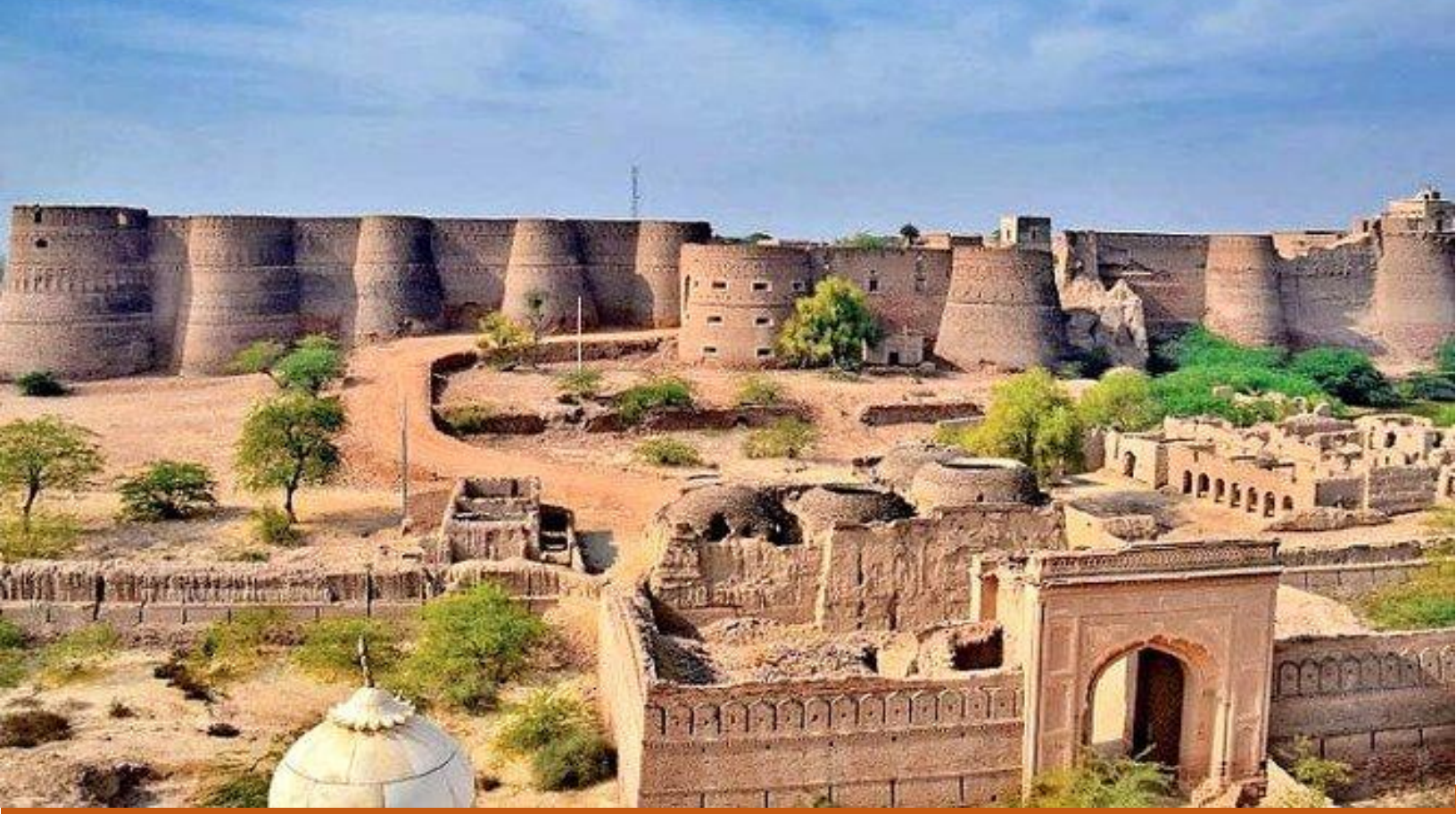

Derawar Fort

Eco-Tourism & Restoration Master Plan

20
28

The Urban Unit
Urban Sector Planning & Management Services Unit (Pvt.) Ltd.

Tourism, Archaeology and Museums Department,
Government of the Punjab

Digital Mapping of TOURISM Sites in Punjab, Pakistan

Derawar Fort –

Ecotourism & Architectural Master Plan, 2028

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Executive Summary

The **Cholistan Desert**, also known as Rohi, is the western part of Thar Desert of the sub-continent and lies within in modern-day Pakistan. Archaeological evidence suggested this area was once watered by the Hakra river and was home to an agricultural-based Indus Valley civilization. This river whose dry bed is still clearly etched into the desert landscape, supported settlements from ca. 4000 BC until around 600 BC. when the river changed its flow and eventually vanished underground. Since then, the Cholistan area has remained a stark and inhospitable desert environment at the edge of empires.

The medieval forts of the **Cholistan Desert** landscape comprise over a dozen structures, some standing and other in various stages of decay. **Derawar Fort** is the best surviving example among this series of historic forts, some of which date back to pre-Mughal times, but all restored and expanded from the 16th to 18th centuries by powerful local clans. Other forts include (roughly from north to south) Meergarh, Jamgarh, Marotgarh, Maujgarh, Dingarh, Khangarh, Khairgarh, Bijnotgarh and Islamgarh. Together, these structures form a network across the desert landscape. They served to protect and facilitate desert caravan routes; both mercantile routes from Central Asia to the heartland of the sub-continent and pilgrimage routes between Mecca and India.

Derawar Fort was originally built in the 9th Century by Rai Jajja Bhatti, a Rajput ruler of Bhatti clan. The fort was taken over by the Nawab of Bahawalpur, Sadeq Mohammad Khan I, in 1733. Although the Nawabs lost control of it in 1747, they regained it in 1804. From then until the 1970s, the fort served as the desert of residence of the Nawabs of Bahawalpur. Derawar Fort has survived largely due to this continuous occupation, whereas many other forts built as part of the medieval desert network have not.

The fort is a massive and visually striking square structure made of clay bricks. The walls stretch over 1,500 meters in length and rise up to 30 meters high. There are forty circular bastions, ten on each side, also stand 30 meters tall and are visible from miles across the desert. Each bastion is decorated with intricate patterns in cut brickwork. Within the fort are the remains of structures, many richly decorated with tile and fresco work. Nearby stands the Moti, or Pearl Mosque and the cemetery of the Nawabs of Bahawalpur, which is filled with ornate and elaborately designed graves.

Derawar Fort and the other forts illustrate a wide variety of architectural forms, from square brick structures with circular corner bastions, to square walls entirely faced with semi-circular towers, to rectangular and even hexagonal enclosures with angled bastions, and square enclosures within an outer wall featuring multiple bastions. These varied forms date from the 16th to the late 18th centuries, although many are renovations of earlier structures dating back as far as the 9th century. Despite their differences in design, all these forts are clustered within a relatively small area of approximately 250 km north to south and 100 km east to west, located east of the historic cities of Bahawalpur and Yazman.

The presence for this group of fortifications across flat sands of the Rohi is presumed to be access to water, the protection and control of these vital water resources, and their strategic relationship to the caravan routes that traverse the desert. **Derawar Fort**, for instance, is situated at a critical point where deep underground water deposits, remnants of the ancient Hakra River can still be accessed. As a result, for many centuries, **Derawar Fort** has served as an essential stop and watering point for caravans entering the great desert on route to trading entrepots to the east.

The medieval forts of the **Cholistan Desert** represent a remarkable and dense concentration of defensive structures within a relatively small area and an inhospitable landscape of sand and stone. Although the precise extent and nature of this network is still being explored, it is evident that it is closely linked to the routes traversed for centuries by desert caravans. This region formed what the ICOMOS thematic study of the Silk Roads (Williams, 2014) refers to as a "corridor of movement and impact".

The forts of the **Cholistan Desert** can be classified as Category 1 infrastructure according to the thematic study, as they "facilitated trade and transportation, and served both as forts and way-stations.

The ICOMOS thematic study (Williams, 2014) notes that "a fundamental issue has always been access to water" (p. 15.) **Derawar Fort** and the group of medieval forts of Cholistan Desert are an outstanding representation of the role water played in shaping power dynamics in this vast desert region. They stand as testimony to the many conflicts among princely clans seeking control over water resources, and with them, the taxes and privileges associated with dominating the lucrative trade and pilgrimage routes that crossed through this area from Central Asia to northern India.

This small but potentially data-rich section of the desert network addresses the priority for nomination identified by the Silk Roads study: the need to capture desert routes and east-west subcontinental routes spanning Afghanistan, Pakistan and India. "These types of sites reflect specific regional political and social responses to the organization and infrastructure of the routes, and as such are an important component of capturing the complexity and diversity of the Silk Roads."

Derawar Fort and the other forts of the Cholistan Desert represent a unique utilitarian response to the challenges of enabling the movement of people and goods across a hostile environment. They provide a valuable example of "infrastructure" designed to address these environmental challenges within the context of changing and often conflict-ridden local circumstances. As such, they bear exceptional testimony to a vanished cultural tradition in this transitional zone between Central and South Asia and constitute an important component of the complexity and diversity of the Silk Roads.

The desert forts vary in their condition and state of preservation; some, such as Marotgarh, have deteriorated, while others, such as Derawar, Bijnotgarh, and Meergarh, remain in better condition. They all, however, share a high degree of authenticity in materials, design, and craftsmanship, and retain attributes that reflect changes in ownership over time.

The Hill Forts of Rajasthan, India, were inscribed on the World Heritage list in 2013 as a serial site of six majestic forts that "bear testimony to the power of the Rajput princely states that flourished in the region from the 8th to 18th centuries." Although these forts are located on the opposite side of the same desert as Derawar and the other Cholistan forts, they represent an entirely different tradition of "forts." The Rajasthan forts are very large and elaborate, enclosing urban centers and palaces with associated courtly culture and arts. It is this interchange of princely Rajput ideologies and patronage in the arts that forms their Outstanding Universal Value (OUV).

Another World Heritage site based on a trade route is the Incense Route – Desert Cities in the Negev, Israel (inscribed in 2005). This property comprises four Nabatean towns, along with associated fortresses and agricultural landscapes, which together provide a comprehensive picture of the Nabatean desert civilization spread along the trade route.

These properties stand in stark contrast to the Cholistan forts, which are structurally impressive but neither ornate nor extravagant, and lack urban development within or near their walls. Also absent are courtly associations and agricultural landscapes; instead, their value lies in their bold functionality related to maintaining the desert caravan routes.

A more meaningful comparison can be found in the group of isolated 19th century forts built by the American Army in Texas to protect the western frontier, or in the Roman fortifications in the Eastern Desert of Egypt, designed to protect the caravan trade routes from the Red Sea to the Nile.

The thematic study on the Silk Roads found that, as of 2014, there were 221 relevant sites on Tentative Lists, reflecting a broad range of site types and landscapes, but with a strong emphasis on the "outcomes" of the Silk Roads and far less focus on the "infrastructure" associated with ancient trade routes. This is a gap that the **Desert Forts of Cholistan** will help to fill.

No comparable property matches the attributes of **Desert Forts of Cholistan**. This group of utilitarian yet varied fortifications is closely spaced across a relatively small desert area, built or renovated over a few centuries to protect water sources and the caravan trade in a part of South Asia that has not yet been adequately explored or documented as an important link in vast network of the Silk Roads.

1. Derawar Fort

1.1. Introduction

Cholistan is one of the most underdeveloped regions of Pakistan. It is rich in culture and heritage, but due to a lack of tourist facilities, people are discouraged from visiting. There is a dire need to provide spaces that

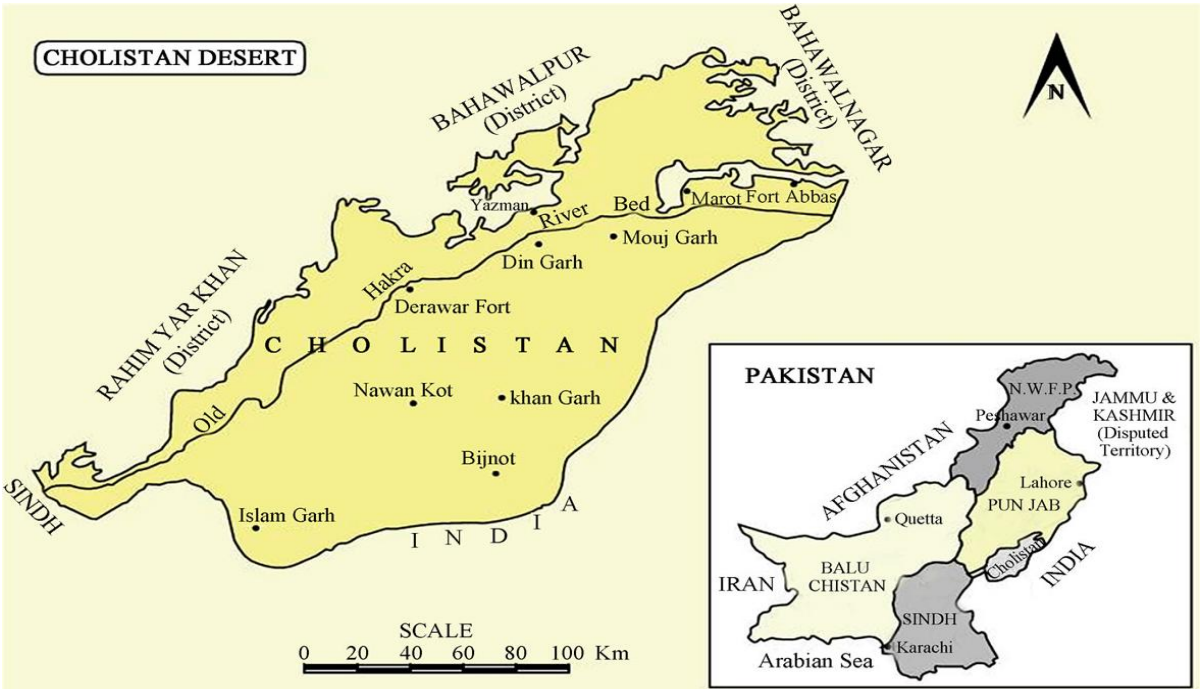
represent the culture while simultaneously offering visual and thermal comfort in the extreme desert conditions, enabling tourists to visit year-round.

"It's a hard fact that the people are too poor economically and educationally, opportunities and resources are limited to the level of extinction, weather is harshest, Architectural/ Cultural heritage is diminishing at an unprecedented speed particularly in Cholistan Desert located in southern Punjab.

But

People are rich culturally and motivationally, opportunities exist for ECO/ Architectural Tourism, Government will respond if a viable plan is presented, harshest weather can be used as an asset, Architectural/ Cultural heritage could be promoted as attraction through Eco/ Architectural tourism of Cholistan. "

Ecotourism accelerates community development by providing alternative and more sustainable sources of livelihood to local population. The primary aim of ecotourism is to conserve resources, especially biological diversity, while emphasizing the sustainable use of these resources. It offers travelers an ecological experience, help conserve the environment and generates economic benefit.[i]



1.2. Desert Tourism Cholistan

It's a fact that the majority of tourism in Pakistan is concentrated in northern areas, with much less attention given to other regions, especially the south. Cholistan Desert has been a land of great historical importance, and there is a need to promote the local lifestyle and development. The desert presents entirely different challenges compared to construction in plain areas.

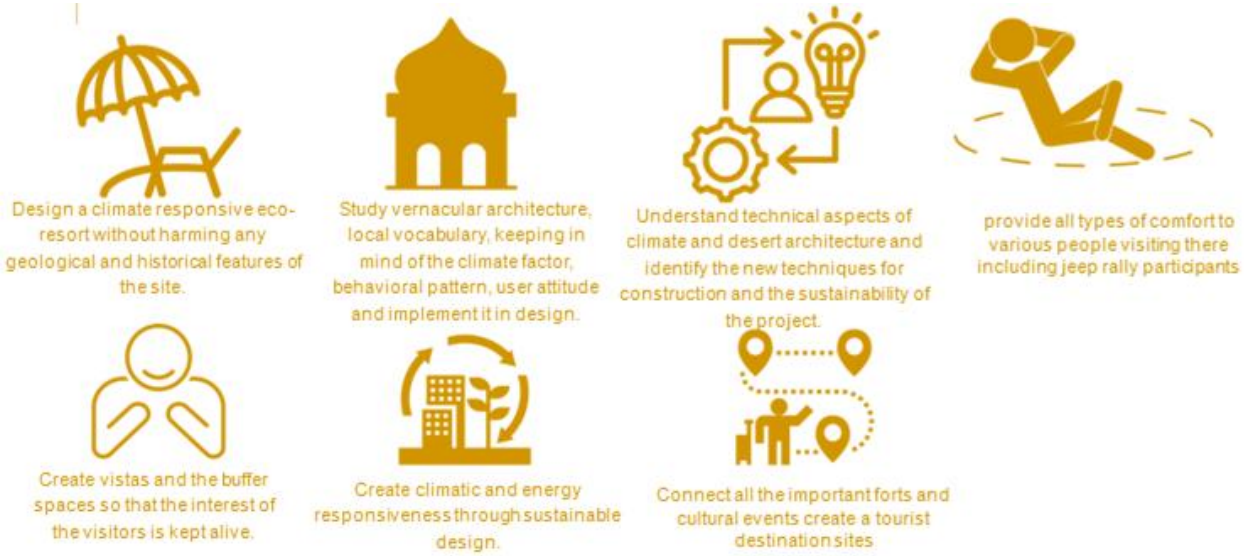
The primary objective of this master plan is to showcase the architectural and cultural heritage of Cholistan by designing an eco-desert resort and entertainment center aimed at attracting both tourists and residents. Currently, there are no proper accommodations available for visitors exploring the region. The popular "Desert Jeep Rally," now a landmark event in Cholistan Desert, also highlights the need for suitable lodging and recreational facilities.

Cholistan's rich architectural, archeological, heritage and artistic culture with requirement of comparatively lesser number of accommodations compels to propose a boutique resort. Boutique hotel resorts are best designed when they are tailored to their location. Most of the times, they're able to offer their décor and overall aesthetic to the community in which they operate. This not only creates a unique accommodation, but it also creates a destination within a destination. New identity that combines region's contemporary style will be significant since it will be one of Cholistan's new landmarks. Boutique Desert Resort and Entertainment Center will also be an excellent destination for people interested in architecture, history, culture and archaeology.

This resort will be more than just a regular place to be relaxed and entertained; it will also have cultural handicraft workshops, events, tours, desert safari music nights, and more. Designing a fully equipped resort with various functions and facilities will solve a market gap of having more alternatives in Cholistan. The resort will also boost an eco-garden, one of the most significant resources to showcase people about different types of plants originally from this region.

Having said all above this resort will help in community development by providing the alternate source of livelihood to local community which is more sustainable. Its aim is to conserve resources,

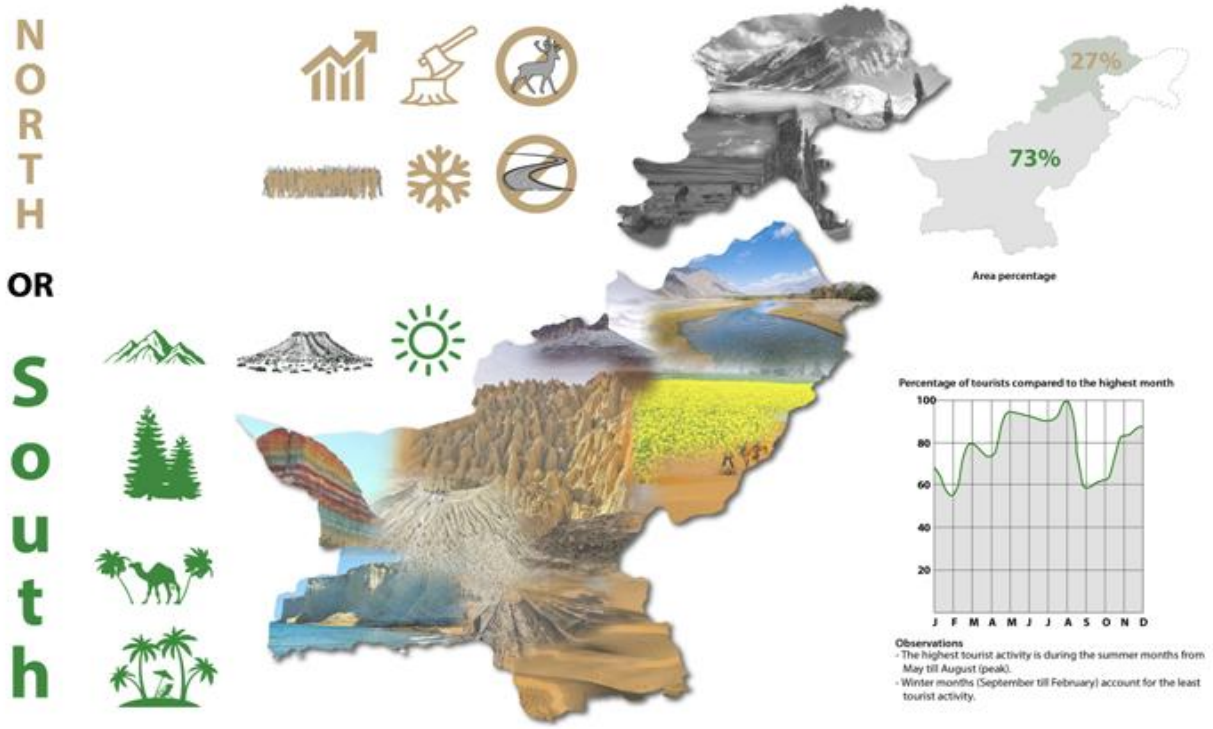
especially biological diversity, and maintain sustainable use of resources, which bring ecological experience to travelers, conserve the ecological environment and gain economic benefit. [ii].



An eco-resort or eco-hotel is a lodging facility that fosters sustainability and green living practices. These practices may include energy and water conservation, using organic produce, having a sustainable build, and patronizing ethically sourced products.[iii]

1.3. Client and User

The client for this project is the Department of Archaeology, Tourism, and Museums, while the Urban Unit is serving as Project Management Unit (PMU). The project aims to facilitate both local and international tourists who visit the region to experience its architectural, archaeological, and cultural heritage, as well as to attend the annual jeep rally.



2. Site Documentation & Analysis

2.1. Site

The major intervention site is located near **Derawar Fort**, while minor intervention sites will be established near the entrances of each of the lesser forts. A prototype facility will also be designed for these locations.

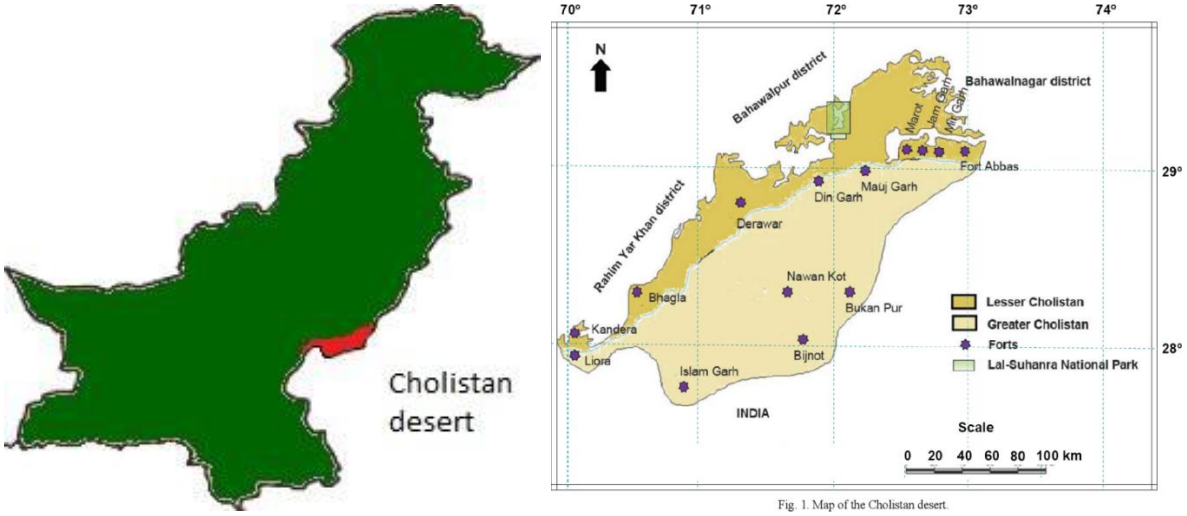
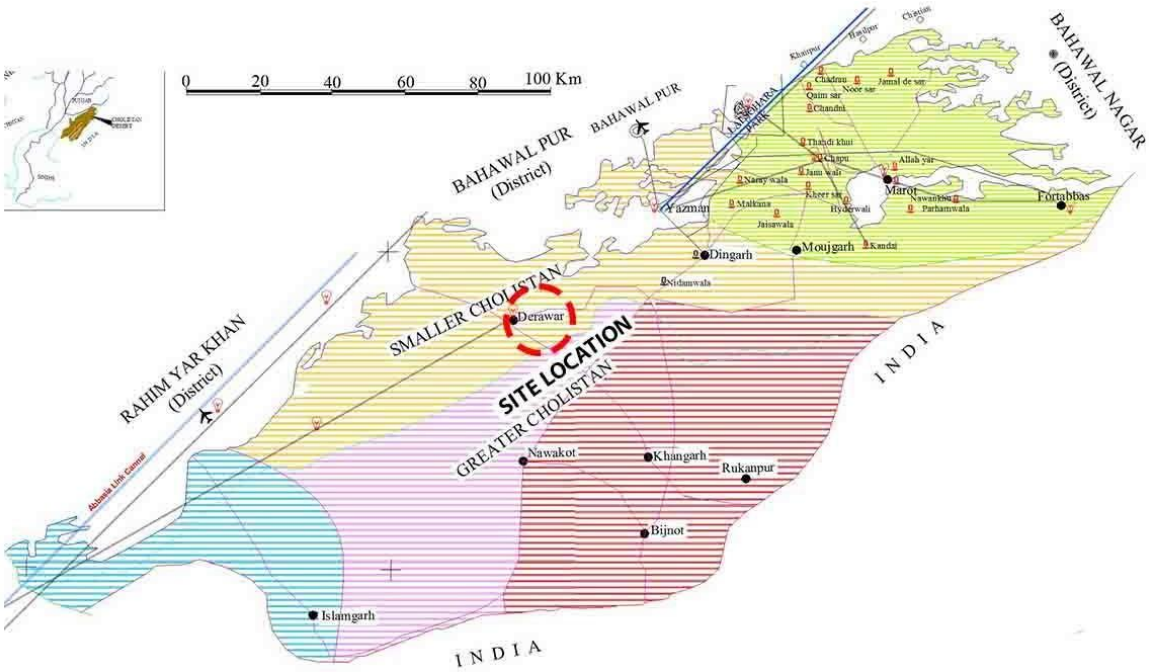


Fig. 1. Map of the Cholistan desert.

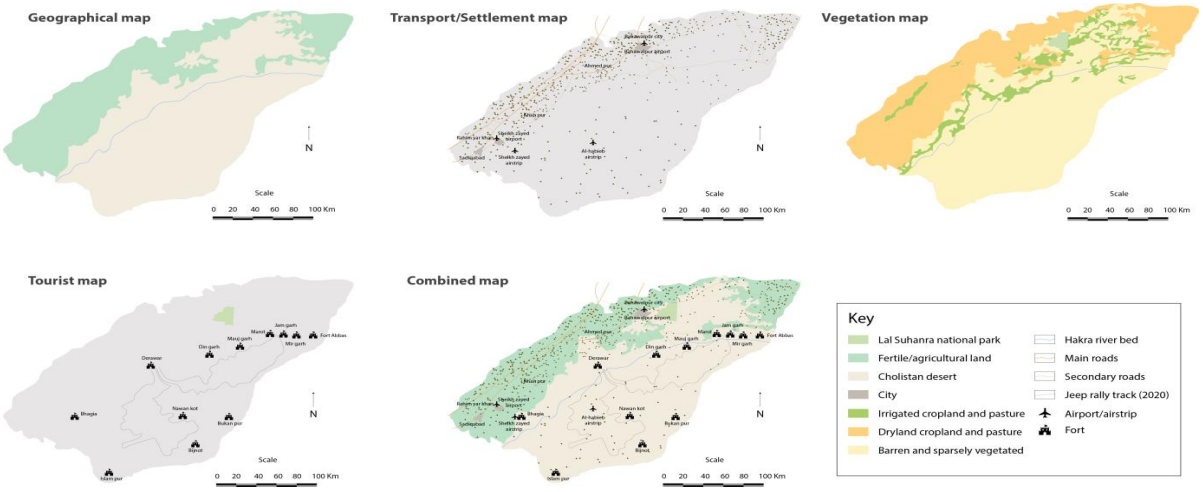
2.1.1. Location of Derawar in Cholistan



2.1.2. Climate and Geography

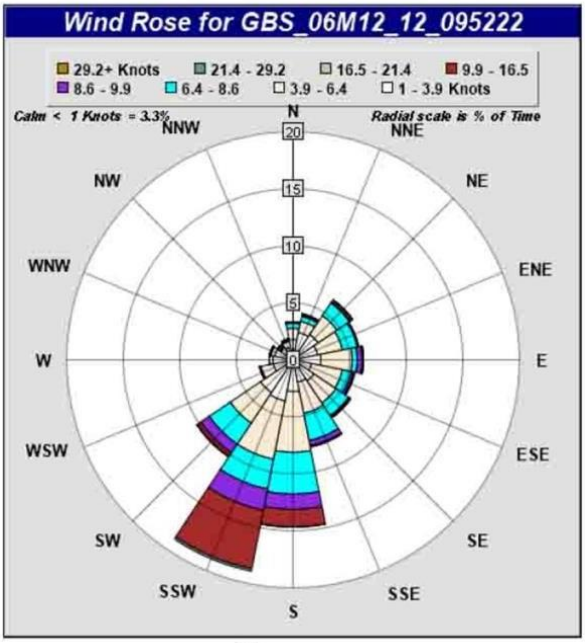
The Cholistan Desert has an arid climate. In summer, temperatures can reach as high as 51.6 °C, while in winter they can drop below the freezing point (Khan et al., 1996). It is a hot, hyper-arid sandy desert. May and June are the hottest months of the year, while the peak rainy months are July and August.

- Cholistan is an arid desert region located at 28°45'54.88"N latitude and 71°20'35.96"E longitude.
- Temperatures vary significantly between day and night in both summer and winter.
- The maximum summer temperature is around 51 °C (123.8 °F), while the minimum is about 25 °C (77 °F).
- In winter, the maximum temperature is typically around 23.6 °C (74.5 °F), and the minimum can drop to 5 °C (41 °F). The average annual rainfall is approximately 209.5 millimeters (8.25 inches).
- The highest recorded temperature is 50.0 °C (122.0 °F), and the lowest recorded temperature is −5.9 °C (21.4 °F).



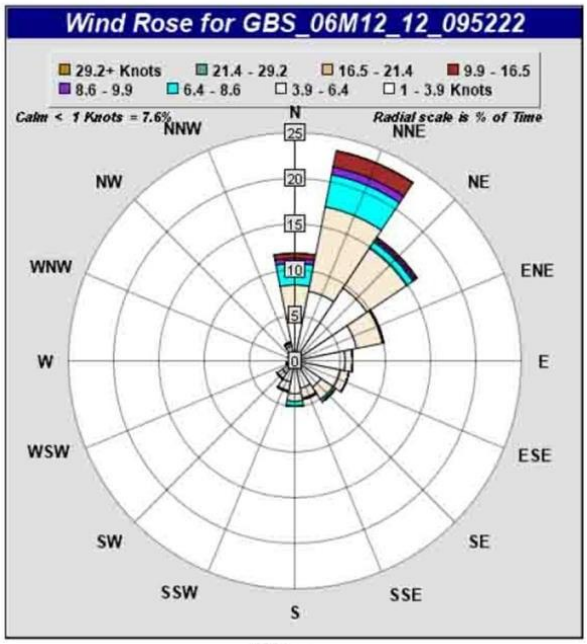
2.1.3. Wind Directions

Anual wind rose



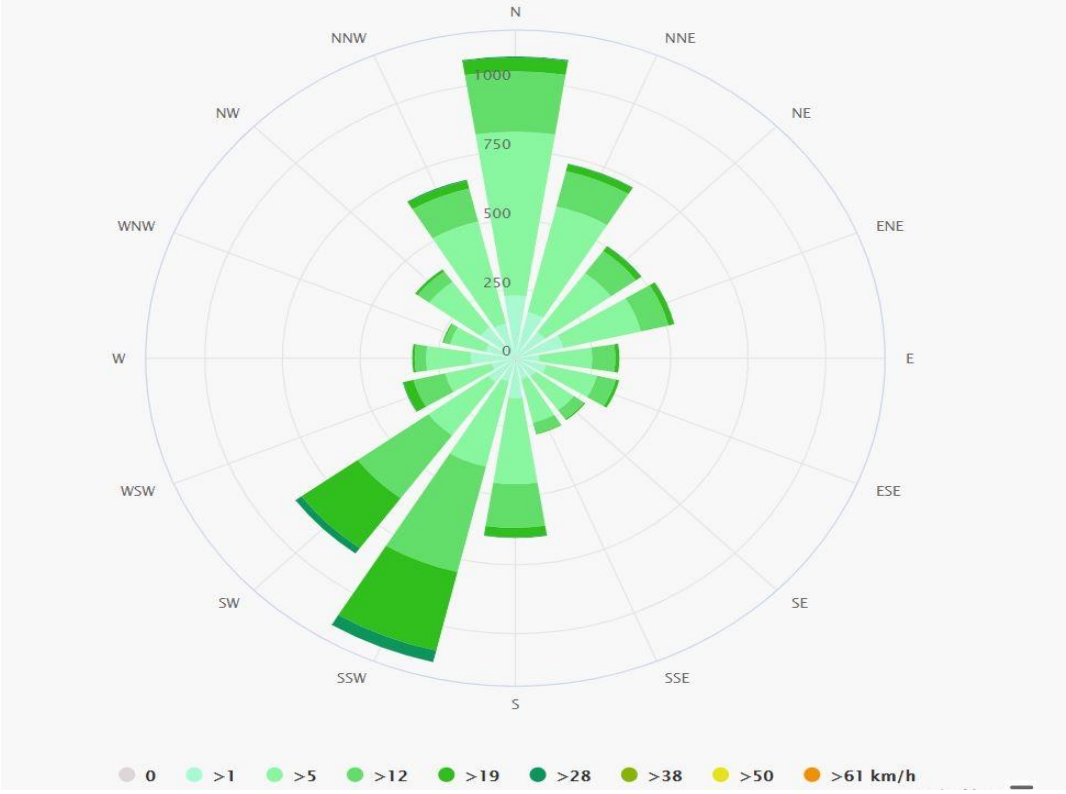
Summer

In summer wind direction north east to south west



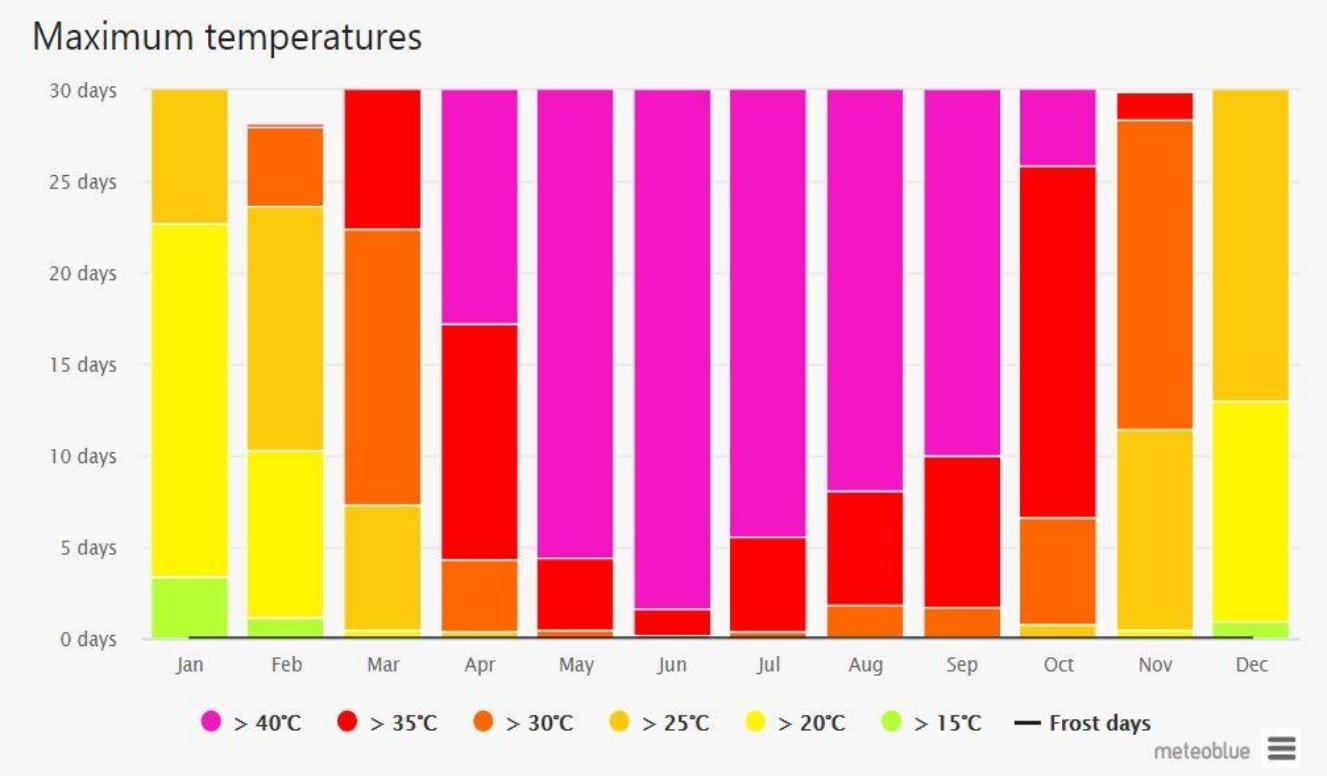
Winter

In winter wind direction south west to north east

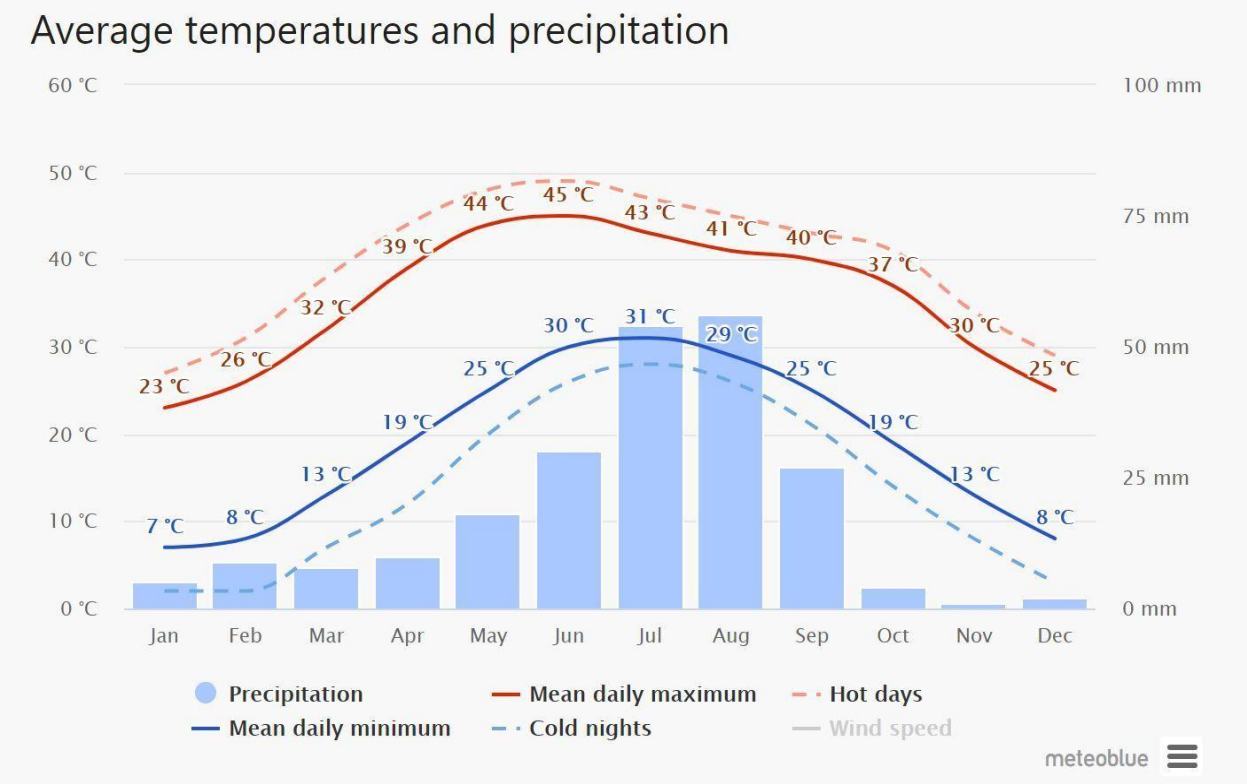


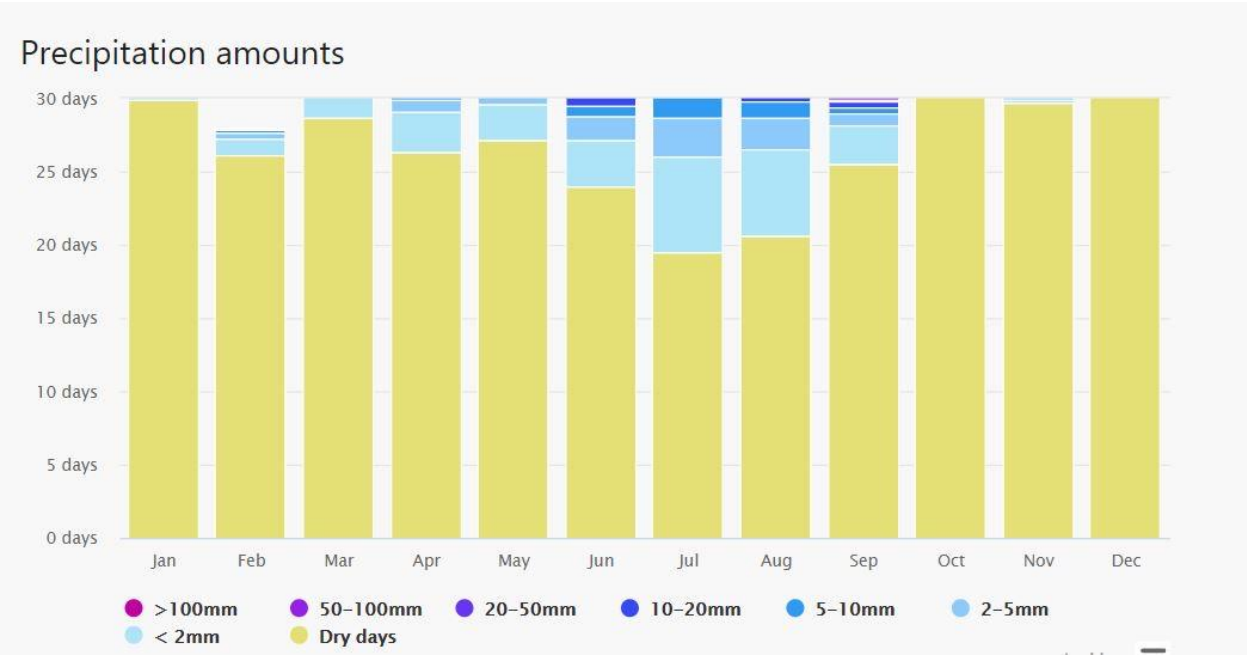
2.1.4. Temperature of the Year

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C (°F)	23.7 (74.7)	27.2 (81)	32.8 (91)	38.4 (101.1)	41.7 (107.1)	40.9 (105.6)	37.7 (99.9)	36 (96.8)	36.5 (97.7)	36.1 (97	31.1 (88)	25.4 (77.7)	33.958 (93.133)
Average low °C (°F)	7.9 (46.2)	10.9 (51.6)	16.8 (62.2)	22.2 (72)	25.7 (78.3)	27.1 (80.8)	26.5 (79.7)	25.4 (77.7)	24.3 (75.7)	20.5 (68.9)	13.8 (56.8)	8.9 (48)	19.167 (66.492)
Rainfall mm	1.3	4	3.2	18.1	9.2	16.1	56.1	79	16.2	2.5	1.3	2.5	17.458
Avg. rainy days	0.6	1	0.9	0.4	0.8	1.1	3.9	3.9	2.1	0.4	1.1	0.5	1.3917

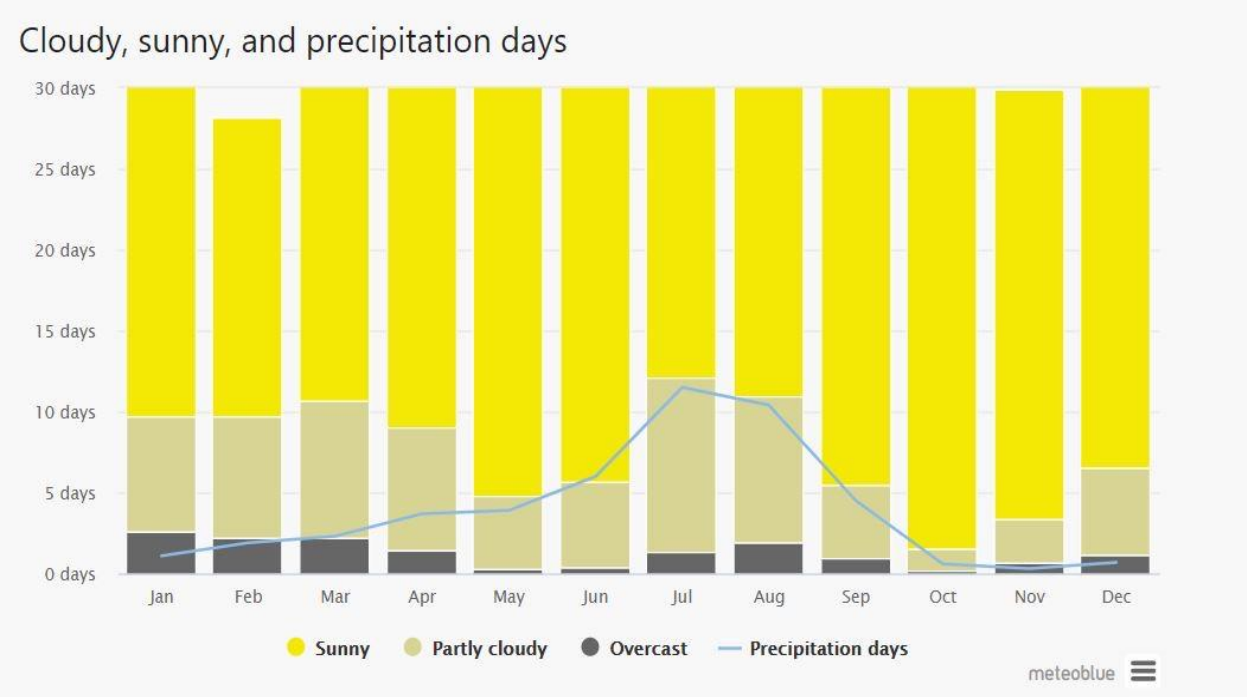


2.1.5. Precipitation of the Year





2.1.6. Sunny Days



2.2. Intervention Site Location in Cholistan

The intervention site is located in Derawar village, which lies within the Cholistan region and is connected to the Greater Cholistan area. Derawar is considered the central point of Cholistan Desert, from where Greater Cholistan begins. The site covers an area of 242 kanals, or approximately 30 acres.

SITE ANALYSIS

ROADS & SITE

SITE

PRIMARY ROAD

SECONDARY ROAD

UNPAVED ROAD

LAKE

DERAWAR FORT

SITE ANALYSIS

BUILT AREA & SITE

SITE

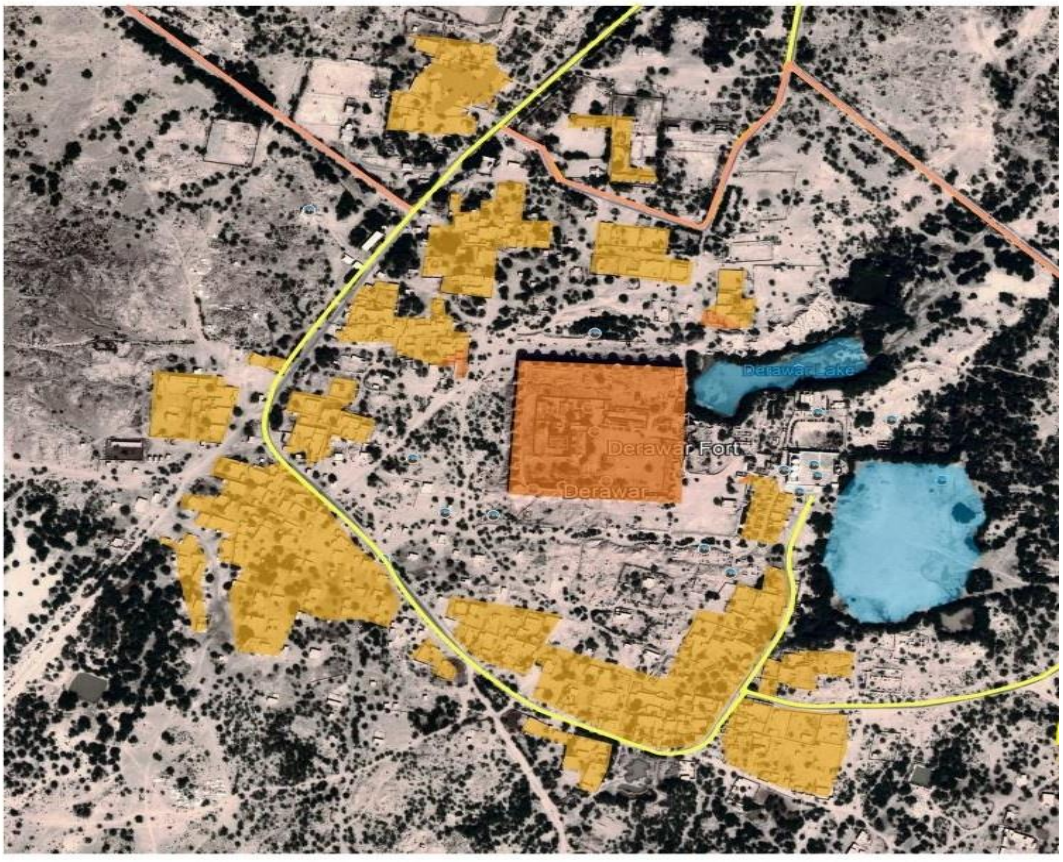
BUILT AREA

LAKE

DERAWAR FORT

UNBUILT AREA

BUSHES & PLANTS



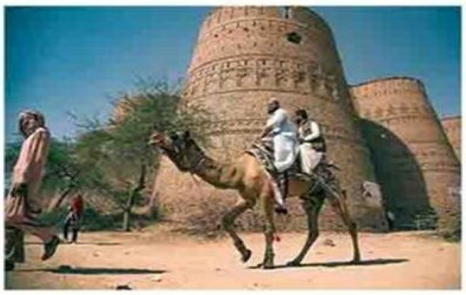
2.3. Site Strengths

This area was once watered by Hakra River and was home to an Indus Valley civilization based on agriculture from around 4000 BC until around 600 BC. The medieval forts scattered across the Cholistan Desert are a group of up to a dozen structures, some still standing while others are in ruins. These Cholistan Forts form a network across the desert, built to protect and facilitate the caravan routes; mercantile paths connecting Central Asia to the heartland of the subcontinent, as well as pilgrimage routes between Mecca and India.

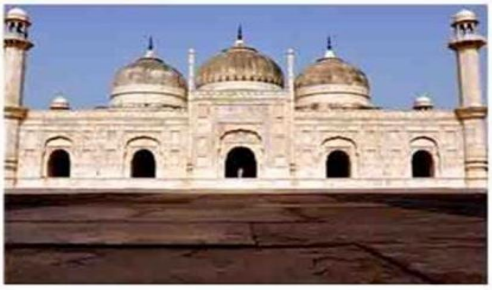
This region forms what the ICOMOS thematic study of the Silk Roads (Williams, 2014) describes as a "corridor of movement and impact." The Cholistan forts are classified as Category 1 Infrastructure in this study, meaning they facilitated trade and transportation by functioning both as forts and way-stations. The ICOMOS thematic study (Williams, 2014) also highlights that "a fundamental issue has always been access to water" (p. 15), and these forts are an outstanding example of how water resources influenced power dynamics in this vast desert region.

2.4. Landmarks around Intervention Site

Key landmarks around intervention site include following:



01- (a) derawar fort



02- (b) jamia abbasi mosque

03- (c) nawab palace

04- (d) royal graveyard

2.5. View to and from Site

In the view towards Site from back of fort, in distance **Derawar Fort**, a mosque and nearby water bodies are visible.

2.6. Approach to the Intervention Site: (Drawer Fort Cholistan)

Main access to site are from Bahawalpur, Ahmed Pur, Raheem-yar-Khan, Fort Abbas and, Mahndoro.

42 KMs	**82 KMs**	**48 KMs**	**42 KMs**	**101 KMs**

- The nearest public transport point to the site is Dera Nawab Sahib.
- The site is primarily connected to the rest of the country by buses via Bahawalpur, with some connections through Ahmed Pur East. Daewoo and other major bus operators operate services from Bahawalpur.
- Bahawalpur Airport is located 101 kilometers away, while Rahim Yar Khan Airport is 133 kilometers from Cholistan, providing connections to Lahore, Karachi and Islamabad.
- Dera Nawab Sahib offers basic civic amenities, including emergency services, for the site.
- Ahmed Pur East (Dera Nawab Sahib) railway station lies on the main railway line from Peshawar to Karachi, connecting the site to Islamabad, Lahore, Quetta, and other major cities across Pakistan.

3. Architectural Intervention Design

3.1. Architecture of Derawar Fort

The courtyard of fort is accessed through the Shahid Gate, which overlooks the **Cholistan Desert.** The innermost courtyard was built above a network of underground tunnels and prisons, a common feature of many subcontinental forts. The fort's eastern gate is currently guarded by a massive tower with gun emplacements installed during the 1965 war with India. According to reports, several structures within the fort were dismantled during this period to create space for training and a parade ground. Originally, the fort was constructed from mud, as evidenced by the damaged walls. The ancient mud fort is represented by the atria on the northeastern flank of the current fort, which itself is built on the ruins of the old mud fort. The fort's floor level stands approximately 20 feet above ground, accessible via ramps.

Derawar Fort has been restored in nearly every era, with the Daud potas giving it its current form. The original mud fort was rebuilt into a more substantial structure by Nawaz Mubarak Khan. Today, it stands large and spectacular, constructed from millions of red fired bricks, showcasing architecture that is both beautiful and imposing. The bricks, about 1-inch-thick, were made from locally sourced clay. These bricks were used to build the massive exterior walls, which are supported by giant round buttresses, 40 in total. There are four buttresses on each corner, nine along the west, south, and north sides, and eight on the eastern side. The walls measure approximately 40 meters (130 feet) in height and stretch around 1.5 kilometers (nearly a mile) in circumference.

The current fort, which has been transformed throughout time, encompasses around 35 acres of land. Other historical structures in vicinity of the fort have included the White Marble Mosque, also known as the Abbasi Mosque, which was erected in 1849 for the Nawab's religious man, Pir Ghulam Farid. There was additionally a Noor Mehal built on the northern side of the fort, where Nawabs used to lodge before approaching the land. Furthermore, a water pond also borders the fort's outer edges on the northern edge of the Noor Mehal. Just a few hundred meters east of the fort lie marble and blue-tiled mausoleums of the Nawabs and their families, including the gracefully domed marble mausoleum of the last Nawabs English wife is also on sight. Likewise, the fort is a multi-structured building that includes Nawab's watch tower, Nawab's resting area, Zanan Khana, workers' and soldiers' area, the Nawab's office, Phansi Ghatt, prisons, and weapon storage among other structures. Two guns are stationed in a parade yard inside the fort. According to historians, the structures inside fort, which are now dilapidated, were vacated by the reigning Nawab's family in 1920. It is not just a masterpiece of beauty, but every single little thing about the fort takes you back to a period when the fort was completely lived in by its residents. Whether it's the mysterious underground jails or the inhabitants' quarters, each part tells its own narrative. One of the most interesting aspects is that there is an underground railroad that took the previous emperor from his castle to the fort. The Nawab's underground lodgings are still there, but they have deteriorated in several parts. It is wonderful to witness the air movement system that keeps the underground royal palace pleasant as an air conditioned area, as well as the impressive passive ventilation system.

Considering the decoration of buildings, which is an essential feature of South Punjab's ancient architectural language, as shown in the **Derawar Fort.** The fort's most notable aesthetic feature is the art of wall murals, which has antiquity roots but whose origins are unknown. The Royal Chamber was lavishly decorated with nonfigurative Islamic art from the Islamic tradition. The frescoes and wall paintings of the room were created in compositions with different pairings of fruits and vegetables, as well as floral patterns, indicating oneness and togetherness, and themes influenced by local flora and fauna, as well as inspiration from outside. Plants in murals have curved leaves that have been decorated in the Iranian manner. Colors and themes were brilliantly blended. Colors for fresco painting were originally made from natural ingredients and kept wet in matkas (earthenware jars). Hirumchi was used for red, burned coconut husk for black, green from sand–e-sabz (green stone), yellow from yellow clay, white from burnt marble chips, and blue from Laagward or Lajwanti (Lapiz Lazuli) to achieve the color range. In reality, wall painting is an Iranian tradition that peaked during the Mughal Empire, notably during the reign of Jahangir. The blue color utilized in the motifs, in various tons of cobalt blue, indigo blue, and turquoise, represents nobility, sincerity, and faithfulness. This style of ornamentation was ideal for the deserted area's setting since it could withstand the harshness of the climate, such as extreme heat, rainfall, and cold.

All of the fort's buildings were built mainly as load-bearing brick structures with cut and molded bricks, generally supported by wooden beams, and with carved wooden doors, and ventilators. Furthermore, hardwood ceilings are adorned with naqaashi work, with floral designs and carvings. This ceiling was made in some rooms using the traditional tarseem bandi technique, in which small pieces of cut wood are joined with each other in a geometric form by an intricate interwoven joinery.

Arches and columns were among other architectural elements. The fort had three types of arches: one was multi-foiled, which are distinguished by various circular or leaf forms carved into their inner profile (the name foil originates from the old French word for "leaf"), and the other was semi-circular and pointed arches. The semi-circular arches at the front of building were part of the area that was regularly used by the British. These arches form an arcaded veranda in the front, while the arches on the sides are multi-foiled blind arches added by the Mughals. The columns were designed in manner of Persia and Egypt's ancient columns. The garden front is pretty ordinary in its arrangement since it provides vistas to all rooms and spaces and adds to the fort's majesty.

3.1.1. Deterioration of the Derawar Fort

The current condition of the Derawar fort makes it impossible to believe that it was once one of the most significant key locations inside the Cholistan Desert, since the fort is crumbling at an alarming rate and no one seems to be concerned about it. The fort was in fine form two decades ago, but the destruction in the last decade has been sudden and massive. According to reports, the fort is still the private property of Nawab Sadiq Muhammad Khan V's descendants, who have been struggling for control for decades. As a result, the fort has been clearly neglected in terms of preservation. The fort's structures are vulnerable to a variety of natural disasters. Bricks used in the fort's erection currently lie at the bottom of its damaged and cracked outer walls, and it indicates that residents have tried to steal building materials from the façade. The Nawab's quarters (a long hallway with rooms off either side), the women's section behind a closed door, a high wall, and some military barracks are all that survived. Some of the bastions have become nothing more

than mud piles. The overall condition of the masonry is deteriorating; although the walls have undergone relatively little neglect, the poorly drained structures have fallen victim to rainwater.

Underground buildings are inaccessible because they have been entirely filled with sand, blocking the pathways. The 2019 monsoon rains blocked the passageways significantly. Furthermore, three bastions and two pieces of the fort's 80-foot-high, 8-9-foot-thick outer wall had been severely destroyed by harsh weather and time. There are several factors that add to the degradation of fort structures; nevertheless, following are the most likely causes of fort structures' deterioration. The presence of various organic materials in masonry walls necessitates laboratory testing for bricks and mortar. It is possible that various impurities in original structures have been reintroduced in materials being used for recent repair and restoration works.

Furthermore, Cholistan Desert's climate is characterized by strong summer winds. At times, the velocity can exceed 20 miles per hour at times, while the average velocity is around 11 to 12 miles per hour (PCRWR, 2004). Wind pressure at these velocities has influenced the fort's buildings. The structures on site are riddled with cracks and holes.

The most damaging consequences of the combination are caused by rain penetrating them and being forced by wind pressure to produce significant interior degradation following saturation of exterior surfaces. In the vicinity of the fort, rainfall is light and infrequent (166 millimeters on average per year). Rain generally falls during the monsoon season (July to September). Monsoon rainstorms are frequently heavy showers (PCRWR, 2004). Rain will cause damage to the brickwork above and below ground level, as well as inside areas, in a variety of ways. Rainwater poured down vertical surfaces after the bricks had been soaked, and wind pressure propelled it through fissures or even through the material itself due to its high porosity. Rain entered the brick walls, causing internal degradation and the formation of holes.

Furthermore, the groundwater in the desert is typically saline (PCRWR, 2004), and rising damp is a common phenomenon and a key cause of deterioration in construction materials, particularly when combined with high salt concentrations. Even if it is minor, it can induce a variety of deteriorating forms. As per its quality "chemical composition," saline groundwater is identified as the most significant factor that can impact the high level of harm to various materials and lead to a variety of deteriorating forms.

3.2. History of Recent Interventions at Derawar Fort

Architectural preservation can be defined in a variety of ways. For instance, Elias defined conservation as "a set of procedures that contribute to the protection of the architectural and historical features of significant old places and structures, including such repairing, removing erosion and sedimentation signs, and safeguarding acceptable standards for protecting of open spaces and squares" (Hmood, 2019). Architectural preservation contributes to the maintenance of an area's identity and pride among its residents. It goes beyond simply restoring and maintaining historical treasures to promote well-being and security via widespread community participation and engagement. It creates chances for jobs and poverty reduction, and also, in the long term, aiding in the achievement of sustainability objectives.

In recent years, the government of Pakistan's Department of Archaeology has undertaken a number of conservation measures to preserve this legacy. In 2017, the Directorate General of Archeology and

Government of the Punjab executed a project titled "Preservation and Restoration of Derawar Fort, District Bahawalpur," which was funded by the "Youth Affairs, Sports, Archeology & Tourism Department, and Government of the Punjab. On July 20, 2017, the project was authorized for a PC-I sum of Rs.101.600 million, which was later amended to Rs.115.742 million on December 18, 2018. However, up to August 20, 2021, actual expenditure was Rs.76.030 million, indicating a financial utilization of 65.7 percent (Zia, 2021).

The exterior of the fort's wall is currently being adversely damaged by salt and is crumbling down in numerous parts. Therefore, preservation work has been divided into phases. The salt-affected bricks were removed in the first phase, and underpinning work was carried out using special-sized bricks, and a 19-foot wide portion of the boundary wall and the 62-foot deep bastion of the Derawar Fort were repaired up to a height of 75 feet. Furthermore, partial preservation works include the restoration of the front of south-eastern and north-eastern fort bastions, the first entry gate, the interiors of the fort, a Mosque the approach and interior of Baradari, and the Godowns. The godowns were maintained at the project site, but diagonal lines were added to the final outside surface of these godowns. Since preservation is required to be done by the original pattern and design, and because there was no trace of such a pattern before the conservation tasks were undertaken there, the presence of such additional patterns indicates a deviation from the original design. Furthermore, work progress is slow, which may cause delays in project's date of completion.

Derawar Fort is a magnificent and iconic location in Cholistan that can be seen from a considerable distance on a clear day. This massive square fort with towering walls and bastions still stands tall in its splendor after nearly twelve centuries and tells the stories of its glorious history. It appears majestic from the exterior, but the inside reveals a different storey: neglected, damaged, and collapsing.

Because of lack of maintenance and restoration work by competent authorities, it, like many other forts in Pakistan, is slowly decaying and quickly becoming ruins. Although Derawar is now an abandoned and neglected fort, it once stood as the gateway to the Cholistan desert, defending this realm against invaders from Iran and Afghanistan. Derawar Fort requires significant restoration work, or else this magnificent desert fort will be gone forever. The government of Pakistan is concerned about its conservation, but only on a relatively small scale. The present condition of the fort indicates that great care should be taken to maintain and preserve it. The fort is on the UNESCO list, and if it remains in such poor condition, maybe UNESCO can remove it. It is the right time for the Punjab government to take action to preserve and maintain it. It is a one-of-a-kind fort in the Cholistan desert with a lot to offer visitors and historical scholars.

3.3. Aims of the Master Plan

- To provide intervention in terms of material, design philosophy, planning, and execution, taking into account the site's extreme temperature variations between day and night, while preserving its traditional value and historical significance, alongside promoting its green and sustainable architectural values.

3.4. Objectives of the Master Plan

- To restore the architectural and archaeological fabric of selected cultural properties, while ensuring the preservation of remaining heritage elements
- To design a climate responsive eco-resort without harming any geological and historical features of the site
- To study the vernacular architecture, local vocabulary, keeping in mind of the climate factor, behavioral pattern, user attitude and implement it in design
- To understand the technical aspects of climate and desert architecture and to explore innovative construction techniques that enhance the project's sustainability
- To provide a full range of comfort and amenities for all visitors, including jeep rally participants and winter tourism enthusiasts
- To create vistas and the buffer spaces so that the interest of visitors is kept alive with safeguarding of cultural properties
- To create climatic and energy responsive through the sustainable design
- To connect significant forts and cultural events to establish a network of tourist destination sites

3.5. Methodology of the Master Plan

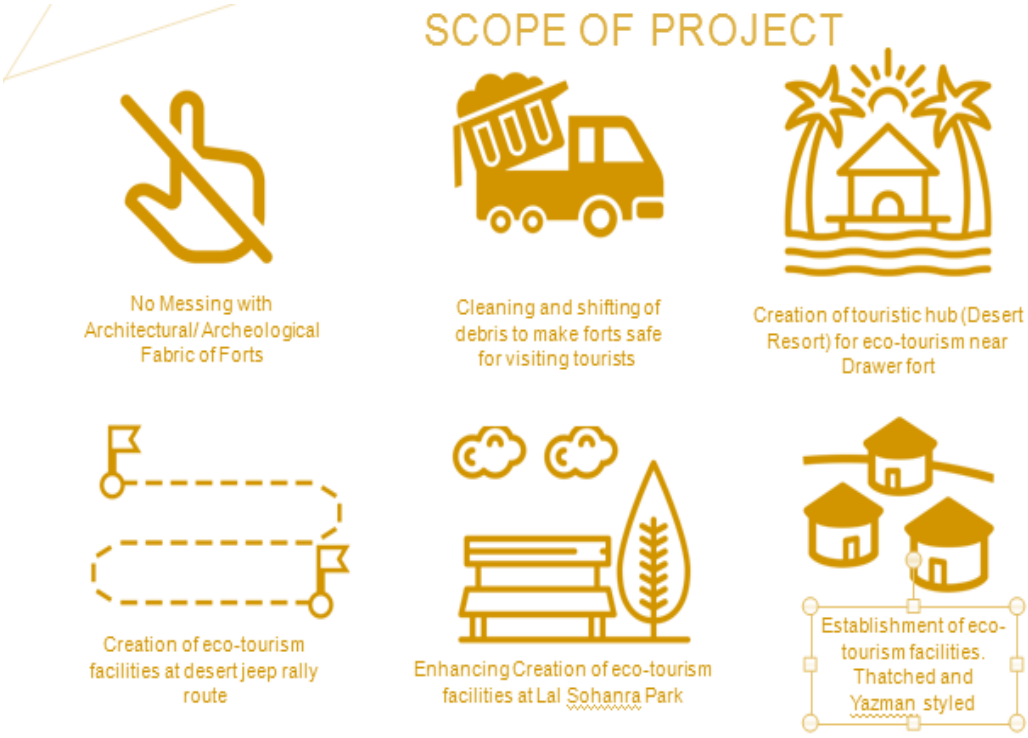
For preparation of this Master Plan:

1. A detailed desk study was conducted before the site study to ensure that field visits were purposeful, efficient, and more insightful.
2. Site visits were strategically planned in coordination with relevant authority to avoid obstacles and logistical hindrances.
3. Initial meetings were held with stakeholders, namely Cholistan Development Authority, Commissioner Bahawalpur and Archeology Department Government of Punjab.
4. During the site visits, the presence of site staff from various authorities was ensured to gather maximum information within a limited timeframe.
5. The accuracy of collected information was cross-verified using both human sources and available literature.
6. Visual surveys were conducted with the support of GIS technology, utilizing modern tools to collect data from remote and on-ground sources.
7. Independent visual observations were recorded by an architect, an archaeologist, and a biodiversity specialist. These accounts were later integrated to create a comprehensive survey report.
8. A comprehensive team of architects, draftsmen, archeologists, biodiversity specialists, quantity surveyors, cost surveyors, GIS specialists, and environmental specialists were engaged to complete all aspects of this Master Plan.

3.6. Scope of Interventions

The interventions that will be performed under each head are;

1. **Restoring Architectural/Archeological Fabric of Forts**
   Architectural/Archeological fabric of majority of the forts will be restored and remaining will be preserved.
2. **Adaptive reusing various Architectural/Archeological Fabrics of Forts**
   Architectural/ archeological fabric of the forts will be reused, adapting it as per need.
3. **Cleaning and shifting of debris to make forts safe for visiting tourists**
   All debris, which is the building material of fort will be collected, sorted, and stored for future and present restoration work. Non-useable material, including dirt and mud, will be used to level the pathways and sunken areas, taking care not to damage architectural/ archeological/cultural property in a fully reversible way.
4. **Creation of tourist hub (Desert Resort) for eco-tourism near Derawar Fort**
   An elaborated central tourist hub including accommodation, transport, cultural, economic, and information facilities will be proposed near Derawer fort, taking care not to damage architectural/ archeological/cultural property.
5. **Establishment of eco-tourism facilities near fort**
   A cluster of traditional thatch huts and Yazman style mud structures will house souvenir shops, rooms for tourist stay, toilet facility, equipment storage, information/refreshment center etc. and in totality it will give a combined look of a model village at each fort taking care not to damage architectural/ archeological/cultural property.



Few minor activities may also be included for example;

6. **Provision of history wall and info signage**
   A history wall will be installed near the tourist facility or the main entrance of forts, while appropriate informational signage will be placed where necessary, ensuring taking care not to damage architectural/archeological/cultural property.
7. **Provision of solar power system**
   A solar power system will be installed in model villages to provide electricity for a light and sound show, along with appropriate energy storage. The system will also power night-time security lighting.
8. **Provision of light & sound show**
   A provision for light and sound show will be made with its operational/storage facility.
9. **Benches with shades**
   Some comfortable sitting spaces shall be provided for tired visitors.
10. **Parking Space**
    An open demarcated provision of parking space will be made.
11. **Creation of mobile/web app**
    A mobile app and web pages will be created to provide info on Cholistan, forts, history with GPS facility. It will aware, guide and facilitate tourists visit this area.

ARCHITECTURAL ACTIVITIES

History wall and signage

Provision of solar power

Light and Sound show

Sitting areas

Shade

Parking spaces

Mobile/web app

PROGRAM

Duration of Stay **Types of users** **Program types**

Activities/programs

3.7. Challenges of Development

Development in the Cholistan Desert includes many challenges such as:

- **Extreme Temperatures:**

Temperatures in the Cholistan Desert can exceed 50°C during the summer months, making it extremely challenging for people to farm, work in mines, or serve as tourist guides. The intense heat hampers economic activities and poses a significant barrier to development in the region.

- **Water Supply:**

The supply of water to the Cholistan Desert is precious and limited. With only 120-240 mm of rain falling per year in the desert, water must be used sensibly and sustainably. Without water the development of mining, farming and tourism and therefore the economy would not be possible. Some parts of the desert have experienced over-irrigation, which has caused water logging of the ground. Here the excess water has evaporated, leaving a layer of salt on the surface making it difficult to grow crops.

- **Inaccessibility**

The desert covers a huge area. Most of the desert is inaccessible due to the extreme environmental conditions and poor infrastructure. Beyond the city of Bahawalpur, development is limited. Inaccessibility to many parts of the desert has led to greater differences between rich and poor.

3.8. Sustainable Design Strategies: Learning from Derawar Fort

A sustainable luxury resort in a desert? Sounds like an oxymoron, doesn't it? But, Cholistan is home to mighty forts, luxurious palaces and exemplary building design, which, are well adapted to the harsh arid climate without reliance on air-conditioning and water for thermal comfort.

With such time-proven sustainable design strategies at hand and modern technology, the proposed retreat design set out to achieve these seemingly disparate goals.

What makes sustainable design in the desert particularly challenging is that –

- The sun and heat, plentiful in the desert, have to be kept out.
- Cooling elements such as trees and water are in short supply.

But Derawar, has dispelled the notion that an abundant supply of water and vegetation are necessary to create a vibrant, beautiful and – the now trendy phrase – sustainable design.

When Rai Jajja Bhatti, a Rajput ruler of Bhatti clan built Derawar Fort in the 9th century, he did not think of damming and diverting rivers to sustain his home and his people, like we do now to feed our golf fixes and arid farmlands.

Instead, Derawar Fort and the proposed design used elements such as:

- Thick masonry walls
- Narrow streets
- Asymmetric volumes
- Contiguous low-rise courtyard dwellings
- Cantilevered building floors
- Screened windows
- Wind scoops
- Wind towers

To serve the dual purpose of creating a dynamic built environment and achieving a milder microclimate within fort and the proposed design complex, while also ensuring cooler and more stable indoor temperatures, the design incorporates the following elements:

- Thermal Lag
- Shade
- Ventilation

3.8.1. Proposed Design

In addition to incorporating existing passive cooling strategies, the proposed design re-interpreted the fort, as a cluster of air-conditioned guest blocks, and as an earth-sheltered non-air-conditioned guest rooms. The public services will be located between both parts of the retreat to facilitate access, transition and operation.

3.8.2. Passive Cooling Strategies:

Thermal Lag:

Thick masonry walls reduce conductive heat gain by delaying the transfer of heat from the outside to the inside. Heavy materials such as water, adobe, stone, and concrete take much longer to heat up and keep the interior surfaces cooler for a much longer time than lighter materials such as wood. This phenomenon is known as thermal lag. The principle of thermal lag works differently from insulation, which reduces the heat conducted instantaneously to the interior surface due to temperature differentials between inside and outside; it creates a time delay in transferring heat from the outside to the inside. The extent of the time delay depends on heat capacity and thickness of the material.

Material	Density(Kg/m3)	Specific heat(kJ/kg.K)	Thermal mass (kJ/m3.K)
Water	1000	4.186	4186
Concrete	2240	0.920	2060
AAC	500	1.100	550
Brick	1700	0.920	1360
Stone (Sandstone)	2000	0.900	1800
FC Sheet (compressed)	1700	0.900	1530
Earth Wall (Adobe)	1550	0.837	1300
Rammed Earth	2000	0.837	1673
Compressed Earth Blocks	2080	0.837	1740

Density, Specific Heat, and Thermal Mass of a Range of Materials. Recreated from http://www.ecospecifier.org

In Derawar, the thickness of walls along with the heat capacity of bricks delays the heat transfer to the inside by 8-12 hours, so that the low night-time temperatures reach internal surfaces around the middle of the day, cooling the inside air down.

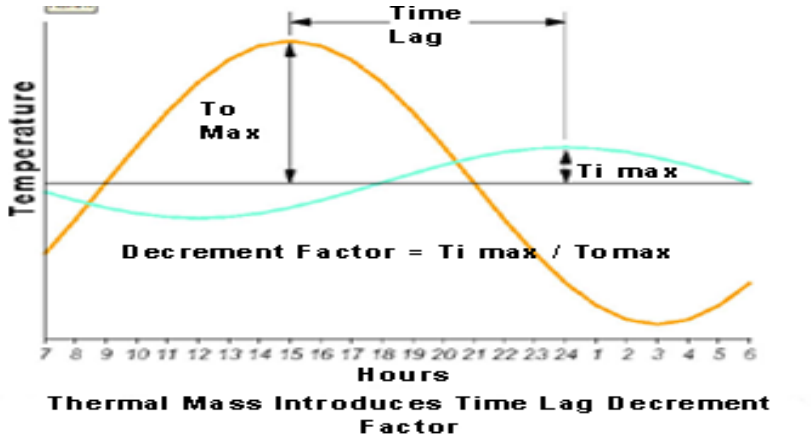


Figure 1: Thermal Lag.
(Source: CLEAR)

Thick masonry walls also aid in keeping the building interiors cool by damping the diurnal range of temperature. The degree by which the material dampens the diurnal swing is called the decrement factor. The masonry walls dampen external temperature extremes of over 43 deg C during the day and near freezing at night, to a reasonably steady internal temperature, with little variation between day and night time temperatures.

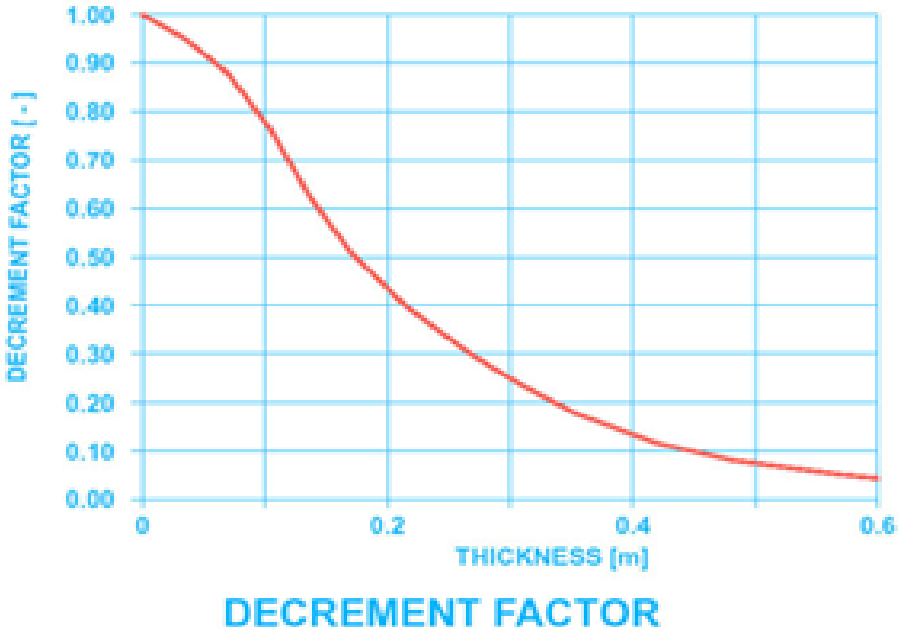


Figure 2: Impact of Thickness on Decrement Factor
(Source: CLEAR)

In the proposed design, the air-conditioned guest rooms have masonry combined with insulation to reduce thermal load on air-conditioning systems, while the non–air conditioned rooms are made of thick walls of rammed earth and are partially earth-bermed to take advantage of the earth's thermal mass and transfer its stable temperatures to the interior of guest rooms.

Shading:

One of the obvious steps to minimizing direct solar heat gain is shade, shade, shade and more shade. This is achieved by creating a seemingly erratic mix of solids, voids (courtyards), and overhangs, which creates self-shading along with a dynamic cityscape. Solar Panels will be used as shading device as well wherever possible.

Ventilation:

At night, ventilation is the primary mode for heat loss. Air movement is just as necessary as cooling to achieve thermal comfort, in extremely hot places such as Cholistan. Ventilation extends what is called the thermal comfort range, by increasing the rate if evaporation from the skin, and heat removal through convective heat transfer from the building.

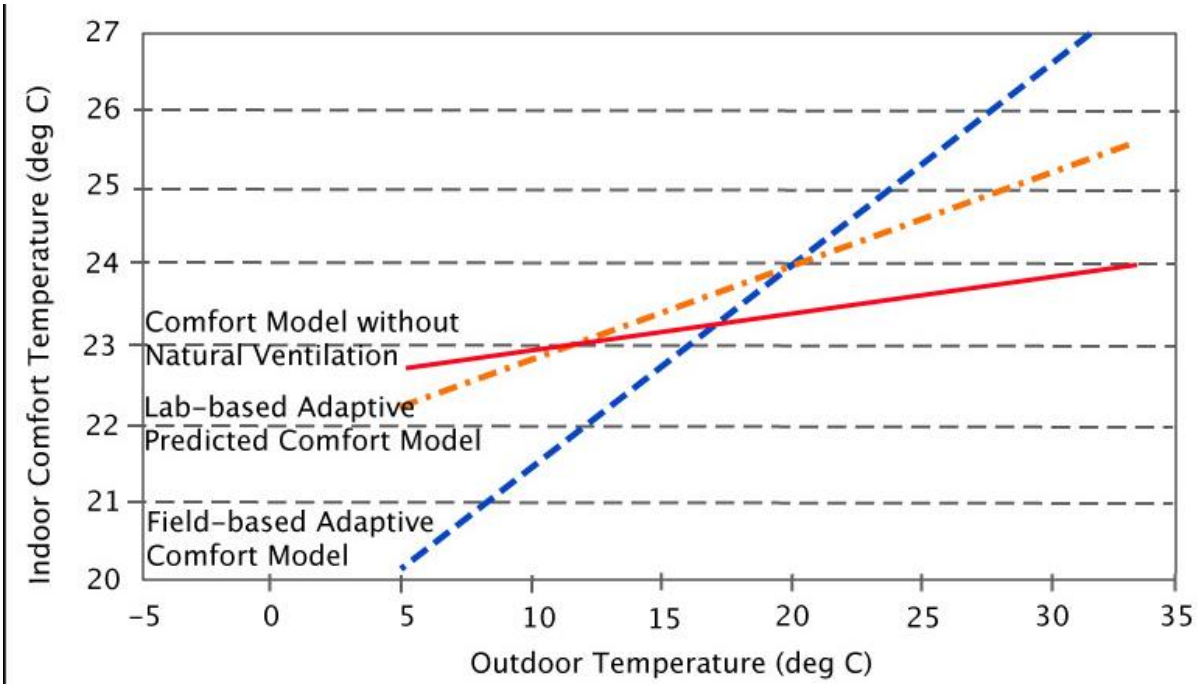
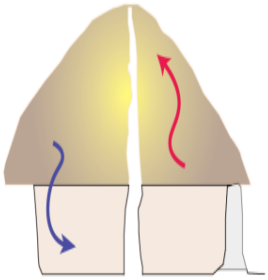


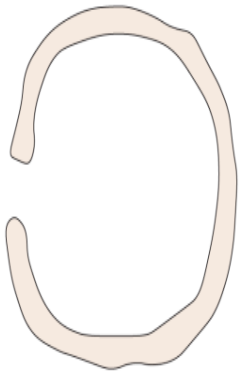
Figure 3: Observed and Predicted Indoor Comfort Temperatures RP-884 Database, With and Without Natural Ventilation. Recreated from: Brager and de Dear, Climate, Comfort & Natural Ventilation: A New Adaptive Comfort Standard for ASHRAE Standard 55. Center for Environmental Design Research, University of California, Berkeley, CA 94720-1839 USA

Pressure differentials created between completely shaded and partially shades open spaces induce air currents – through the courtyards, buildings and streets. At the building level, courtyards, wind pavilions and the fenestration screens induce air movement while filtering the sand particles out.

Cholistani Gopas are also an example of sustainable design.

Local example



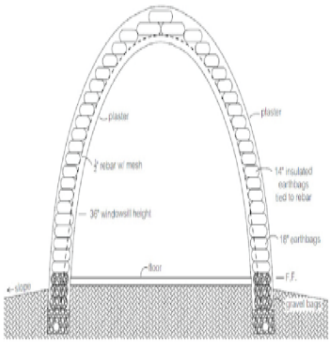


Cholistani gopa

Layer of Thatch on conical top provides insulation and keeps warm air above living areas.

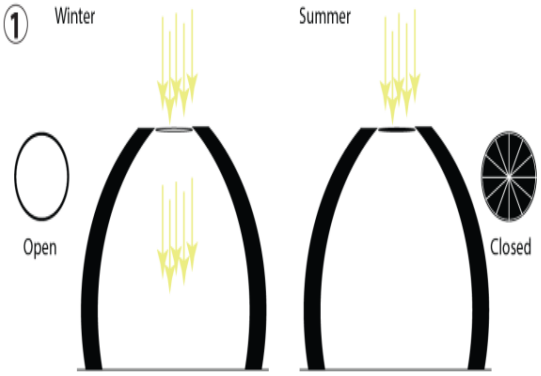
Solution

Super adobe

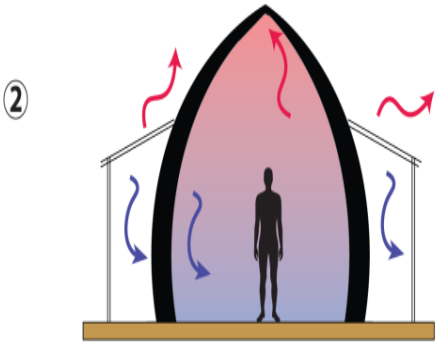


-Shallow (3ft) foundation required
-Low cost
-Locally available materials
-Easy to build
- High insulation
- Best for desert climates
(7-8 temperature difference recorded in Sahara desert)

Modifications



- Helps in temperature regulation by controlling sunlight.
- Reduces need for artificial light



Thatched slopes help cool living areas

Figure 4: Cholistani Gopas design

4. Proposed Architectural & Archaeological Interventions

Leaking Water

Major Cause of Destruction of Derawar Fort

4.1. Emergency Stabilization Area 1

Derawar Fort is on the edge of extinction if emergency attention is not given to it. A large area which had underground rooms on the right-hand side of Haram near internal mosque is giving way to storm water, while huge crevices are formed because of underground structures, and these need to be addressed on an emergency basis before downpour 2025. Growth of unwanted trees and shrubs has resulted in seepage of water into basement floors as soon they are going to go away soon.

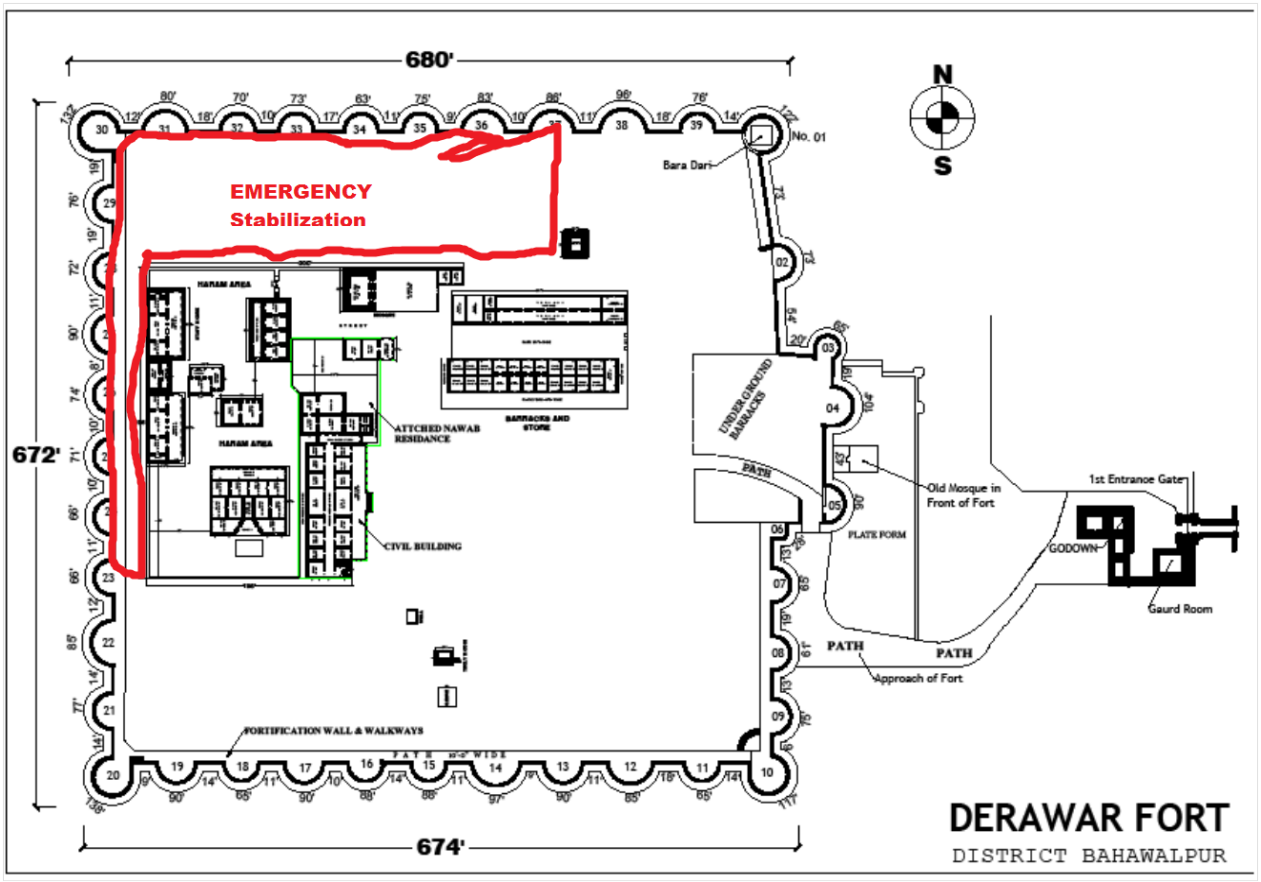


Figure 5: Emergency Stabilization area of Derawar Fort

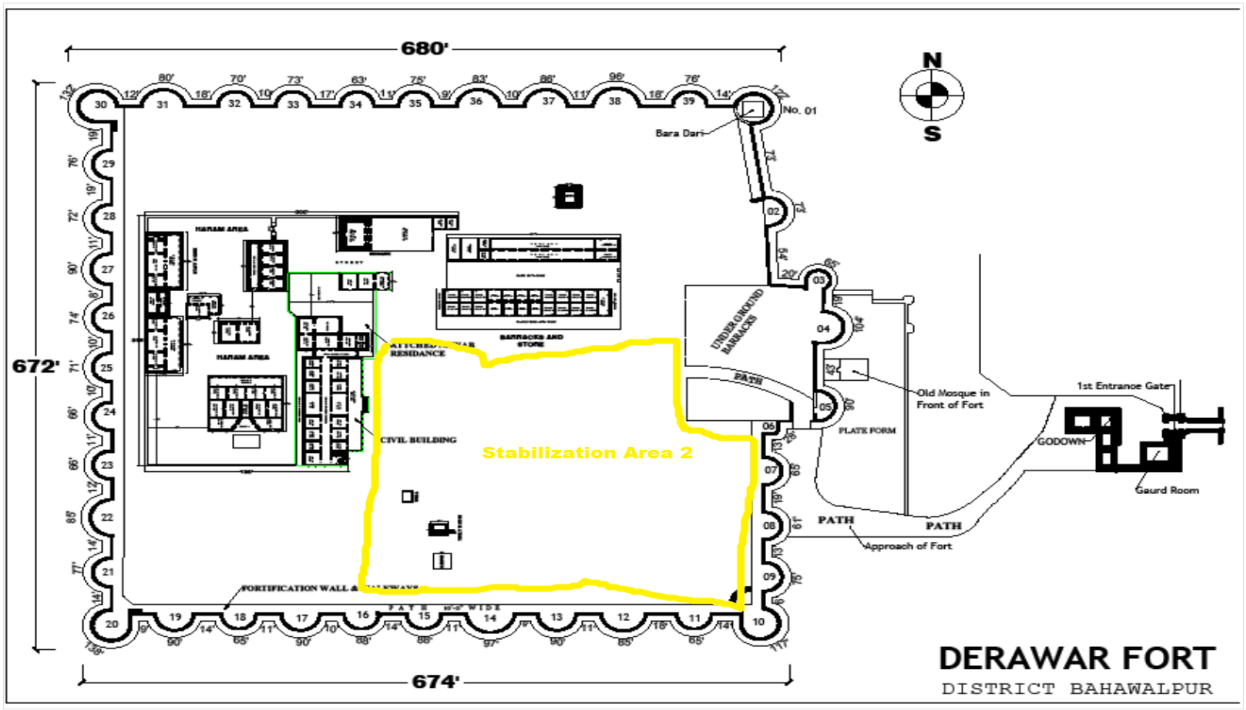
Large cervices are formed by storm water causing immense demerge to the architectural fabric of the Fort. Bastion walls have developed large cracks which may lead to collapse very soon if emergency rescue measures are not taken before monsoon 2025.

Even Plants are growing inside rooms and verandas of Haram structure. This is height of negligence. This tree is at least 20 years old and no one has removed it.

At places, damage is so extensive that supports provided to walls cannot stop decay. This situation calls for an EMERGENCY attention of authorities for Derawar Fort.

4.2. Stabilization Area 2

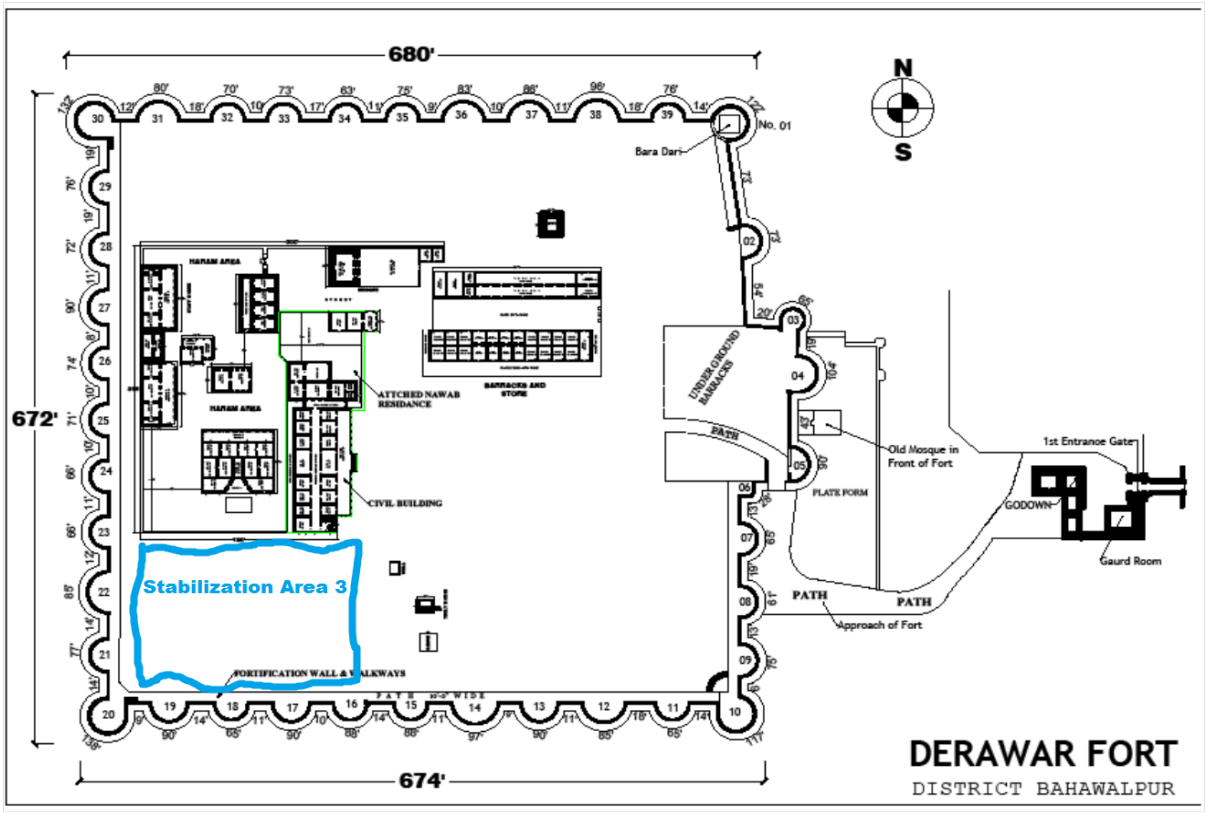
Main court of the Fort is also in need of urgent attention although it has not decayed fully but it's on way to collapse very soon due to same problems in area next to Haram where this report has recommended emergency stabilization. These trees and shrubs are going to kill fort structure very soon.



Unwanted vegetation has caused sagging in ground where water gathers, and whole of fort yard needs leveling and then plastering with local lime material commonly found in Cholistan desert used in vernacular construction.

4.3. Stabilization Area 3

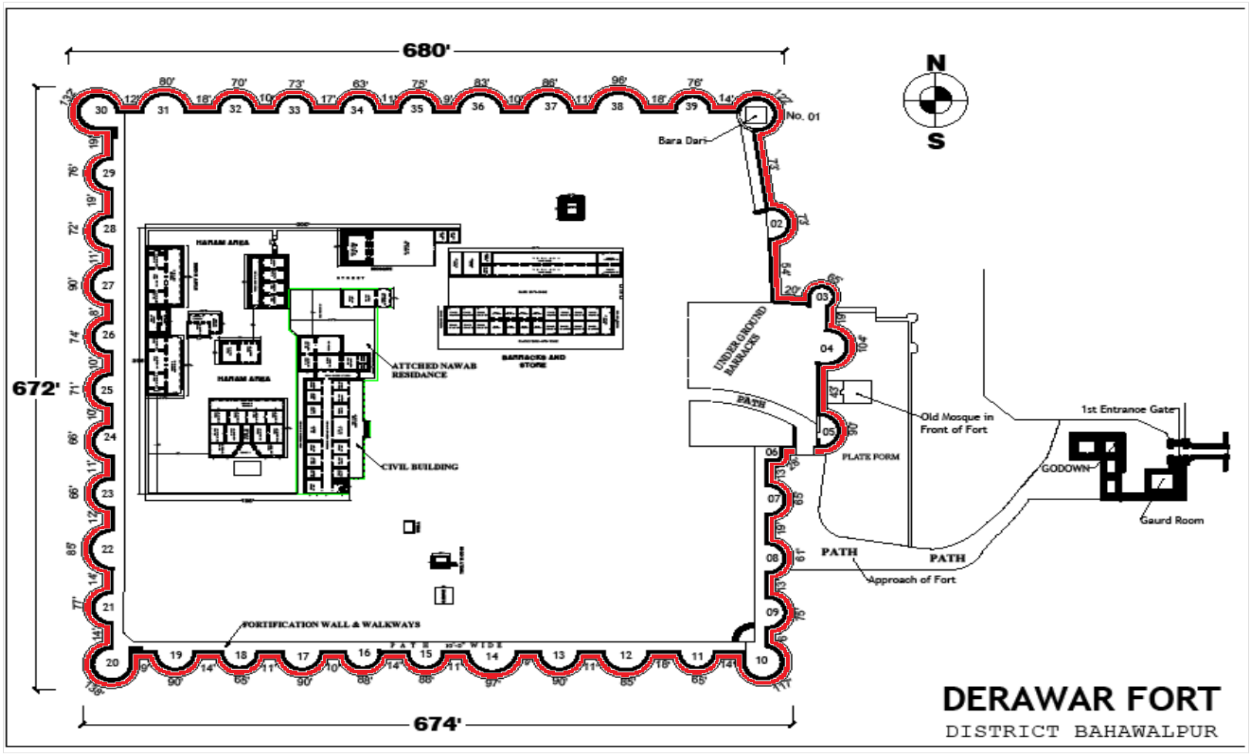
Area 3 marked in blue was pond of Derawar Fort (as shown in figure below) now dried and cracked. Due to neglect and having no maintenance it is filled with wild vegetation which is puncturing through its surface causing damage to structures of fort. It needs to be stabilized and reused as pond to revive the micro climate of fort and to stop leakages causing deterioration and sinking.



View of Pond from bastions in background fallen wall and sinking buildings of Haram are visible.

4.4. Restoration of Fort Wall Phase 1

Immediate restoration of iconic defense wall of Derawar Fort with its 40 bastions in 1500 feet perimeter is eminent. Almost one third of the wall has already been restored towards the front and side of fort but a lots of emergency restoration is envisaged before it's too late particularly towards the side and back of Haram building.

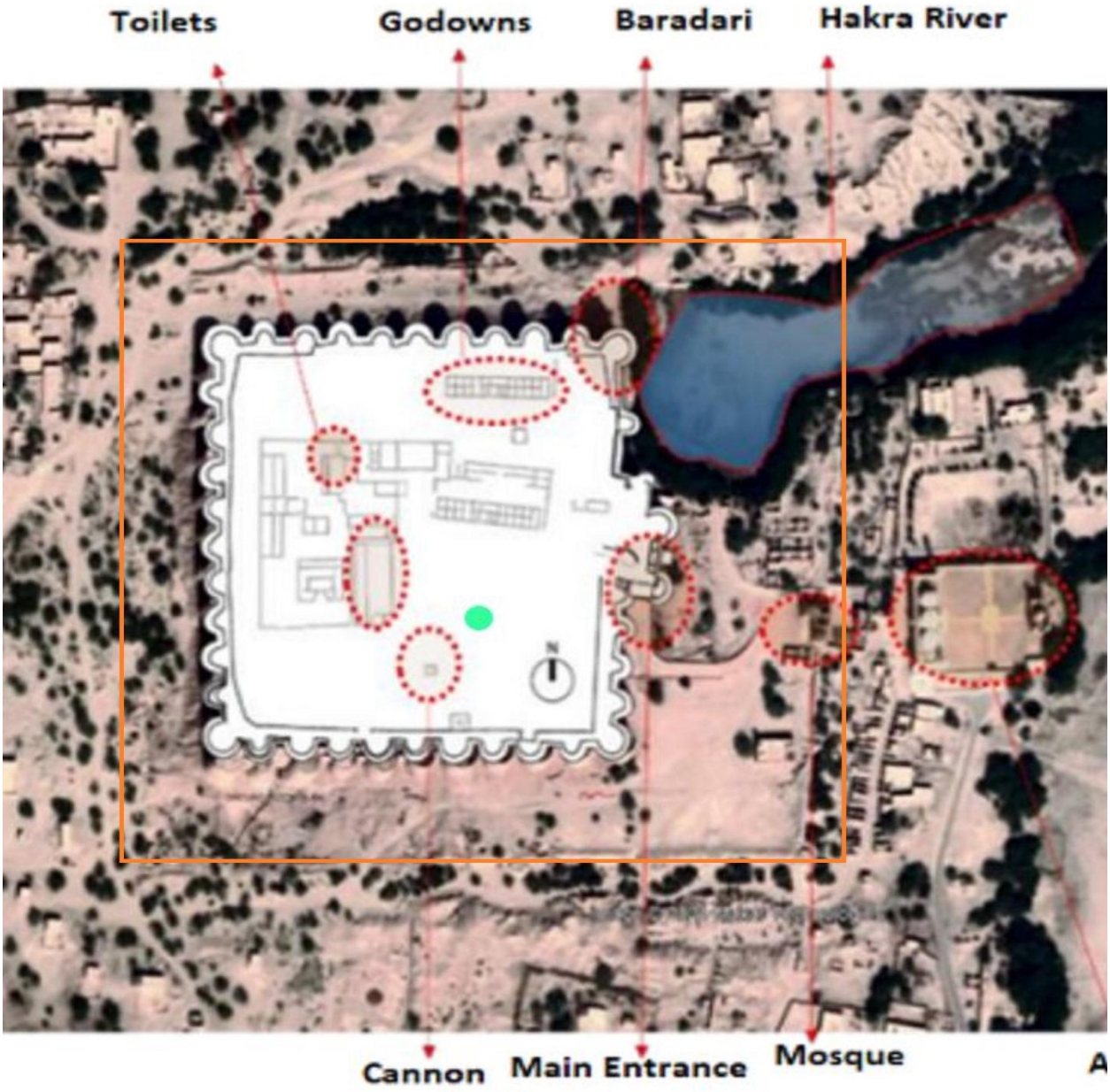


Deteriorated top floor of walls is giving way to water inside of the wall which is mud filled or of sun dried unburnt bricks, causing walls to erode from inside out as can be seen in picture that water has washed away the outer layer of burnt brick when it attacked it from inside of the structure.

Almost 30-40% of the wall has already been restored, but immediate action is required to restore the remaining envelope of the Derawar Fort. Here, the report would praise the authorities to maintain an adequate level of restoration by using original size of brick and original mortar i.e., lime surkhi.

4.5. Restoration of Fort Outer Wall Phase 1

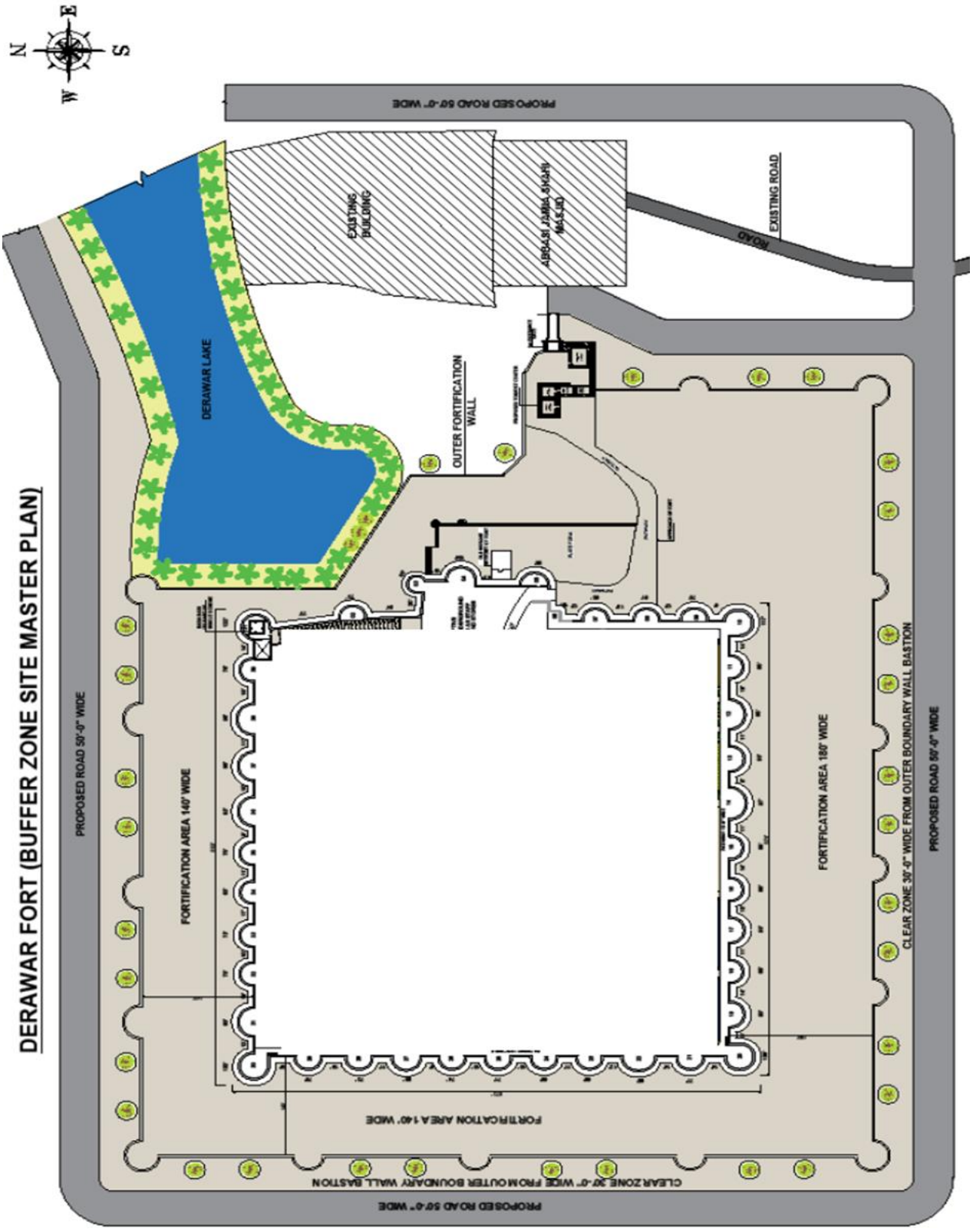
Derawar Fort with all desert forts was designed with two layers of defense. One strong and tall defense wall and second outer defense wall and between both walls go downs, security posts, houses for public and general amenities were placed.



Orange Square showing the rough location of outer defense wall which is in bad shape but still bastions and parts of the wall exist and shall be restored to create a boundary for Derawar Fort.

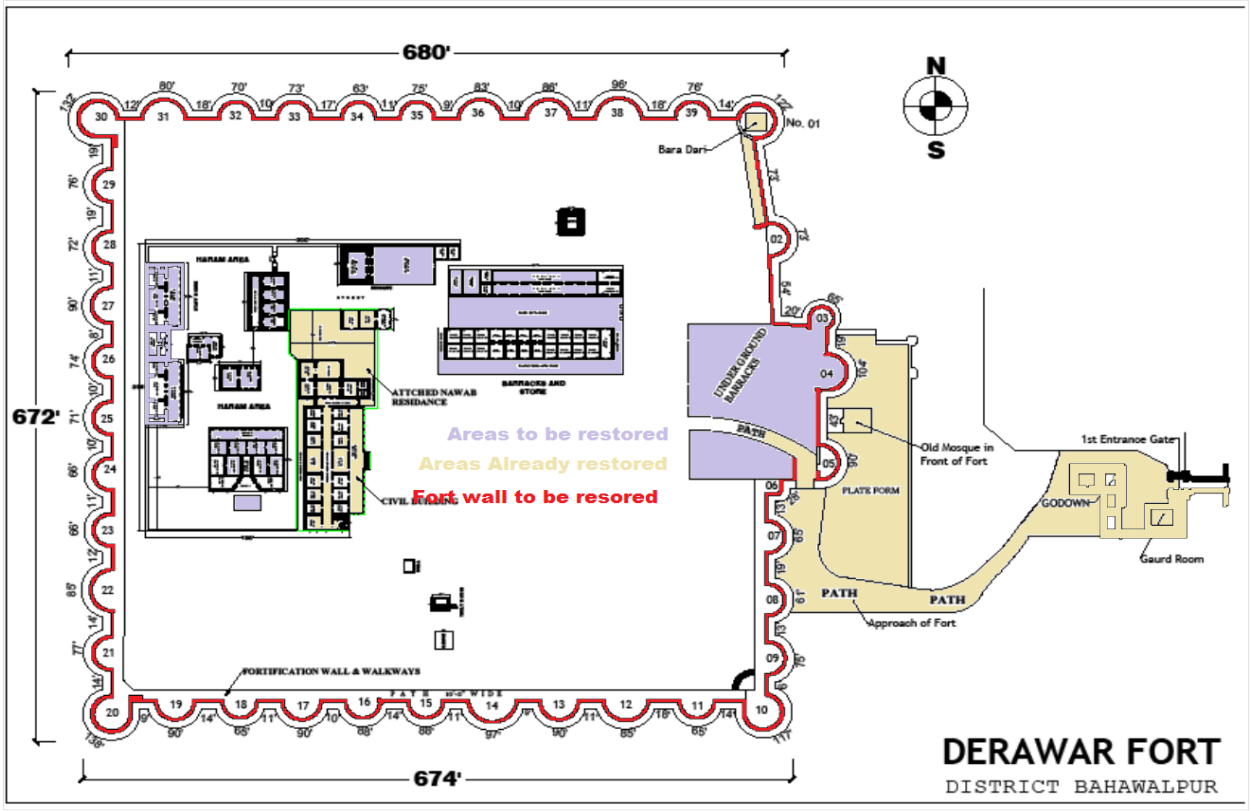
Debris of outer wall indicates its location and it will be perfect location to create a boundary for Derawar Fort along with a circular road outside outer wall to create a buffer between heritage and expanding population around Derawar Fort.

Gateway of outer boundary wall was recently restored, with some parts of the outer wall restored towards the front of fort opposite Abbasi Mosque.



Plan showing outer wall and 50 feet road around fort and mosque, creating a clear-cut boundary and protected zone

4.6. Restoration Phase 2



It's heartening that Nawab's residence, his secretariat with security gate in outer wall and main entrance with parts of front wall and some side wall have already been restored to an acceptable level. But with same remaining buildings of fort especially Haram building, barracks, mosque and underground barracks and stores are in dire need of restoration rather are at the verge of collapse.

Haram has lost all of its roofs and walls are in shambles but surprisingly retaining its architectural details.

Pathetic condition but still can be restored if attention is given to this architectural marvel.

Barracks are also not in good shape.

Few parts of the barracks are comparatively in better shape where water has not taken its toll.

4.7. Restoration Phase 3

Restoration of tunnels and underground floors is a tedious and lengthy process that may begin in Phase 2 and continue into Phase 3, following detailed archaeological investigations and studies. The areas around the entrance ramp contain ruins of underground barracks and stores. Additionally, trolley tunnels and stair tunnels are still visible, and old photographs confirm the existence of multiple tunnels beneath the fort's floor.

An old Picture of Derawar Tunnels. (Not Verified)

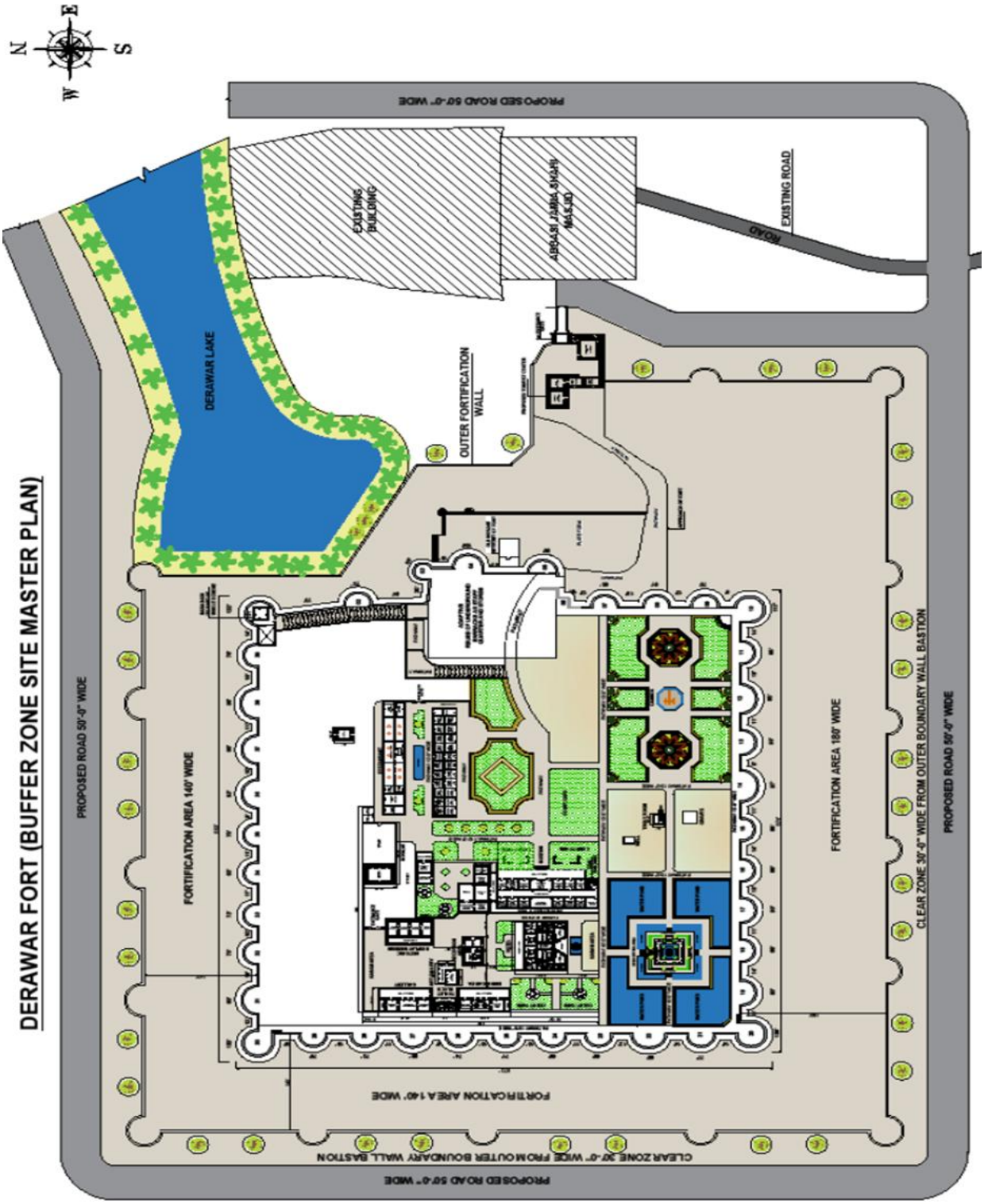
Area on right side of the Haram is decaying and ruins show existence of rooms underneath which may be restored in the long run. Roof of underground floor and walls are visible through the cervices formed by storm water.

Underground room and room below where one can see the fallen roof girders of lower floor while roof of upper floor is completely missing

Fallen roof and archway of tunnels in front courtyard is clearly visible but this open area is a threat to Fort as it must be causing huge damage as storm water may make its way to lower structure causing heavy losses.

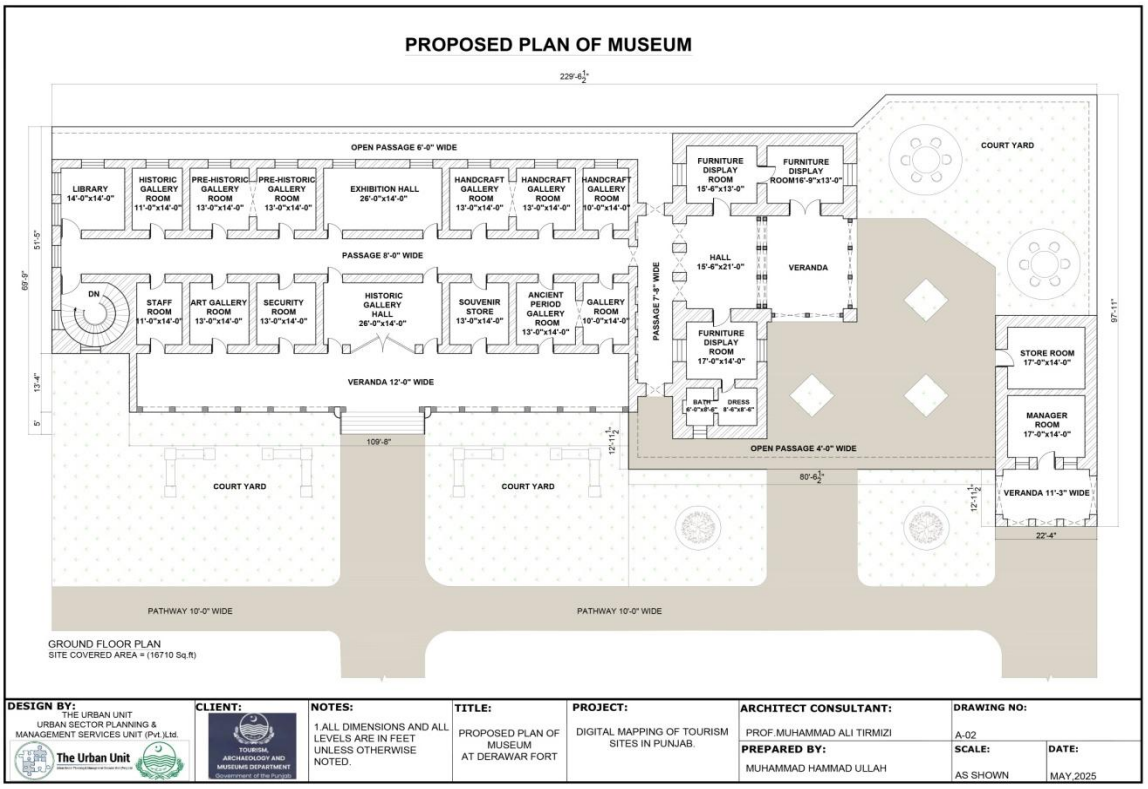
4.8. Adaptive Reuse of Derawer Fort

Those heritage buildings die which has no function or use, hence a use or adaptive reuse of these buildings is a must to keep them alive.

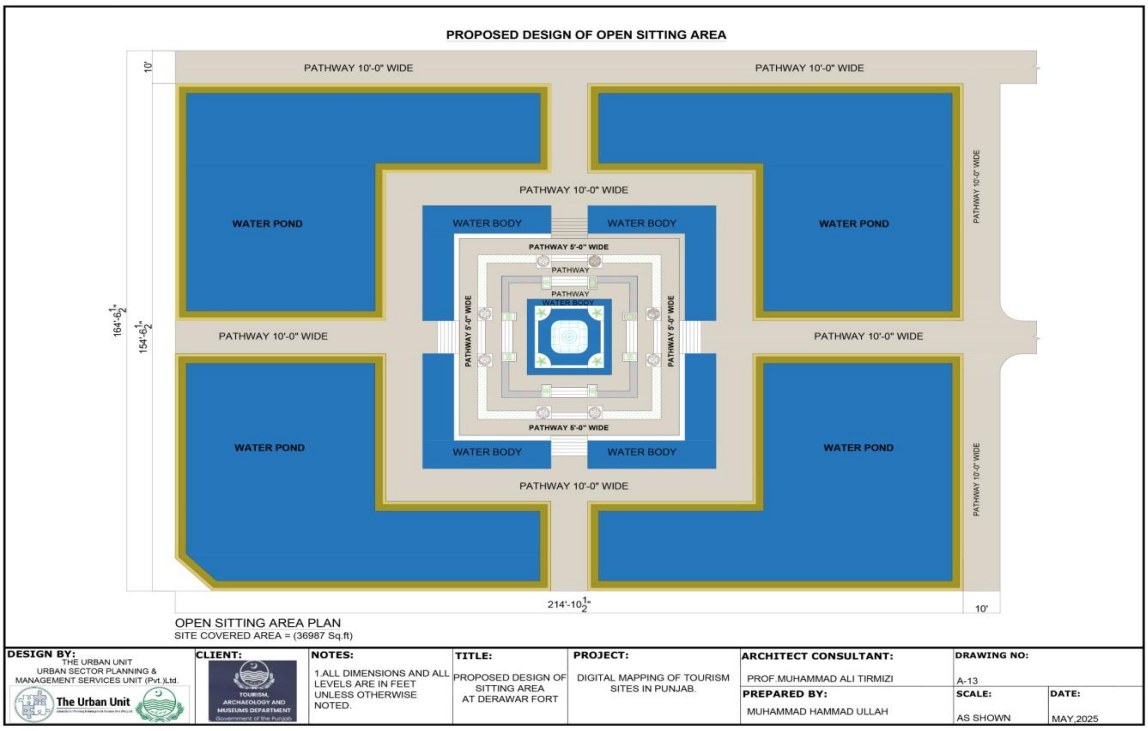


4.8.1. Adaptive reuse of Derawar Fort Suggestions

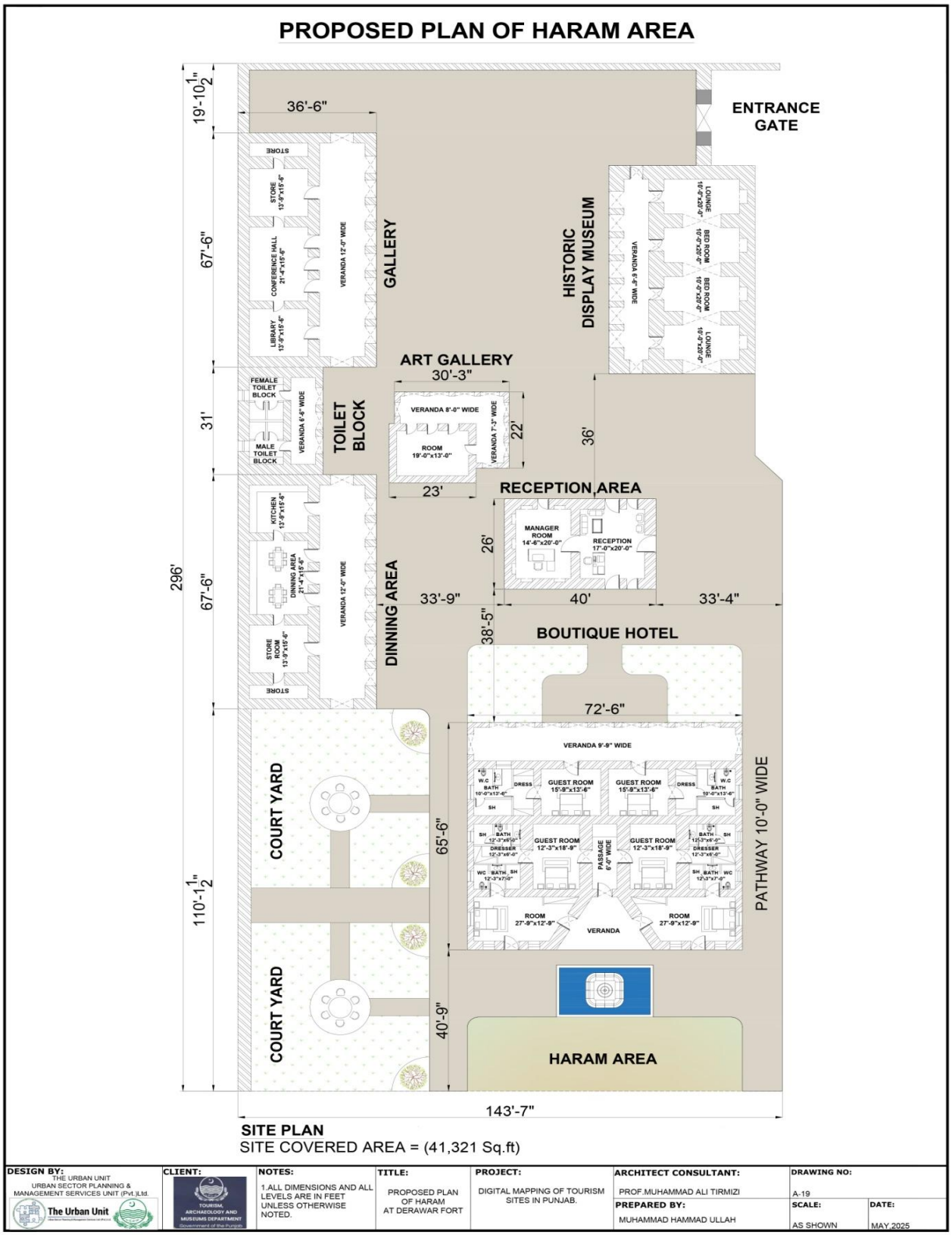
1. Nawab's residence and his secretariat to be converted into a living museum



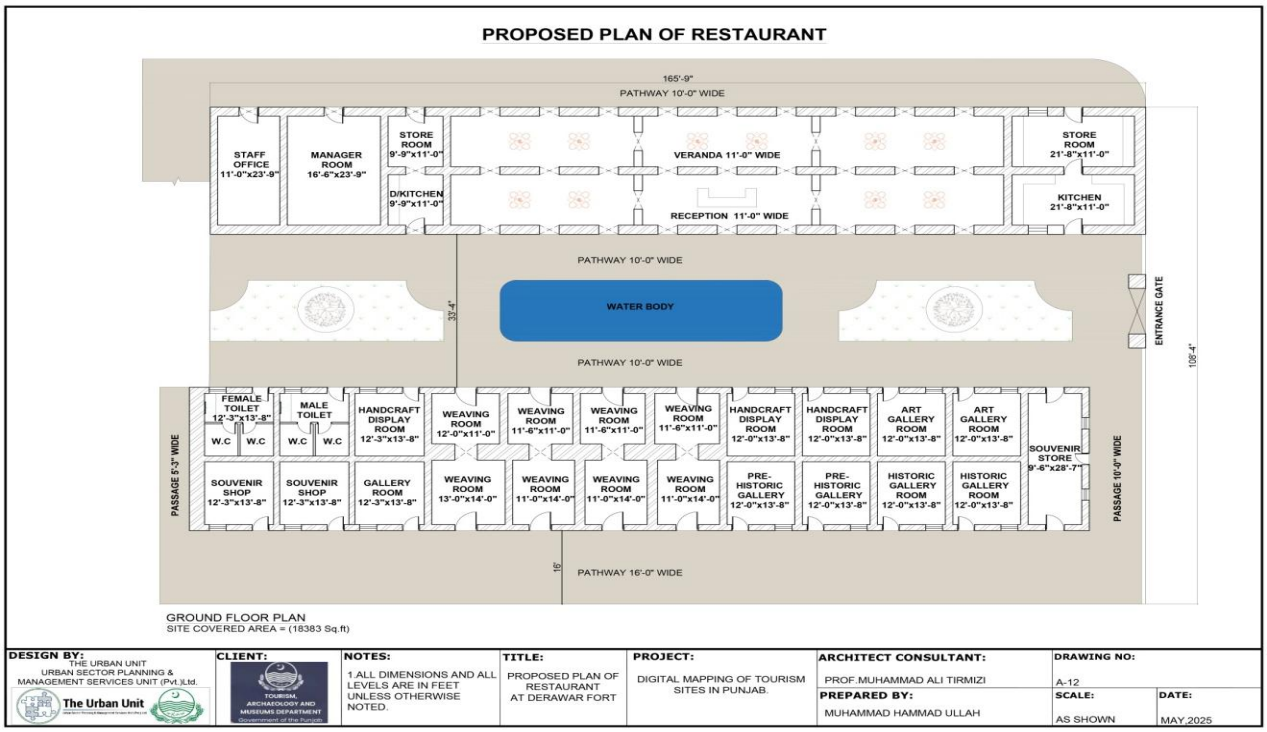
2. Side Pond to be converted into an exclusive sitting space



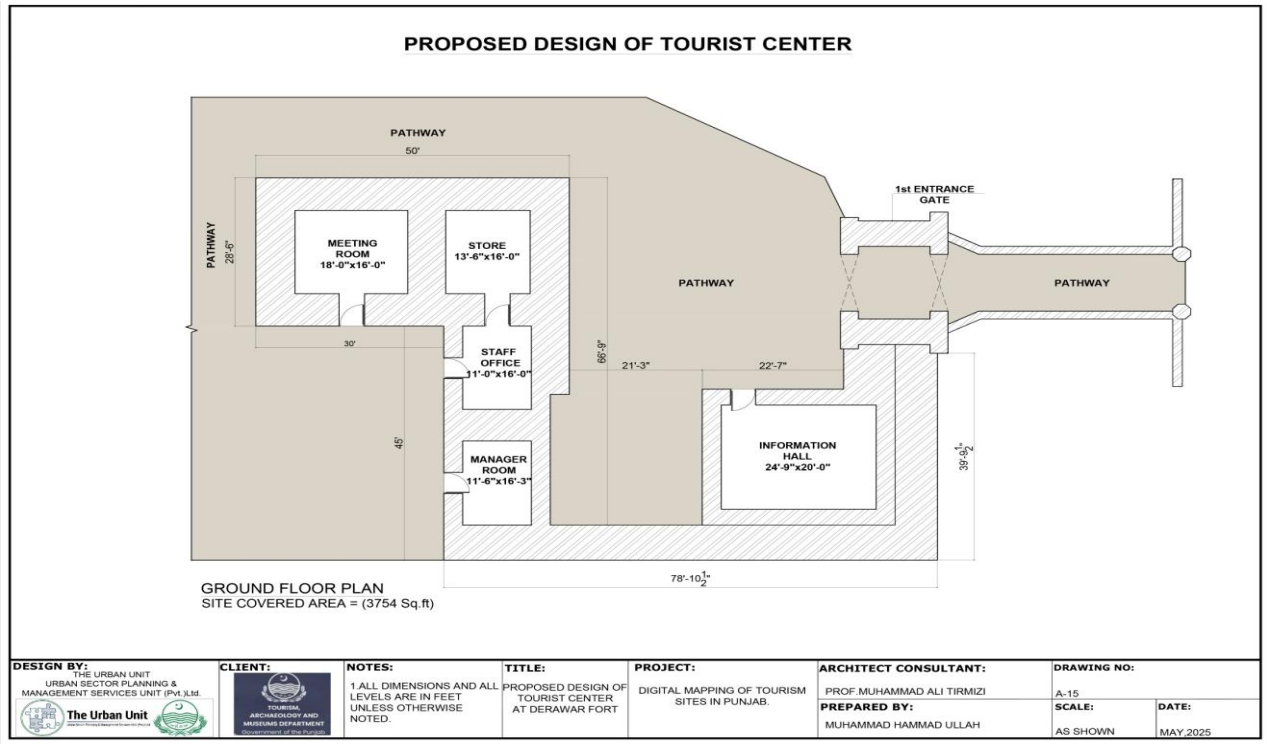
3. Haram building to be used as a Boutique Hotel



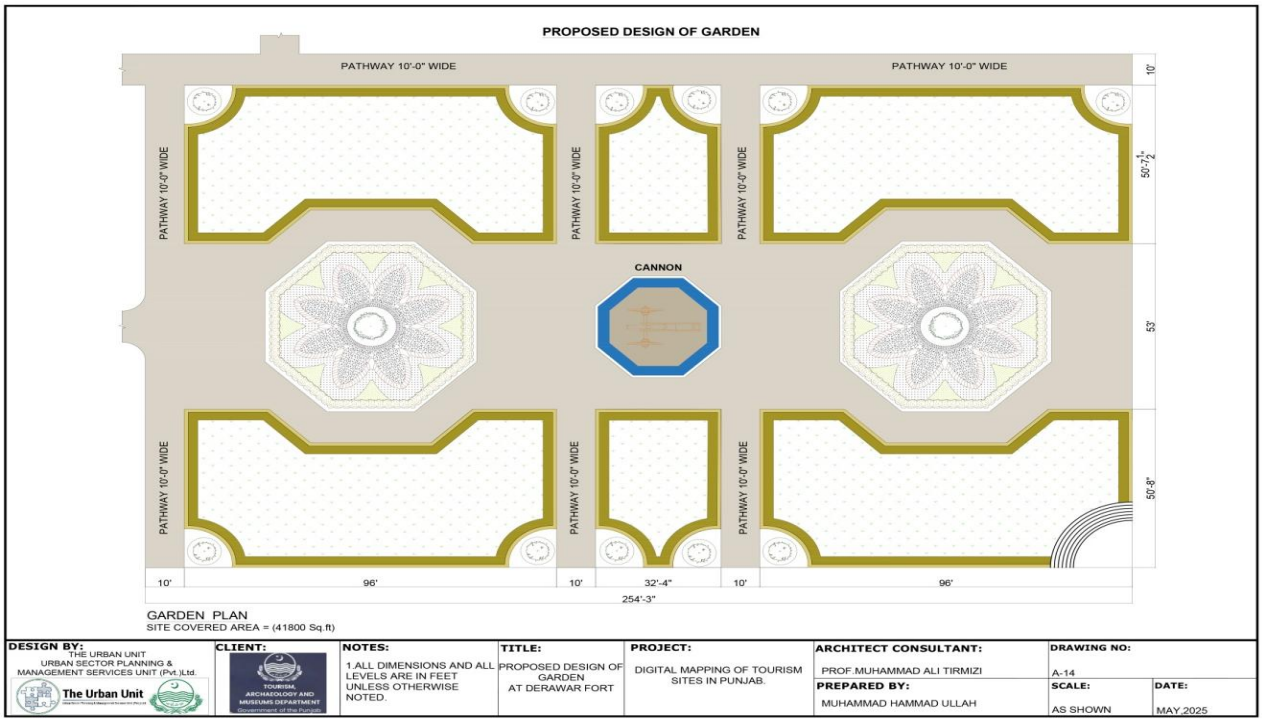
4. Barracks to be used as Vernacular Art and Craft Display and workshops
5. Middle courtyard and back Verandah to be used as a specialized Vernacular restaurant serving some of popular contemporary cuisine of Cholistan as well



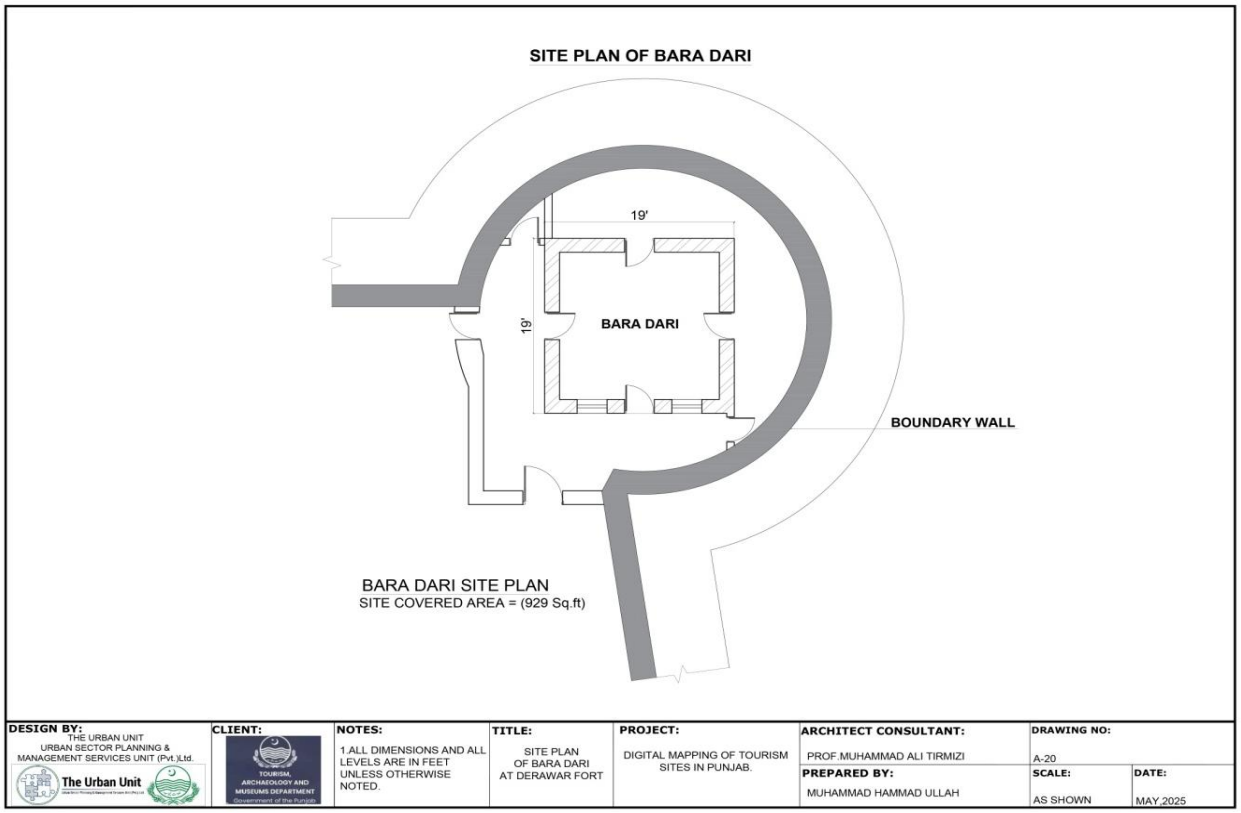
6. Grain Store Outside Main Fort to be used as information center for Cholistan



7. Front Lawn to be leveled, water proofed and restored to a garden

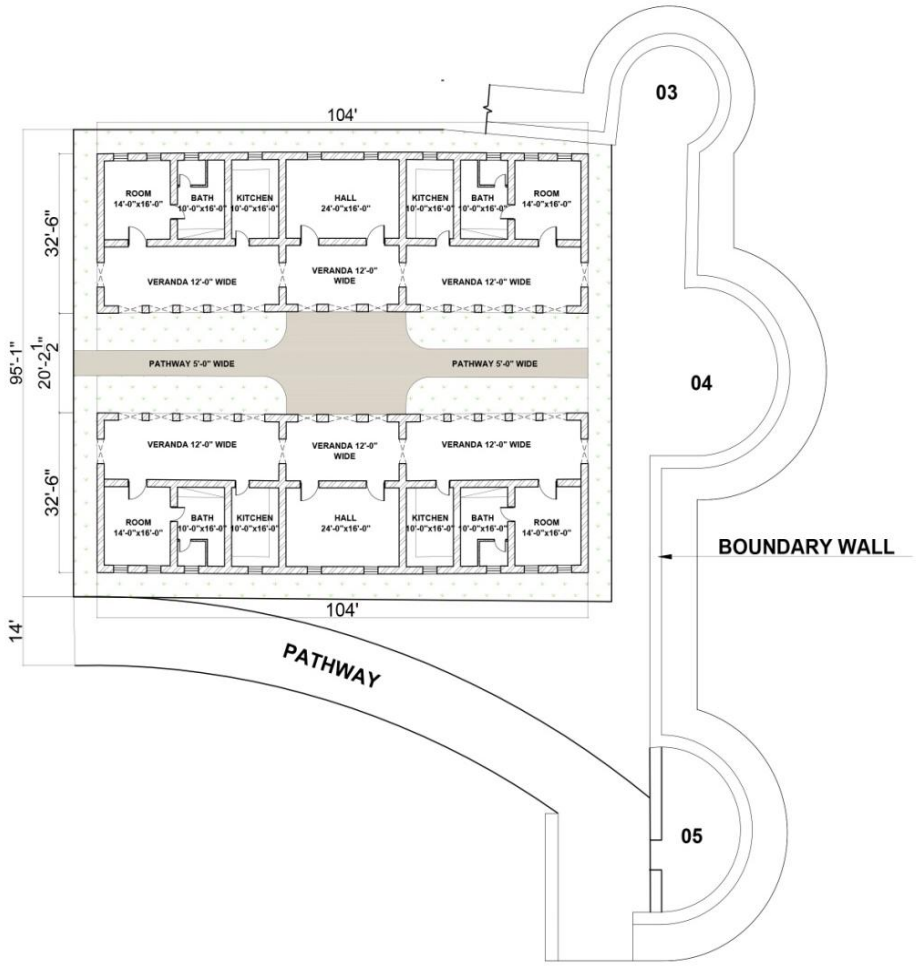


8. Baradari to be converted into a Coffee Shop and an observation point, being the highest point inside the fort



9. Underground barracks to be used as workers' residences and stores

PROPOSED PLAN OF SERVANT QUARTER AND STORE

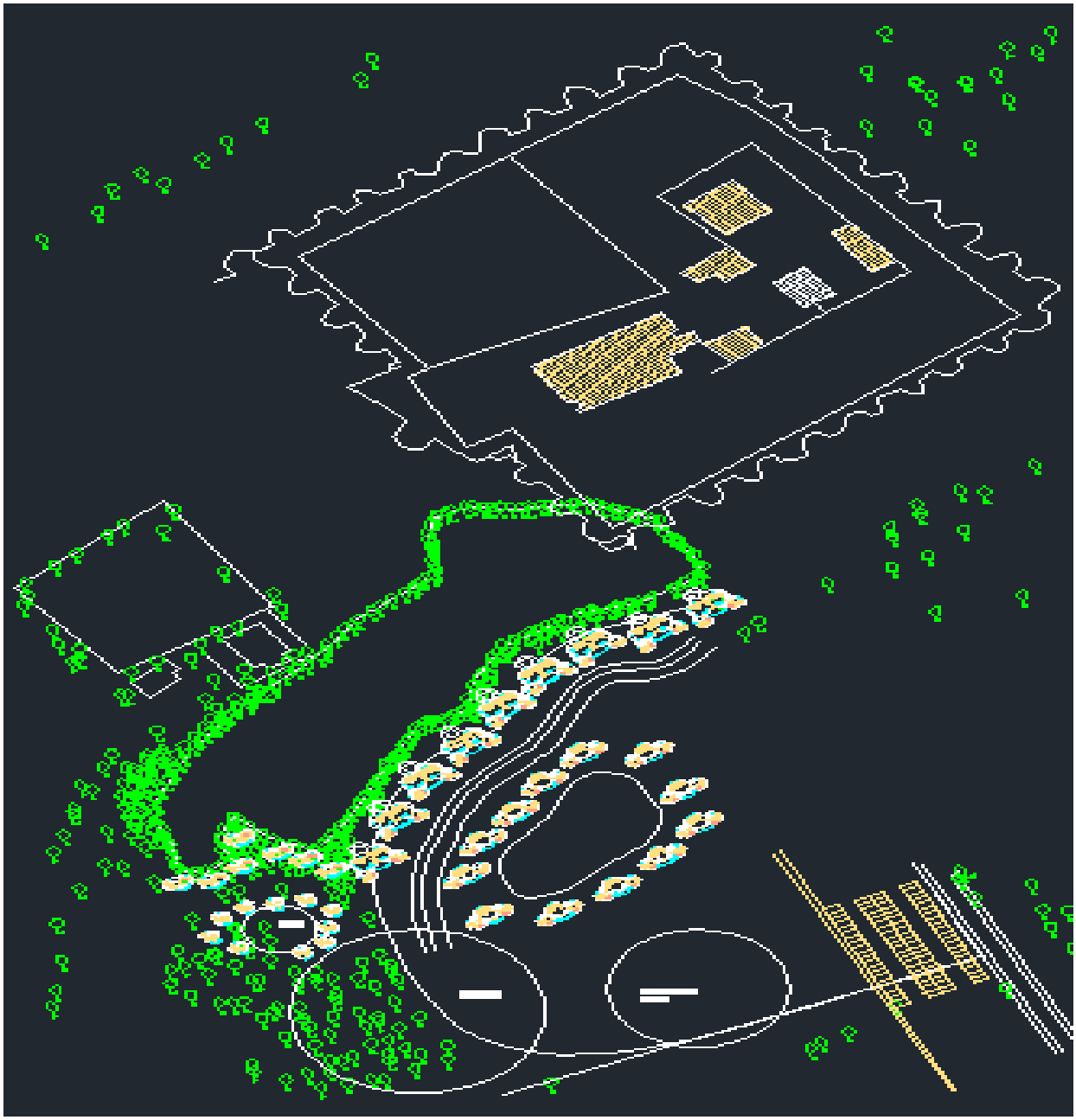


DESIGN BY: THE URBAN UNIT URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT (Pvt.)Ltd. The Urban Unit	**CLIENT:** TOURISM, ARCHAEOLOGY AND MUSEUMS DEPARTMENT Government of the Punjab	**NOTES:** 1.ALL DIMENSIONS AND ALL LEVELS ARE IN FEET UNLESS OTHERWISE NOTED.	**TITLE:** PROPOSED PLAN OF SERVANT QUARTER AND STORE AT DERAWAR FORT	**PROJECT:** DIGITAL MAPPING OF TOURISM SITES IN PUNJAB.	**ARCHITECT CONSULTANT:** PROF.MUHAMMAD ALI TIRMIZI **PREPARED BY:** MUHAMMAD HAMMAD ULLAH	**DRAWING NO:** A-22 **SCALE:** AS SHOWN **DATE:** MAY,2025

4.9. Derawar Desert Resort

During Jeep rally almost 100 drivers and crew participate while 100,000 spectators/tourists are expected to visit Cholistan desert and unfortunately no decent accommodation facility is available in the area. It is also a hard fact that jeep rally activity lasts only 3 days and total visit tenure is not over 7 days.

Architectural/archeological tourists are also very marginal and tourists do not stay within Greater Cholistan due to absence of good accommodation hence they make day trips from cities located in lesser Cholistan region.



4.9.1. Accommodation Calculations:

Following are the requirements:

- Total number of accommodations 50
- Royal Villas 10
- Standard Villas 10
- Cottages 30

4.9.2. Total no of Guests:

Royal Villas	5x4=20
	5x2=10
Standard Villas	5x4=20
	5x2=20
Cottages	10x4=40
	20x2=40

All accommodations are with sofa cum beds or roll up beds to expand the capacity as and when required.

Total 150 minimum up to 250 guests.

4.9.3. Parking Calculations:

- Ratio 1:1.5 according to number of rooms (so 1.5 x 50) 75 cars.

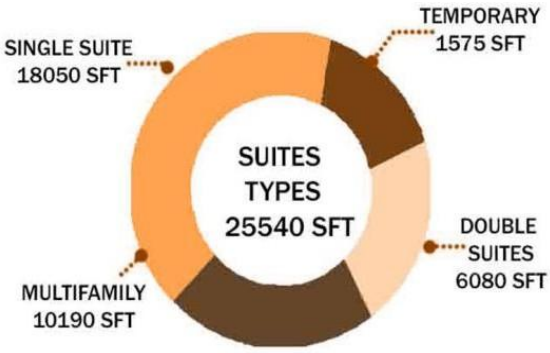
4.9.4. Employees Calculation:

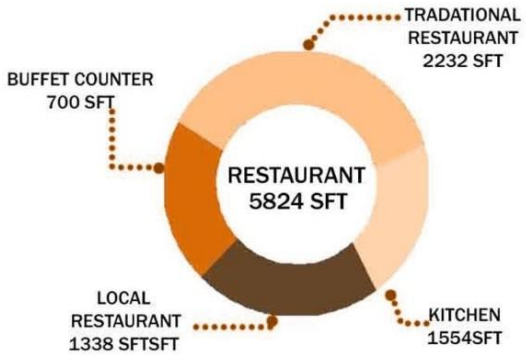
As per standards

- Total number of rooms/ 8 so 50 /8 = 7 persons
- Restaurant 75/8 = 10 persons
- Admin = 3 persons
- Security = 4 persons

4.9.5. Restaurant:

- 250 / 4 = 60-75 persons employee accommodation for 24 employees





4.10. Cholistan Tourist Trail

Almost a dozen forts stand in the Cholistan desert which could become part of Desert Safaris in two different loops, northern loop and southern loop respectively having a base camp and accommodation facilities at Derawar Fort Boutique hotel or at Derawar Desert Resort, but it is only possible if all forts are restored and made worth visiting with minimum level of facilities provided there.

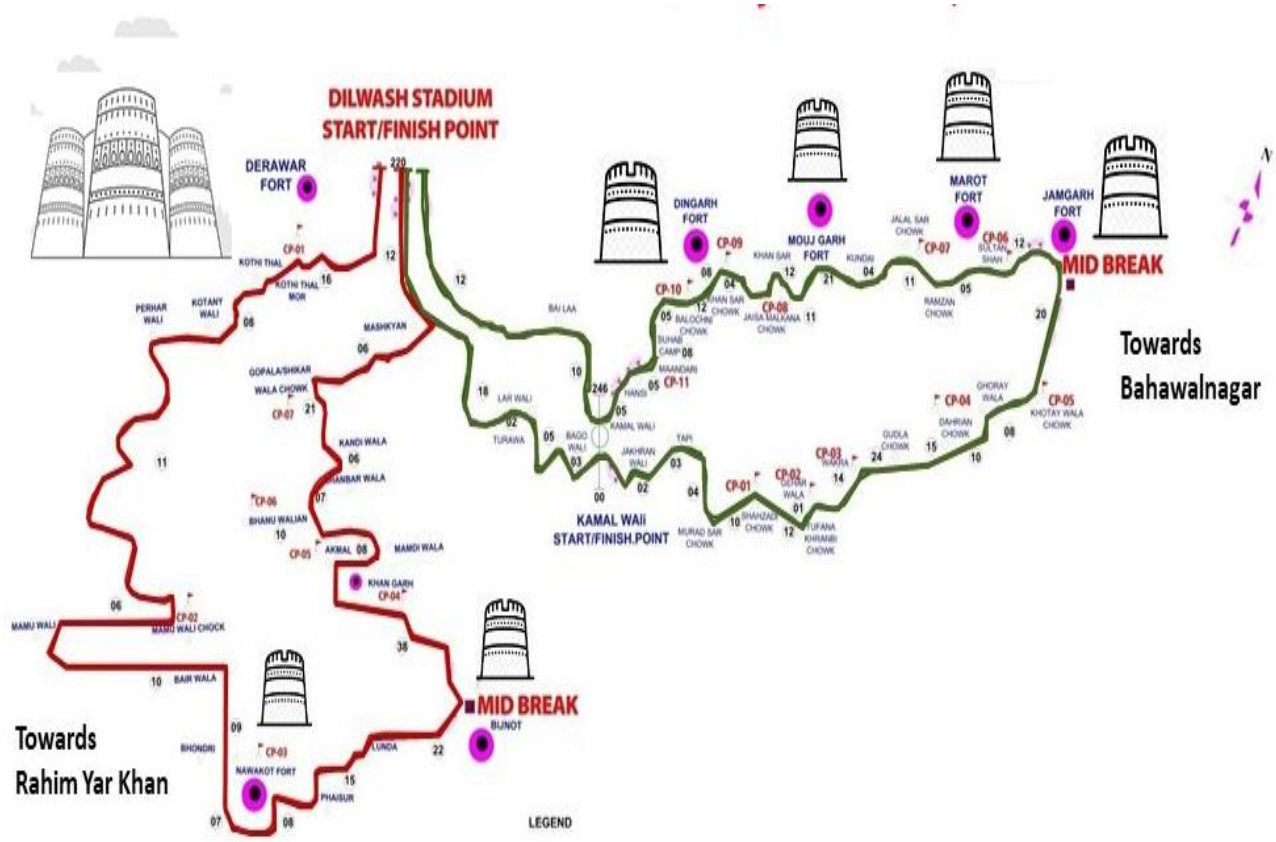


Figure 6: Two different Tourist trails in Cholistan

4.11. Rehabilitation of Abbasi Mosque Derawar

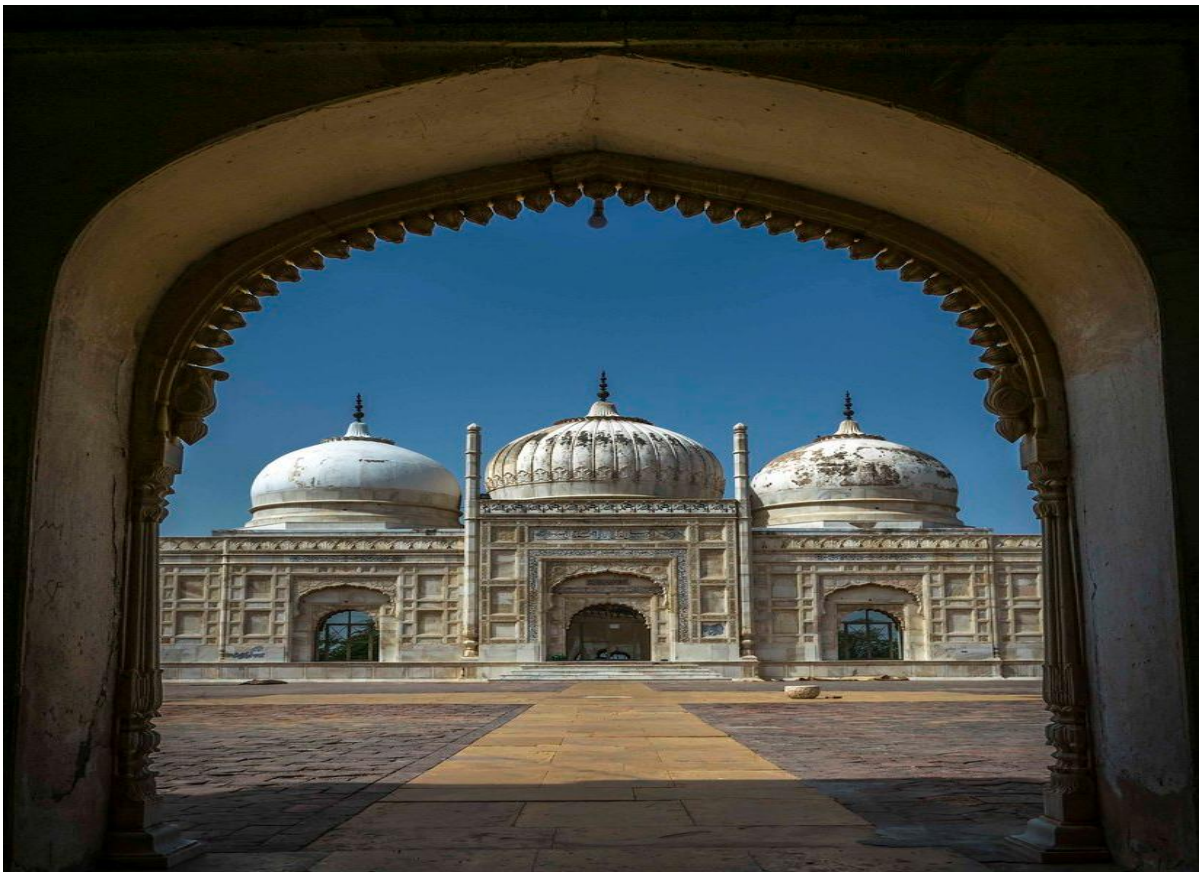
The Abbasi (Derawar) Mosque, sometimes called the Shahi Mosque, is one of the primary structures at Derawar, though it stands about 280 meters ESE of the fortress. As with all mosques on the subcontinent, Qibla direction is westward; hence, the mosque is approached from east. Unlike the fortress, which was built as early as the tenth century and continuously rebuilt, the Derawar Mosque dates from early 19th century. It was constructed in 1835 (some sources say 1849) by Nawab Bahawal Khan III (r. 1825-52). Although descended from the Nawab Amirs of Bahawalpur city, Muhammad Bahawal Khan III was the fifth ruler of the Princely State of Bahawalpur.

Figure 7: Abbasi Mosque Derawar

This fine mosque is generally described as a replica of Delhi's Jama Masjid, the city's congregational mosque, was constructed in 1650s by the Mughal Emperor Shah Jahan. By early-mid 1800s, the Mughal Empire was but a shrunken vestige of itself, its authority limited to the walled city of Delhi (and even there,

under strict observation by the British occupiers). Nevertheless, Mughal architecture remained redolent with associations of Empire and authority, such that the style retained its popularity throughout various Princely States and territories of the subcontinent. Even at the peak of Empire's prosperity, corresponding to the rule of Emperor Aurangzeb (d. 1707), there began a trend towards small, jewel-box style mosques, which were commonly described as Moti Masjids or Pearl Mosques. Such houses of worship were invariably made of white marble (accounting for their pearlescent appearance) and featured fine detailing and sumptuous materials. Moti Masjids were typically built within palaces at the heart of dense urban agglomerations (e.g., the Moti Masjid of Delhi, or its corresponding cousins at Lahore and Agra). Why such an elaborate and presumably costly mosque was built on the edge of the Cholistan Desert may seem puzzling the modern visitor. However, the presence of the Abbasi dynastic tombs in the immediate vicinity hints that the site was of critical importance to the dynasty. Indeed, the Nawab and his family maintained a substantial residence within the fortress's walls.

In its formal appearance, the mosque is a single-file, five-bay enfilade facing a vast quadrangle, the sahn, a design familiar from the Lodhi era (e.g., similar to the early Mughal or Suri-period Qila-e-Kuhna in Delhi). The twin minarets anchoring the corners are a motif that first appeared at the Wazir Khan Mosque in Lahore and became de rigueur for mid-century Jama Masjids. As with Delhi's Jama Masjid, the domes are set on high drums and extend distinctively into the sky. There is no attempt to "hide" the domes behind upper portions of the pishtaq and the roofs of flanking bays, as was preferred at early congregational mosques, such as that at Fatehpur Sikri.



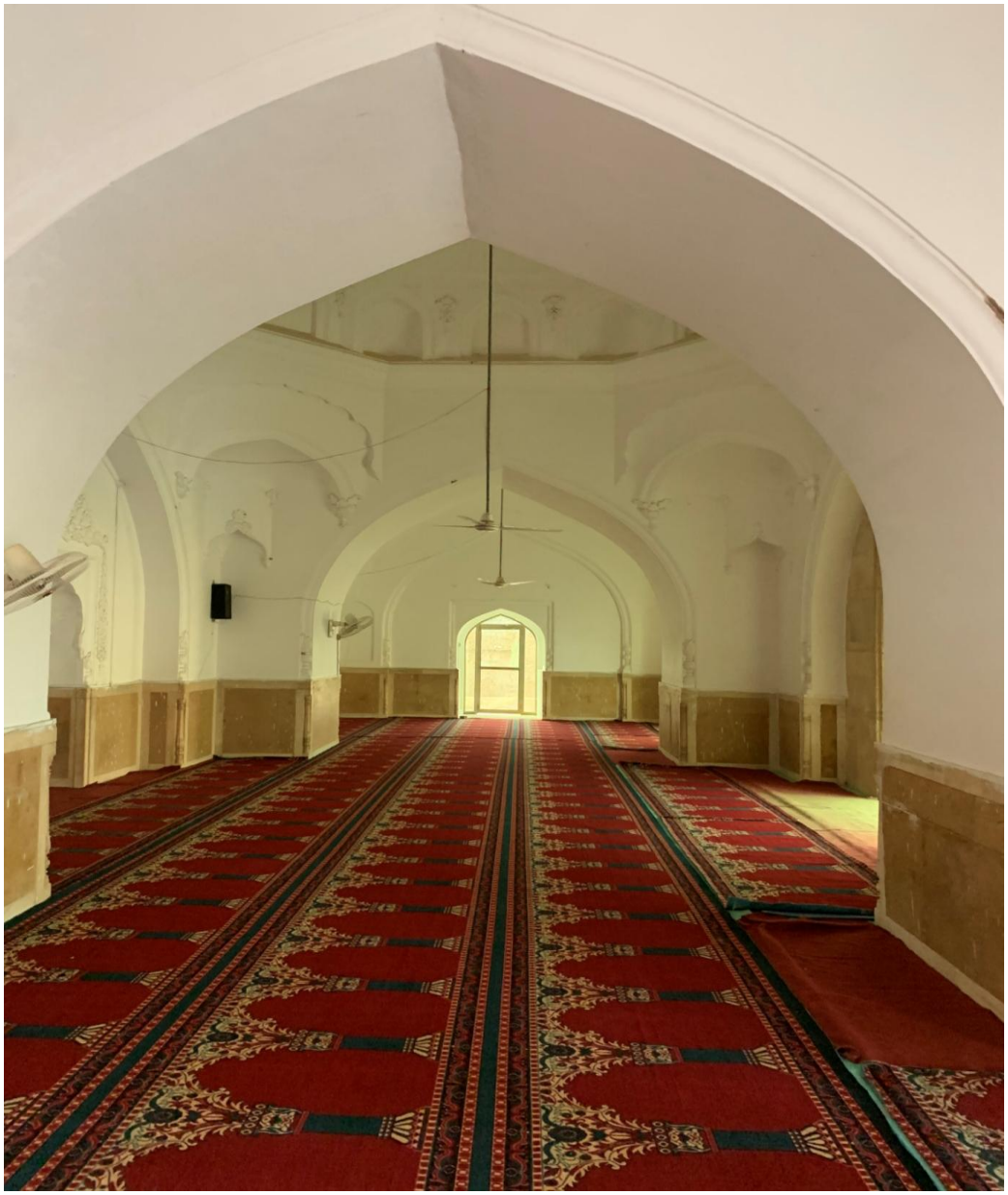
One design peculiarity is small size of the portals compared with the overall scale of facade. A tendency towards small openings is found in many 18th-century mosques in north India, such as the Sunahri mosque (from about 1744-45) or the Qudisya Bagh Mosque, also in Delhi (c. 1748). But at Derawar, the diminutive size of the openings vis-à-vis the height of the facade is rather unprecedented.

The architects skillfully filled the otherwise vacant space around the five openings with a framework of recessed niches surmounted with dedicatory plaques. The treatment of central portal is exquisite, comprising two nested cusped arches surrounded on three sides with a calligraphic frame. Two additional sets of panels are set atop the inner archway, while another band of calligraphy is set above the three-sided outer frame (these comprise the ninety-nine names of Allah, and various Quranic verses). As a finishing touch, the flame-shaped merlons on the cornice are signed with a series of short repeating inscriptions: "O Allah, O Muhammad."

Another unusual and possibly unique feature is the jharokha window on the west facade. It marks the location of the mihrab (the niche facing Mecca) and is accessible from the interior. Almost uniformly on the subcontinent, the west facades of mosques are minimally decorated as they constitute the qibla wall; there is rarely a need for visitors to approach from that direction. However, as the Abbasi Mosque is located east of fortress, the architects may have felt the need to provide some ornamentation, as that side of mosque faces the fortress. Although it is unclear precisely how the jharokha was used, one imagines that the imam may have stood there to greet the Nawab as he emerged from the palace and made his way to the mosque for Friday prayers.

An embellished grand gate stands towards east side while a small opening also exists on south side. East gate is very typical to mosques of the era- a very special feature of Mughal style. Historically, the main entrance housed servants' quarters and the lower portion comprised a hostel and a library.

Abbasi Mosque features a 4.9-metre-wide (16 ft), 39-metre-long (128 ft) prayer hall and is crowned by three bulbous marble domes that dominate the surrounding dunes. Two octagonal minarets flank a tri-arched façade carved in low-relief Quranic calligraphy, while marble jharoka balconies evoke a late-Mughal aesthetic.



Unlike the adjacent fortress, the mosque remains in fine fettle. It stands as testimony to the artistic sensibilities of the Nawabs and their appropriation of Mughal-era forms to declare themselves as legitimate successors of the Mughals, at least in their corner of the former Empire.

SITE PLAN OF ABBASI MOSQUE
SITE PLAN
SITE COVERED AREA = (38,110 Sq.ft)
166'
202'-8"
MINAR
MAIN HALL
DOME
MEHRAB
PASSAGE 6'-0" WIDE
PASSAGE 6'-0" WIDE
OPEN TO SKY
ENTRANCE 1
ENTRANCE 2
DESIGN BY:
THE URBAN UNIT
URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT (Pvt.) Ltd.
The Urban Unit
CLIENT:
NOTES:
ALL DIMENSIONS AND LEVELS ARE IN FEET
SEMINARS
UNITS OTHERWISE NOTED.
TITLE:
SITE PLAN OF ABBASI MOSQUE
AT DERAWAR FORT
PROJECT:
DIGITAL MAPPING OF TOURISM SITES IN PUNJAB.
ARCHITECT CONSULTANT:
PROF. MUHAMMAD ALI TIRMIZI
PREPARED BY:
MUHAMMAD HAMMAD ULLAH
DRAWING NO:
DATE:
SCALE:
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4.12. Rehabilitation of Royal Necropolis Derawar

The royal cemetery of Derawar is the eternal resting place of ruling family of the former Muslim princely state of Bahawalpur and holds historical significance as it contains the tombs of eight rulers of an independent state in one location. Its architecture is a blend of local and Islamic styles, reflecting the splendor of the early Muslim era, and features two contrasting styles: flat-roofed tombs and domed mausoleums. The main hall showcases customary local design with blue and white glazed tiles, while seven domed tombs, including two remarkable marble ones reminiscent of the Taj Mahal, stand out. The most significant grave is that of Katharine, the wife of Nawab Sadiq V, situated at the back of the main hall and surrounded by a delicate marble screen.

It is believed that royal cemetery stands right on the ruins of old graveyard belonged to early Islamic era. Located in the sandy terrain, this funerary proved to be the most enigmatic in the entire region. The foundation of cemetery was laid down by the Nawab Mohammad Bahawal Khan Abbasi-II (1772-1809). He moved the center of royal family as well as their dead ones from Bahawalpur to Derawar owing to the consisted attacks of Durrāni rulers of Kabul on Bahawalpur. He initiated this cemetery to bury his elder brother who died during his lifetime and was the first one engraved over there. Its initial structure was in form of an ironed projection (Chhajjah). In the subsequent period, there occurred some slight changes. However, the present edifice of royal cemetery was constructed by Sir Sadiq Mohammad Khan Abbasi-V (1924-1966).

He actually wanted to fabricate such a lofty edifice, which may speak for a long time with a mute tongue of his master's high magnanimity. On Islamic monuments particularly on tombs and mosques, the pictorial art styles are disallowed rather the art of calligraphy and floral patterns have significant place as alternative of the former. Based on local traditions, the decorative style of Derawar cemetery makes an excellent contribution to Islamic ornamentation.

4.12.1. Historical Perspective of Necropolis

Derawar is an ancient settlement located in Cholistan, which is a part of Former Muslim State and present division of Bahawalpur (Punjab). Historically, Cholistan tract is better known and has not always been arid. Once it was populated and cultivated by an old river, locally known as Hakra. The site of Derawar is located

on the northern edge of dry bed of Hakra. In archaeological accounts, it belongs to the Hakra Wares phase of Indus Valley Civilization.

During medieval period, Derawar was well known for its magnificent fort that was founded by Rā wal Dev Rāj in the 834 A.D. (909 Sambat). In 18th century A.D., Sindhi warriors Daudputras landed in this region and obtained a Jagīr of Choudarri from Mughal governor of Multan where they established a new town being their capital that was the expression of their Muslim identity as they named it "Allahabad". This jagīr was fertile being located on the eastern bank of Indus and the Punjab. Gradually, they extended their control over the surrounding area and knit them into one political unit. They apprehended the fort of Derawar in 1733, which was a stronghold of Bhatti rulers of Jaisalmer. This possession gave the Abbasids a powerful stroke to the defense of Northwestern frontiers of the State for all times to come. Derawar very soon turned into a hub of political, social and cultural activities of the State. But, Rāi Singh, Raja of Jaisalmer regained Derawar with the mediation of Mughal governor in 1747. Nevertheless, Rāi Sing voluntarily turned in Derawar back to Nawab Mubarak Khan in 1759. In return for this possession, the Nawab had to pay half share in the taxes at Derawar.

As Derawar slipped away, the Nawab Bahawal Khan founded a city Bahawalpur as new capital because it stood on a very ideal location. It was situated right in the center of their possessions and viable to watch their all territories while first capital Allahabad was at a distance on the westwards. With the establishment of Bahawalpur City, Daudputras formed the region into a State and all political activities moved towards this new capital. The Abbasids made great strides to flourish their new abode. Bahawalpur also became the burial of royal family. Actually, the founding father of the State, Mohammad Sadiq Khan Abbassi-I (1727-1746) engraved in Shikārpūr Sind that was former abode of Daudputra Abbasids while two rulers; Amir

Bahawal Khan I (1746-1749) and Amir Mubarak Khan (1749-1772), along with some other family members were enshrined in the Malook Shah graveyard at Bahawalpur.

However, the Afghan attacks on Bahawalpur between the periods from 1785 to 1788 caused to move their cemetery in Derawar during last decades of 18th century. Taimur Shah (1747-1793), Afghan sovereign vandalized the Bahawalpur city and turned it into ashes. Therefore, the first precautionary measure of Daudputras was to secure their three priorities; their treasure; their woman; and their dead ones. Against any disruption by antagonists, they had already moved first two primacies to Derawar, that became center of their military strength and therefore, was free from collateral threats so the royal cemetery was also established over there at a distance of 500 yards from the Fort Derawar. Accordingly, Derawar assumed a political worth mainly due to its grandiose fort that was the hub of political and administrative activities and at present being the interment of former royal family. However, royal cemetery is an heirloom of Abbasids who kept it lock and watched by two guards. The construction of the present building of cemetery started on 5th January 1934 and completed on 22nd September 1952.

The main hall is the nucleus of cemetery as eight rulers of former Muslim State are buried. Their graves are built in an array. The first grave from the eastern side is the burial of Jindwada Abbasi, brother of Bahawal Khan II and died during his lifetime while Bahawal Khan II, was the first ruler buried in the royal cemetery. Sir Sadiq Muhammad Khan-V originator of the present edifice was the last Nawab of the State enshrined over there. He breathed his last on 24th May, 1966. After partition his services and financial contribution for the sake of new country, deserve a separate and more detailed treatment. He annexed the Bahawalpur State

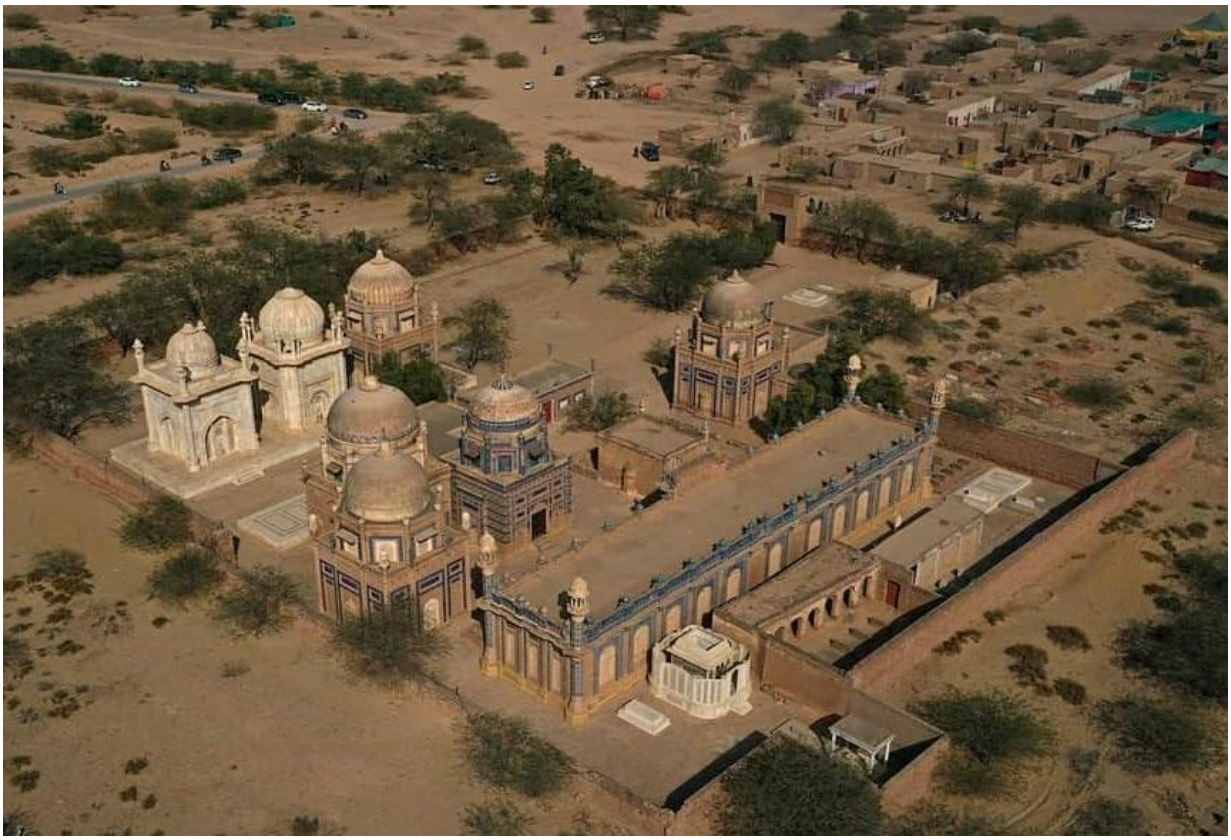
with Pakistan without any condition. He refused to accept any sort of material advantage offered by India and turned down many offers made by Jawahir Lal Nehru. The edifice of graveyard gives us an insight of his grace, his piety, love for beauty and art. This is an expression of his refined nature from a strong ruler to an obsessive lover for architecture. In the last grave, Amir Mohammad Abbas Khan, the eldest son of Sir Sadiq Khan V who was the former governor of Punjab. He was born on 22 March 1924, and died on 14th April, 1988. The space for two further members of royal family is specified on the royal chamber in west of hall; Amir Salah Uddin and his eldest son Bahawal Khan. Adjacently, four kids of royal family are buried in this marvelous hall. They are: Saḥibzāda Fateh Khan the son of Bahawal Khan-IV, Rahimyar Khan the son of Sadiq Khan-IV, Phulan Khan grandson of Bahawal Khan-III and Abdullah Khan, son of Sir Sadiq Khan-V.

4.12.2. Architecture of Necropolis

Derawar cemetery comprised the total area of 289 x 167 feet with a single entrance from the eastern side. The main gate is made of wood, measured by 12.3 x 8.9 feet. The graveyard is a multi-structured edifice. It contains main grave hall with flat roof, seven tombs with dooms, and three graves under a pavilion. The backyard of main hall is also crowned with a grave, elegantly wrapped in marbled screen. Some other members of ruling family are engraved in front open yard. The entire structure of graveyard fulfills the aesthetic aspect and looks pleasant to the eye. The architecture of Royal graveyard is inspired by the funerary memorials of Uch and Multan, which present an amalgamation of Iranian, Central Asian and local elements. In this region, foreign style of architecture is introduced through constant relations with Central Asia started with the arrival of Ghaznavids in the Subcontinent. Moreover, in 13th and 14th CE, Iran and Central Asia came under dark clouds caused by the Mongol hordes. A large population, including artisans, moved to southern parts of the Subcontinent. Accordingly, funerary buildings were embellished with a new

style of architecture. As Ahmed Nabi Khan posits that the soil of above mentioned areas was the first and foremost that absorbed Iranian and Central Asian style of architecture. Sheikh Khurshid named it as Seraiki architecture.

This style of architecture is rooted in central Asia. It was however first developed in Seraiki speaking area of the Gomel valley and even in certain areas of Baluchistan like Sibi and Kharan, maturing finally at Multan.



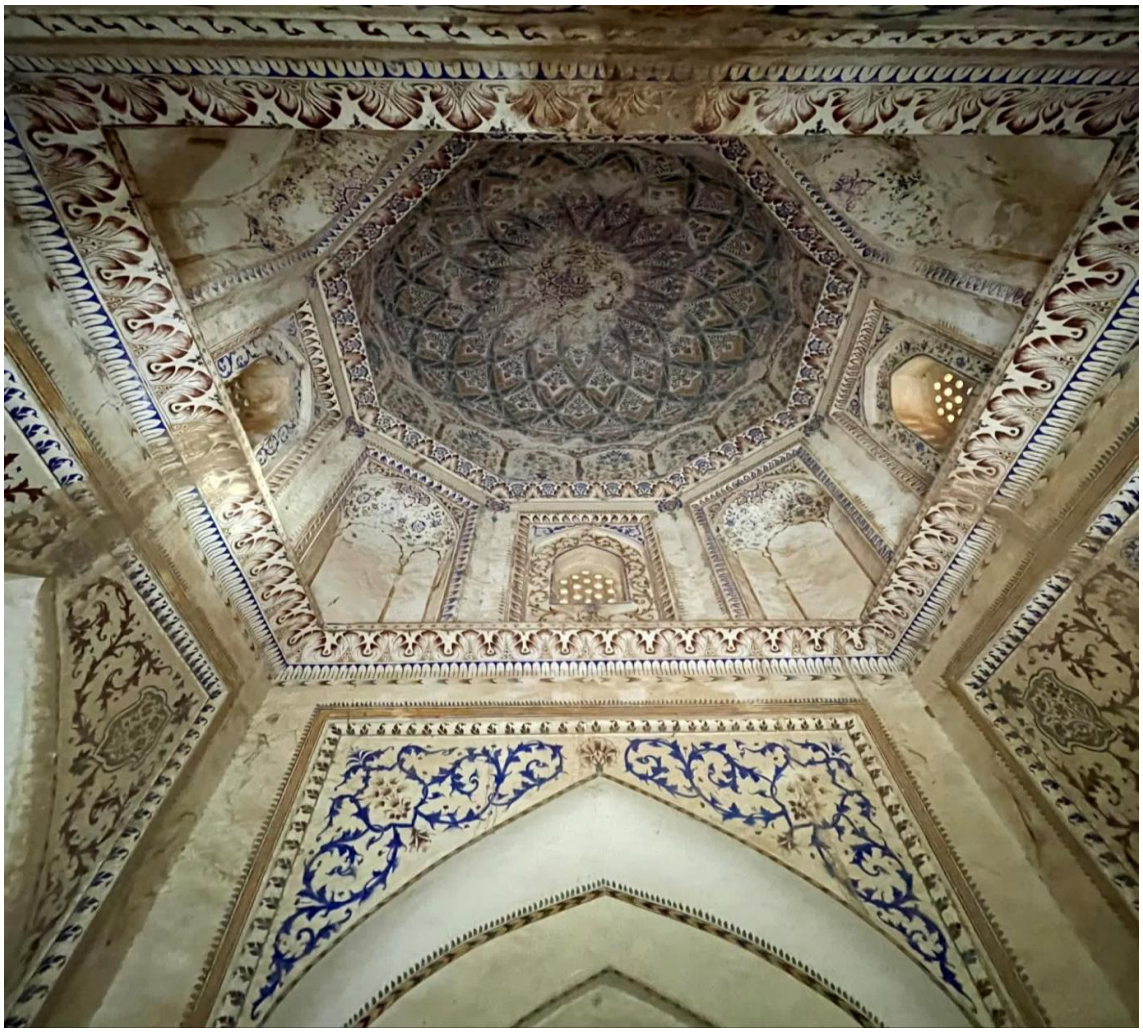
The architectural design of the royal edifice has two different categories: flat roofed tomb and tombs with dooms.

Flat Roofed Royal Mausoleum. The main entrance of grave hall has been flanked by two doors on each side, which are a fine model of wood carving. A stripe of blue tiles in vertical shape, imprinted with the Quranic verses of Ayatul Kursi, embrace the door. On the parapet of hall, the ninety-nine names of Allah are printed on blue tiles, in calligraphic style.

The roof is beautified with twenty-eight cupolas. Four shafts at each corner of hall rise high and taking the shape of Minarets with cupolas. The conception of a wonderful memorial is presented in its finest and beautiful expression in the interior of grave hall. The Royal Chamber is gorgeously ornamented with

traditional Islamic nonfigurative art, measured by 118 x 18 feet. Almost every inch of interior is covered with decoration. The ceiling of the hall is adorned with the flat glass. Mirrored roof embellished with a border of brittle wood with conventionalized floral scrolls and carefully arranged in harmony. Actually, ceiling decoration with glass is a Mughal tradition.

Walls are garlanded with painting on floral pattern. Plants have curves style of leaves and are ornamented with the Iranian style. There are bouquets to suggest the ever-blooming vases of flowers symbolic of immortality. Colors and motifs are infused in a brilliant form. Glazed tiles of blue and white colors have been used for the frieze of four-sided wall. Wall painting is an Iranian tradition, which reached in its full gloom during Mughal era, particularly in the period of Jahangir. The first use of floral patterns in the Bahawalpur region was started in the tomb of Bi Bi Jindwādi (lady of long life) at Uch. Animated motifs of the tomb of Bi Bi Jindwādi are most illustrative of this phenomenon. This tomb was constructed by the prince of Khurasān in 1493.



Likewise, enameled tile work (*Kashikari*) is lavishly used throughout the building. This type of decoration is well-suited to the desert environment, as it can withstand extreme climatic conditions such as intense heat, heavy rains, and cold temperatures. The choice of blue for the tile work in graveyard, displayed in varying shades of cobalt blue, indigo, and turquoise, symbolizes nobility, truth, and fidelity. Tile work originated in Iran and was later adopted across the Islamic world. The earliest known example of Iranian-style blue and white tiles in the region is found in the tomb of Baha-ud-din Zakaria in Multan, dating from 1264 to 1286.

The floor of main chamber features a geometric pattern made with white marble. Each cenotaph measures 7.9 feet in length and 3.11 feet in width and is enclosed with white marble, accented by vertical strips of black marble While the graves vary in style and design, each cenotaph bears an inscription of *Surat Al-Ikhlas*, reflecting the deep monotheistic belief of those buried there. All cenotaphs are covered with white cloth sheets, except for the grave of Sir Sadiq V, which is draped with a green cloth. At the head of each grave stands a white marble column resembling a tombstone. Nine of these columns are of equal height, measuring 4.7 feet, while one is taller, at 5.4 feet. These columns are beautifully carved with floral designs on marble tiles, similar to those found in the tomb of Yousuf Gardesi in Multan. The exterior of the royal grave hall is a flat-roofed, rectangular structure.

The flat-roofed tomb is an indigenous architectural tradition, indirectly inspired by the rectangular tomb of Yousuf Gardesi (d. 1136 A.D.) in Multan. Similar flat-roofed tombs can be found in the shrines of Jalal Uddin Surkh Posh (d. 1291 A.D.), Jahaniya Jahan Gasht (d. 1383 A.D.), and Sadruddin Rajan Qatal (d. 1424 A.D.) at Uch. These tombs of saints were later renovated by Nawab Bahawal Khan III in 1845 and Sadiq Khan IV in 1882, respectively. On the outer side of main hall, there are twenty-eight windows: nine made of white marble and remaining constructed with red sandstone. All the windows are fitted with latticework painted white. Verses from *Surah Yasīn* are inscribed on a strip of blue tiles surrounding the wooden windows. These Qur'anic verses are deeply religious in essence and philosophical in nature. Traditionally recited during times of death or crisis, their inclusion in the tomb's decoration has been a thoughtful and meaningful choice.

Domed Mausoleum: The domical roofing on memorials in the Sub-Continent was made for the first time intomb of Muhammad bin Ḥaroon in 854 hijra, at Bela in Baluchistan and Khalid bin Walīd‟s tomb at Kabirwāla in Khanewāl district. In southern Punjab, the first doom was found on the tomb of Bahauddīn Zakaria (1262 A.D) at Multan. In Bahawalpur region, the mausoleum of Shah Gardez at Adam Wahān, near Bahawalpur, was considered the first doomed tomb. It is composed of mud brick and burnt bricks. External base of dome is decorated with a frieze of glazed tiles, in blue and white with painted word of Allah. Its date and other information are not known, however; Ahmad Nabi Khan considers this tomb to be forerunner of the tomb of Bahauddīn Zakaria. The royal cemetery has a bunch of seven domed-mausoleums, which presents a very welcome contrast in the architectural accomplishment. The female members of royal family are buried in the enclosed tombs with domes. It is a tradition of royal family that names of female members are not to be disclosed for public. Besides, no male can enter in these tombs except their family members because these women are considered in veil even after their death.

Tomb1

From the eastern side of cemetery, first tomb is the burial of mother of Sadiq Khan-IV. It is a simple brick structured tomb on a square plan. Its second story has octagonal shape with seven windows, which are covered with cemented lattices. On the outer border of lattices, there are strips of blue tiles having Quranic verses as well as floral designs. The drum of its onion shaped dome has lost its paint but other structure is maintained. Eight cylindrical turrets made of burnt bricks wrap it. The parapet has a simple border of cut bricks. The wooden door has also a border of blue tiles imprinted with Quranic verses.

Tomb 2

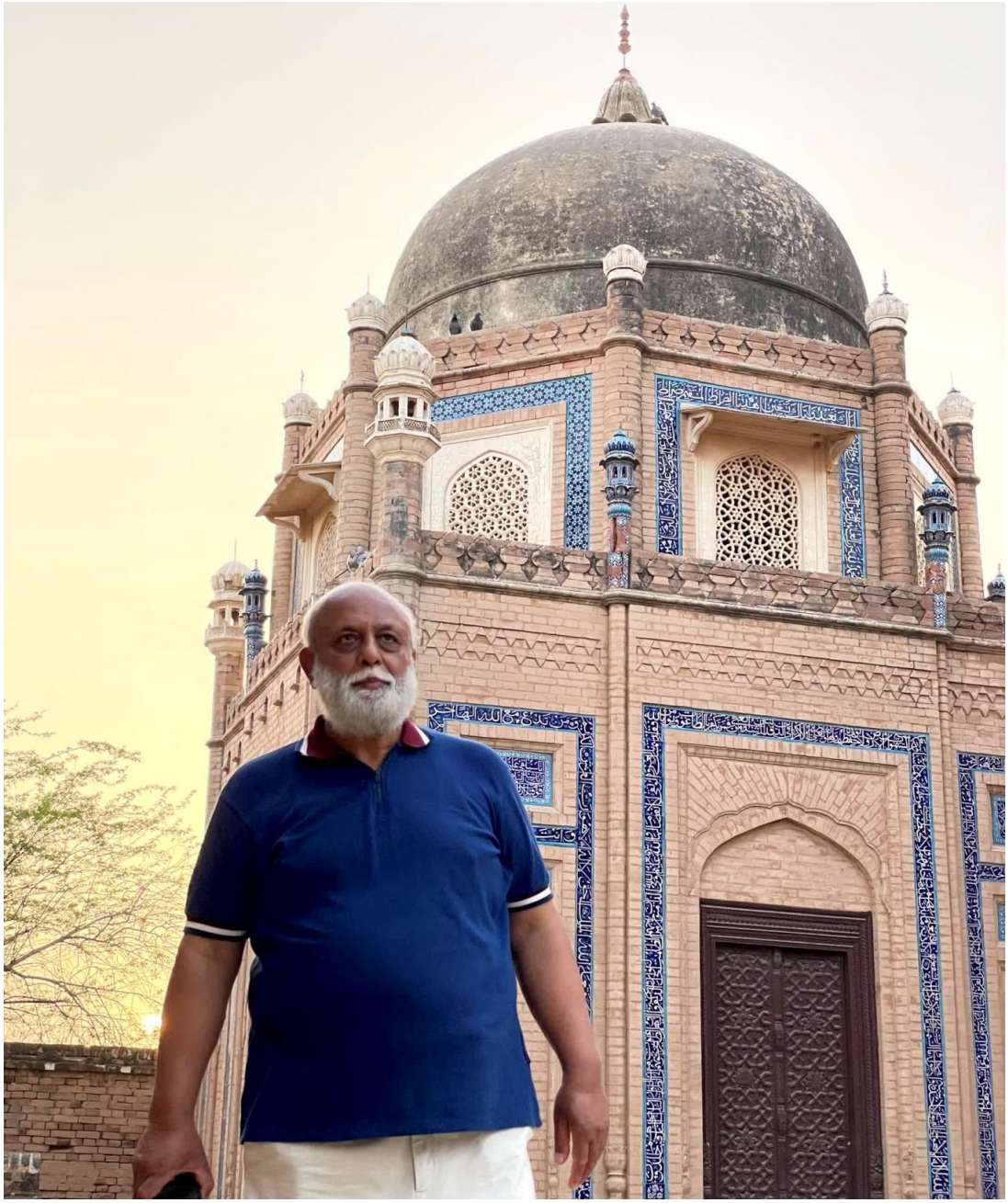
This is the tomb of wife of Sadiq Khan IV, located on the eastern side near outer gate. The exterior is adorned with square-shaped glazed tiles, each decorated with intricate designs featuring pottery, fruit dishes, pots,

and trays in the typical Multani style. The structure is richly embellished with blue and white mosaic work, appearing as a grand repository of decorative panels. The use of *faience* mosaics is a hallmark of traditional Multani craftsmanship, first seen in the tomb of Baha-ud-din Zakaria in Multan. Six bands of blue tiles encircle the tomb, adding to its visual richness. The mausoleum also features three wooden lattice screens in Central Asian style, placed on the exterior windows.

Tomb 3

This is funeral of the mother of Sadiq Khan-IV. She has credit to offer the British to take over the administration due to the perplexing situation prevailing in the State in 1866. She died in 1878 AD. Her tomb is standing on square plan. Its second floor held the octagonal shape, and decorated with blue tiles. Its dome

is embellished with blue tiles, which are decaying with the passage of time. Turrets have glazed tiles. The mausoleum is constructed of burnt bricks of excellent quality. Wooden door is decorated with different Quranic inscription.



Tomb 4

In this tomb the mother of Sadiq Khan-V is lying. The tomb is standing in front of main hall, with plain dome. It has octagonal upper storey with eight windows, beautified with lattices. The walls are adorned with well textured cut bricks. Its facade has a band of red bricks having triangle shape used into different directions. Actually, this pattern has been derived from Hindu tradition, according to which the triangle is the

representatives of the elements of water, air, fire, and earth. A strip of white and blue tile with floral pattern is embracing the windows and door.

Tomb 5, 6&7

Three mausoleums are situated on the north of graveyard, in the same line, having the same area of 76.8 feet. The other female members of royal family are enshrined over there. One tomb is made of red brick, with decorative details of blue tile and cut bricks as well. It has upper storey and its dome is strengthening by eight turrets, which are round in shape and slightly tapered toward the top. The other two tombs are marbled and placed on inlaid marble platform. Both marbled tombs create a very fantastic and striking ambiance. The one marble tomb has blue tiled floor. Its windows are embellished with colorful glass in green, blue and yellow. The first marbled tomb in the Subcontinent was that of Saleem Chishti constructed in 1572 CE.

These tombs are beautified with equal twin columns on each corner of square. The top of all domes of graveyard is crowned with a complex finial, placed on the base of lotus. The use of glass in all these tombs is definitely for the purpose of decor as well as to save the interior from dust as locating in the desert. The domes of all tombs are directly placed over the walls and have melon like Samarqandi style.

Backyard

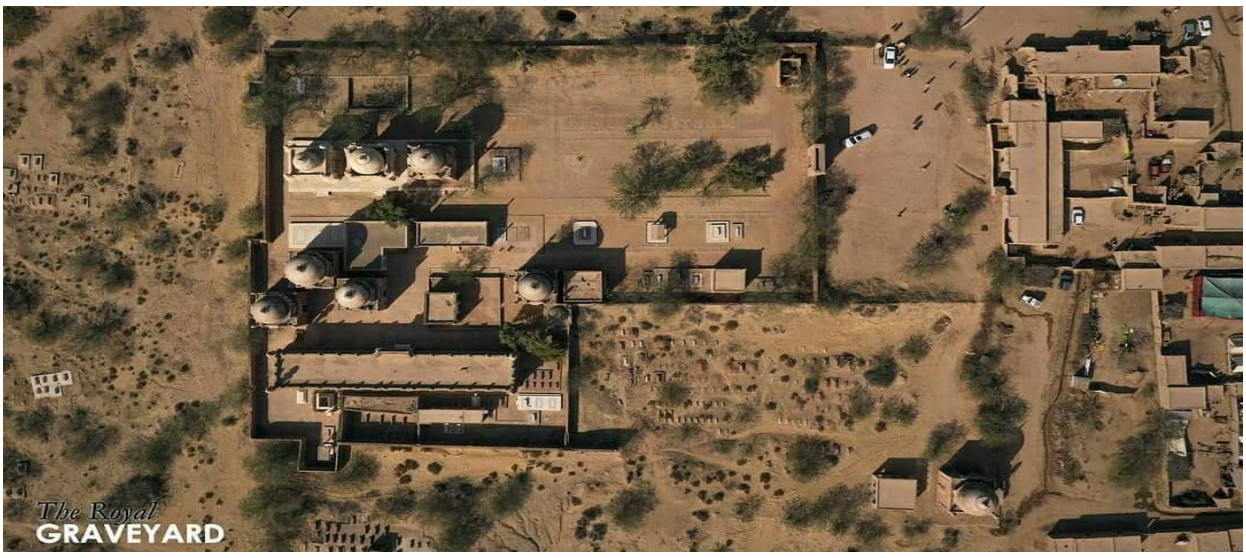
The special feature of this graveyard is its impressive backyard. On the backside of grave hall, there is a unique and fabulous tomb of the British wife of Sadiq Khan-V, named Katherine". She was the cousin of Queen Victoria and aunt of Mother Queen Elizabeth. She embraced Islam and renamed as Fatima. Field postulates her eternal feelings for Nawab in these words;

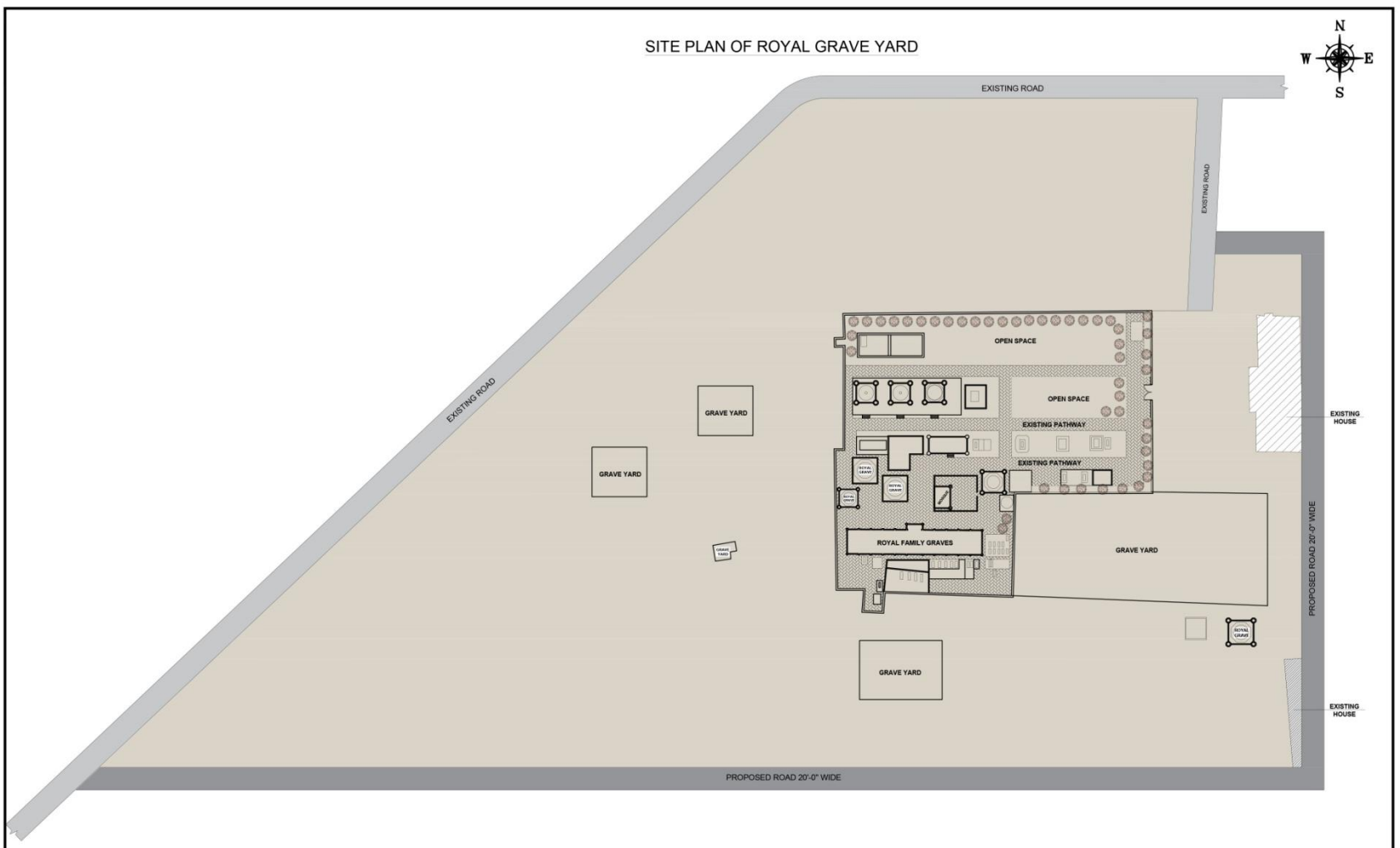
"Outside and around to the south stood another gleaming white tomb with a marble tracery retaining wall, giving the effect of white lace. Here lay the remains of the present Ruler's English wife who begged to be buried "at his feet" since, by tradition, she could not be inside the main mausoleum. She was just outside near the space provided for the ruler when he dies."

Her tomb comprises an area of 57 feet in oval with carved melon like roof. It has black and white marble floor with checkerboard pattern, which can be understood in terms of its illusionary effect. A beautiful marble screen with the height of 7.10 feet surrounds the cenotaph. The screen is consisted of the most delicate and subtle lattice of imperial splendor. It has a sentimental appeal for the spectators and creates loveliest phenomena. The use of marble screen is induced in the subcontinent, on main entrance of Khanqah Faridia Pak Patan by Allauddin Khilji (1296-1320). In addition, the tomb chamber of Nizamuddīn Auliya is also flanked by marble lattice screen. The same screen is used in the tomb of Saleem Chishti (1572) at Fatheh Pur Sikri. Nevertheless, the use of marbled screen in full bloom was accumulated in Taj Mahal of Agra where the cenotaph of Shahjahan and Mumtaz Mahal, were wrapped in elegant marble screen, but with the difference of lattice.

On the right side of Katharine's tomb, there is a marbled grave of the daughter of Sadiq Khan-V. On the opposite of Katherine's tomb, there is another grave of wife of the Nawab Sadiq-V in open area. On the right side of yard, there are three graves with square pavilion and one grave in open yard. Some other cenotaphs have canopy structure.

It is widely understood that wood was one of the earliest materials used in human artisanship. In Islamic architecture, woodcarving became an essential decorative element. However, in the Derawar necropolis, woodwork plays a subdued role due to the perishable nature of wood in the hot and arid climate of the plains. Woodwork is limited to doors, windows, and, to a lesser extent, the ceilings, where it appears as delicate decorative frames. Despite its limited use, the existing wooden elements are exquisitely carved with floral motifs by the skilled artisans of Sitpur. Even the door frames feature intricate floral patterns, showcasing a remarkable sense of rhythm and craftsmanship. In contrast, metal has a minor role in graveyard's architecture, appearing only in the form of knobs, locks, door pulls, and dome finials. The primary decorative materials used throughout the cemetery are glazed tiles, cut bricks, and marble.





DESIGN BY: THE URBAN UNIT URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT (Pvt.)Ltd. The Urban Unit	**CLIENT:** TOURISM, ARCHAEOLOGY AND MUSEUMS DEPARTMENT Government of the Punjab	**NOTES:** 1.ALL DIMENSIONS AND ALL LEVELS ARE IN FEET UNLESS OTHERWISE NOTED.	**TITLE:** SITE PLAN OF ROYAL GRAVEYARD AT DERAWAR FORT	**PROJECT:** DIGITAL MAPPING OF TOURISM SITES IN PUNJAB.	**ARCHITECT CONSULTANT:** PROF.MUHAMMAD ALI TIRMIZI	**DRAWING NO:** A-17
					PREPARED BY: MUHAMMAD HAMMAD ULLAH	**SCALE:** AS SHOWN / **DATE:** MAY,2025

5. Proposed Project Stages and Costing

The Derawar Fort Master Plan Project is designed to be divided into three stages:

5.1. Proposed Project & Stages

5.1.1. Emergency Plan

- Stabilization of fort structure, immediately before monsoon 2025

5.1.2. Short Term Plan

- Restoration of Fort Outer Boundary Wall
- Construction of Ring Road Around Fort
- Biodiversity Restoration:
  - Restoration of Derawar Lake through Solar-Powered Deep Well Irrigation System
  - Removal of Invasive Vegetation (large trees and bushes)
  - Establishment of Grass Cover to Strengthen Topsoil of Fort
- Rehabilitation and Interpretation of Derawar Fort's Underground Tunnel Network

5.1.3. Medium Term Plan

- Conversion of Nawab Residence and his secretariat into a living museum (Already Restored)
- Conversion of Side Pond into Exclusive Sitting Space
- Conversion of Haram building into Boutique Hotel
- Barracks to be used as Vernacular Art and Craft Display and workshops
- Conversion of Middle courtyard and back Verandah into a specialized Vernacular restaurant serving some of the popular contemporary cuisine of Cholistan as well
- Conversion of Grain Store Outside Main Fort into information center for Cholistan and Proposed Tourist Center
- Front Lawn to be leveled, water proofed and restored to a garden
- Conversion of Baradari into a Coffee Shop and Observation Point
- Underground barracks to be used as worker's residences and stores
- 200 kW Solar Power System for Derawar Fort
- Development of Derawar Lake Area Total Area: 87,352.544 sq. ft. (approx. 2 acres)

5.1.4. Long term Plan

- Derawar Desert Resort
- Rehabilitation of Abbasi Mosque Derawar
- Rehabilitation of Royal Necropolis Derawar
- Royal Grave Yard Boundary Wall

5.2. Proposed Project Costing

Summary of Rough Cost Estimate for Derawar Fort				
Sr.No	**Description of Work**	**Amount in PKR**	**Amount in Millions**	**Remarks**
	Emergency Plan			
1	Stabilization of fort structure, immediately before monsoon 2025	52,455,978.000	52.456	
	Emergency Plan Amount Rs	**52,455,978.000**	**52.456**	
	Short Term Plan			
1	Restoration of Fort Outer Boundary Wall	431,053,950.00	431.054	
2	Construction of Ring Road Around Fort	108,689,220.57	108.689	
3	Biodiversity restoration	20,000,000.00	20.000	
a	Restoration of Derawar Lake through Solar-Powered Deep Well Irrigation System	8,548,515.00	8.549	
b	Removal of invasive vegetation (large trees and bushes)	1,627,500.00	1.628	
c	Establishment of Grass Cover to Strengthen Topsoil of Fort	2,570,000.00	2.570	
4	Rehabilitation and Interpretation of Derawar Fort's Underground Tunnel Network	20,350,000.00	20.350	
	Short Term Plan Amount Rs	**592,839,185.57**	**592.84**	
	Medium Term Plan			
1	Conversion of Nawab's Residence and his secretariat into a living museum (Already Restored)	19,500,000.00	19.500	Museum Set-Up
2	Conversion of Side Pond into Exclusive Sitting Space	46,179,650.00	46.180	
3	Conversion of Haram building into Boutique Hotel	331,948,200.00	331.948	
4	Barracks to be used as Vernacular Art and Craft Display and workshops	30,186,350.00	30.186	
5	Conversion of Middle courtyard and back Verandah into a specialized Vernacular restaurant serving some of the popular contemporary cuisine of Cholistan as well	5,000,000.00	5.000	
6	Conversion of Grain Store Outside main Fort into information center for Cholistan and Proposed Tourist Center	12,352,383.00	12.352	
7	Front lawn to be leveled, water proofed and restored to a garden	36,761,600.00	36.762	
8	Conversion of Baradari into a Coffee Shop and Observation Point	5,432,950.00	5.433	

9	Underground barracks to be used as workers residences and stores	36,765,200.00	36.765	
10	200 KW Solar Power System for Derawar Fort	34,950,000.00	34.950	
11	Development of Derawar Lake Area Total Area: 87,352.544 sq. ft. (approx. 2 acres)	30,500,000.00	30.500	
	Medium Term Plan of Cost	**589,576,333.00**	**589.58**	
	Long Term Plan			
1	Derawar Desert Resort	353,950,000.00	353.950	
2	Rehabilitation of Abbasi Mosque Derawar	30,000,000.00	30.000	Lump sum
3	Rehabilitation of Royal Necropolis Derawar	50,000,000.00	50.000	Lump sum
4	Royal Grave Yard Boundary Wall	5,000,000.00	5.000	Lump sum
	c) Long Term Plan of Cost	**438,950,000.00**	**438.95**	
	Project Implementation Arrangements			
1	Project Management & Implementation Unit	40,000,000	40	
2	Detailed Engineering, Archaeological & Conservation Design along with Procurement and Cost Estimation carried out by a Specialized Architecture and Conservation Consulting Firm.	70,000,000	70	
3	Third Party Validation (TPV) conducted by highly qualified experts to ensure the validation and quality assurance of the work	15,000,000	15	
	Project Implementation Arrangements Cost	**125,000,000**	**125**	
	Total Amount of Emergency Plan, Short, Medium and Long Term Plan and Project Implementation Arrangements	**1,798,821,497**	**1,799**	
	Design & Resident Supervision @ 1+5 %	**89,941,074.83**	**89.94**	
	Contingencies @ 2 %	**35,976,429.93**	**35.98**	
	Horticulture @ 1 %	**17,988,214.97**	**17.99**	
	PST @ 5 %	**89,941,074.83**	**89.94**	
	G-Total of Amount Rs.	**2,032,668,291**	**2,032.67**	
COST:-				
The Total Cost of this Rough Cost Estimate has been worked out amounting to Rs.2032.67 Million including Design & Resident Supervision1+5 %, Contingencies 2%, Horticulture 1 % and PST 5%.				

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5.2.1. Detail Costing

Rough Cost Estimates of Stablization of Fort structure:

Sr. No	Ref No	Description of Work	Unit	Quantity	Rate	Total Amount
MRS, 1st BI-ANNUAL-2025 (01.01.2025 to 30.06.2025) DISTRICT BAHAWALPUR						
Stabilization of Fort Structure (Earth Work Filling)						
1	Chap-3/49	Jungle clearance and removing within 100 ft. (30 m). Site clearance and removal of debris, vegetation, and loose unstable material from base	1000 Sq. ft.	90,000.00	376.20	33,858.00
2	Chap-3/5-i	Earth filling in layers in ordinary soil for embankments lead up to 100 ft. (30 m), including ploughing, mixing and compaction by mechanical means at optimum moisture content and dressing to designed section, complete in all respects:- I) 95% to 100% maximum modified AASHTO dry density	1000 Cft.	5,400,000.00	9,707.80	52,422,120.00
					Total Amount	**52,455,978.00**

Rough Cost Estimates of Construction of Fort Outer Boundary Wall:

Sr.No	Ref No	Description of Work	Unit	Quantity	Rate	Total Amount
Restoration of Fort Outer Boundary Wall						
1		Site clearance and vegetation removal along wall base (1.5 km × 5m)	Sq.m	7,500.00	50.00	375,000.00
2		Dismantling of damaged wall sections for restoration (approx. 15%)	Cu.m	40,000.00	500.00	20,000,000.00
3	Chap-3/21/1-ii	Earthwork in foundation strengthening under old wall	Cu.m	30,000.00	375.40	11,262,000.00
4	Chap-6/5-i	PCC 1:4:8 bed for new footing (heritage-grade)	Cu.m	1,000.00	12,280.15	12,280,150.00

5		Handmade clay brick masonry in lime mortar (main wall body)	Cu.m	30,000.00	7,500.00	225,000,000.00
6		Lime plaster in 2 coats (inner & outer face)	Sq.m	40,000.00	350.00	14,000,000.00
7		Restoration & reconstruction of 40 bastions (avg. 250 Cu.m each)	Cu.m	10,000.00	7,000.00	70,000,000.00
8		Decorative cut-brick detailing on bastions	Sq.m	4,000.00	1,500.00	6,000,000.00
9		Lime pointing in exposed brick areas	Sq.m	8,000.00	400.00	3,200,000.00
10		Drainage system for wall base (weep holes + ring drain)	Rft	4,921.00	800.00	3,936,800.00
11		Scaffolding, shuttering, and worker safety setup	Lump Sum	1.00	5,000,000.00	5,000,000.00
12		Structural stitching, grouting, and wall anchoring (in weak zones)	Rft	20,000.00	3,000.00	60,000,000.00
					Total Amount Rs	**431,053,950.00**

Rough Cost Estimates of Ring Road around Fort:

Sr No	Ref No	Description of Work	Sides /No's	Length (FT)	Width (FT)	Avg Depth (FT)	Unit	Rate (PKR)*	As Per Qty	
									Qty	Amount (PKR)*
MRS, 1st BI-ANNUAL-2025 (01.01.2025 to 30.06.2025) DISTRICT BAHAWALPUR										
	Construction of Ring Road Around Fort									
1	Chap-3/53	Clearing and Grubbing	1	6044	50		1000 Sft.	4,616.90	302,200.00	1,395,227
2	Chap-3/54	Compaction of natural ground	1	6044	50		1000 Sft.	3,024.75	302,200.00	914,079
		Earth Work								
3	Chap-3/5-i	Common Earth Fill and making of embankments lead upto 100 ft. (30m)	1	6044	50	3.5	1000 Cft.	9,707.80	1,057,700.00	10,267,940

		including ploughing and mixing with blade grade with compaction of earthwork with power road roller, including ploughing, mixing, moistening earth to optimum moisture content in layers by layers with dressing and levelling of earth to designed section,etc. complete in all respects: i) 95% to 100% maximum modified AASHO dry density as per drawing and specification.								
4	Chap:-3/17-a	Transportation (Lead) of earth all types when the total distance, including the lead covered in the item of work, is more 1000 ft. (300 m) as per drawing and specification					1000 Cft.	7,484.15	1,057,700.00	7,915,985

		a) upto ¼ mile (400 m)								
		Sub-base course								
5	Ch:-18/3-a(II)	Providing and laying Granular Sub-Base with 98% Compaction complete in all respect as per drawing and specification	1	6044	50	0.667	100C ft.	10,135.50	201,567.40	20,429,864
		Base course								
6	Ch:-18/4-a	Providing and laying BASE COARSE OF CRUSHED STONE AGGREGATES (CLASS B) , making water bound macadam (WBM) with spreading of khaka including placing, mixing, spreading and compaction of base course material to required depth, camber and grade to achieve 100%maximum modified AASHO dry density Complete in	1	6044	50	0.5	100C ft.	13,640.70	151,100.00	20,611,098

		all respect as per drawing and specification								
		Road Edging								
7	Ch:-18/5	Providing and laying road edging of 3" (75 mm) wide and 9" (225 mm) deep brick on end, complete in all respects	2	6044	0	0	Per Rft.	66.75	12,088.00	806,874
		Prime coat								
8	Ch:-18/6	Bituminous priming coat, including cleaning of road surface, Complete in all respect as per drawing and specification	1	6044	50		100Sft.	2,043.65	302,200.00	6,175,910
9	Ch:-18/7	Bituminous tack coat Complete in all respect as per drawing and specification	1	6044	50		100Sft.	1,158.85	302,200.00	3,502,045
		Asphalt Wearing Course								
10	Ch:-18/10a-IV+10b	Providing and laying 50mm average thick Asphalt Wearing Course plant premixed, With 4.50% Bitumen complete in all respect as per drawing and specification	1	6044	50		per 100Sft	7,029.45	302,200.00	21,242,998

		(per inch thickness per 25mm)								
		Ancillary Work								
11	N.s	Construction of side drains (both sides)	2	6044			Rft	650	12088	7,857,200
12	N.s	Road signage, edge markers, and safety reflectors					Lum Sum	1	1,000,000.00	1,000,000
13	N.s	Provision for street lighting conduits (including poles)	1	100			Rft	65,700.00	100.00	6,570,000
									Total Amount	**108,689,221**

Rough Cost Estimate of Removal of Invasive Vegetation (large trees and bushes)

Item No.	Description of Work	Unit	Quantity	Unit Rate (PKR)	Amount (PKR)
	A. Pre-Removal Survey & Setup				
1.1	Survey and mapping of vegetation on upper levels and walls	LS	1	150,000	150,000
1.2	Erection of temporary scaffolding/safety barriers where required	m^2	150	750	112,500
	B. Manual Removal of Vegetation				
2.1	Cutting and safe removal of large trees (above 6-inch trunk diameter)	No.	30	10,000	300,000
2.2	Removal of medium bushes and shrubs (1–6 inch diameter)	No.	100	1,000	100,000
2.3	Manual extraction of root systems without damaging masonry	No.	200	1,500	300,000
2.4	Cleaning and clearing organic buildup (leaf matter, compost, soil)	m^2	100	350	35,000
	C. Post-Removal Restoration				0
3.1	Filling of root cavities in masonry with lime-based mortar	m^2	150	600	90,000
3.2	Surface consolidation (minor cracks, loose brick/mud)	m^2	100	750	75,000

	D. Waste Handling & Site Cleanup				0
4.1	Collection and transport of removed biomass (no burning allowed)	m^3	100	750	75,000
4.2	On-site biodegradable composting (optional)	LS	1	100,000	100,000
	E. Miscellaneous & Supervision				0
5.1	Tools and PPE (gloves, goggles, cutting tools, hand tools)	LS	1	100,000	100,000
5.2	Skilled labor (heritage conservation-trained workers)	MD	15	6,000	90,000
5.3	Supervision and photographic documentation (before & after)	LS	1	100,000	100,000
				Total Amount Rs	**1,627,500**

Rough Cost Estimates of Establishment of Grass Cover to Strengthen Topsoil of Fort:

Sr. No.	Description of Work	Unit	Quantity	Rate (PKR)	Amount (PKR)
	A. Site Preparation				
1	Clearing existing vegetation, debris, and surface leveling	sq.m	3,000.00	50.00	150,000.00
2	Soil testing and amendment (if required)	lump sum	1.00	50,000.00	50,000.00
	B. Selection and Procurement of Grass Species				-
3	Vetiver grass (for erosion control and soil stabilization)	bundles (rooted plants)	400.00	500.00	200,000.00
4	Bermuda/Kikuyu grass (for quick ground cover) 500 kg seed	sprigs/seedling	1.00	300,000.00	300,000
5	Native grass species (if applicable)	bundles	300.00	400.00	120,000.00
	C. Planting and Establishment				-
6	Preparation of planting pits/holes	no. of pits	400.00	250.00	100,000.00
7	Planting Vetiver grass roots or seedlings	no. of plants	400.00	375.00	150,000.00
8	Spreading grass seeds or sprigs over prepared area	sq.m	2,000.00	50.00	100,000.00
	D. Watering and Maintenance				-
9	Initial watering and soil moisture management	lump sum	1.00	150,000.00	150,000.00
10	Mulching (straw or biodegradable material)	sq.m	2,000.00	50.00	100,000.00

11	Fertilization and soil conditioning if necessary	lump sum	1.00	100,000.00	100,000.00
	E. Monitoring & Growth Support				-
12	Regular maintenance, weeding, and growth monitoring	monthly for 6 months	6.00	150,000.00	900,000.00
	F. Miscellaneous				-
13	Transportation and logistics costs	lump sum	1.00	150,000.00	150,000.00
				Total Amount Rs	**2,570,000.00**

Rough Cost Estimates of Restoration of Derawer Lake through Solar-Powered Deep Well Irrigation System:

Sr. No	Description of Work	Unit	Qty	Unit Rate (PKR)	Amount (PKR)
	A. Surveys & Investigations				
1	Topographic & Hydro-Geological Survey	LS	1	500,000	500,000
2	Bore well Feasibility & Soil Testing	LS	1	350,000	350,000
	B. Deep Bore Well System				
1	Drilling of Deep Bore well (8" dia, ~300 ft.)	ft.	300	2,649	794,715
2	Submersible Solar Pump (7.5 HP, with controller)	Set	1	1,950,000	1,950,000
3	Solar Panel Array (6 kW + structure)	Set	1	1,200,000	1,200,000
4	HDPE Piping and Fittings to Lakebed	Rft	750	1,478.40	1,108,800
	C. Lakebed Preparation				
1	Desilting and shallow earthwork in lakebed	m^3	1,500	350	525,000
2	Native aquatic plant stabilization (bulrushes, grasses)	m^2	1,000	350	350,000
3	Earth bunding /fencing around recharge area	Rft	600	450	270,000
	D. Eco-Tourism Infrastructure				
1	Viewing platform/Interpretation signage	LS	1	400,000	400,000
	E. O&M and Supervision				
1	Installation labor + supervision	LS	1	600,000	600,000
2	Operation & Maintenance Setup (6 months buffer)	LS	1	500,000	500,000
				Total Amount Rs	**8,548,515**

Rough Cost Estimates of Rehabilitation and Interpretation of Derawar Fort's Underground Tunnel Network:

Sr. No.	Description of Work	Unit	Quantity	Rate (PKR)	Amount (PKR)
	A. Site Assessment & Documentation				
1	Detailed site survey and mapping of tunnel network	lump sum	1.00	250,000.00	250,000.00
2	Structural assessment and soil testing	lump sum	1.00	300,000.00	300,000.00
	B. Structural Stabilization & Restoration				-
3	Clearing debris and loose materials from tunnels	cubic meter (m^3)	1,500.00	2,000.00	3,000,000.00
4	Reinforcement of tunnel walls (shotcrete or lime plaster)	sq.m	1,500.00	1,500.00	2,250,000.00
5	Structural bracing and support installation	no. of supports	150.00	10,000.00	1,500,000.00
6	Waterproofing and damp-proofing of tunnel surfaces	sq.m	1,500.00	1,200.00	1,800,000.00
7	Repair and reinforcement of any damaged sections	lump sum	1.00	1,000,000.00	1,000,000.00
	C. Safety & Access Infrastructure				-
8	Installation of lighting and ventilation systems	lump sum	1.00	1,000,000.00	1,000,000.00
9	Construction of access stairs, ladders, walkways	lump sum	1.00	3,000,000.00	3,000,000.00
10	Installation of safety signage and barriers	lump sum	1.00	2,000,000.00	2,000,000.00
	D. Interpretation & Visitor Facilities				-
11	Informational panels, signage, and display boards	no. of panels	25.00	38,000.00	950,000.00
12	Documentation, signage design, and layout	lump sum	1.00	1,000,000.00	1,000,000.00
13	Guided tour pathways and lighting for interpretation	lump sum	1.00	2,000,000.00	2,000,000.00
	E. Monitoring & Maintenance				-
14	Regular monitoring, inspection, and maintenance for 1 year	annual for 1 year	1.00	150,000.00	150,000.00
	F. Miscellaneous				-
15	Transportation, logistics, and unforeseen expenses	lump sum	1.00	150,000.00	150,000.00

	Total Amount Rs	**20,350,000.00**

Rough Cost Estimates of Conversion of Nawab Residence and his secretariat into a living museum

Sr No	Description of Item	Unit	Qty	Rate (PKR)	Amount (PKR)
	1. Exhibition & Museum Set-Up				0
1.1	Exhibit showcases (glass, security grade)	Nos	20	800,000	16,000,000
1.2	Interactive displays, audio-visual installations	Lump Sum	1	500,000	500,000
1.3	Wall-mounted panels, signage, interpretive text	Lump Sum	1	1,000,000	1,000,000
1.4	Furniture for museum lobby, reception, store	Lump Sum	1	2,000,000	2,000,000
				Total Amount Rs	**19,500,000**

Rough Cost Estimates of Conversion of Side Pond into Exclusive Sitting Space

Sr. No	Description of Item	Unit	Qty	Rate (PKR)	Amount (PKR)
	1.Site Clearance & Earthworks				
1.1	Removal of pond water, sludge & debris	sqft	5,000.00	150	750,000
1.2	Backfilling with compacted earth/sub-base	sqft	20,000.00	130	2,600,000
1.3	Leveling and compaction of entire area	sqft	34,393.00	50	1,719,650
	2. Hardscaping (Paving, Platforms, Edge Work)				0
2.1	Natural stone/tile paving (paths + deck)	sqft	20,000.00	650	13,000,000
2.2	Brick coping around original pond edges	Rft	11,800.00	1200	14,160,000
2.3	Raised seating platforms with shade	Nos	6.00	450,000	2,700,000
2.4	Water channel/reflective feature (optional)	Lump	1.00	1,000,000	1,000,000
	3. Landscaping & Greenery				0
3.1	Lawn & groundcover (heritage pattern)	sqft	8,000.00	70	560,000

3.2	Trees and ornamental shrubs	Nos	60.00	50,000	3,000,000
3.3	Decorative planters + native flora	Lump	1.00	800,000	800,000
	4. Seating, Furniture & Pergolas				0
4.1	Benches with traditional detailing	Nos	20.00	40,000	800,000
4.2	Pergolas with creeper vines	Nos	4.00	350,000	1,400,000
4.3	Movable seating with cushions (luxury type)	Nos	20.00	50,000	1,000,000
	5. Lighting, Drainage & Utilities				0
5.1	Garden lights (solar + low voltage)	Nos	40.00	3,500	140,000
5.2	Under-seat LED feature lighting	Nos	20.00	15,000	300,000
5.3	Surface water drainage system	Lump	1.00	600,000	600,000
	6. Artistic & Interpretive Elements				0
6.1	Sculptures, stone inlay or mosaic flooring	Lump	1.00	750,000	750,000
6.2	Interpretive signage (heritage themes)	Nos	6.00	150,000	900,000
				Total Amount Rs	**46,179,650**

Rough Cost Estimates of Designated Parking:

Item No.	Description	Unit	Qty	Rate (PKR)	Amount (PKR)
	1. Preliminary & Site Works				
1.1	Site preparation, cleaning, leveling	sqft	41,321	50	2,066,050
1.2	Temporary site office & storage	Lump Sum	1	500,000	500,000
1.3	Safety signage and barricading	Lump Sum	1	200,000	200,000
	2. Civil Works (Structure & Rehabilitation)				
2.1	Structural repairs & strengthening	sqft	41,321	750	30,990,750
2.2	New internal partitions (brick)	sqft	12,000	850	10,200,000
2.3	Roof waterproofing	sqft	10,000	500	5,000,000

2.4	Staircase repairs	Nos	20	300,000	6,000,000
	3. MEP Works				
3.1	Electrical wiring, lighting, panels	sqft	41,321	650	26,858,650
3.2	Plumbing (water supply & drainage)	sqft	41,321	400	16,528,400
3.3	HVAC (split/VRV systems)	sqft	41,321	450	18,594,450
3.4	Fire alarm and safety systems	sqft	41,321	350	14,462,350
	4. Interior Finishes				
4.1	Flooring (tiles)	sqft	41,321	1250	51,651,250
4.2	Wall finishes (plaster, paint, heritage treatment)	sqft	82,642	150	12,396,300
4.3	Ceiling finishes (gypsum/wooden)	sqft	30,000	500	15,000,000
4.4	Doors and windows (wood/metal/glass)	sqft	10,000	750	7,500,000
	5. Furniture, Fixtures & Equipment (FF&E)				
5.1	Guest room furniture	Rooms	25	900,000	22,500,000
5.2	Lobby, reception, lounge furniture	Lump Sum	1	20,000,000	20,000,000
5.3	Kitchen equipment (for café/restaurant)	Lump Sum	1	15,000,000	15,000,000
5.4	Light fixtures (decorative & task)	Lump Sum	1	50,000,000	50,000,000
	6. External Development & Landscaping				
6.1	Paving and landscaping	sqft	5,000	650	3,250,000
6.2	External lighting and signage	Lump Sum	1	1,000,000	1,000,000
6.3	Parking area development	sqft	3,000	750	2,250,000
				Total Amount Rs	**331,948,200**

Rough Cost Estimates of Conversion of Barracks into Vernacular Art and Craft Display and Workshops:

Sr.#	Description of Item	Unit	Qty	Rate (PKR)	Amount (PKR)
1	Site preparation and cleaning	sqft	4,981	150	747,150
2	Structural repair & heritage restoration	sqft	4,981	1000	4,981,000
3	Interior finishes (walls, flooring, ceiling)	sqft	4,981	800	3,984,800
4	Electrical wiring and lighting installation	sqft	4,981	500	2,490,500
5	Workshop furniture & equipment (benches, tools, storage)	lump sum	1	1,000,000	1,000,000

6	Display fixtures and art showcases	sqft	4,981	450	2,241,450
7	HVAC and ventilation systems	sqft	4,981	450	2,241,450
8	Security & fire safety systems	lump sum	1	500,000	500,000
9	Landscaping and outdoor display setup	lump sum	1	5,000,000	5,000,000
10	Fire Safety & Emergency Systems	Lump Sum	1	1,500,000	1,500,000
11	Parking & Courtyard	Lump Sum	1	5,500,000	5,500,000
				Total Amount R.s	**30,186,350.00**

Rough Cost Estimates of Conversion of Middle courtyard and back Verandah into a specialized Vernacular Restaurant serving contemporary cuisine of Cholistan as well:

Sr.#	Description of Item	Unit	Qty	Rate (PKR)	Amount (PKR)
1	Dining furniture & fixtures	lump sum	1	3,000,000.00	3,000,000
2	Fire safety & security systems	lump sum	1	1,000,000.00	1,000,000
3	Retail corner setup & display units	lump sum	1	1,000,000.00	1,000,000
				Total Amount R.s	**5,000,000.00**

Rough Cost Estimates of Conversion of Bara Dari into a Coffee Shop and Observation Point:

Sr.#	Description of Item	Unit	Qty	Rate (PKR)	Amount (PKR)
1	Site Cleaning & Preparation	sqft	929	150	139,350
2	Structural Repair & Waterproofing	sqft	929	1200	1,114,800
3	Flooring (vernacular tiles/terracotta)	sqft	929	850	789,650
4	Wall Restoration & Finishing (lime plaster)	sqft	929	750	696,750
5	Electrical Wiring + Lighting Installation	sqft	929	750	696,750
6	Basic HVAC / Ceiling Fans + Ventilation	lump sum	1	250,000	250,000
7	Café Counter & Bar Setup (vernacular theme)	lump sum	1	300,000	300,000
8	Coffee Shop Equipment (brewer, sink, fridge)	lump sum	1	400,000	400,000
9	Indoor & Terrace Furniture (tables, stools)	lump sum	1	300,000	300,000
10	Observation Point Railings + Info Panels	lump sum	1	350,000	350,000
11	Stair Access or Ramps (if applicable)	lump sum	1	500,000	500,000
12	Signage & Cultural Display Elements	lump sum	1	35000	35,000

Total Amount R.s	**5,432,950.00**

Rough Cost Estimates of Underground Barracks Conversion into Workers' Residences & Stores:

Sr.#	Description of Item	Unit	Qty	Rate (PKR)	Amount (PKR)
1	Site Clearing, Debris Removal, Leveling	sqft	12,540.00	150.00	1,881,000.00
2	Structural Strengthening (walls, roofs, arches)	sqft	12,540.00	1,250.00	15,675,000.00
3	Flooring (cement screed/stone finish)	sqft	12,540.00	1,243.00	15,587,220.00
4	Wall & Ceiling Restoration (lime plaster)	sqft	12,540.00	750.00	9,405,000.00
5	Doors, Windows & Ventilators (metal/wood)	lump sum	1.00	850,000.00	850,000.00
6	Electrical System (lighting, sockets, fans)	sqft	12,540.00	750.00	9,405,000.00
7	Plumbing & Drainage (toilets, wash area, kitchen)	lump sum	1.00	1,200,000.00	1,200,000.00
8	Partitioning (residences, storerooms)	sqft	12,540.00	650.00	8,151,000.00
9	Basic Furnishing (bunks, shelves, lockers)	lump sum	1.00	900,000.00	900,000.00
10	Security Enhancements (grills, locks, lighting)	lump sum	1.00	400,000.00	400,000.00
11	Ventilation, Exhaust, & Dehumidification Units	lump sum	1.00	600,000.00	600,000.00
12	Signage & Cultural Display Elements	lump sum	1.00	35,000.00	35,000.00
				Total Amount R.s	**62,208,220.00**

Rough Cost Estimates of Conversion of Grain Store Outside main Fort into information center for Cholistan and Proposed Tourist Center

Sr.#	Description of Item	Unit	Qty	Rate (PKR)	Amount (PKR)
1	Site Clearance & Debris Removal	sqft	1,661	150	249,150.00
2	Structural Restoration (walls, arches, roof)	sqft	1,661	1250	2,076,250.00
3	Flooring (cement screed/heritage stone)	sqft	1,661	1243	2,064,623.00
4	Lime Plastering & Heritage Paint	sqft	1,661	380	631,180.00
5	Doors, Windows (Repair/Installation)	lump sum	1	250,000	250,000.00
6	Electrical (lighting, sockets, fans)	sqft	1,661	380	631,180.00

7	Reception Furniture & Visitor Lounge Setup	lump sum	1	1,600,000	1,600,000.00
8	Display Boards, Map Panels, Cultural Wall Art	lump sum	1	1,400,000	1,400,000.00
9	AV Equipment (Screen, Kiosk, Sound)	lump sum	1	1,450,000	1,450,000.00
10	Outdoor Signage, Pathway & Branding	lump sum	1	2,000,000	2,000,000.00
				Total Amount R.s	**12,352,383.00**

Rough Cost Estimates of Conversion of Grain Store Outside main Fort into information center for Cholistan and Proposed Tourist Center:

Sr.#	Description of Item	Unit	Qty	Rate (PKR)	Amount (PKR)
	1. Site Preparation & Earthworks				
1.1	Clearing, grubbing & removal of debris	sqft	39,116	35	1,369,060
1.2	Excavation and leveling up to required slope	sqft	39,116	25	977,900
1.3	Soil refilling with good quality topsoil	sqft	39,116	40	1,564,640
	2. Waterproofing & Drainage				0
2.1	Subsurface waterproofing membrane system	sqft	20,000	450	9,000,000
2.2	French drains and water run-off channels	Rft	500	1600	800,000
2.3	Manholes, inspection chambers & outlets	Nos	10	60,000	600,000
	3. Lawn Development (Soft cape)				0
3.1	Turf grass plantation (drought-tolerant)	sqft	30,000	60	1,800,000
3.2	Flower beds (seasonal and native species)	Rft	800	500	400,000
3.3	Shrubs, hedges, and ornamental planting	Lump Sum	1	600,000	600,000
3.4	Tree plantation (heritage/local shade trees)	Nos	50	25,000	1,250,000
	4. Hardscape & Features				0
4.1	Pathways (brick/tile finish, heritage style)	sqft	5,000	650	3,250,000
4.2	Seating areas with pergolas/stone benches	Nos	5	150,000	750,000
4.3	Garden lighting (solar + traditional)	Lump Sum	1	1,000,000	1,000,000
4.4	Water feature (pond or small fountain)	Lump Sum	1	750,000	750,000
	5. Irrigation System				0
5.1	Underground irrigation piping system	sqft	30,000	350	10,500,000

5.2	Sprinklers, drippers & control units	Lump Sum	1	1,000,000	1,000,000
	6. Signage & Site Furniture				0
6.1	Directional & interpretive signage (metal)	Nos	10	50,000	500,000
6.2	Trash bins, heritage-style	Nos	10	25,000	250,000
6.3	Garden entry gate restoration	Lump Sum	1	400,000	400,000
				Total Amount	**36,761,600**

Rough Cost Estimates of Adaptive Reuse of Underground Barracks into Workers' Residences & Stores:

Item No.	Description	Unit	Qty	Rate (PKR)	Amount (PKR)
	1. Preliminary & Site Works				
1.1	Cleaning, clearing debris, site fumigation	sqft	8,840	40	353,600
1.2	Minor excavation and slope adjustment for access	sqft	1,000	150	150,000
1.3	Temporary lighting, safety hoarding	Lump	1	150,000	150,000
	2. Structural Repairs & Waterproofing				0
2.1	Crack filling, plaster patch repair (lime-based)	sqft	4,000	1200	4,800,000
2.2	Internal basement waterproofing membrane	sqft	8,840	850	7,514,000
2.3	Ventilation shaft repair or extension	Nos	4	150,000	600,000
	3. Residential Area Fit-Out (4,420 sqft)				0
3.1	Internal lime plaster & breathable paint	sqft	4,420	380	1,679,600
3.2	Partition walls & doors for 6 dorm units	Nos	10	120,000	1,200,000
3.3	Flooring (cement/terracotta hybrid finish)	sqft	4,420	850	3,757,000
3.4	Restroom blocks (2 shared toilets/showers)	Lump	1	800,000	800,000
3.5	Basic furnishings (beds, lockers, fans)	Person	24	140,000	3,360,000
	4. Storage Area Fit-Out (4,420 sqft)				0
4.1	Reinforced storage racking systems	sqft	3,000	900	2,700,000
4.2	Concrete flooring finish with hardener	sqft	4,420	850	3,757,000
4.3	Humidity and pest control system	Lump	1	350,000	350,000
4.4	Safety lighting and ventilation (non-residential)	Lump	1	250,000	250,000
	5. Electrical, Plumbing & Utilities				0
5.1	Electrical wiring, fittings, emergency lights	sqft	8,840	350	3,094,000

5.2	Plumbing for restrooms, water supply lines	Lump	1	800,000	800,000
5.3	Water tank + basic water filtration unit	Lump	1	300,000	300,000
	6. Fire Safety & Security				0
6.1	Fire extinguishers, alarms, escape signage	Lump	1	350,000	350,000
6.2	Steel emergency exit door installation (2 points)	Nos	2	200,000	400,000
6.3	CCTV + basic access control for storage zones	Lump	1	400,000	400,000
				Total Amount	**36,765,200**

Rough Cost Estimates of 200 kW Solar Power System for Derawar Fort:

S.No.	Description of work	Unit	Quantity	Estimated Unit Price (PKR)	Total Cost (PKR)	Remarks
1	Site Survey & Structural Assessment	Lump Sum	1	20,000.00	20,000.00	Site inspection and feasibility assessment
2	Design & Engineering Services	Lump Sum	1	50,000.00	50,000.00	System design, permits, and planning
3	Solar Panels (200 kW Total) 600 panels	Pieces	600	35,000.00	21,000,000.00	Quality PV modules, including safety margin
4	Mounting Structures & Framework	Set	1	2,000,000.00	2,000,000.00	Customized for heritage site, weather resistant
5	Inverters (Two 100 kW Inverters)	Pieces	2	3,000,000.00	6,000,000.00	Redundancy and reliable power conversion
6	DC Wiring & Connectors (Approx. 3,000 meters)	Meters	3,000	410.00	1,230,000.00	High-quality, weather-resistant cables
7	AC Wiring & Switchgear Approx. 1,000 meters	Meters	1,000	600.00	600,000.00	To connect inverters to the grid
8	Monitoring & SCADA System	Lump Sum	1	1,500,000.00	1,500,000.00	System for performance monitoring
9	Electrical Protection Devices	Set	1	500,000.00	500,000.00	Breakers, fuse boxes, surge protection

10	Earthing & Lightning Protection	Lump Sum	1	300,000.00	300,000.00	Earthling rods, lightning rods, and grounding systems
11	Civil & Construction Works	Lump Sum	1	1,000,000.00	1,000,000.00	Foundations, trenching, mounting site preparation
12	Commissioning & Testing	Lump Sum	1	500,000.00	500,000.00	System startup, testing, and quality checks
13	Permits & Documentation	Lump Sum	1	250,000.00	250,000.00	Legal approvals, documentation, and approvals
				Total Amount	**34,950,000.00**	

Rough Cost Estimates of Development of Derawar Lake Area Total Area: 87,352.544 sq ft (approx. 2 acres):

Development of Derawar Lake Area Total Area: 87,352.544 sq ft (approx. 2 acres)									
1	Development of Derawar Lake								
		1	x	1	=	1 Jobs			
					@	30,500,000.00	P.Job	30500000/-	

Rough Cost Estimates of Development of Derawar Lake Area Total Area: 87,352.544 sq ft (approx. 2 acres):

Sr No	Description	Unit	Qty	Rate (PKR)	Amount (PKR)
	1. Site Preparation & Infrastructure				
1.1	Site clearing, leveling, compaction	sqft	100,000	50	5,000,000
1.2	Boundary fencing (mud/brick)	Rft	3,000	1,850	5,550,000
1.3	Internal road/pathway base & paving	sqft	30,000	350	10,500,000
1.4	Entrance gate & security checkpoint	Lump Sum	1	1,500,000	1,500,000
	2. Guest Accommodations (50 Units)				
2.1	Royal Villas (Area 1000 Unit (sqft)	10	1,000	5,170	51,700,000
2.2	Standard Villas (Area 800 Sqft)	10	800	3,800	30,400,000
2.3	Cottages (4 pax) (Area 600 sqft)	30	600	3,500	63,000,000
2.4	Furniture, Fixtures (Avg 350K/unit)	50	1	17,500,000	17,500,000

	3. Restaurant (60–75 pax)				
3.1	Covered Dining Hall + Kitchen (~5,000 sqft)	sqft	5,000	5,170	25,850,000
3.2	Kitchen Equipment & Pantry Setup	Lump Sum	1	4,000,000	4,000,000
3.3	Furniture & Decor (tables, buffet, lights)	Lump Sum	1	3,000,000	3,000,000
3.4	Washrooms, Storage	Lump Sum	1	1,500,000	1,500,000
	4. Parking & Circulation				
4.1	Car Parking Bays (75 cars @ 150 sqft each)	sqft	11,250	650	7,312,500
4.2	Carport Structures/Shade (30% area)	sqft	3,375	500	1,687,500
4.3	EV Charging Station (Optional)	LS	1	1,000,000	1,000,000
	5. Staff Housing & Admin Block (24 Staff)				
5.1	Dormitories (12 twin rooms @ 250 sqft)	sqft	3,000	4,000	12,000,000
5.2	Staff Dining, Kitchen, Lounge	Lump	1	2,500,000	2,500,000
5.3	Office/Admin/Reception	sqft	2,000	3,500	7,000,000
5.4	Washrooms, Lockers	Lump	1	1,200,000	1,200,000
	6. Utilities – Water, Power & Sanitation				
6.1	Solar Power System (100 kW)	kW	100	300,000	30,000,000
6.2	Bore well, Overhead + Underground Tanks	Lump	1	3,000,000	3,000,000
6.3	Greywater + Septic System	Lump	1	2,500,000	2,500,000
6.4	Internal Plumbing & Wiring	sqft	80,000	550	44,000,000
6.5	Generator Backup + Panels	Lump	1	3,500,000	3,500,000
	7. Landscaping & Outdoor Spaces				
7.1	Landscape pathways & plazas	sqft	15,000	550	8,250,000
7.2	Garden, native flora, palm groves	Lump	1	4,000,000	4,000,000
7.3	Bonfire, amphitheater, sitting decks	Lump	1	3,000,000	3,000,000
7.4	Decorative Lighting + Garden Lights	Lump	1	3,500,000	3,500,000
				Total Amount Rs	**353,950,000.00**

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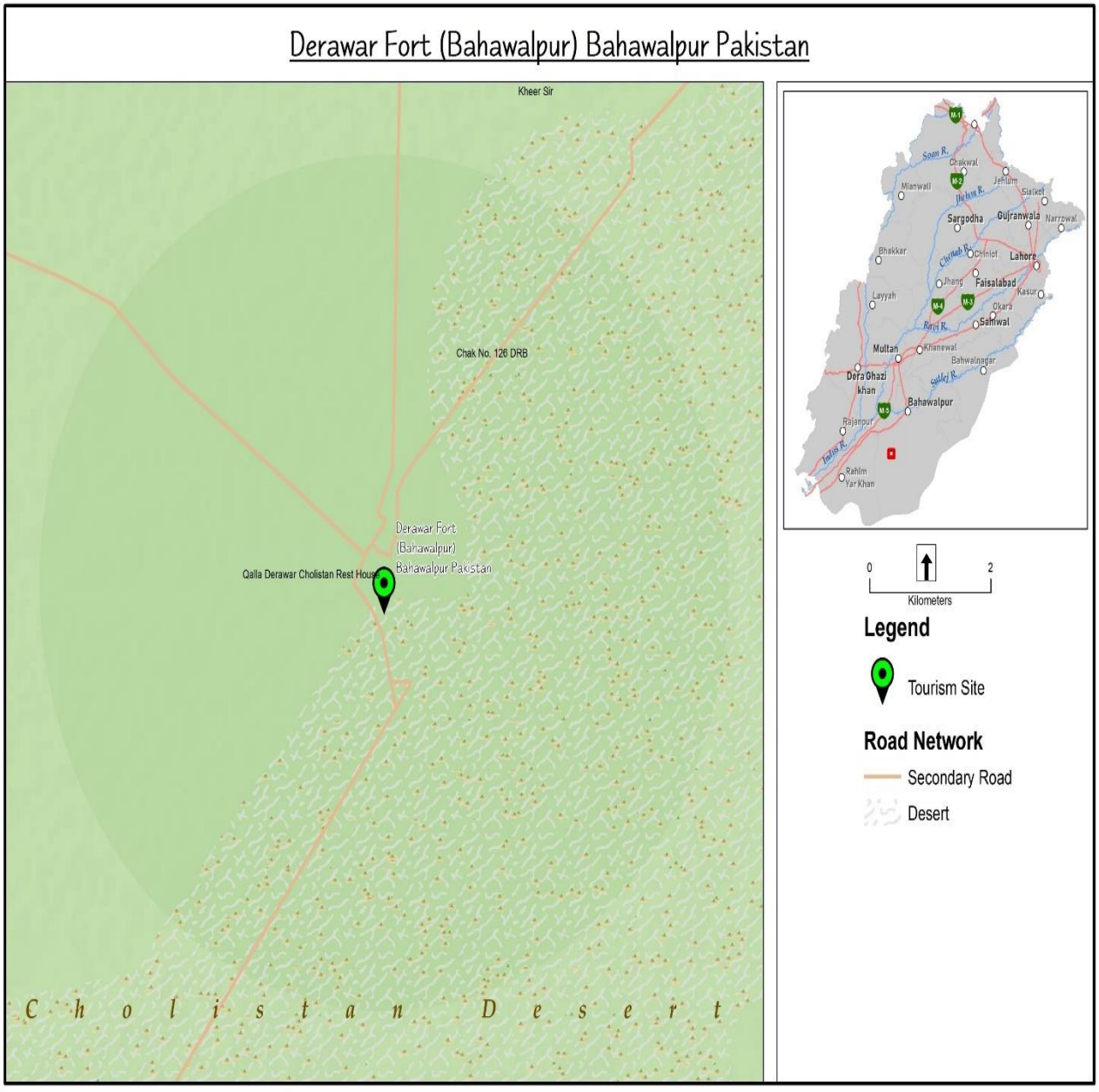
Annexures

Annex – A: Derawar Fort



Annex – B: Derawar Fort

1. Eco/Architectural Tourism

Architectural Tourism is one of the most rapidly growing sectors in the world with regard to economical, technological and social transformations. The mutual relationship between architecture and tourism is obvious since ancient times where architecture, as a tourist attraction, had a very important role. Temples have been built in honor of the gods, grand theatres, stadiums, the Colosseum and other monumental public buildings that attracted large crowds as they represented culture and society. Architecture is a means of expression for cultural diversity and innovative potential of a region, and tourism, as an industry, directly helps to preserve architecture. Tourism and architecture never before were as closely connected as is the case today. There has been a huge spike in "Heritage Tourism", which has seen sudden interests in ancient history and heritage.

"Architecture is the prime and unquestionable source of HISTORY"

The term architectural tourism means going to a travel destination to see historical monuments and architecture, as a main ambition and/or as a secondary added-on effect for the tourist.[iv] Hector Ceballos Lascurain, an environmentalist from Mexico was first to coin the term Ecotourism of Architecture to describe eco-friendly and responsible travel. Ecotourism has the potential to ensure sustainable use of the country's resources and generate jobs for the local population. **Architecture plays a vital role in ecotourism as it is an expression of natural surroundings through space.** Eco lodges and sustainable resorts that are well integrated within the surrounding environment understand local livelihood, art, and culture.[v]

"Tourism where the main motivation of tourists is the conservation and appreciation of the ecosystems in the environment as well as the traditional cultures prevailing in natural areas… contains educational and interpretation features…minimizes negative impacts upon natural and socio-cultural environment…supports maintenance of natural areas which are used as eco-tourism attractions by generating economic benefits for host communities, providing income opportunities for local communities and increasing awareness towards conservation of natural and cultural assets."[vi]

Permitted activities under this policy include:

- Trekking, nature walk, bird and wildlife watching, and flora and fauna photography
- Boating/cruising to view wildlife and experience wilderness
- Overnight camping, star-gazing in designated sites/forts/monuments
- Travel focused on experiencing Cholistan's fairs and festivals that promote eco-tourism and sustainability of local traditions
- Lodging in campsites, eco-lodges, home-stays and guest houses that are located in an area of natural/cultural beauty and involves local specificities
- Activities in specified areas of the forest such as jungle safari in vehicles or camel safari, overnight camping in designated sites.

How Tourists Can Support Eco-tourism:

- Using locally owned and run services
- Provide direct financial support to local
- Using locally owned and run accommodation. Not only does the money from home-stays directly benefit the community but tourists also gain an authentic insight into the region.
- Purchase any equipment and food from locally produced sources
- Support local income generating and small business enterprises. This is possible by supporting locally owned transportation, shops and restaurants, and using local guide and staff services.
- Taking responsibility for maintaining and improving the environment
- Provide financial support for local economic and environmental projects that will benefit the local communities and thereby actively encouraging local community involvement in the tourism projects
- Camel rides are especially popular for tourists in Cholistan and support locals

2. Cholistan

Cholistan desert, an extension of Great Indian Desert, is located in southern Punjab province between latitudes 27°42' and 29° 45' north and longitude 69° 52' and 75° 24' east.[vii] This desert is comprised of about 2.6 million hectares.[viii] This desert has a length of about 480 km while the width varies from 32 to 192 km.[ix] Based on the topography, parent material, soil and vegetation the whole Cholistan desert can be divided into two geomorphic regions. The northern region or Lesser Cholistan borders canal irrigated areas and covers about 7,770 km2 and the southern region or Greater Cholistan is comprised of 18,130 km2. The Lesser Cholistan consists of saline alluvial flats (locally called 'dahars') alternating with low sandy ridges. The clayey flats of Lesser Cholistan are generally homogenous to a depth ranging from 30 to 90 cm. These soils are classified as either saline or saline-sodic, with pH ranging from 8.2 to 8.4 and from 8.8 to 9.6, respectively. The Greater Cholistan is a wind-swept sandy desert and comprised of river terraces, large sand dunes, ridges and depressions[x].

History

Around 4000 B.C. the Cholistan was a cradle of civilization commonly known as the Hakra valley civilization. This was when the river Hakra flowed through the region. The river supplied permanent water until 1200 B.C. About 600 B.C. it became irregular in flow and consequently vanished within a century or so. The Hakra civilization that flourished here was one of the longest in the course of world history. It was also the earliest civilization of the Indian subcontinent. In cultural advancement it can be compared with the Mesopotamian, Anatolian, Egyptian, and Babylonian civilizations.[xi] No one is sure how this great Aryan civilization ended. Probably a variety of problems such as hostile invading tribes, changes in the course of the river and depletion of irrigation facilities contributed to the ultimate disappearance of this great civilization[xii].

Climate

Cholistan is a hot arid sandy desert. The mean annual rainfall varies from less than 100 mm in the west to 200 mm in the east. Rain usually falls during monsoon (July through September) and in winter and spring (January through March). Monsoon rains occur mostly in heavy showers. Cholistan is one of the hottest deserts in Pakistan. Mean minimum and maximum temperatures are 20° and 40° C, respectively). Temperatures are high in summer and mostly mild in winter with no frost. The mean summer temperature (May-June) is 34° C with highs reaching nearly 50° C. Annual rainfalls is highly variable both on temporal and spatial scales. Aridity is the most striking feature of Cholistan with wet and dry years occurring in clusters. The Cholistan was formed predominantly by the deposition of Aeolian sands or alluvium deposits. The alluvium deposits are composed of granites, schists, gneiss and slates. The soils of Cholistan are generally saline, alkaline and gypsiferous. The dunes reach an average height of about 100 m. There is no permanent, natural bodies of surface water in Cholistan Factors like low rainfall, high rate of water infiltration into the sands, and high evaporation rate prevent the natural accumulation of surface water (FAO 1993). Fresh (rain) water is collected in locally made water ponds called 'tobas. Underground water is at a depth of 30-40 m which, with a few exceptions, is brackish containing salts 9,000-24,000 ppm (Baig et al.1980).

Natural Vegetation

The vegetation in Cholistan is typical of arid regions and consists of xerophytic species which are adapted to extreme seasonal temperatures, moisture fluctuations and wide variety of edaphic conditions. Compared to the hyper arid southern region, vegetation cover is comparatively better in eastern Cholistan (200 mm rainfall zone). Most of Cholistan is covered by sand dunes. Fortunately, a wide range of nutritious and drought tolerant species of grasses, shrubs and trees occupy the entire territory. These plant species, though slow growing, respond very well to the favorable climatic conditions and provide ample biomass for livestock consumption. Important genera of grasses include Cenchrus, Lasiurus and Panic'um. Favored shrubs include Calligonum and Holoxylon and Prosopis, Zizyphus and Acacia are notable indigenous trees (Rao and

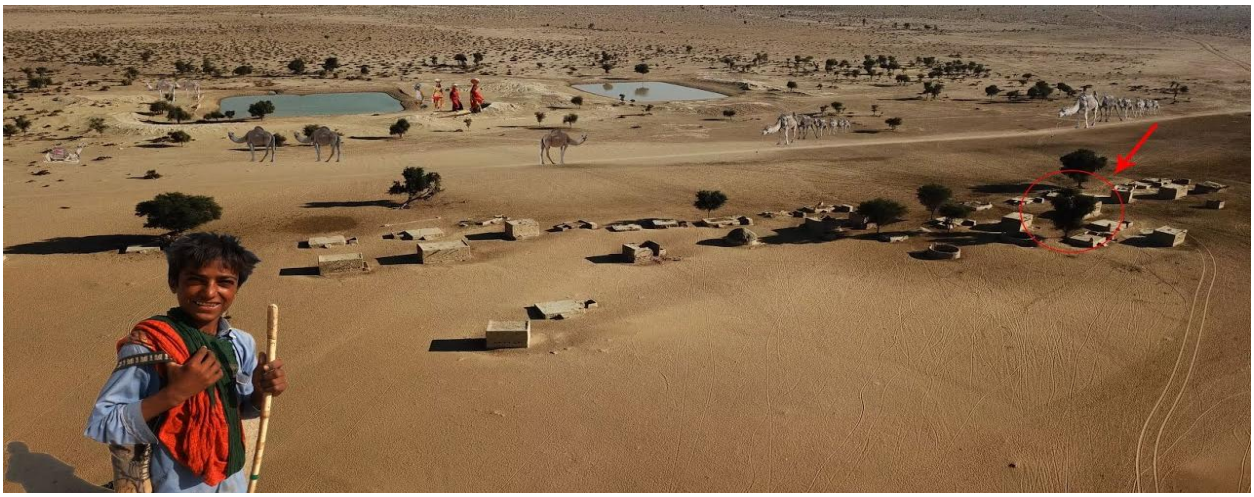
Arshad 1991). Each site is represented by typical plant species based on availability of soil moisture, salinity and plant characteristics.

Socio-Economic Aspects

The total human population of Cholistan desert is around 1.2 million. The economy of the region is predominantly pastoral. People have practiced a nomadic life style for centuries. Large herds of camels, cattle, sheep and goats are owned by the nomads. The area is not served by a modern communication system and can be traversed by either camels or jeeps. Local people use camels as a mode of transportation. Habitations are small and extremely scattered[xiii].

The pastoral system is characterized by mass migrations of animals and people throughout the year in search of water and forage. The onset of monsoon and the distribution of rainfall mainly dictate the pattern of movement of nomadic herders. Around the months of March or April, nomadic households move towards surrounding irrigated areas forced there by rising temperature in the desert and depleted feed and water resources. The incentives for this movement include temporary employment opportunities within the irrigated farming community, grazing of livestock on wheat stubbles, drinking water for human and livestock and readily available markets for livestock and livestock byproducts.

Farmers in the irrigated areas in turn obtain sufficient labor for crop harvesting and other farming operations and animal manure to enhance soil fertility through camping of livestock on fallow fields. The nomads and their herds return back to the deserts around July or August with the news of first monsoon showers. Distances travelled during this migration vary from 10 to 100 km. While in desert natural vegetation is the main source of feed for grazing livestock. Tobas serve as drinking water both for nomads and their livestock. Tobas are made in clayey flats locally called dahars in a catchment area to avoid heavy water percolation. Tobas belonging to the same clan are generally located close to each other (often within 1 km radius). At the start of the rainy season, livestock graze within one or 2 km radius of each toba. This distance increases to about 15 km as the season progresses. During October and November, when water resources become almost totally depleted, each clan moves its herds to semi-permanent centers equipped with a series of traditional (hand-dug and unlined) wells and kunds (usually lined)[xiv].



The nomads manage their mixed livestock in such a way that milking cows are moved nearby the urban centers where milk is sold readily while other animals like camels, goats, sheep and bullocks are kept in the desert for grazing. Nomads attach high values to their herds. Livestock are the main source of their survival and a number of cultural norms are linked with the animals. Livestock are frequently used for meat, milk and, gifts. Communal ceremonies like weddings, funerals, and tribal celebrations include slaughtering and

exchange of animals. A person's status in the desert nomadic life style is chiefly represented by the size of herd he owns. Numbers and trend in the Cholistari livestock population is summarized in Figure 1. The figure reveals average annual herd increase of 2.7% for cattle and 3.4% for goats and a slight decline in the numbers of sheep and camels. All livestock are indigenous breeds well suited to the environment. Herd reproductive performance is naturally poor with low birth rates and high mortality[xv].

Culture of Cholistan

The culture of Cholistan desert is so different and beautiful that it stands out completely. Men wear bright colored turbans and women wear bright colored clothes with very discreet embroidery which is basically the specialty of this area. The biggest source of income is only cattle breeding and its related businesses. The demand of milk, butter and animal fats is met from this source. Around 1.6 million cattle are found in the area and they can be easily increased to a great level if only the government puts in special efforts to upgrade the productivity of this area. In the winters as animals are less in numbers and the weather becomes harsh, they switch to various artistic crafts such as cloth weaving, pottery and leatherwork. Pottery industry is thriving here due to its rich soil and different products like pitchers, Surahies, glasses and piyalas.

The area produces high-quality carpet wool, which is used to make beautiful rugs, carpets, and other winter items. Blankets are also crafted to meet the demand during harsh winters, when temperatures can fall below freezing. Wool obtained from sheep is sold to generate income for local community. Additionally, various textile products are manufactured in the region, including khaddar fabrics and fine-quality khaddar bed clothes.

The Seraiki language is dominant there which is a flavor of Lahnda dialect or Lahnda Languages grouping. Many Sufi poets and saints belong to this region such as Khawaja Ghulam Farid who wrote a lot of poetry in Seraiki language and helped the culture of this place to nurture.[xvi]

3. Architecture of Cholistan: Description & History

The Cholistan desert or Rohi is around 15000 km2 and is located on the East of Bahawalpur city and extending into the Indian Thar Desert. There was a time when this area consisted of around four hundred forts. It is thus aptly known as the land of forts. The forts were constructed in rows of 3, each being 29 kilometers apart from each other[xvii].

There is archaeological evidence that the area was once watered by Hakra river and was home to an Indus Valley culture based on agriculture. This river, the bed of which can be seen clearly etched into the desert landscape, supported settlements from ca. 4000 BC until around 600 B.C. when the river changed its flow

and subsequently vanished underground. Since then the Cholistan area has been a stark and inhospitable desert environment.

Cholistan desert has varied architectural styles ranging from massive Drawer Fort to small round vernacular thatch Guppa. We need to go through these styles before drawing any conclusions. Following is a literature review of Cholistan architecture.

The medieval forts of the Cholistan desert landscape are a group of up to a dozen standing structures, some standing and some deteriorated though forty-seven forts are on record. Derawar Fort is the best surviving example of this series of historic forts, some dating from pre-Mughal times, but all restored and expanded from the 16th to 18th century by powerful local clans. Other forts include (roughly from north to south) Meergarh, Jaangarh, Marotgarh, Maujgarh, Dingarh, Khangarh, Khairgarh, Bijnotgarh and Islamgarh. These structures form a network across the desert landscape. They served to protect and enable the desert caravan routes; mercantile routes from central Asia to the heartland of the sub-continent and pilgrimage routes between Mecca and India.[xviii]

4. Vernacular Architecture of Cholistan

The word vernacular derived from ‘vernacular’ means ‘native’. Hence vernacular architecture – native science of building. The term "vernacular architecture" in general refers to the informal building of structures through traditional building methods by local builders without using the services of a professional architect. It is the most widespread form of building. The builders of this structure are unschooled in formal architectural design and their work reflects the rich diversity of Pakistan's climate, locally available material and the intricate variation in social custom and craftsman.[xix]

It’s a common practice that vernacular architecture of any society is in contrast to its military and imperial architecture in style, material, scale, and craftsmanship but vernacular architecture of Cholistan is extremely in contrast to forts and palaces of Cholistan. Very few typologies of architecture exist in area as described below:

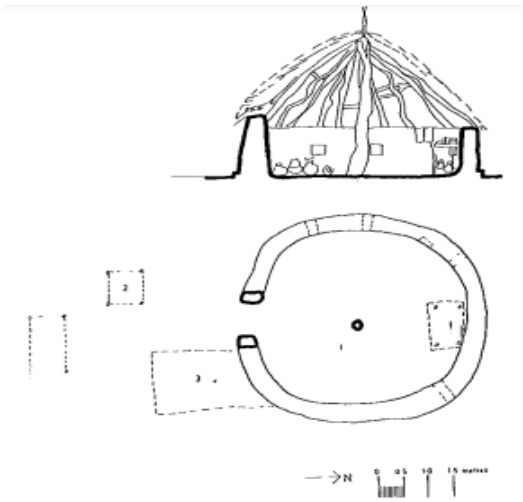
House Types

A distinct evolution in three stages is dissemble in the types of structure employed for domestic architecture: from the traditional circular plan of the gopa shelter, with its domical thatched roof, to the rectangular plan with double-pitched roof and the enlarged rectangular plan with flat roof.

However, throughout all these developments, the essential layout of the house remains intact. This comprises a single-family room facing onto an open platform or clear area, the equivalent of the courtyard, but demarcated by a low kerb in place of the screen wall.[xx]

A gopa dwelling, Nawankot

Photo K K Mumtaz

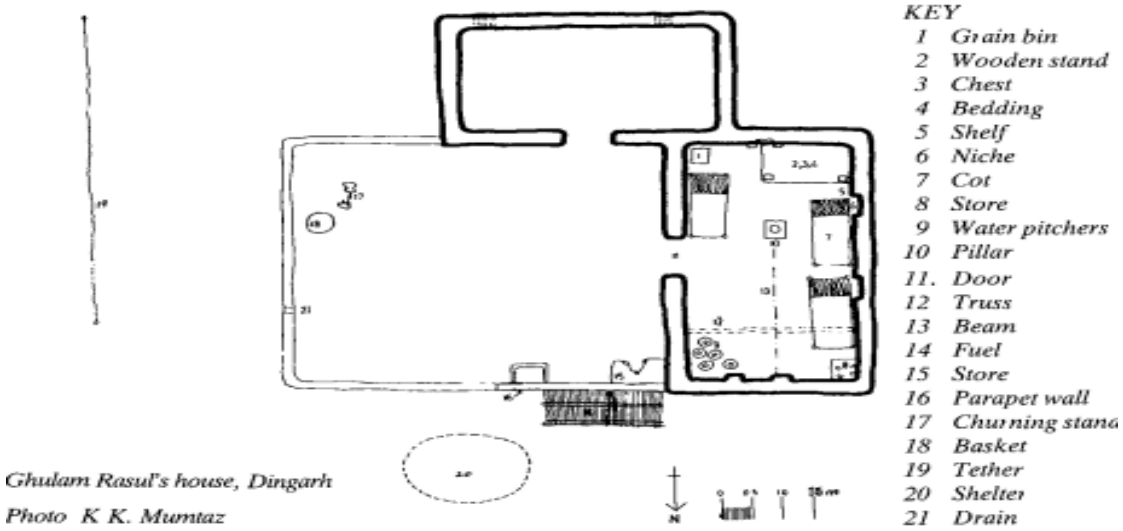


KEY
1 Gopa
2 Enclosure
3 Shed

A gopa house, Kalri/Kami toba Plan and section, showing gopa, enclosure (mani) and shed (jhuggi)

Source K K Mumtaz

Next type of house, representing the latter two types of construction is found in the more permanent settlements. The sizes and orientation of the principal rooms are fairly standard. The rectangular plan with pitched roof is about 3.5 meters by 7 meters (about 12 feet by 24 feet) externally. The flat roof type is slightly larger in plan. In either case, the principle rooms always face east with their longer walls along the north south axis. An entrance in the center of eastern wall opens out onto a raised terrace. The central ridge (shehteer) is supported by a timber column (thumba) and a truss, or rather a trestle (ghorhi) formed by two rafters.



Ghulam Rasul's house, Dingarh
Photo K K. Mumtaz

The eastern wall has a door (dar) while the other three walls have shallow niches (fa/a) at about 1.5 meter above the floor. Each wall is perforated by small (3 inches' diameter) vent holes arranged in groups of four, at about one meter above the floor. Projected above the niches, and running the full length of the west wall is a shelf (safeel) on which crockery and utensils are placed.

Ghulam Rasul's house in Dingarh (in background), and a gopa shelter — without mud infill — for animals. Photo K K Mumtaz.

Against the southern wall are stored bulkier household objects; grain in an earthen bin (kalhoti), a wooden stand (gharawan) on which are placed a large box (tong) with a lid, and spare bedding. In the northwest corner is a decorated earthen store (bhikaree), and in the north eastern corner some half dozen earthen jars (gharas) containing the household supply of water.

On the terrace are a pair of stoves (chulha) in the northwest corner, protected against the wind and sand by a parapet wall. On the other side of this wall is stacked the firewood (balan) and fodder (chara). The eastern end of the yard is used for activities associated with milking, such as churning the milk for butter and making curd. Beyond the yard to the east, stretched between two pegs, is a rope (tandi) to which are tied the calves while the cows are being milked. Some 10 meters to the south and east is a gopa shelter for animals. A second room with a flat roof and with its long axis in the east-west direction has recently been added on the south side of the yard. This room could not be studied in detail as the women were working in it, plastering the floor and walls. However, it was of the flat roof type.[xxi]

Construction is done generally by the men assisted by a mason (mistri) from the city. However, plastering of roofs, walls and floors is done by women. Sun-dried bricks of the standard British size (9" x 3" x 4.5") are used for walls. Columns, beam and rafters in the pitched roof type of construction are all of unsewn local timber. The roofing consists of a thatching of khip grass onto which a mud plaster is applied (gil). A second coat of mud and straw plaster (gaara) is applied to the first, and finished with a third coat (goya or phoonsi) of mud and cow dung. This tast is always done by women. The first mud plastering on the walls (lipai) is done by the mason, but subsequently by the women each year after the rains.

Annex – C:

Derawar Fort: Unwanted Flora Assessment & Removal Control Strategy

Introduction

Derawar Fort is located in the Cholistan Desert, approximately 130 kilometers from Bahawalpur and 20 kilometers south of the city of Ahmedpur East. This historic fort, visible from miles away, is the largest in Cholistan and serves as a major tourist attraction. Historically, it was a vital point along ancient trade routes and was repeatedly conquered by rulers due to its strategic significance. Today, the fort faces serious threats from the uncontrolled growth of unwanted flora, including herbs, shrubs, weeds, trees, and various invasive plant species. This vegetation has damaging effects on the fort's walls and soil, accelerating its deterioration. Seasonal rains support the growth of this diverse flora, which thrives in the desert environment and continues to compromise the structural integrity of the fort. The Urban Unit team recently visited the site to assess current issues, identifying the spread of unwanted vegetation as a major concern. It is crucial to understand and address the destructive impact of this flora to ensure the effective preservation and conservation of this historic landmark.

Overview of Concerned Issues

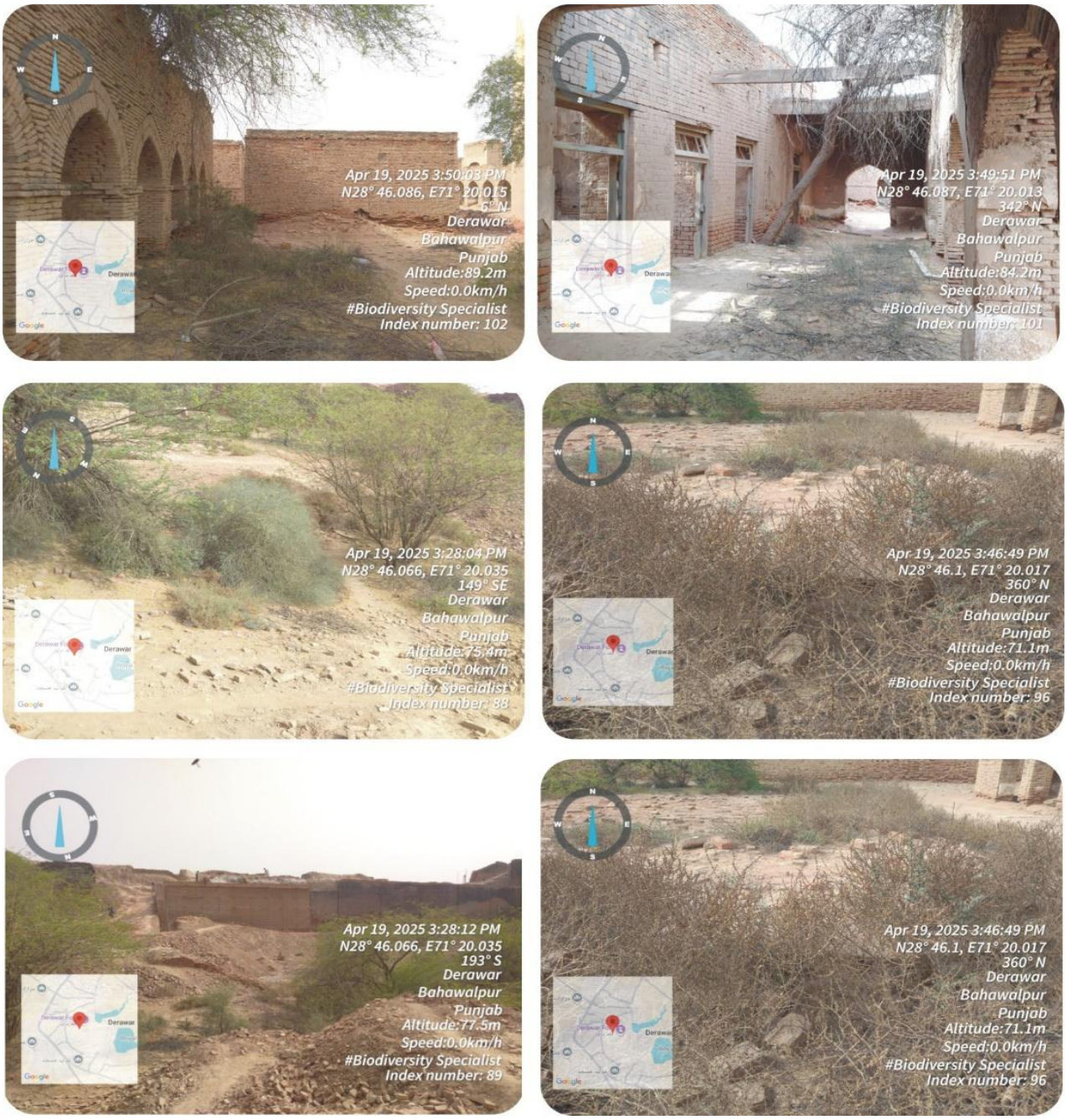
Derawar Fort is an excellent model of ancient Architecture. The composition of mud of construction material is unique. The sandwich layer of the wall represents unique style of construction. The ancient brick structure and mud composition is under threat due to various uncontrolled thriving unwanted flora diversity, anthropogenic and environmental factors. Additionally, vegetation traps moisture against the walls, promoting erosion and biological decay of the mud and lime-based materials used in the fort's construction. Rain water is the source of mud spill in bricks and flora seeds make space to grow inside cracks. These cracks get severity with time. The roots of the weeds, herbs and shrubs make the wall structure weakened by penetrating inside. The continuous roots penetration into cracks increases the surface area of cracks, and structures become destabilized. The visit to the fort and comprehensive survey shows that there is large diversity of flora having rapid dispersal potential. Some trees are also identified which are present in the Fort and even present inside the inner rooms and spaces. These tree roots have deep root system which spreads all around at vast area under earth. Deep root system is the source of destabilization of structures and wall of the Fort. The underground root rapid growth also leads towards destruction. Terrestrial plants, trees, herbs and shrubs have ability to absorb water in roots, stems or leaves to consume for long periods. The moisture inside the parts of the plants and trees also weakens the structures.

A detailed survey and identification of plant species were conducted at the Derawar Fort site. A diverse range of herbs, shrubs, plants, and trees was observed within the Fort's interior. Soil and growth analysis of the area indicates that seeds of many herbs and shrubs can remain viable for extended periods and tend to germinate rapidly during the rainy season. Each plant species exhibits a unique seed dispersal mechanism, contributing to the fast spread of unwanted vegetation. While various control techniques, both chemical and manual, are available, chemical methods are not recommended due to the relatively small area of the Fort and the potential environmental risks. Instead, manual removal is suggested as a more sustainable and environmentally friendly solution. The survey also revealed a notable absence of fruit-bearing trees and plants within the F,ort, which in turn has affected local biodiversity, particularly the presence of bird species. Introducing appropriate fruit plants could attract more birdlife, enhancing the site's ecological value and creating a more vibrant environment that would undoubtedly contribute to the overall tourist experience at Derawar Fort.

Identification & Assessment of Flora Species

Herbs, Shrubs, trees and plant species were recorded at site area by using direct and indirect methods. Pictures of destructive flora were taken from different sites of the Fort. The floral diversity at Fort area is harmful for existing structures. It is crucial to overcome the growth of mentioned vegetation from the site. Floral diversity each year produces large number of seeds and disperses all over area in the fort and outside as well. These produced seeds have ability to sustain in harsh conditions and may survive sometimes for

long times. As rain water falls over the seed testa, these seed start to grow and then whole life bear a lot of seeds a rapid growth rate keeps it destructive for the natural ecosystem of the Fort. It is crucial to adopt removal/control strategy to restore natural ecosystem for sustainable preservation, conservation and tourism promotion.



Source: All images taken during Field visit of Derawar Fort Cholistan, 2025 by the Urban Unit Team

List of Flora Species:

Sr.	Scientific Name	Common Name	Family
1.	*Calotropis procera*	Aak	Asclepidaceae
2.	*Kali tragus*	thistle	Amaranthaceae
3.	*Tamarix aphylla*	Frash	Tamaricaceae
4.	*Tribulus terrestrial*	Gokhru	Zygophyllaceae
5.	*Chenopodium album*	Bathu	Amaranthaceae
6.	*Capparis decidua*	Karrir	Capparaceae
7.	*Prosopis juliflora*	Valaiti Keekar	Fabaceae
8.	*Fumeria indica*	Shahtrah	Fumariaceae
9.	*Ziziphus nummularia*	Ber	Rhamnaceae
10.	*Salvadora Spp.*	Jaal	Salvadoraceae

Removal and Control Strategies

Harmful flora mitigation, removal and control planning is crucial for effective and sustainable conservation of archeological sites. Flora species which are keenly identified in above species table, need some remedies and operational strategies in order to conserve the archeological structures, sustainable ecosystems and

tourism potential. Many strategies can be followed to mitigate this serious issue including below mentioned methods.

Strategy Type	
1	Chemical Control
2	Manual Removal of Harmful Flora
3	Restoration of Native Floral Species
4	Community Awareness Strategies
5	Collaboration with Experts and Organizations

Chemical Control Method:

Archeological sites have diverse range of flora which are destructing the ecosystems and sites sharply. Mostly small herbs, shrubs and grasses can be control by applying some herbicides, fungicides, and round ups in the target site areas. These chemicals have minor impact on soil and archeological structures and all other herbs, shrubs and target plants can be controlled. Some chemicals which are most effective for this purpose are:

- Herbicide, Roundup (Acid Equivalent)

These herbicides are important to use because of mode of action. These herbicides reduce the enzymatic activity in plant growth and eventually the plant vanishes. But most important is timing of the use of this herbicide. Glyphosate is most effective when applied during the growing season when invasive and harmful flora are actively photosynthesizing and absorbing nutrients. Applying glyphosate at the right time, such as during late spring or early summer, ensures that the herbicide works quickly and efficiently, leading to rapid plant death. Mostly, herbicides can be more effective only in early growth seasons and rapidly transfer the action. All herbs, shrubs, grasses and small growing plants can be destroyed by the use of round ups and related chemicals which have acid equivalent composition.

Manual Method:

Manual strategy can be initiated in the field and site areas to remove harmful flora for archeological site degradation in each proposed area. A team may be engaged from concerned and line departments to carry on this effective campaign.

Manual removal may involve following activities:

Pulling (By Hand)

This method is simple and effective for removing and managing unwanted flora from archaeological sites. It requires a well-trained team, proper planning, and effective time and resource management. The process involves manually pulling plants from the ground, ensuring that the entire root system is removed to prevent regrowth. Small plants can be easily uprooted, while larger ones may require more effort. This technique has no adverse effects on the soil or surrounding structures, making it a safe and sustainable option. Although it is time-consuming, it contributes to the long-term restoration of a balanced ecosystem. Large-scale, fast-

track campaigns can help reduce the overall time required, allowing for more immediate positive impacts on site preservation and environmental health.

Digging Up & Cutting Method

In some archaeological areas, large trees and plants are present, which cannot be easily removed using traditional or local methods. Their removal requires the use of heavy machinery such as shovels, cranes, or other specialized equipment. Effective excavation and complete root removal are essential to ensure long-term ecological sustainability and to protect the integrity of archaeological sites. At Derawar Fort, trees such as *Jaal* have unfortunately grown close to structural elements and are contributing to the deterioration of basement foundations. Immediate action is needed to prevent further damage and to preserve the Fort's historic infrastructure.

Awareness Strategy & Community Engagement:

It is very important to engage local communities of the areas to hold events and seminars to prevail the importance of the archeological sites and their conservation. Community can play an important role in protection, preservation, conservation and management of the areas. Land owners near the archeology sites can remove these unwanted plants and trees from their lands and can reduce the process of dispersal at large scale. This continuous practice will take few years to mitigate the process of invasive species dispersal. Influential individuals of the areas, and youth and students, can enhance the awareness strategies if trained properly. Media can be used to enhance the importance of Derawar Fort, video documentaries and awareness stuff can create many fruitful impact through operational management. Community engagement practices can be effective by following these methods:

- Community participation in ongoing projects
- Training programs to educate about archeological preservation and its importance
- Sustainable land management practices

Collaboration with Experts and NGO's:

Collaborating with botanical gardens, environmental NGOs, and universities for technical expertise and resources can help formulate more effective and sustainable strategies for controlling unwanted flora.

Figure 8: Jaal tree inside Derawar Fort having under earth deep roots

All sites related to Derawar Fort need to be treated with above-described methods for effective protection, preservation and conservation of archaeological sites of Derawar Fort sustainability and tourism enhancement. Royal Necropolis also seems to be treated with above-described methods for long term sustainability and conservation. It is important to understand that the balance of biodiversity is essential to promote tourism of any area. The introduction of fruit trees will be effective at Royal Necropolis for tourism and biodiversity enhancement. The native birds and small biodiversity are facing food, water and shelter issues for survival in Cholistan. Provision of basic needs for biodiversity at site areas is important. So the native fruit trees and plants introduction at site areas will be effective in terms of tourism and biodiversity enhancement.

Recommendations

1. Regular monitoring and cleaning of archeological remains is important task to perform under trained archeologists, experts and decision makers.
2. Introduction of native trees and plants at right areas is necessary. Plants and trees having features of food, shelter and sufficient water needs must be introduced at right areas of Fort, Mosque and Royal Necropolis.
3. Archeological sites are precious assets of the country and their care must be taken while working on heavy machinery to remove unwanted flora from the sites. Heavy machines may disrupt archeological delicate structures.
4. Regular crack monitoring and sealing especially at boundary wall and bastions base areas can improve the effective protection from harmful effects of vegetation growth.
5. An area must be reserved for plantation and these plantations should be native away from walls and infrastructure of the Fort.
6. Drainage improvement and effective systems can enhance the process of preservation, conservation and management. At one corner of Derawar Fort near to Baradari, there is massive destruction. Rain water enters the basement areas which is a source of massive destruction. Jaal trees, karrir and other herbs and shrubs are the cause of soil erosion and outer wall destruction.
7. We must prefer trusted herbicide brands for use in site areas. These herbicides must be used in a specific ratio each time. More strong herbicides may damage soil fertility.
8. Engineers and workers must use manual tools while working on archeological structures. This practice may preserve the archeological assets to attain (SDGs) Sustainable Development Goals.
9. Government must introduce effective rules in which community must be the priority. It is crucial to provide financial benefits to the community for sustainable preservation and conservation of archeological sites in Punjab.
10. Regular archeological staff training and awareness workshops may bring effective development in protection, preservation, conservation and management of archeological heritage

Annex – D:

Archaeological Assessment:

Introduction and History of Derawar Fort

Located about 130 km south of Bahawalpur in the Cholistan (Rohi) Desert, Derawar Fort is comparatively the best-preserved of region's historic forts, which were once vital to desert trade routes. The Cholistan Desert, part of the former Bahawalpur State, spans over 26,000 km^2 and is home to the remains of 39 forts, many of which have disappeared due to neglect, environmental erosion, and human vandalism, for instance, Bara Fort.

Built in 9th century by Rajput ruler Rai Jajja Bhatti and later taken over by the Abbasi family in 1733, Derawar Fort has centuries of military, trade, and dynastic significance. It served as a key defensive post along routes linking Central Asia and the Indian subcontinent, and stands near the ancient Hakra (Sarasvati) riverbed, home to over 400 archaeological sites linked to early Indus Valley civilizations (4000–2000 BCE).

Now a legally recognized heritage site, the Fort and surrounding areas require urgent conservation. This assessment forms part of a broader tourism and heritage strategy aimed at sustainable preservation through interdisciplinary research. It seeks to go beyond technical degradation issues by addressing the broader environmental, social, and institutional factors that threaten the site's integrity, making it a cornerstone for cultural revival and heritage-led tourism in southern Punjab.[1]

Figure 9: Map of Pakistan with the highlighted region of Cholistan and other deserts

[1] Nazir, H. Derawar Fort Cholistan-History, Architecture, Conservation.

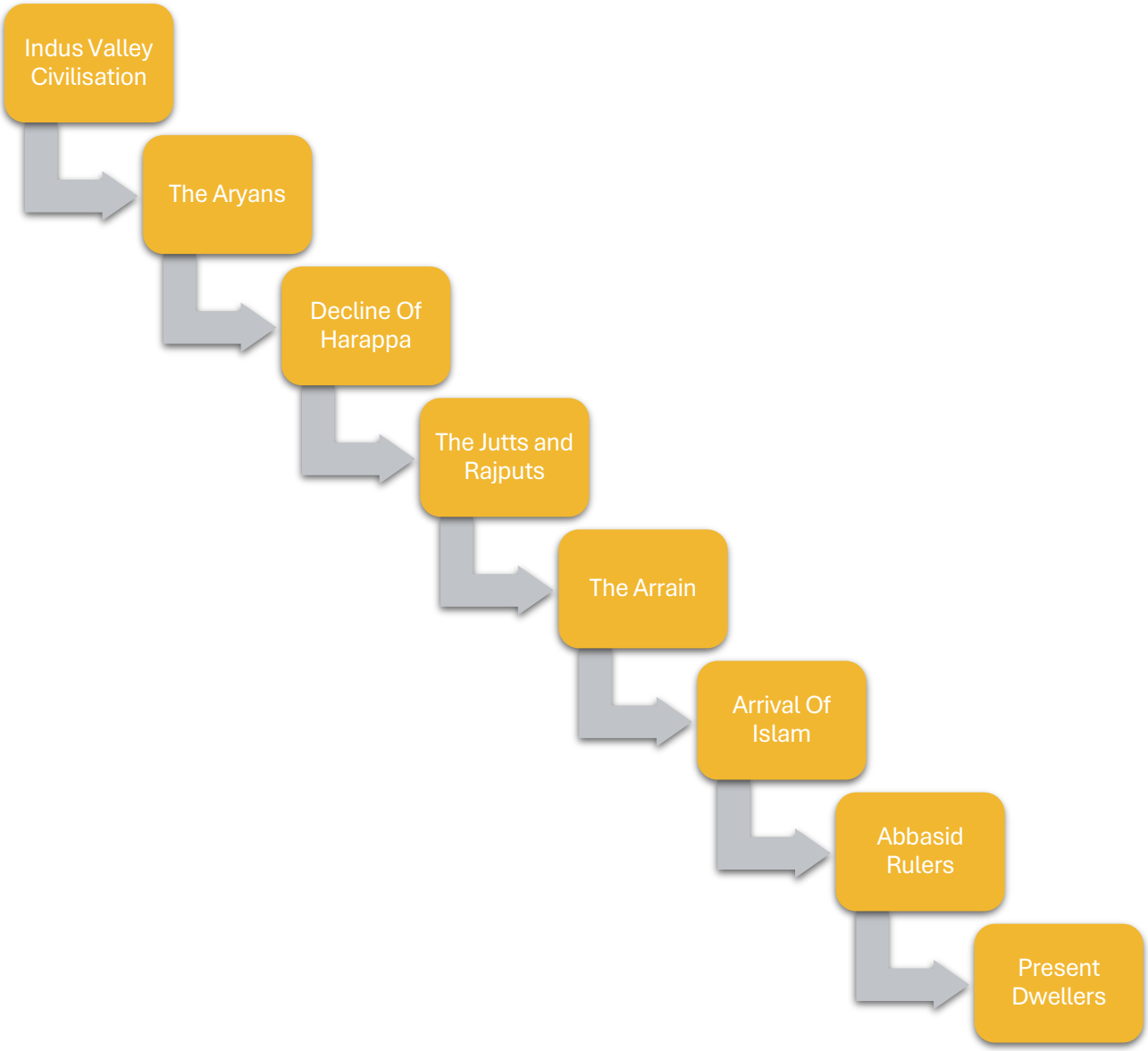


Figure 10: Historical Timeline of Cholistan Desert

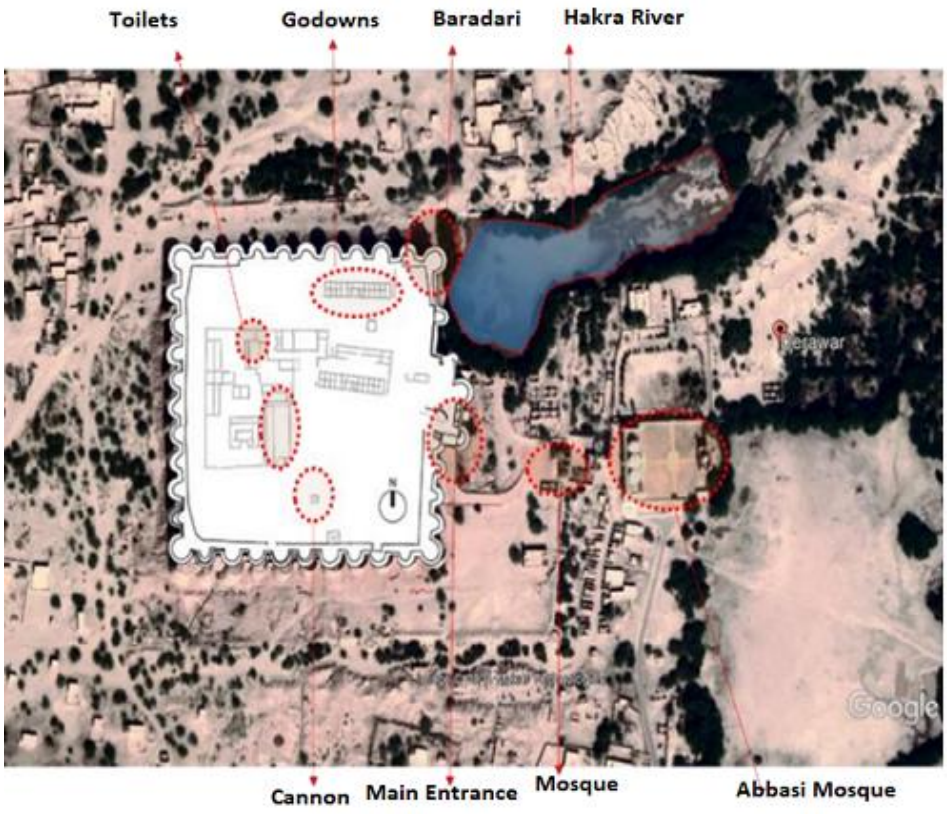


Figure 11: Plan of Derawar with Highlighted Spaces

Objectives

- **Develop and implement immediate and long-term conservation strategies** to stabilize and preserve the structural integrity of Derawar Fort, addressing both environmental (mainly rainfall and no proper drainage) and human-induced threats
- **Evaluate the architectural and structural condition** of Derawar Fort through a comprehensive archaeological assessment by field surveys and documenting the current state
- **Identify and analyze key preservation challenges**, particularly damage caused by seasonal rainfall, unplanned conservation, encroachment, graffiti, lack of funding, and lack of trained staff
- **Build institutional and community awareness** by training conservation personnel specifically from the Rohi region, as when a community starts to own a heritage site, it indirectly revives
- **Incorporate the site into a sustainable heritage tourism model**, promoting long-term cultural and economic benefits for the region

Field Observations and Findings

The field assessment of Derawar Fort was conducted on April 19 under clear desert weather conditions. All accessible sections of the Fort and its associated structures were thoroughly examined to document and analyze their current physical condition and to identify any visible threats.

The construction technique of the Fort walls features a three-layer composition: a core of mud brick, followed by a layer of half-baked brick, and finished with an external surface of fully baked brick (red fired bricks. Although this traditional layering method was once effective for insulation and load distribution, it has become susceptible to deterioration due to prolonged environmental exposure and insufficient maintenance.

Key areas of the site were evaluated during the visit, including the Zanan Khana (women's quarters), Baradari (pavilion), jail room, central courtyard, and the underground tunnel system (surface observation). These structures exemplify the architectural richness and strategic planning inherent in the Fort's original design.

The most significant deterioration observed is the result of water infiltration. Rainwater penetrates the Fort's surface levels, percolating downward into buried and subsurface structures. Over time, this moisture compromises the foundational layers, weakening and collapsing outer bastions and fort walls.

Additionally, a serious issue of salivation was noted. The groundwater in the Cholistan Desert region has a high salt content, which, upon entering the fort's structures, leads to salt crystallization within the brickwork and plaster. This process accelerates material decay by initiating chemical reactions that break down the brick bonds and surface finishes. Salt efflorescence was visibly evident on several interior walls and near the base of structural elements.

Despite its robust original construction, Derawar Fort is now facing increasing challenges from natural decay processes, most notably water erosion and salt-induced material degradation, which necessitate immediate conservation efforts.

Figure 12: The bricks used in Fort's erection currently lie at the bottom

Figure 13: Rainwater penetrates surface level and percolates downward into buried structures, leading to the outer walls/bastions.

Figure 14: The roof and walls of the room have been damaged.

Figure 15: Underground room has been blocked due to rain

Figure 16: Urban Unit team inspecting the ongoing restoration work of boundary wall

Recommendations

Scope: Structural & Environmental

Based on the field observations and identified risks, the following conservation and management measures are proposed. These are categorized by urgency (emergency, short-term, long-term) and scope (structural, environmental, social, tourism-related) to support strategic planning and phased implementation.

Emergency Measures

- **Surface Sealing to Stop Water Infiltration**
  Fill visible surface gaps and eroded areas caused by water percolation using well-compacted soil. Over this, apply a clay-based temporary flooring treated with reversible waterproof solutions (e.g., lime-clay slurry with natural sealants). This will immediately reduce rainwater infiltration into buried structures and buy time for long-term conservation planning. This measure is temporary, reversible, and must be regularly maintained using the attached maintenance checklist (see Appendix A) and materials and Tools for Emergency Surface Waterproofing and Stabilization (see Appendix B).
- **Maintenance Checklist Protocol**
  A field-maintainable checklist must be implemented to monitor this intervention, including surface inspections, patch repairs, drainage flow tracking, and signs of seepage or salivation (see Appendix A).and (Appendix B) for Materials and Tools to assist local teams in executing this emergency step with minimal procurement
- **Outer Boundary Demarcation for Visibility and Control**
  Demarcate the entire outer boundary of Derawar Fort using temporary fencing or markers to

improve visibility for visitors and signal the site's protected status. This also helps manage public movement and discourages unregulated entry or vandalism.

- **Rainwater Diversion to Support Surface Sealing**
  Once the temporary flooring is applied, implement basic rainwater diversion channels or trenches to prevent further water pooling or infiltration near critical areas. This helps sustain the flooring intervention and reduces load on structural foundations.
- **Bastion Restoration with Damp-Proof Course (DPC)**
  For bastions that require consolidation/restoration must include the insertion of a DPC layer to mitigate future salivation due to desert groundwater or capillary rise. This will extend the life of repaired sections and prevent salt crystallization from recurring.

Identification of Revival Zones for Adaptive Reuse

During field activity, clearly flag and map zones within the Fort that are structurally stable and culturally significant, such as the courtyard or Baradari, for potential adaptive reuse. These spaces can host temporary setups for visitor engagement, such as:

a) A folk music performance zone (reviving local Cholistan traditions),
b) A small heritage café or food kiosk using traditional design
c) An immersive storytelling installation or visual history corner

- **Uncontrolled Vegetation Clearance:**

Rapid vegetation growth around and within the Fort structure, especially at bastions and junction points, is **damaging to walls and foundations**. Carefully remove all **weeds,** shrubs, and invasive growth using manual or low-impact tools, under the supervision of a conservation specialist to avoid disturbing the underlying heritage fabric.

Long-Term and Strategic Interventions

Scope: Ethical conservation, community ownership, and sustainable revival of Derawar Fort

Following emergency stabilization, long-term success must begin with the reversal of temporary measures-specifically the clay flooring and surface fillings-allowing for proper archaeological excavation under expert supervision. This excavation will guide all future interventions, ensuring they are scientifically grounded, minimal, and reversible, in line with international conservation ethics.

Crucially, Derawar Fort must not be treated merely as a technical restoration project. Its protection depends on the emotional ownership of the local community. Conservation must become a shared responsibility-rooted in awareness, participation, and benefit.

“What people believe is theirs, they will fight to protect.”

Recommended Actions:

- Initiate **controlled excavation and documentation** to uncover buried structures and guide authentic restoration

- Restore bastions and boundary walls using **traditional materials** with proper **damp-proofing (DPC)** to address salivation
- Develop a **drainage strategy** to manage surface water and prevent future erosion
- Legally **demarcate and protect the fort boundary** and ensure visual integrity for approaching visitors
- Designate parts of the fort (e.g. Baradari or Zanan Khana) for **adaptive reuse**-folk music, cultural events, or visitor rest areas-ensuring **reversibility**
- Embed the site within **regional tourism ecosystem**, such as the **Cholistan Desert Rally**.
- Engage local youth and students in **guided tours, clean-up efforts, and heritage awareness**, fostering long-term community guardianship
- Establish a **site management unit** with local representation and sustained government support

This long-term framework centers Derawar not only as a conservation priority but as a symbol of **regional identity**-a space for learning, gathering, and remembering

Maintenance Checklist

Task	Frequency	Responsible	Remarks
Inspect surface flooring for cracks or holes	After every rainfall	Site caretaker/ PMU	Look for erosion, waterlogging
Reapply clay-waterproof slurry in worn areas	As needed	Skilled mason	Use same reversible mixture
Check rainwater diversion channels	Weekly / after rain	Field technician	Clear blockages, re-shape if needed
Observe seepage in substructures	Bi-weekly	Heritage conservator	Note damp zones, salting, or mold
Record rainfall events and water flow patterns	Ongoing	Site supervisor	Maintain logbook
Monitor salt emergence on walls/floor	Monthly	Conservator	Treat active salting with poultice
Photograph and document changes	Monthly	Documentation officer	Include before/after visuals

Item	Purpose	Suggested Specifications / Notes
Clay (natural fine-textured)	Base material for temporary surface sealing	Preferably from local soil for compatibility
Lime (hydrated or natural hydraulic)	Mixed with clay for strength and breathability	5–15% in mix, improves water resistance

Natural waterproofing agent	To enhance water resistance of clay surface	E.g., linseed oil, pine resin, neem oil, or jiggery mix
Sand/Fine Aggregate (optional)	To improve compaction and prevent cracking	1:3 ratio (clay :sand) if required
Clean Soil (for gap filling)	Filler for depressions caused by erosion	Compacted in layers
Poulticing cloth or clay pack	Temporary desalination of salt-affected walls	Use cotton cloth and fuller's earth or kaolin
Shovels and Spades	For soil filling and channel formation	Basic digging tools
Trowels/Wooden Floats	For applying and leveling the clay mixture	Essential for even finishing
Buckets/Containers	For mixing and transporting materials	Reused containers acceptable
Water Sprayer/Can	To keep surface damp during application	Avoid overwatering
Brushes or cloth pads	For cleaning and applying waterproof coating	Use coarse brushes for cleaning cracks
Measurement tape and Markers	For tracking restored areas and demarcation	Temporary bamboo stakes or chalk lines
Temporary Fencing/Ropes	For outer boundary demarcation	Use natural fiber rope or bamboo fencing where possible
Logbook/Inspection Sheets	To maintain maintenance records	Can be printed or handwritten
Camera/Mobile phone	For photographic documentation	Standard phone cameras acceptable

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