wide central area where the slope was less than the upper part and the water flowed more slowly. Finally, the flat part of the plain that led to the *Caspian* Sea from the north was a suitable place for the accumulation of debris that moved from upstream to the sea. Accordingly, the city had been demarcated like that during the Safavid period (Figure 2) .

In the Safavid *Ashraf al-Belād*, the royal gardens and the residential areas of the common people are both located on the hillside of the mountains. In this case, they are far from the steep southern parts and also from the flooded northern plain. This type of locating was a natural reaction to the increased intensity of floods in higher areas during rainy seasons which could be annoying and undesirable for both the royal and the privet area. In addition, some strategies were considered in the water supply system to prevent soil leaching due to water flow. In the following sections, these strategies will be discussed in detail.

4.3 The basic way of the irrigation used in persian gardens

As mentioned earlier, water resources as well as their flow movements on the ground have had an outstanding impact on the formation of Iran's historical landscapes. Due to the fact that gardening is older and primer than urban design in Iran, the importance of water can be seen in historical gardens. The influence watering has on the formation of the garden becomes more vivid when the structure is analyzed. The importance of water initiates from its scarcity in most parts of Iran along with its sacred value in Iranian history. But this article will not be discussing it to avoid prolonging the discussion.

Water, as the main element of the Iranian garden, plays more than one role in growing plants. Providing more humidity, improving the quality of the often dry environment, and reducing the air's dust and temperature, which creates a kind of "Micro Climate" in the garden in contrast with the annoying conditions outside, give gardens a paradise-like effect. It is mentioned in historical resources and travelogues repeatedly.[2] On the other hand, the reflection of the image of trees and beautiful buildings in the gardens' pools and the sound of the gentle flow of water are the effects that have undoubtedly been designed with elegance and precision in Persian gardens. These features define a different concept for the Persian garden by creating a relaxing and imaginative atmosphere.

From another point of view, the water issue in Persian gardens had some other aspects. The various forms of water used to irrigate gardens in Iran, prove this conception. From this perspective, two general forms of water can be found in Iranian gardens: quiet water and flowing water. Each of these presences has taken some roles in a garden that totally shaped the garden's watering system design. Quiet water, which is observed in most Iranian gardens in the form of small or large pools, was applied as water storage to supply the water needed to irrigate the garden for a certain period of time. In this way, since the water source was usually the same for the royal gardens and the city, these pools have been drained at certain times. After these pools get filled up, the incoming water was closed to them to be directed to the city to feed it.

Flowing waters could be found often in the form of streams in direct paths. They were connected to the main source, which is usually the large pool, and have been responsible for supplying water to the different areas of the garden. These streams were designed like pipes that were placed in the ground. In this way, the water would reach the farthest parts. In complex gardens, where the gardens have been designed to be related to each other, these streams carried water from one garden to the large pool of another garden. As the water resources of these nested gardens are usually limited, not all the gardens had access to the original water source. In this way, each one usually had a separate pool to store its water, which often had dimensions and depth commensurate with the garden's size and how long it should hold the water.

In the next step, garden plots have been determined as a result of this simple but very practical water supply system. Land dividing was a regular method in the historical gardens of Iran that followed two main factors. First, in the whole region of Iran, which has been the center of the formation of Persian Gardens, rain has not been a permanent and reliable source for irrigating gardens. Therefore, garden designers have always had to channel water and thus divide the land. In the second stage, the shape and dimensions of these plots, in addition to having enough water for each plot, also depended on the land's shape and slope. Therefore, in gardens with a sharper slope, they would become smaller in width with a higher height difference than each other. Vice versa, in areas with a lower slope, it is possible to create larger pieces with less height difference. In addition, this form of land segmentation in sloping beds prevented water-scouring and soil movement.

Based on what has been said in this section, three main elements in the structure of Iranian gardens can be understood: pools, streams, and plots of land. All of these elements were somehow derived from the simplest irrigation system applied in Iran and have created the final shape of the gardens. In this way, this simple but functional structure was so flexible that over time and in different geographical conditions, it was able to create a wide variety of garden shapes. Although they were in the same historical period and the same city, not even the two gardens are exactly alike.

4.4 Irrigation system in Ashraf

In the previous section, it was noted that the need for water and, in parallel, its scarcity throughout history in Iran has been effective in the formation of gardens and their structures. By the time of Safavid rule, gardening

was a thousand years old traditions based on its roots and context, it was mainly based on water shortage. But the key question is whether the principles of designing gardens continued in *Ashraf al-Belād* as it was placed in a waterlogged area. Studies of historical sources and remaining traces show that the garden design process in this city has been a continuance of Iranian gardening tradition. The structure of the gardens in this city is also based on three main elements: the pool, the streams, and the plots of land. All the gardens in this complex are based on these elements and nevertheless had been shaped in different designs.

As mentioned in the section "water sources", *De Morgan* and some other evidence mention *Ashraf*'s water sources. *Mohammad Mirzā* another source who has lived there for two years in the Nāseri era, adds that the wastewater of *Cheshmeh Emārat* overflows into a swamp located at *Shāh Kaleh* seaport (Mohammad Mirzā Mohandes 2011, 247). *Melgunov*, another traveller in the Qajar era, states that the wastewater coming out of the *Bāgh-i Shāh* leads to the city from the front door through a shallow stream (*Melgunov* 1997, 193-194.). Therefore, due to these two documents, it is clear that there were at least two ways that led royal gardens' wastewater to other parts of the city. One route from *Cheshmeh Emārat* to the *Shāh Kaleh* seaport, and the other one from *Bāgh-i Shāh* to the central part of the city. *Melgunov* also points out that water flows from the *Bāgh-i Khalvat* and *Bāgh-i Tapeh* to the pool of the *Bāgh-i Shāh*, just like others (Ibid., 192).

Now, should the routes mentioned in the historical sources were marked on the map, we find an image like Figure 3. As what is highlighted on the right side of the map, a tributary of the river has reached the gardens from the northern side of the *Sahib al-Zamān* garden. After passing through this garden, this stream got into the middle pool of the *Haram* garden. From here, it has been split into two branches. One of them goes to the *Shāh* garden in the center of the garden complex and flows into a large pool in the middle of the garden. A smaller branch enters the middle pond of the *Khalvat* garden. On the other side of the map, another water source in the city is marked. A spring that the pavilion of the *Cheshmeh Emārat* garden has been built on it with a pool in the middle of it. From here, the water flows to the *Tapeh* garden and then, through some pipes that have been installed inside the wall, to the middle pool of the king garden. Finally, a large stream carried water through the *Bāgh-i Shāh* to the city's great square and then kept continuing among a street which was in the middle of the urban area.

This water route divided the city into two halves with a south-north extension. Due to the formation of the main street of the city along this stream, it was the water flow that created the main skeleton of the city. In other words, just as in the Persian garden, the irrigation system determines the arrangement of the components and directs it, the same amount of influence has prevailed in the Iranian city as well. It means that the urban irrigation system has influenced the urban spatial organization. Now

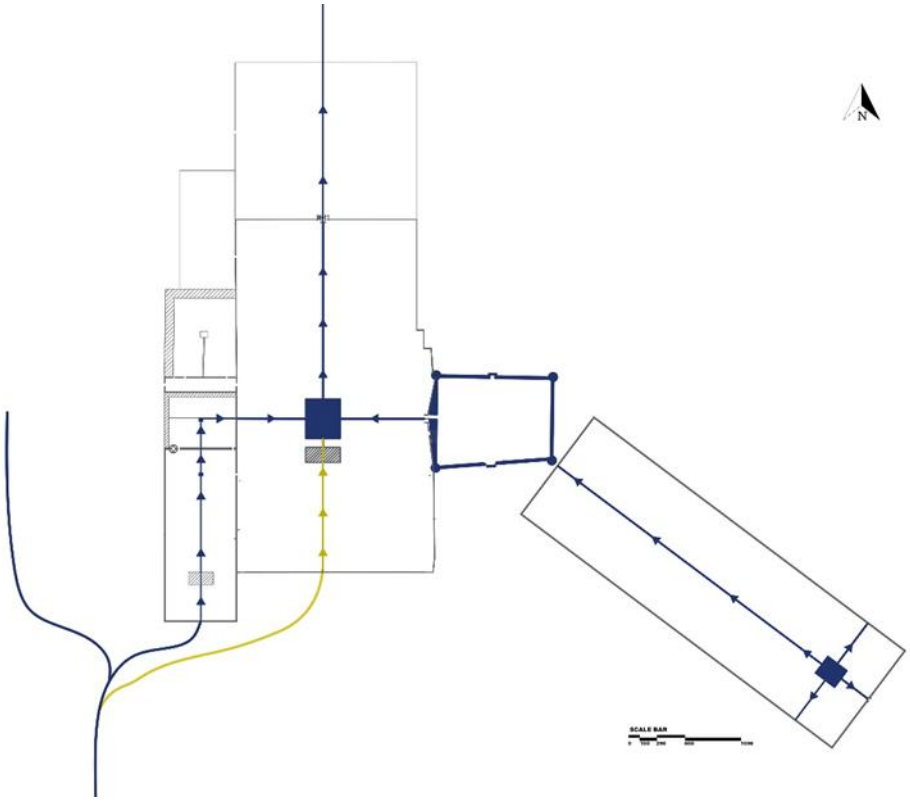

Fig. 1. Both of the royal gardens' water sources and their flow path through the gardens get marked on the plan. In addition, the route added after Shāh Abbās along the southern side of the Bāgh-i Shāh and its imaginable specific branch of the river is shown in yellow. Also, the stream which exited from the Shāh garden in the middle of the square could be observed in front of the gate.

by adding the importance of the royal gardens, which were the primary core of the formation of the urban structure, this concept finds another aspect. The reason is that the royal gardens' irrigation system, placing them close to the water sources, and sending the water to the city, in addition to affecting the structure of the gardens themselves, had also more effects on the urban structure.

In *Ashraf al-Belād*, as mentioned in the introduction, the royal gardens were the first core of the original city. It means that these gardens were built before the appearance of any other urban structure. Therefore, it comes to mind that the priority of the formation of these gardens has led to a kind of structural modelling that followed them. In other words, the Safavid designers faced a landscape full of trees which provided them with a green city without the need for gardening and irrigation. This green base had brought the Safavid dream of urban concept closer to reality. The idea of having a green urban landscape was initially shaped in cities such as *Isfahan* and *Qazvin*, the Safavid capitals in the center of Iran, by building numerous gardens in the city. Therefore, in such a green context, the only remaining work was to organize the plants in the city. This work was also possible through an orthogonal urban structure that emphasized on its main axis by a water stream that came to the city from the gardens.

As stated by historical resources, the wastewater, which has flowed out of the royal gardens, has led to public agriculture. *Sotoudeh* clarified that there was a sewage system designed to collect urban wastewater. As he notes, these underground sewers, designed by Georgian and Dutch architects contemporary with the construction of the city, started from the *Bāgh-i Shāh* and came out in *Hūmayūn Tapeh*[3]after collecting the urban sewer. This wastewater was devoted to cultivating the northern plains of the city (Sotoudeh 1987, 653). Through this underground system, there was just one direction like a narrow river flowing on the ground of the main street. According to the documents, the extension of the south-north stream of *Bāgh-i Shāh* which led out water over the main street was the only visible stream and other underground sewers were not visible (Fraser 1985 23; Melgunov 1997, 193-194). Thus, we can confirm the direction of the main street which was laid in the middle of the city and was compatible with the mentioned stream.

Based on the above information, it can be deduced that the water resources of the royal gardens and the regular people's quarters were separated. In other words, the water consumed by the individuals did not pass through the gardens.[4] However, the stream that brought water from the Shāh Garden into the main street had a decorative role. Therefore, the water can be considered a strong link between the gardens and the urban landscape because they both depended on the water as a decorative and functional element. On the other hand, the abundance of water, which was the lifeblood of the gardens, unlike the Iranian central cities, not only does not contrast with the gardens and the urban landscape, which separated them from each other but also integrates them. The same distinction characterizes *Ashraf* from other cities and its gardens from other royal gardens.

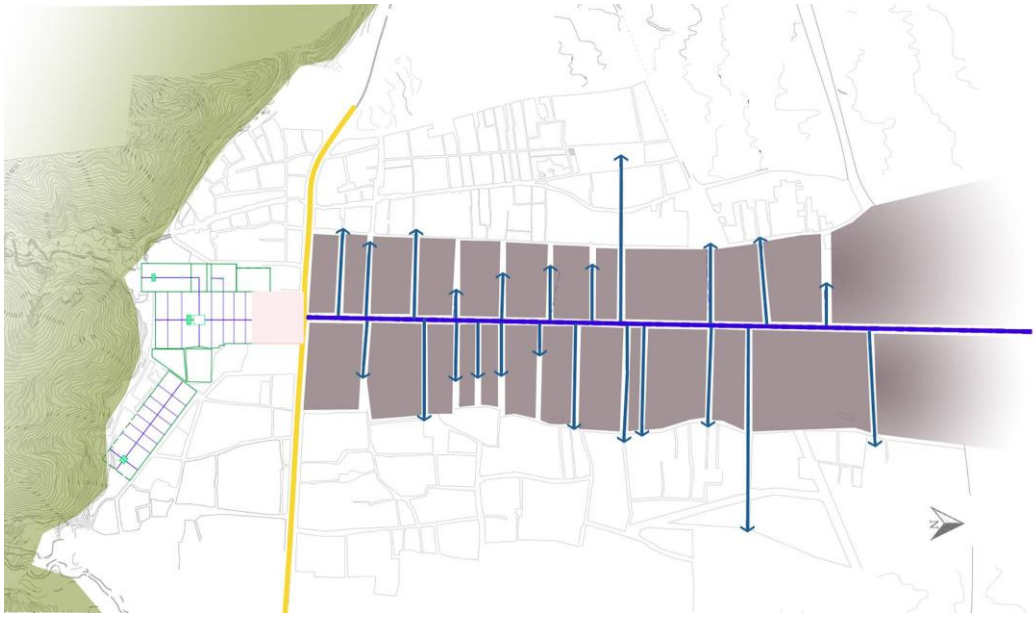

Fig. 4. The effect of the water management system in adaption with the urban access network shaped the geometry of land divisions in the urban landscape of Ashraf al-Belād, based on the comparison of historical documents and the current surveys.

In this way, by determining the paths and pieces of land, the geometry of urban subspaces gets determined, and the city has been divided into organized pieces of land, just like the royal gardens (Figure 4). These plots were the people's residential gardens. Finally, the city's visible geometry was formed from the small built spaces and green spaces that came together, which shaped a unique landscape with the intertwining of urban built spaces and trees. In other words, the study of the city of *Ashraf al-Belād*, as a city that was built from zero, and the existence

of an older structure did not affect its shape, shows that the Safavid designers also considered the city as a big garden. They used the same streams and land division formulas to shape the urban skeleton. What confirms this opinion is that in this city, the flowing water streams from the royal gardens were not the only source of water in the city. There were other sources to supply the water needed by people's residential and private gardens. Therefore, it can be concluded that the water in the middle of the street is more a continuation of the idea of gardening in the city than having a practical role.

5. Discussion (Evolutions Through the Time)

Until the modern changes in the urban irrigation system, Persian cities have been affected mainly by the location of the water supplies and the ways of irrigating different parts of the city. It was a vital issue, especially for the cities situated on the Iran plateau, mostly covered with dry lands. However, in a rainy city such as Ashraf al-Belād, it was different. As said before, the plants are rarely dependent on irrigation to grow there.

By contrast, the examined Persian gardens' design system, as developed throughout history was followed not only in Ashraf's royal gardens but also, in the whole city as a key pattern to organize and plan. The urban landscape, with all its royal and private gardens, has been understood in a unified way and the form of a big garden city. This point is emphasized by the Italian traveler Pietro Della Valle who visited here during the time of Shāh Abbās I and at the same time as the city and gardens were being built.

So far, it can be concluded that if the urban landscape structure was affected by the irrigation system, as it appears from the historical resources and the available evidence, then it is expected that over time and with the changes that occurred in the water supplies, the image of the city should also change. A closer look at the historical documents, as well as comparing the current state of the city and the remains of the gardens, considering that the current urban structure contains traces of the original one, confirms this opinion. In other words, this essay shows how this dependence on water resources has caused changes in the structure of gardens and the city over time. For this purpose, this effect is reviewed in the royal gardens and the city.

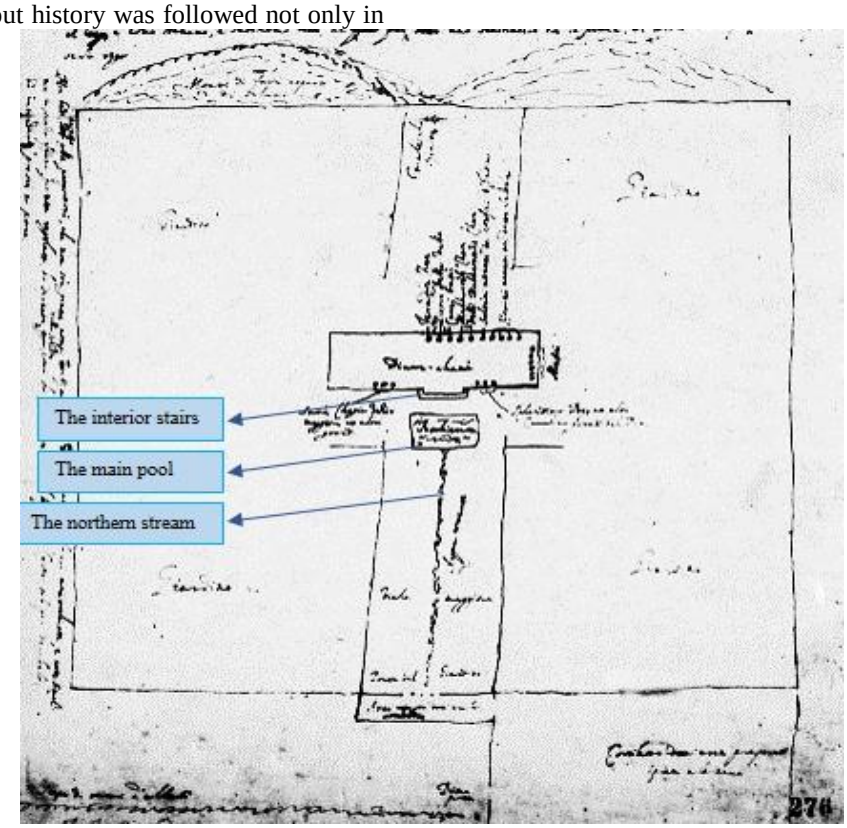

Fig. 2. A drawing by Della Valle, in which only the path of the water stream from the large pool of Bāgh-i Shāh to the north is shown, and the southern stream is not seen in it at all. A little puddle and an Ābshoreh set where the stairs of the pavilion get marked in this drawing. (Source: Mahvash Alemi's Archive)

5.1 Gardens

Due to the developments in Iran's road network since Qajar, most of the documents mentioning Ashraf al-Belād belong to this period and after. They clarified some data about Safavid aspects like water supplies when the water directions in the royal gardens and city in the Qajar period were explained. As changes rarely happened in the city's water sources before the industrial revolution, we can use the Qajar documents to find the original water supplies. Fortunately, there is one travelogue that refers to these gardens in their founding time which can be used to compare and find changes. Pietro Della Valle, an Italian traveler, entered this city for the first time to visit Shāh

Abbās. His explanation is useful to imagine the city in its original state.

The whole watering system is marked in Figure 1. Thus, We found a three-way water route: two routes from the western and eastern gardens to the main pool of Bāgh-i Shāh and the third one which drains out from it through the northern street. This matter has been addressed in the Della Valle travelogue and his drawing which depicts Bāgh-i Shāh (figure 5). He describes the east and west entries of the pool and a water stream from here downwards into the northern street. Such an idea sounds rational and fits in with the direction of the water in the garden. The interesting thing about all the Qajari resources is that they all refer to a water channel on the south side of the pavilion of Bāgh-i Shāh. This route is mentioned in important written sources such as "Nāser al-Din Shāh 's Journey to Māzandarān", the Qajar maps of Bāgh-i Shāh (Figures 1&6), and the Qajar photographs before and after Nāser al-Din Shāh 's repairs.

Abbott, who saw the garden in the time of *Fath Ali Shāh Qajar* (1772-1834 AD) before the *Nāser al-Din Shāh*'s

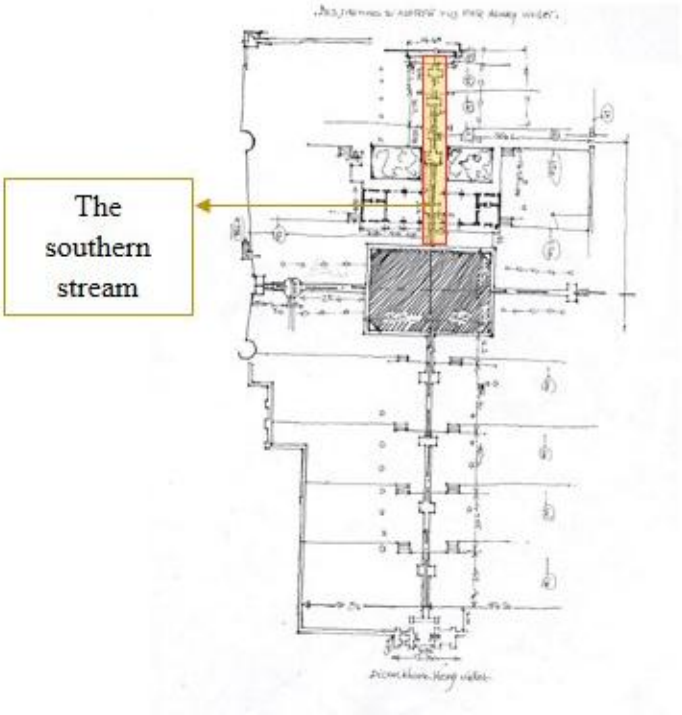

Fig. 6. Henry Viollet's sketch of Shāh garden which shows the southern length of the water path behind the pavilion.
(Source: The archive of the ministry of cultural heritage, tourism, and handicrafts)

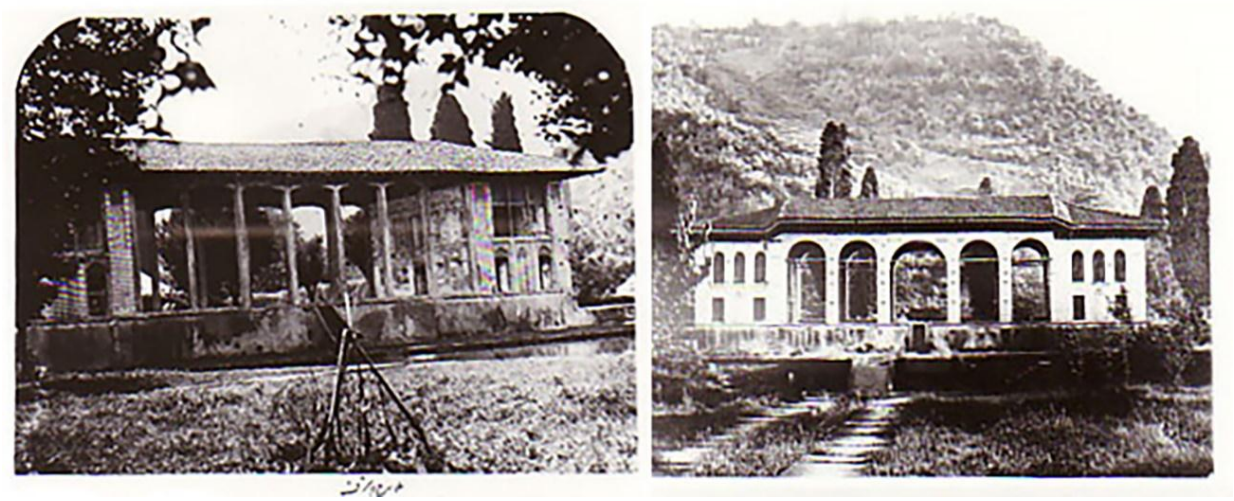

Fig. 7.Two photographs belong to Qajar. The left one shows before Nāser al-Din Shāh's interventions, and the right one shows these changes. An Ābshoreh which is located in front of the pavilion in both of the pictures proves the idea of the southern water path that did not exist at the beginning.
(Source: Photography Archive of Golestan Palace)

Fig. 3. Changes in water routes in Bāgh-i Shāh over time, which indicate all the changes in water resources in different

interventions also points to the upstream waterway of the Shāh garden (Quoted in: Sotoudeh 1987, 624). As there has been no evidence regarding the matter since *Della Valle*'s visit to *Abbott'*s, it can be assumed that this route existed at least since the latest Safavid or the Afshāri period in the garden. There are some reasons which proved this idea. The first one is *Della Valle*'s Drawing and descriptions. He clarified that there was no stream through the upper side of the building in the south. The second one is the Qajari pictures that show the stream. These pictures even show an *Ābshoreh*[5]in the middle of the north face of the building here *Della Valle* shows the entrance stairs (Fig 5). The interesting point is that there are some Qajari pictures had had been taken from the building before and after Qajar interventions. We can see the *Ābshoreh* in both of them (Figure 7). It means that it was unchanged in Afshāri and Qajar building, indicating that the southern entry of the main pool belongs to Afshāri or late Safavid rebuilding.

Also, it should be noted that how could there be a water stream if the water entered the garden through the middle eastern-western axis located in front of the pavilion? What was its source if there was another? There is a significant answer to those questions that *Nāser al-Din Shāh* addresses. He talked about another direction of stream located on the upper side of the pool, south of the main building, and a pool at the southern end of the *Shāh* garden which flowed water into the stream. He points out that water drains into this pool from a spring (Nāser al-Din Shāh Qajar 2011, 141), but he does not clarify which spring. Due to this point, it could not be an exact observation. Another possibility is that they specified another branch from the *Borzū* River to feed the southern part of *Bāgh-i Shāh* after *Shāh Abbās*.

This argument is also confirmed in *Mohammad Mirzā*'s travelogue; Where he describes as accurately as possible the clay pipes that were installed in the southern wall of the garden to bring water "from the southern mountains" to the beginning of the south-north path of the garden (Mohammad Mirzā Mohandes 2011, 629-630). Therefore, by referring to the documents it is possible to depict the path of the water of *Bāgh-i Shāh* during the establishment of the gardens during the time of *Shāh Abbās* and the Qajar era (Figure 8).

At present, *Bāgh-i Shāh* is the only garden that remained in the city. Except that, the pavilion of *Cheshmeh Emārat*, locked among the buildings which raised in place of the garden, and some parts of *Bāgh-i Tapeh*, without its functionality as a garden, have remained. As expected, the east and west streams of the *Bāgh-i Shāh* had vanished because the gardens that transferred the water into them do not exist anymore. The garden's big pool converts into a four-piece planted ground to grow some decorative plants that originally did not belong to the gardens. Finally, just the south-to-north water streams has remained with a water pump which constantly pumps up the water to the southern end of the garden. So, there is no connection between this garden's irrigation system and the original water supplies or the city.

5.2 The city

As mentioned before, the urban water circulation network during the Safavid era was one of the main factors in shaping *Ashraf al-Belād*. Its effects started from the location of the royal gardens at the beginning, taking into the direct access to fresh water, and continued with creating the main axes from the gardens throughout the city, which were matched with the water flow paths. Therefore, it can be expected that after the changes happening in the water supply system, some changes should as well happen in the urban structure. These changes started after *Shāh Abbās* and the city's glory days when in recent decades changes were accelerated toward industrialization. After *Shāh Abbās* and before the modern evaluation of the city, residents had access to water

through the rivers and streams flowing on the ground. In the original urban planning, a long stream crossed along the central axis of the city, but at the same time, there were many routes of surface water flowing on the ground. Accordingly, the shape of urban spaces that were formed far away from the main urban axis, have been specified by these routes which made pre-planning plots by following the natural unevenness.

Considering *Ashraf*'s gradual housing, it can be claimed that, at first, the people settled in the planned and systematic parts, and then the city expanded on both the eastern and western sides organically. In fact, after designing the overall geometrical structure of the city and during the gradual residential through the migration of non-native people, two parts have been shaped in this city which were geometrically different. The first one was the pre-planned section which involved regular geometry of the royal gardens and designed parts of the city. The second one was the gradually shaped parts of the public spot, which were created and developed in organic geometry. This organic geometry which was in contrast with the rectangular designed one had been shaped by the regular people after abandoning the city (Figure 9).

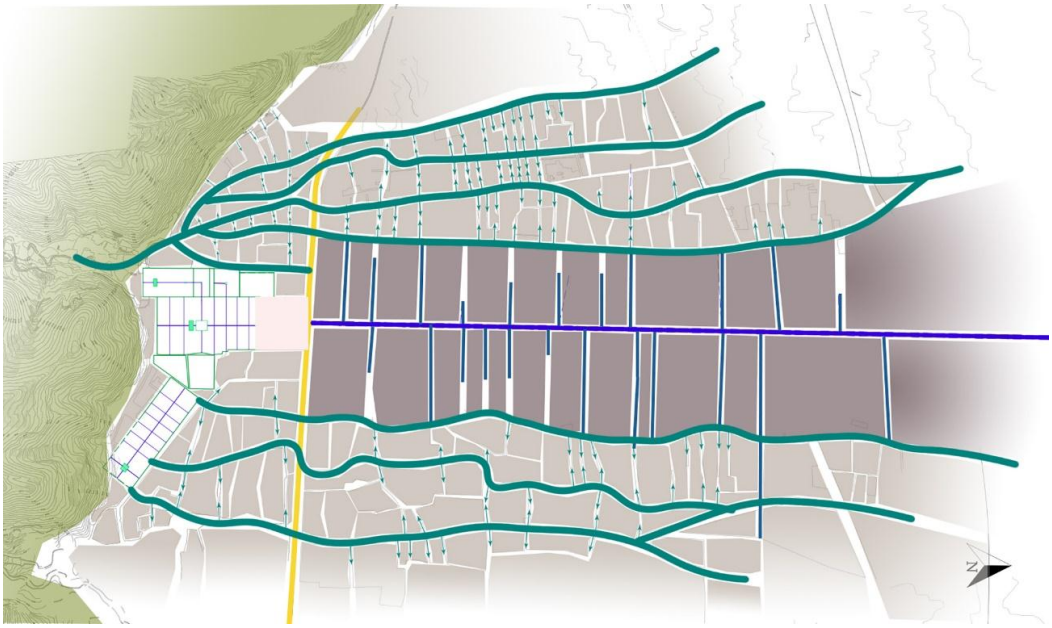

Fig. 9. A schematic picture of the organic development of the city that has taken place after the prosperity of the city during the reign of Shāh Abbās until today and based on surface water flow routes, ownerships, and land prices.

Today, with the integrated provision of water to the city using underground water supply systems and the separation of the water source of the gardens from the ones of the city, the fundamental relationship between the original parts of the city has been completely severed. The spring of *Bāgh-i Cheshmeh Emārat* supplied the remaining parts of it. As a result, the previous relationship between the garden and the city's water circulation has been completely transformed, in a better word, it has disappeared. However, adapting the urban access routes to the water flow routes on the ground that has reached from the past to the present day can still clarify the general shape of the city structure and the division of land parts over time.

6. Conclusion

Landscape design in Iran has always been closely intertwined with water and its influence, whether in arid regions like central Iran or in regions with ample rainfall like northern cities. Ashraf al-Belād, as expected, presented numerous challenges to Safavid designers tasked with creating a city befitting a royal residence. The findings of this research shed light on the inventive approach these designers adopted to tackle these challenges. Their solution of choice was to integrate gardening principles into urban design. Essentially, they emulated the structure of a garden within the city, opting for a well-tested approach that could be systematically applied to urban landscape design.

This endeavor yielded two significant outcomes: firstly, it resulted in the successful design of a city with a distinctive character, and secondly, it brought the concept of the ideal Safavid city closer to reality. Analysis of other cities flourishing during this era reveals a shared goal of transforming urban areas into lush, tree-filled environments resembling expansive gardens. This underscores the profound importance of the geometric layout in these cities, which undeniably mirrors the geometry found in gardens, a connection that becomes increasingly evident with a detailed examination over time. Although the cityscape has evolved significantly since then, this historical harmony between urban design and garden structures remains significant, albeit not readily apparent in today's urban settings.

The intentional planning of garden cities and the creation of a unified landscape is discernible in dividing the urban landscape into two distinct geometric zones. In this context, the city layout is notably more structured in areas

leading to the main thoroughfare, while a more organic alignment follows the east-west axis, reflecting the natural topography of the region. What unifies these disparate sections is their adherence to the water flow ; one is meticulously designed, and the other flows naturally. Essentially, the geometric disparities in the two parts of the city, coupled with changes in the royal gardens due to shifts in water sources, reinforce the foundational idea of the Safavid landscape's dependence on water and elucidate this enduring relationship to us.

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[1] *Jean-Jacques De Morgan*

[2] The contrast between inside and outside in Iranian gardens was the subject of the most European writers noticed. It is absolute that the writers have felt the annoyance of Iran's hot and dry climate more than the natives.

[3] Today is called Namayūn or Namayan *Tapeh* which means visible hills.

[4] Due to the addition of wastewater from royal gardens to the underground sewer and their use for agriculture and gardening, the city's water resources were probably from other streams that flowed from the hills. In addition to the Great *Nekārud River*, it passed around the city's border, and also a tributary of the *Borzū River* has been led into the city.

[5] A stone which placed where the water falls from a higher pool into the stream and make beautiful wavy shapes on flowing water.