### Islamic Republic of Iran

Iranian Ministry of Cultural Heritage, Tourism & Handicrafts

### MCTH



### State of Conservation report of Sassanid Archaeological Landscape of Fars Region World Heritage Site

**UNESCO** 

World Heritage Convention

Tehran 2020

In the name of God

### **3.** Adjusting the boundaries of the components of the serial property to include the landscape setting of the archaeological and architectural attributes within the boundaries and/or buffer zone of the World Heritage property,

Based on previous surveys of Firuzabad Valley, one may suggest that there are 70 archeological sites and most of their archeological remains date back to Sassanid era and the start of the Islamic era. Distribution of archeological sites suggests that most of these remains are within the limits of properties inscribed on the World Heritage List (figure 1). In order to protect outstanding universal values of the properties, it was endeavored to review the core and buffer zones of archeological remains in Tangab, from Ghale Dokhtar to Goor City along the river. The annexed report of archeological remains of the area suggested that there were other archeological sites, too. After revision of dividing lines of the core zone and its archeological landscape, all of archeological remains of the site would be protected. Meanwhile, the bed of Tangab River from Tangab City to Goor City and Sassanid Empire on the valley and the riverbed was included in the limits of the world heritage site (below: revised map of world heritage site and archeological outlook of Sassanid city on Firuzabad Plain).



Map. 1- Distribution of Archeological Sites of Firuzabad Plain (Fars)

### **Tangab River**

The basin of Firuzabad River can be traced back to the southern plates of Shirz, Mishuan and Bari mountains located 40km away from the southwest of Shiraz and south of Ghareaghaj River. The water initially flows into a valley where lots of villages such as Melgaleh, Shurab, Darenjan and Hanifghan are located. The biggest villages on the valley are Jokan and Hanifghan. As a result, the valley is known by the names of these two villages, too. The same goes for the river flowing through the valley. However, the river is sometimes called "Khajeii". Hanifghan River has fresh drinking water. Its flowrate in Tangab station is about 3.08m<sup>2</sup> per second. In the end of the plain, the river flows through a relatively small strait called "Hallalo". Then, it flows through the bed of Sirzekan valley and enters Firuzabad canyon or Tangab canyon (figure 1). After exiting 12km long canyon of Tangab, the river is called "Firuzabad" (figure 2). The whole canyon goes through an anticlinal mountain called "Podeno" (figure 3). The flowrate of the river increased in Firuzabad valley since the stream of calcareous springs flow into the river. The river diverts slowly to the east and it gradually flows in northwest to the southeast. The river creeps like a winding snake and flows to the bed of a valley called "Sartel". Then, the river takes an eastern turn and flows over the skirts of Asiab Badi mountain chains. Firuzabad River is 13km long and it has 3 percent slope. It divides Firuzabad Floodplain into western and eastern parts. The walls of Firuzabad river suggest that the plain deposits are more than 10m deep and the deposits are mostly fine-grained (Javaheri and Javaheri, 2006: 7-10; Afshin, 1994: 435) (figure 4).

In past, the river irrigated many farmlands on Firuzabad Plain. It also supplied water for two water streams and 11 subterranean canals dug during Sassanid and Islamic eras (Ahmadi, 2014: 89-96). Nowadays, Tangab dam has stopped water from flowing on the valley. The water is transferred through pipes to Firuzabad Plain for drinking and agricultural purposes.

### Archeological Significance of Tangab or Goor City

From a general outlook, the aerial images of Goor City or Tangab taken by the German team led by Dietrich Huff and Hans Hügi, properly locate and introduce all of the sites inscribed in World Heritage List (figure 5). In this outlook, some sites are not properly located. It should be noted that at the time, the plot was based on consistency and association of cultural and natural view of archeological sites on Firuzabad Plain. After the Islamic Revolution and eight-year Holy Defense War between Iran and Iraq, research and development plans for cultural heritage of Firuzabad were ceased. In 1990s, Mohammad Mehriar developed maps of core and buffer zones of these three sites, namely Ghale Dokhtar, Ardeshir Palace and Goor City (Map. 1, 2 and 3). Considering the fact that such sites have been inscribed on the UNESCO's World Heritage List, maps of core and buffer zones of such sites were revised and adjusted accordingly (Map. 4).

The first historical monument in Tangab is called Gavi Cave. The cave is located on right side of Tangab River and it is parallel to a tunnel on which drum house was built. The abovementioned shelter is in vicinity of a river providing a wide view. From this site, tools made of different types of stones such as scratchers, chisels, and splinters dating back to Paleolithic era have been discovered (Norozi, 2005: 267) (Figure. 6).

The next historical property is called "Ghale Dokhtar", i.e. Dokhtar Castle. It occupies a mountainous plateau which is surrounded on three sides by narrow passes. It covers an area

exceeding 0.5km<sup>2</sup> and it is so big that an army could easily fit into it. Two defense walls have been constructed from the summit of the mountain to the river bank and consequently overshadows the road completely. On the highest part of the fort, there is a domed hall with adjacent rooms. The fort was built in three levels which were connected together via stair towers. On the lowest level of the fort, there are guard rooms and water storage. On the second level, there is a yard with large halls while the king's palace with domed halls and porches are located on the third level (Huff, 1987: 92). In the northwestern part of the fort, there is a single construction called "Tal Nagarkhane". The construction is somehow connected to the fort. It is an unsurmountable ridge of the mountain on which a fort was built. In the past, the place was used as an observation post. However, the evidence suggests that the fort was also used during the Islamic era (Huff, 1987: 92) (Figure 8).

To the south and the camping site of Ghale Dokhtar, there is large piece of rock on which there is a Kufic inscription. Unfortunately, abrasion made it impossible to read the inscription (Figure 9). The embossed engraving of enthroning of Ardeshir in the center of Tangab and next to Mihr Narseh's Bridge shows the king receiving the kingly crown from Ahura Mazda. Behind Ardeshir's back, four of the top figures and clerks of Sassanid Empire have been engraved. In the fifth century AD, Mihr Narseh the minister of three Sassanid kings ordered the construction of a bridge in the middle of Tangab and next to the embossed engraving which suggested the enthroning of Ardeshir. The process of construction of the bridge was inscribed on a mountainous rock next to the bridge. The bridge was made up of rubble stones and gypsum mortar in its center and properly-cut stones were used in its façade (Norozi, 2005: 191) (Figure 11). The inscription near Mihr Narseh's Bridge describes the way it was built and who built it. The inscription is over the bridge and to the right side of the embossed engraving which shows the enthroning of Ardeshir (Figure 12). On terminal side of Tangab after the bridge and embossed engraving, there is Tangab caravansary on right side of the river and between the embossed engravings showing victory and enthroning of Ardeshir. Considering the architectural style of the caravansary, it probable dates back to early Islamic era (Norozi, 2005: 164) (Figure 13).

In the southeast of Tangab caravansary, there is an embossed engraving of Ardeshir's victory engraved on a mountain's slope. In addition, the is an embossed inscription showing victory in fighting Suran War in Tangab (Firuzabad) right over the Sassanid road. The embossed engraving is the largest one of its kind carved out during Sassanid era. It revolves around war and victory of Ardeshir in his fight with Artabanus IV of Parthia. The engraving shows Ardeshir riding a horse and using his spear to defeat Artabanus IV and his horse. Right behind Ardeshir's back, Shapur I and Ardeshir's son are defeating a top Parthian figure. In the last part and behind Shapur's back, there is a top Sassanid figure who has seemingly captured a Parthian figure (figure 14). The engraving is located below the victory engraving and on a side of the Sassanid road which connects Ardeshir's palace to Ghale Dokhtar. The road starts from Ardeshir's palace, passes Tangab and Mihr Narseh's Bridge and leads to Ghale Dokhtar. A part of the road was carved out in a step-like shape and another part of the road was built out of rubble stone and plaster (Figure. 15). However, next to the Sassanid road and to the east of Victory engraving, there is an embossed flat surface with lost details. It is solely a cut-out frame without any visible design on and it was carved out of rocks (Figure. 16). After exiting Tangab, Ardeshir's palace is at another end of Tangab called "Murdestan". The building was constructed by Sassanid Ardeshir I. Before the northern patio, there is a circular water pond.

The palace was built based on a symmetrical design. It includes a patio with adjacent rooms and three domed halls in the back, a central yard and its neighboring rooms. A separate building called "Chahartagh" is located to the south of the palace (Figure. 17).

In connection to Ardeshir Palace, there are remains of a stone building on a natural hill which apparently is 270m long and 70m wide. The building is to the north of Ardeshir's palace and to the left of the river. Most of the hill is made up of rubble stone and plaster. Due to destruction and erosion, designs of buildings are not clear. Tal Nagarkhane was used during both Sassanid and Islamic eras (Norozi, 2005: 49) (Figure. 18). In addition, there lies "Tal Khezr" which is a large natural hill to the south of Ardeshir's palace. It has two walls. The external wall is made of large stones simply laid on each other while the internal wall is made up of rubble stone and plaster. At the top of the hill, there is a monument call "Ghadamgah Khezr Nabi". There are remains of a water storage and architectural ruins (Norozi, 2005: 42) (Figure. 19). Further to the east of Tal Nagarkhane and the river, there is a hill called "Bagh-e Sorkh". The small hill is next to the road connecting Firuzabad to Shiraz. Due to development of roads, especially Jam-Firuzabad route, a part of the hill was destroyed. Compared with other historical sites located between Tangab and Goor City, the hill is much further from the river. The area was used during Sassanid and Islamic eras (Norozi, 2005: 40) (Figure. 20).

Between Tangab and Goor City, there are significant remains of historical monuments in vicinity of the river. In this regard, one could point to remains of the second bridge of Goor City which was built to the north of Goor City over the river. Nothing but remains of two abutments of the bridge near the river and some remains on the river bed have survived over time. The materials used for building the bridge are rubble stone and plaster in the center and stone blocks in the body of the structure. The abutments are pentagonal and they have a breakwater-like design in the direction that water hits the bridge. The abutments are 5.5m away. Dimensions of one of the abutments is  $8.55 \times 5.90m^2$  and for the other, we have  $9.10 \times 6.10m^2$ . Dietrich Huff called the bridge "Port Bridge" (Norozi, 2005: 195; Huff, 1987: 76) (Figure. 21). In addition, recent studies revealed that the bridge was also used for carrying water as it included a route for carrying water from Ardeshir's Palace to Goor City (Norozade Chagini et.al, 2014: 157-165).

In the course of conducting studies concerning methods of transferring water of Firuzabad Plain in 2013, a part of the surrounding areas of Firuzabad River in the southeast of Kizarin Village collapsed and remains of some broken clay pots got out due to the pressure of higher levels loads and the consequent fall. After all, three clay pots with soil inside and of the shape of the pot were taken by Cultural Heritage Protection Guard to Firuzabad Research Center. Then, they were sent to Persepolis and from there to Pars Museum in Shiraz for further restoration. Since farming activities were happening on the riverbed and there is no evidence of archeological sites or hills, the clay pots were dated to the third millinium B.C. and probably to the Chalcolithic era. We called the place where the pots were found "Gilak" because these farmlands belong to a village called "Gilak" which is the closest village to the place where the pots were found (Ahmedi, 2013, 2018) (Figure. 22).

At the end of river route (i.e. from Tangab strait to Goor City), there lies a city called "Ardeshir Khore". With an area of 314 hectares, the city is located on east side of the river and right on Firuzabad Plain. The city was originally founded by Ardeshir I. The city is completely circular and its central axes are right in the middle of the city. Two main streets with north-south and

east-west directions cut each other in the city center. There are four gates on four main directions. The city is surrounded by moat and mud walls. Concentric radial streets divide the city into different sections. The city was habituated till 4<sup>th</sup> century B.C. (Huff, 1987: 76-81) (Figure. 23). In addition, the no. 1 bridge of Goor City is located in west of the city and north of the bridge over Firuzabad-Farashband road. To build the bridge, rubble stone and plaster were used in its center and stone blocks were used in making the façade and body of the bridge. Stone blocks were kept in their place by swallowtail clamps. Only 8 abutments of the bridge have survived. The bridge has east-west orientation (Norozi, 2005: 192) (Figure. 24).

### **Determining Core Zone of River**

In order to determine the river's core zone, a field visit of the area from Tangab to Goor City is necessary. The field study covers the site and the first-degree core zone of the world heritage of "Firuzabad". In Tangab, some properties dating back to a period form the pre-historical era to the Islamic era have been found. From the terminal estuary of Tangab to Goor City, there are pre-historical to Islamic sites within the core zone of the river. In order to integrate the core zones of all historical sites inscribed in the UNESCO World Heritage List, the best option is using the bed and the core zone of the river. In order to determine the core zone of the river, location of historical sites on basin and limits of the river, as well as other national and human-related factors such as geomorphology of the river, roads, farmlands, waterways, and subterranean cannels were noted. The core zone has been indicated on the map with continuous red lines.

After approval of the maps, the core zones of archeological sites inscribed in World Heritage List should be integrated. Therefore, considering natural and historical evidence noted below, the core zones of such sites have been integrated. In order to determine the fluvial limits containing the surrounding sites of World Heritage List, determination of new core zones would be followed by integrating them. Before dealing with maps of fluvial limits, we will shortly discuss the historical sites on the fluvial path from Tangab to Goor City.

The historical sites of Tangab start from Gavi Cave which is a pre-historical place dating back to Paleolithic era (Norozi, 2005: 267). The cave is located to the west of Tal Nagarkhane of Ghale Dokhtar and it is to the left of the river. Then, there is Tal Nagarkhane of Tangav to the northwest of Ghale Dokhtar, the whole area of Ghale Dokhtar and a more extensive part of it. In order to integrate the surrounding core zones of Ghale Dokhtar with other properties of Tangab inscribed in World Heritage List (i.e. embossed engraving, Mihr Narseh Bridge and inscription, caravansary and road built during Sassanid Empire), it is sufficient to join the surrounding core zones of Tangab to the north of Atashkadeh Village and next to the ancient road of Tangab should be joined to the new area at terminal estuary of Tangab.

From there on, the lines of surrounding core zones on the west side of the river go parallel with the river. To the east of Ardeshir's palace, there is a natural watercourse which passes the north of Ardeshir's palace and enters the surrounding limits of the palace. On the other hand, the surrounding core zones of Tal Khezr were once again joined to the southern borders of the palace and it covers some of the subterranean water canals, streams and springs around the palace to the east of Tal Khezr (Map. 5) (Figure. 25 and 26). Next, the lines of surrounding core zones are parallel to the riversides. To the east of Kizarin Village, there are archeological

remains such as a pre-historical site which dates back to the third millennium B.C. From the place to bridge no.1 of Goor City, there is no other archeological constructions. Endeavor was made to maintain certain terrains on western side of the river.

The northern part of the river right at the terminal estuary of Tangab, the area from Sassanid era water channel called "Ketab" to "Tal Nagarkhane", were taken as borderlines. As a result, integration of the area with limits of Tal Nagarkhane was accompanied by turn of the river to the south. From there on, the eastern side includes the river as it leads to Goor City. An extensive part of the path has been damaged due to development. In north of Kizarin Village, there is bridge no.2 on the river of Goor City. The bridge fulfills certain functions such as means of crossing and carrying water from the spring near Ardeshir's palace to Goor City. From there on, natural terrain such as dirt roads and high and low ground near the river margins were taken into account during determination of borderlines of the river. The fluvial borderlines in northwest of Goor City leads to Goor City all archeological sites inscribed in the World Heritage List were integrated by the most significant source of water in Firuzabad Valley (i.e. the river). In order to take the new site into account, making new maps (maps. 6 and 7) and passing new regulations are required.



Figure. 1-Inflow estuary and dam of Tangab



Figure. 2-Outflow estuary of Tangab and Firuzabad Plain



Figure. 3-Middle of Tangab canyon



Figure. 4-Firuzabad River



1.Palace and fort of Ghaleh Dokhtar in the valley- 2. Bridge- 3. Embossed Sassanid engraving next to the bridge 4. Embossed Sassanid engraving- 5. Fire Palace- 6. Fire temple- 7. Walls and fortifications of Goor City- 8. City center of Goor City

Figure 5-Historical remains from Tangab to Goor City (Hugi, 2001: 86)



Figure.5-Gavi Cave from the eastern view



Figure. 7- Tal Nagarkhane as seen from south



Figure. 9-Embossed engraving of Ardeshir's enthroning as seen from its western view



Figure. 11-Inscreiption near Mihr Narseh Bridge



Figure. 6-Northern view of Ghale Dokhtar



Figure. 8-Tangab inscription



Figure. 10-Southern view of Mihr Narseh Bridge



Figure. 12-Southern view of Tangab Caravansary



Figure. 13-Northern view of Savaran Battle



Figure. 15-Unfinished embossed engraving



Figure.17-Tal Nagarkhane as seen from north



Figure.19-Tal Bagh-e Sorkh seen from its western view



Figure. 14-Eastern view of a Sassanid road



Figure. 16-Northern view of Ardeshir Palace



Figure. 18-Northern view of Tal Khezr



Figure. 20-Bridge no.2 of Goor City as seen from its north



Figure.21-Southern view of a clay pot found on the river bank



Figure. 23-Bridge no.1 of Goor City as seen from its north



Figure. 22-Aerial image of Goor City



Figure. 24-Water transfer channel for getting spring water of Ardeshir's Palace to Beram Pir Subterranean Canal and from there to Goor City (Norozzadeh Chegini, 2014: 164



Figure. 25-Outflow estuary of Tangab (Norozzadeh Chegini, 2014: 159)



Map.2-Water source going from Ardeshir Palace to Goor City (Norozzadeh Chegini, 2014: 168)



Map. 3-Newly-revised property boundaries



Map.4-Newly-revised property boundaries

Revised Regulations concerning the Core Zones of Sites Inscribed in UNESCO's World Heritage List

The areas inscribed in the continuous red line which host the sites in Firuzabad already inscribed in World Heritage List (Ghale Dokhtar, Ardeshir's Palace, Goor City and other historically significant sites in Tangab and Firuzabad Plain) were in the borderlines of the river.

- 1. Any construction, disruption and destruction, separation of certain areas and claiming their ownership, adjustment of topographic status, flattening, mining, excavation of sand, and any measure which leads to destruction and/or damage to the sides and bed of the river and surrounding limits of the historical works are banned.
- 2. Conducting archeological activities, research, restoration, reconstruction, and organization which are intended to protect and revive historical-cultural values of a site should be preceded by developing a plan, executive details and pass of the plan by Ministry of Cultural Heritage, Tourism and Handicrafts (Plans for organization, restoration and repair should be premised on historical documents and evidence).
- 3. Arranging for agricultural activities and planting any trees within core zones of the sites are forbidden.

Note.1-Agricultural activity within the site of Goor City is permitted until the lands' ownership is transferred to Ministry of Cultural Heritage, Tourism and Handicrafts. In that case, farming could proceed at 5m distance from surrounding wall of the city if surficial planting and traditional irrigation methods are used.

Note. 2-Planting trees, seedlings and farming activities on sides of the road and out of core zones of historical structures is permitted since farming activities were being done in the past.

- 4. Development or provision of any residential service such as water piping, putting electricity lines, burying water and wastewater pipes under the ground and similar measures within the borderlines of historically significant places and near the limits of the river is forbidden if they are not preceded by approval of Ministry of Cultural Heritage, Tourism and Handicrafts.
- 5. Any act of intrusion and capture near the ancient road of Tangab, river, surrounding springs of Ardeshir Palace and ancient channels are forbidden.
- 6. Digging wells, underground story, graves and burial of the dead within the borderlines of the river and historical sites are forbidden.
- 7. Setting up any tower, structure or barrier which bars the visual connection of an archeological site with its surroundings is forbidden.
- 8. Traffic of heavy and semi-heavy vehicles used for farming and road development, use of vibrating or explosive devices which could destroy or damage the premises of historically significant places are forbidden.
- 9. Development or widening of roads, passageways and asphalting dirt roads which are within the premises of archeological sites are forbidden.

However, the redefinition of boundaries within Bishapur and Shapur Cave are under field investigations which are postponed due to the global pandemic of COVID-19, the result of which will be provided as soon as the finalization of studies.

### 4. Adopting and implementing the proposed new regulations for the buffer zones of the Firuzabad and Bishapur components,

As it mentioned, the newly proposed boundaries and regulations for Bishapur region is under final assessment and will be provided as the matter of priority in the next few months. Following are the new proposed regulations for Firuzabad region:

### Proposed regulations for the buffer zone of Firuzabad region

- 1. Construction of any kind, must comply with the following articles:
- Issuing any construction permission within the boundaries of rural guiding plans adopted by the ministry of roads and urban development, without any inquiry and receiving associated permission from MCTH, is prohibited;
- Construction of buildings and execution of public services projects such as development of roads, establishing emergency assistance bases, police stations, etc., is allowed following the confirmation of the necessity studies and their approval by MCTH;

### Atashkade Village

- Construction of no more than a one-storey building with the maximum height of 4.5 m from ground level of the adjacent passageway is allowed;
- Construction is allowed within the vicinity of rural areas and boundaries defined in the rural guiding plans, any expansions beyond the limits is prohibited;
- The architectural design of the buildings such as facades and all the elements on the exterior of the it (including materials, façade design, doors and windows, sign boards, banners, etc.) must be of authentic material, forms and colors regarding the cultural-historical attributes of the region and executed with full respect to the OUV of the sites. The final design must be approved by MCTH before any execution;
- Construction of any gable roof and use of steel sheets, deep colors and glossy materials on the surface of the roof is prohibited;
- Usage of Bituminous waterproofing materials on the vertical surfaces is not allowed.

### Khevid-e Mobaraki village

- Construction of no more than a one-storey building with the maximum height of 4.5 m from ground level of the adjacent passageway is allowed;

### Kei- zarreen village and Motahari town

- Construction of buildings with the maximum height of 7.5 m from ground level of the adjacent passageway is allowed;
- 2. Execution of any tourism plans including construction of temporary structures such as tents, arbors, facilities, etc. is feasible only with approval of MCTH and within the boundaries defined in urban master plans and rural guiding plans adopted by the ministry of roads and urban development;
- 3. Alteration in the function of farmlands is prohibited;
- 4. Any plans related to agricultural activities such as construction of canals, land grading, modern irrigation plans, digging wells and other similar cases must be approved by MCTH before any execution. Therefore, their execution without inquiries made to MCTH and receiving required permissions is forbidden;

- 5. Setting fire in agricultural fields and burning wastes within the limits of the buffer zone is prohibited;
- 6. Extraction of sand, gravel and stones, interventions and development-works in the vicinity of the riverbed and current watercourses, dumping wastes and constructions debris, etc. is forbidden;
- 7. No military camping and maneuver is allowed in the buffer zone to keep the significance and OUV of the sites;
- 8. All historic objects and monuments within the boundaries of the buffer zone is subjected to the rules and regulations of MCTH.

### 5. Finalizing, as a matter of priority, the integrated conservation and management plan for the property, including strategies for risk preparedness and disaster response, and submit the plan to the World Heritage Centre prior to its formal adoption for review by the Advisory Bodies,

The management plan of the property, including monitoring and risk preparedness and disaster mitigation plans is defined as a single project to be carried out in the next few months and will be provided as soon as final completion of the studies. The following is a brief summary of the project:

### Summary

Cultural heritage is irreplaceable and irreversible, and compensation will be difficult or impossible in the event of damage and destruction.

Although at one time the role of cultural heritage did not seem vital, today it is clear that its absence will lead to cultural rupture and consequent vulnerability and ultimately a national crisis that will be a threat to all generations. In this regard, cultural heritage crisis management is a topic that has already received more and more attention from the government today. An issue that needs to be identified, properly oriented, and capacity building, due to the multilateral and multidimensional nature of the category of cultural heritage. Development of management-related, educational and executive plans at the individual, organizational, and social levels are among the objective of this thematic study. This study will contain two parts, scientific and comparative, which can be done by using the internal structured system, the power of external communication, and cultural-educational planning, and many other tools. Training at different levels and considering various aspects, such as understanding the values of cultural heritage, identification of vulnerable segments of the sites, identifying the effective factors and the amount of their impacts, type of management and leadership required to deal with different stages of crisis can be defined which leads to planning in cooperation between governmental and non-governmental institutions.

#### **Objectives and Procedure**

The present proposal regards Sassanid archeological landscapes in Fars region, as a world heritage site, and intends to identify the critical factors, identify the vulnerability of existing works and assess the risk for each of the works in the site, including Tangab Castle, coronation lithograph Ardeshir Babakan, the lithograph of Ardeshir's victory over Ardavan, the ancient city of Ardeshir Khoreh (City of Gur), Ardeshir Babakan Palace, Bishapour and Tang-e- Chogan historical complex, Shapur Cave and Shapur(1)statue and Sarvestan Palace which leads to a risk map showing risks and damages through spatial information system (GIS) and a comprehensive risk management plan.

Following are the steps to gain the intended outputs:

Step 1: Define monitoring indicators for the property;

Step 2: carry out the monitoring plans and indicators to answer the following requirements:

- *identify and categorize critical factors;*
- rating each of the risks;
- *determine the consequences of hazards for each of the sites;*
- assessing risk for further preparation of risk maps for each of the effects;
- gather information to provide systems of documentation and data analysis;

Step 2: Preparing a risk identification map;

Step 3: Map the vulnerability of sites;

Step 4: Prepare a risk map and;

Step 5: Develop a comprehensive risk management plan.

#### Methodology

This study will be supported by quantitative and qualitative methods. Within the quantitative methods, the statistical information including satellite data and spatial analysis and meteorological data, soil and vegetation data and water resources will be addressed by using space technology tools and devices related to geometrics technologies, which will include satellite images, digital maps, and feature tables.

Within the qualitative part, the statistical community will be subject to anthropological and socio-cultural studies through filling in questionnaires, library studies, interviews and sampling method, in which specialists, indigenous people and local communities will be engaged while the Cronbach Alpha method is considered to determine the reliability of research.

Benefitting from the methods of multi-criteria decision making and ranking factors as well as determining strategies and consulting with experts in the field, the information will be analyzed.

#### Initial Identification of factors affecting the property

To begin with the process, it was necessary to conduct some preliminary studies to develop a proposal. The initial studies assisted us to categorize the factors threatening the sites into 15 categories; which are discussed below:

The identified hazards in the Sassanid Landscape of Fars Region WHS are as follows:

- Agricultural development;
- Industrial development;
- Urban and rural development;
- Mine activities;
- Earthquake;
- Fire;
- Collapse & The fall of stones;
- Land subsidence;
- Flood;
- Theft;
- Vandalism;
- Road accidents close to historic monuments;
- Environmental threats;
- Human injuries;
- Wild animals and livestock.

In terms of risk severity, risk outcome and risk level will be examined according to existing definitions:

Probability: Indicates the possibility of a risk occurring over a while.

Vulnerability: Indicates the extent of the damage and loss that can occur if the hazard occurs.

*Risk*: It is calculated from the product of the probability of occurrence of the risk and the consequence of the risk.

This assessment is specified in Table1:



Figure 1. Risk assessment in upper-mentioned categories

To determine the rates and perform this evaluation, the tables of risk severity, risk outcome and risk calculation have been used.

Probability	Rate	Definition			
Repeated	5	Happens repeatedly			
Likely	4	Occurs several times or more often			
Occasionally	3	Sometimes it happens			
Very unlikely	2	It is unlikely but it is possible and it happens very rarely			
It almost does not happen	1	It is will never happens or can be completely avoided			
Figure $\gamma$ . Risk severity index tables					

Vulnerability	Rate	Definition
Catastrophic	5	Complete destruction will occur
Critical	4	The damage is severe and irreparable and if left unattended will lead to complete destruction
Significant and remarkable	3	damages are progressive, and if left untreated, the condition becomes critical
Low	2	damages are compensable
Details to be covered	1	damages can be ignored, but it is better to be treated

Figure <sup>r</sup>. Risk Outcome Index Tables

Low risk		vulnerability								
Medium risk		uils e ere		ujfi	ical	ıstr ic				
High risk		o bd o bd o ve	MO	ign ant	<b>Trù</b> t	atc phi				
Very High risk		1 1 1	7	v1 0 (	<u> </u>	0 0				
ltity	Repeated	5	<i>10</i>	15	20	25				
	Likely	4	8	12	16	20				
i abi	Occasionally	3	6	9	12	15				
Prob	Very unlikely	2	4	6	8	10				
	It almost does not happen	1	2	3	4	5				

Figure <sup>e</sup>. Risk calculation index table

From the review of the initial data, the following results can be estimated regarding the probability of risks and their vulnerability in each site.

Site	Probability	vulnerability	Risk
City of Gur	3.78	3.22	12.17
Bishapour and Tang-e Chogan	3.56	3.06	10.86
Qal'eh Dokhtar	3.17	2.61	8.27
Ardashir Papakan Palace	3.11	2.61	8.12
Shapur Cave	2.89	2.39	6.90
Sarvestan Palace	2.72	2.28	6.20
coronation of Ardeshir Babkan Relif	2.67	2.22	5.93
Ardeshir's victory over Ardavan relief	2.67	2.17	5.78

Figure  ${}^{\diamond}$  . The degree of danger and vulnerability in each site



Figure <sup>\$</sup>. Rating the degree of risk in each site

### Timing

Title		Time (Month)											
		1		2		3		4		5		6	
Basic studies													
Monitoring													
Gathering and processing quantitative data, thematic maps, satellite data													
Build a GIS spatial database													
Collection and processing qualitative data (questionnaires and local scans)													
Pre-processing and organizing data													
Satellite data processing													
Qualitative and quantitative data analysis													
Develop a risk management plan													
Reporting													

Figure  $\gamma$ . Timing of the study

# 6. Ensuring that attributes in poor condition, at risk of serious deterioration, or at risk of collapse are identified, monitored and given urgent priority for conservation programmes and resources,

### SOC of Qale Dokhtar

Qhale Dokhtar is a defense fort and it is a significant barrier to enemy's progress on Tangab Valley. It was originally built out of rubble stones and plaster on top of a mountainous rock over 100m high. The fort was built in Tangab Valley during the reign of Ardeshir I (third millennium B.C). During the years after the fort was built, its maintenance and conservation costs were so high that Sassanid Empire solely used it when necessary. Today, the fort is highly significant in terms of architectural principles and adopted techniques because for the first time in history of Iranian architectural art, the portico and dome were constructed in the building. Therefore, conservation and restoration of the structure is highly critical.

The findings of few years of study suggested that some parts of the fort have fallen down, especially in the arch of western portico of the dome, and underlying rock of the fort has slid down due to destruction and cracks in the roof and squinches. Therefore, the project of restoration and conservation of Qhale Dokhtar focused on the western and northwestern side of the central domed room of Qhale Dokhtar. Over past few years, the western side as well as the wall behind the dome in the northern and eastern façade were restored. The whole surface of the wall and roof of the dome were restored by proper mortar. In addition, the foundation and the floor of the eastern and southeastern sides which connected the fort to its underlying rock were restored and protective walls were recovered too. Fortunately, the dome and porticoes of the central hall of the fort were conserved and restored thoroughly in this salvation project.



### Monitoring

Following the conservation-oriented studies of Qhale Dokhtar, the findings revealed that structural restoration should be preceded by reviewing the current conservation status, flooring, and erection of foundations as well as reinforcement of a part of the floor. This step was intended to guarantee the stability and proper conservation of outstanding universal values of the fort.

### **Review of Damages (Diagnosis)**



Northern Front of Fort

Over time, the rocks slid down and foundation and floor of the fort lost their strength. Slope of the mountain in this side is significant and therefore, this problem needs to be addressed.





Walls of the portico are no longer vertical and they should go through emergency conservation operation







Parts of the fort's body, especially its northern side, are unstable and they are experiencing emergency conservation operation.

### **Protective Belt**

In 1976, a protective belt was set up by a Swiss group around the dome. Now, parts of the wall require structural and performance recovery.



### **Stone Wall Technology**

This type of construction, as evidenced by archeological reports, were quite advanced for their own time.

This type of structure is wonderful in three ways. First, the way of processing plaster has turned it into a strong and durable mortar. Second, laying of stones is similar to modern molding and

concreting. Third, engineering and stability knowledge which put a large square dome and strong arches over a rectangular bed.

Thorough analysis of Sassanid gypsum mortar, its interaction with stones, its changes relative to the surrounding environment and understanding this construction technique require further physical and chemical tests in laboratory as well as experimental tests in the workshop. This was started by the Swiss group. These practices will be arranged for and they will be conducted in the next chapter of conservation measures.





Concerning reduction of effects of natural erosion, negotiations were arranged with international teams to conduct complementary studies and determine optimal restorative solutions.

### Architectural Lines

Fortifications of the fort are widely distributed and they have the same value as the main building. This reveals to us the way life went on outside the fort.

The most significant point to note concerning the premises is that parallel architectural lines should become clear and vivid. To do so, restoration of fortifications and removal of vegetation and disruptive elements are the measures included in next year's plans.



### Interventions

**Restoration of Stones** 

Over the years, one of the frequent measures has been restoration of stone. Repair of existing sections, reconstruction of destroyed sections and laying usable stones have been done in many corners of the property. Moreover, skill of local workers and masons in laying stones with gypsum mortar has increased gradually due to years of restoration of Sassanid properties in Firuzabad and it is a point of strength.



### **Emergency Conservation of Susceptible Sections**

As mentioned above, high priority sections which need immediate action are currently undergoing emergency conservation measures so that they could be properly restored after design steps are over.

### Visit Routes

Definition and reconstruction of tourists' visit rout was done by improving the tough paths of accessing the fort by setting up stairs on its western side.



# 7. Conducting geophysical surveys for the site of Ardashir Khurreh in order to identify areas of archaeological sensitivity, and ensuring that agricultural practices are forbidden in archaeologically sensitive areas,

In order to assure of optimal conservation of properties categorized as archeological landscape of Sassanid era in Fars, a project called "Geophysical Survey and Archeological Documentation" was defined. The expected results of the project are concerned with two major fields: First, Geographic Information Systems (GIS) in which all available data of the biological mix would be collected and the databases could be provided to and used by experts. Second, conservation of archeological sites would be addressed. The protection would be provided not only according to databases on expert fields but also by engaging local community in vicinity of archeological sites so as to provide them with sustainable economic benefits.

### Conducting Geophysical Surveys of Ardeshir Khore Site for Further Identification of Archeologically Significant Sites and Guaranteed Ban on Agricultural Activities in these Areas

One year after the inscription of archeological sites of the area on UNESCO'S World Heritage List, the World Heritage Site of Firuzabad started the documentation, development of a database and implementation of extensive measures through modern science and cutting-theedge practical tools. In order to enable the outlook plan of Sassanid Firuzabad Site cover the large scale and archeological sites, modern sciences and top applied tools were used to locate the ancient city of "Goor" in Firuzabad valley.

Documentation of archeological structures of Goor City (Firuzabad) started through explorative geophysics since November  $5^{th}$  2019 and it lasted for one month .

.The goal of such studies was identification of likely structures in farmed areas of Goor City The plan was implemented through joint cooperation of Iranian and international archeologists and experts. These studies opened up the first chapter of five-year cooperation plan to use

modern tools such asmagnetometer to detect buried sites as well as close range photogrammetric system (drone) to collect surface data in two sites each covering a 10,000 square meter area. The long-term plan of the project has so far attained 50 percent progress by using GIS software.

### **Literature Review**

Back in 1940, Eric Schmidt took two aerial images of Goor City. Each image had an accurate subtitle of a creative documentation expert's observations. In the book "Flight over Ancient Persian Cities", he described the images by noting, "Here, Ardeshir I founded the capital of Sassanid Empire to dethrone the Parthian rule and from there, he spread his empirical reign everywhere. A circular defense section with <sup>3</sup>/<sub>4</sub> mile diameter has only a gate on the lower right side while at the center of the circle, there are traces of a tower for the eternal fire which is the only structure on the top left side of the area (March 30th 1936; 8:02 A.M., height: 854m, speed: 1/250m/s; no filter; view: almost northeastern) (Schmidt, 1940: 20). Describing his oblique image of the central circle of Goor City, he wrote, "Since most residences of the ancient city are buried under the current layer of ground, the shape and composition of the hill in the central circle of Goor City suggest that there are older significant buildings around the fire tower. Even the sites of houses and rooms were determined by highlights of vegetation over

the ancient walls (March 30th 1936; 7:58 M.A., Height: 824m, Speed: 1/250m.s; no filter) (Schmidt, 1940: 21).

Later on, National Cartographic Organization of Iran cooperated with Armed Forces Geographical Organization in 1955 to make a complete mosaic image of the whole country. To do so, imaging of residential and valuable areas was done. In different years, photogrammetry of Goor City and Firuzabad Valley was done by National Cartographic Organization. In 1967, the first aerial image of Goor City taken by local experts were released. The first image of Goor City which had sufficient resolution and quality was taken by National Cartographic Organization in the same year.

In 1977, the first round of operations for restoration and protection of Ghale Dokhtar was started and a German delegation led by Dietrich Huff started their surveys of Goor City and issued their documented reports. In Huff's report, there are some numerical data including diameter of the city and location of streets among others were recorded systematically. His data originated from a cartographic operation and he made a map which is not available yet. Based on the same cartographic data, Huff made a plot of Goor City.

### A Description on the Survey Operation

The survey started on October 20th 2019 by selecting the necessary sites for doing the operation. To select those sites, few options were taken into account. First, the sites were separately selected from two parts of Goor City and each part covered a 10,000m2 area so that the operational maneuver gets easier, the maneuver could be done in a shorter period of time and the data could be accessed more quickly. To conduct geophysical survey successfully, each part had to be selected in a way that it included both a part of the sites as well as some farming lands. To do so, some maps were suggested and the final choices were made after the field visit. On October 26th 2019, the field visit of selected sites was done and two out of three previously suggested sites on the map were selected. The two sites had special locations in the city. The first site (called Site A) covered the southern street from Ardeshir Gate to central area of the city. The second site (called Site B) was on east to west road of Goor City and it covered the middle areas between central circle and second circle. The second site also included some farming lands. The latter site was chosen to identify the main street and its connection with the wall of the central circle of Goor City (figure 2).

The survey of Goor City through magnetometers was limited to site A and B. Each site covered some 10,000m2 area. The site A was located in the southwestern part of the city over the fence and it was divided into 4 squares each of which measured 50 by 50m. Due to unevenness of the terrain in eastern part of the site, it was divided into smaller squares and rectangles so that their magnetic survey could be done. The magnetic survey in this grid was conducted through 1m profiles in a reciprocal manner. Simultaneously, aerial imaging was done by focusing on site A. The flight altitude of the drone was 50m and it covered about 75 percent of the geophysical survey grid. The magnetic map of the site revealed different anomalies underground. The site B in the northwest of the central area of the city was 10,000m2 in size and four squares (50 by 50m) were selected from the site. The survey procedure was completed in a similar manner to part A and documentation of details was undertaken through drone flights.

### Conclusion

The magnetic survey results for both sites revealed significant anomalies there. In site B which covered a part of the fencing wall, linear anomalies were found which might be associated with architectural constructions but their exact nature cannot be determined due to the sheer extent of destruction (building roads, farming lands and destruction of likely structures in the site). There were many bipolar anomalies in the site, too which were suspected to be due to heated sections. The anomalies could be related to accumulation of heated materials, bricks or ruins of architectural structures. In the central part of the second site, the revealed anomalies pointed to likely foundations around the central part of the city especially the circle-shaped structure. The latter anomalies require further surveys and conservative measures. Resumption of magnetic surveys for finding other remains of the circle-shaped structure is significant since there are farming lands and agricultural activities going on in this site. Over the farm lands, no regular patterns of architectural plan were found but the sheer volume of ruins suggest that there were architectural structures over there which got destroyed over time. Multiple large and highly magnetic bipolar anomalies in this site suggested that there was either stacked-up ruins or a heated structure below the surface.

Goor city was resided for a thousand years from the third century to the eighth century BC. Due to density and complexity of architectural materials used in the city, identification of periods of residence requires archeological excavation. As a result, exploratory boreholes are planned to be dug over certain magnetic anomalies so that type of anomaly and buried architecture are determined, archeological questions are responded and a roadmap for conservation and restoration of structures in the site is made.



Figure. 1-Archeological site distribution map for Firuzabad Valley (Fars).



Figure.2-Documented grid of Goor City: Geophysical survey of Site A and Site B.



Figure. 3-Magnetic map of Site A and its overlap with aerial image of the site (Goor City, Firuzabad).



Figure. 4-Magnetic map of site B and its overlap with the aerial map (Goor City, Firuzabad).

### 8. Establishing a monitoring system that is appropriate to sustain the Outstanding Universal Value of the property and fully incorporates the monitoring arrangements into the integrated conservation and management plan;

The monitoring strategies of the property along with management plan of the property, including risk preparedness and disaster mitigation plans is defined as a single project to be carried out in the next few months and will be provided as soon as final completion of the studies. The following is a brief summary of the project:

The main goal of the monitoring plan is to achieve optimal protection and maintenance within the long run. The plan will be developed through the qualitative and quantitative improvement of monitoring knowledge as well as sciences related to historic building materials, including behavioral studies, production technology, application of materials, restoration and maintenance of structures and their design, application of new methods and tools and monitoring as well as the use of scientific methods. It is assured to engage variety of experts and students in the conservation projects and communication with researchers in the process in order to create an educational platform enriches the ideas and application of the plans.

The following steps are defined for the monitoring of the property according to the standards:

- Improvement of current technical documents and other documentations;
- Updating the damage maps and re-identifying the factors affecting the property;
- Defining tools and equipment needed for monitoring the current status of the property and qualitative and quantitative methods and approaches, as well as improving the infrastructures required such as databases, etc.;
- Determining the ideal timing for monitoring and measuring the parameters;
- Data collection and their integration in a database;
- Analysis of collected data;
- Integration of results into planning procedure and within the management plan;
- Reporting.