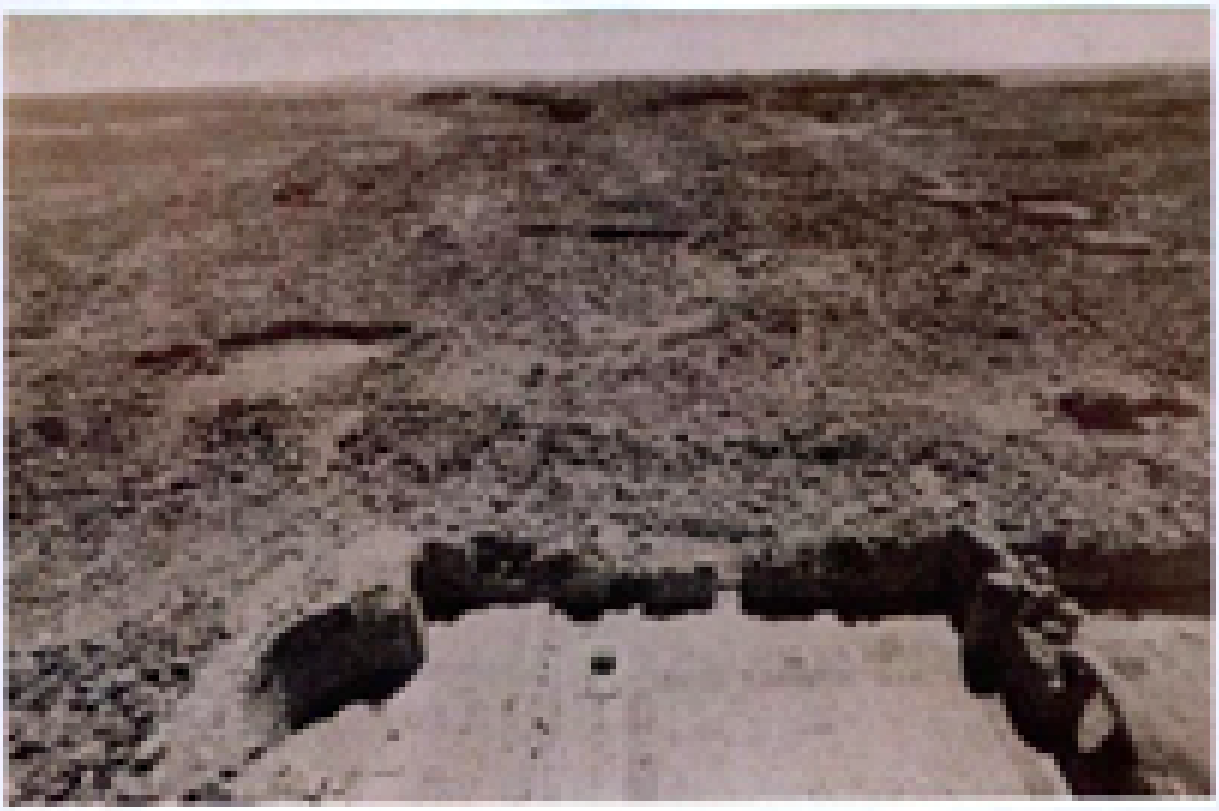
Aerial photo of the Town of Um er-Rasas

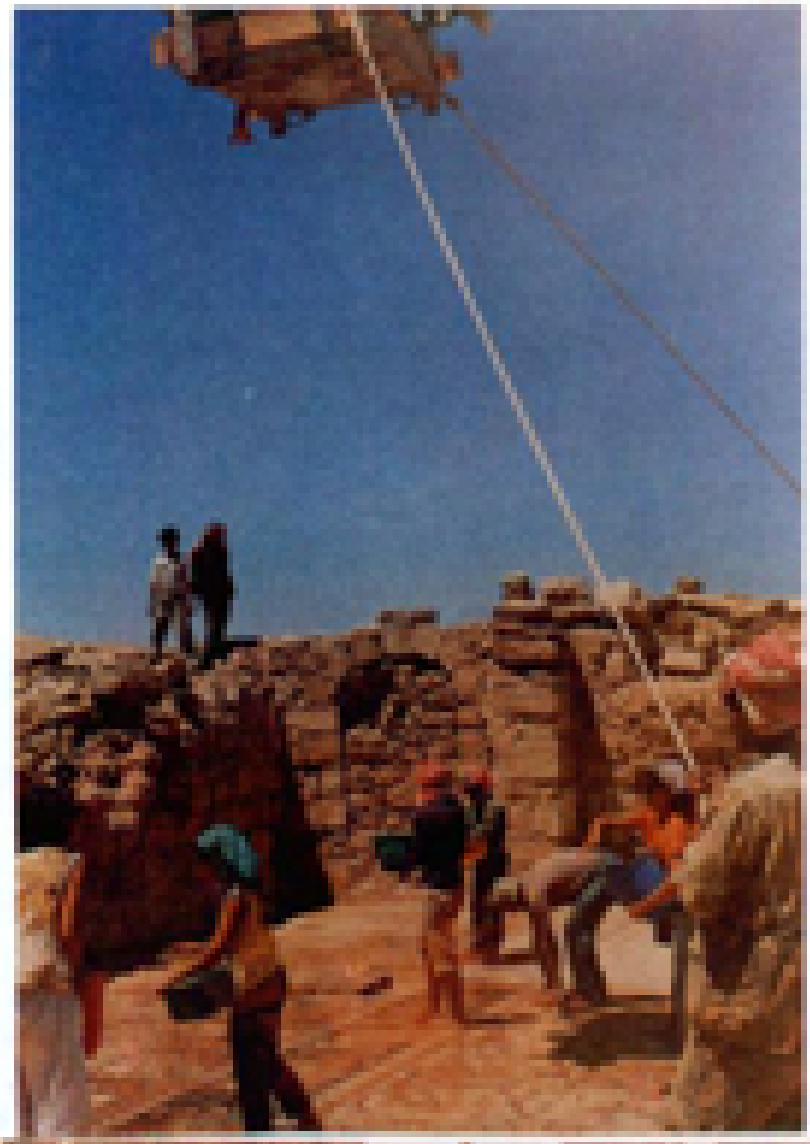


The Southern Main Part Of Um Er-Rasas as seen from the north before works of excavation. In the foreground is the Church of St.Stephen (1987)

The Two Quarters of Um er-Rasas
As see from the north. St. Stephen Church in the foreground

The Walls of the Castrum

The Castrum as seen from top



People at work in St.Stephen Church

Terraced Agricultural field (or a dam)

The Square double Storeyed Building in the middle ,the Stylite Tower in the background, the Reservoirs in the foreground as seen from north.

Reservoirs hewn in the bedrock in the foreground
Dammed rain water in the background

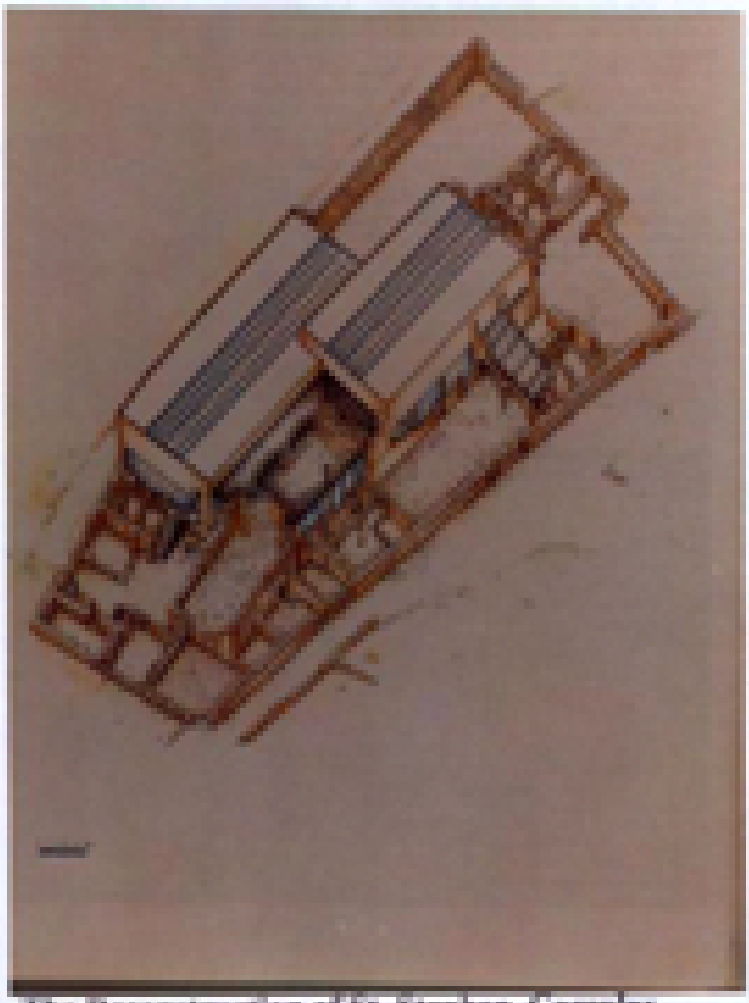
Detail of the reservoirs, one still roofed with arches and slabs

Arieal View of
The Tower with its Church to the South

The Tower of Umm-Rasas

A watch room with rolling stone door among the agricultural fields

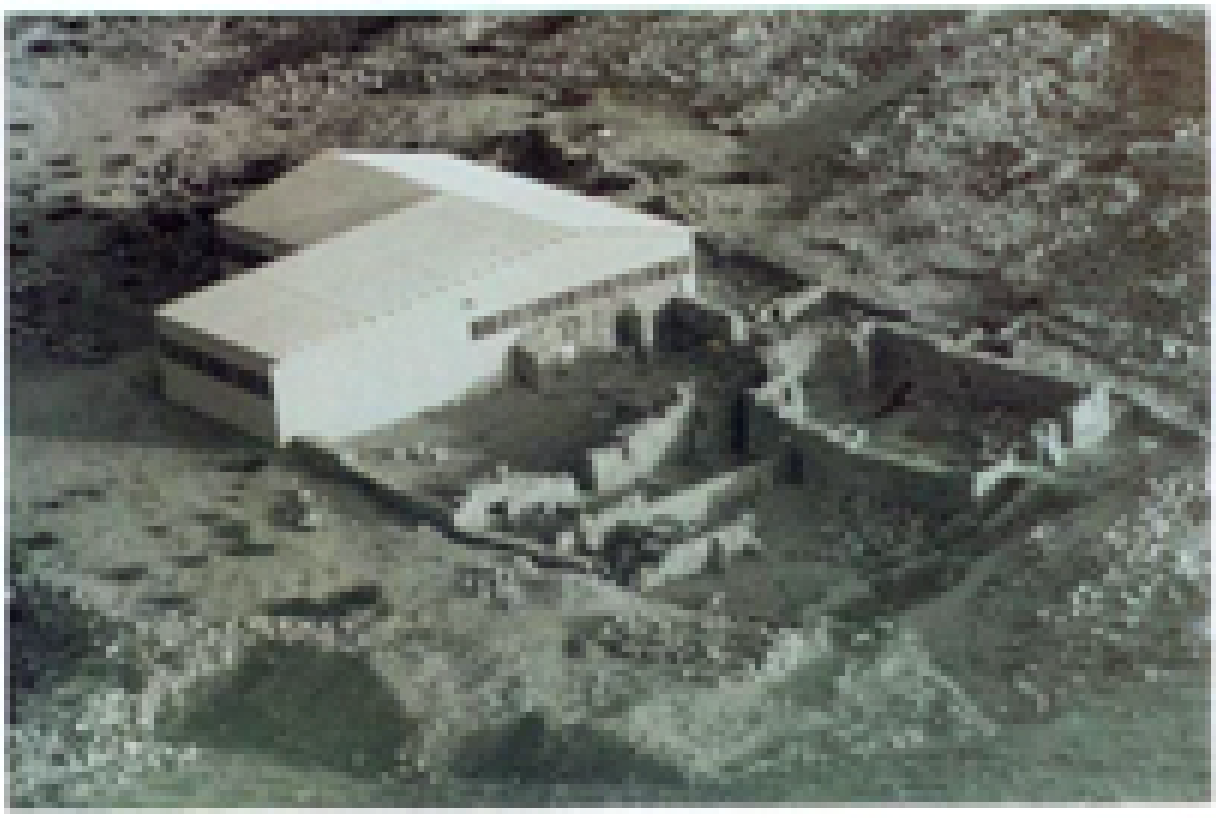
Another watch room with farmstead



The Reconstruction of St. Stephen Complex

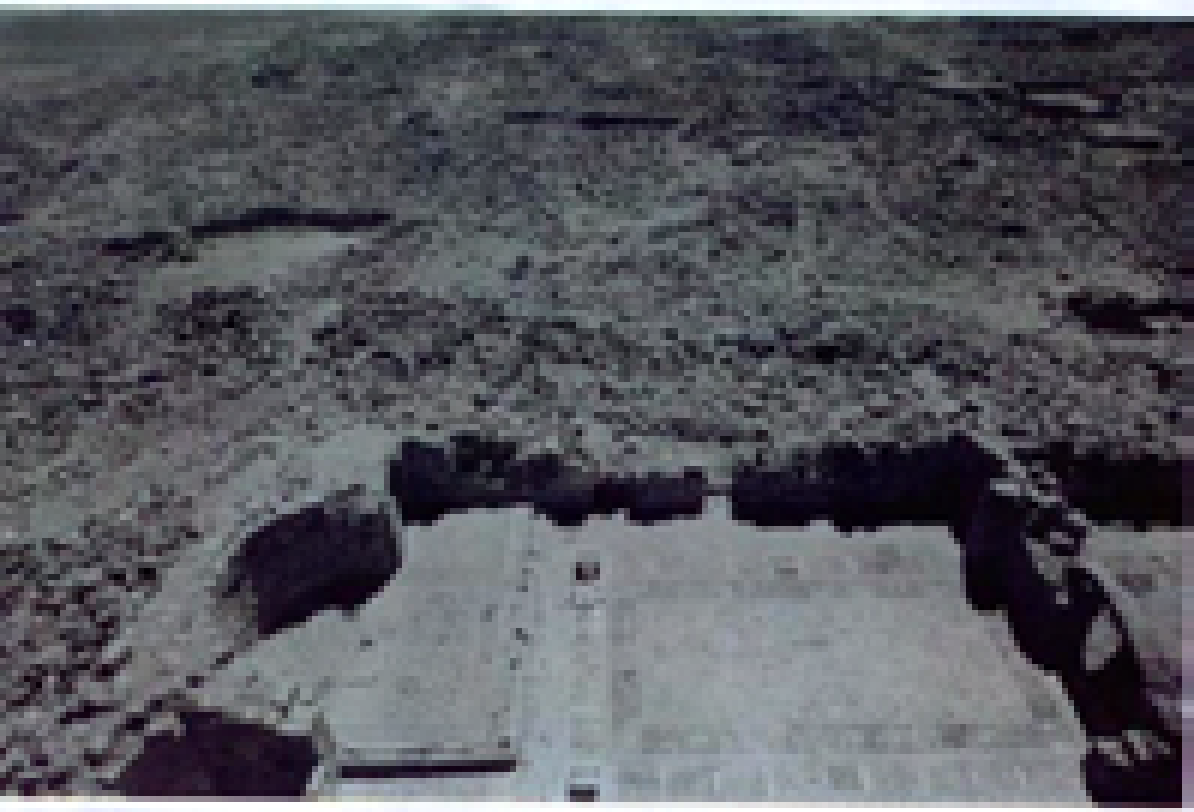
The Church of the Stylite Tower

The Church of Aedicula



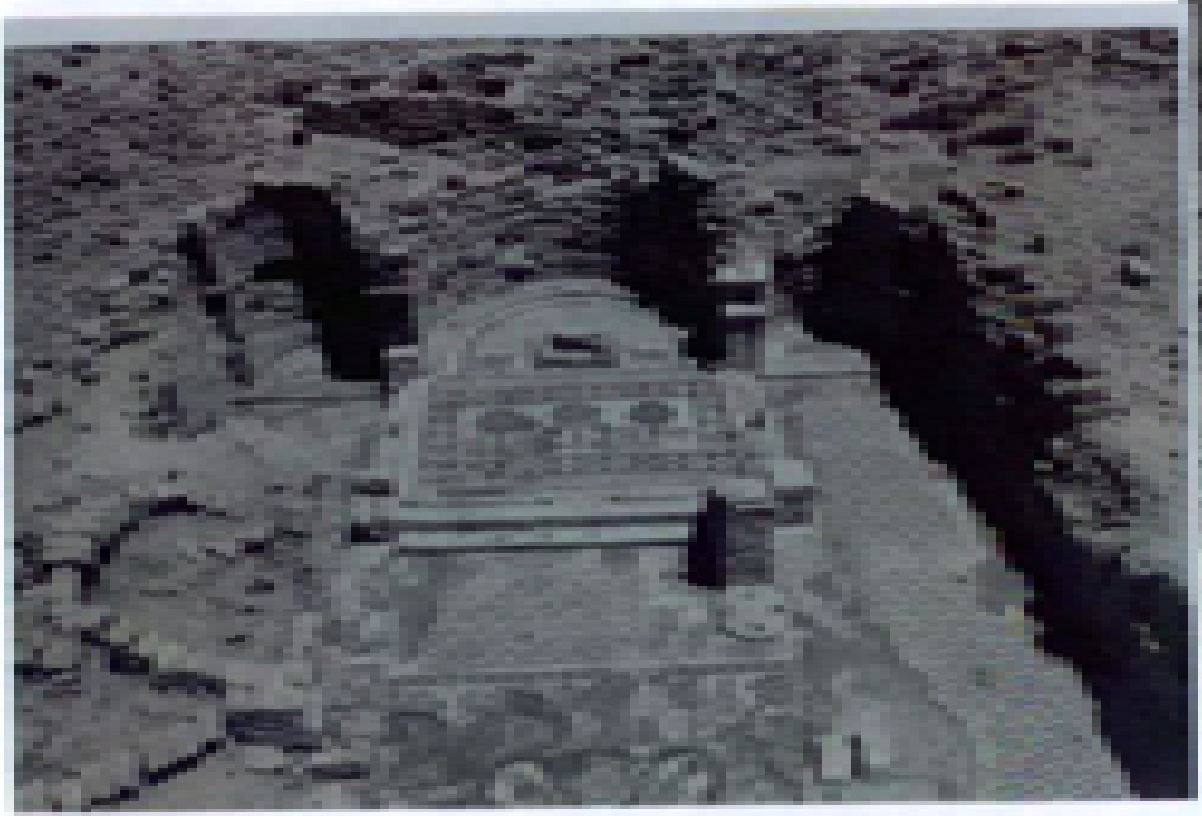
An Aerial View of the Church of Aedicula

The Twin Churches Inside the Castrum



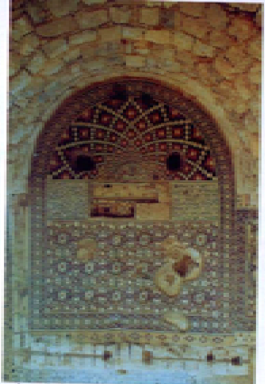
As seen from the North.St.Stephen Church in the Foreground

The Twin Churches



The Church of the Lions in the Quarter Outside the Castrum

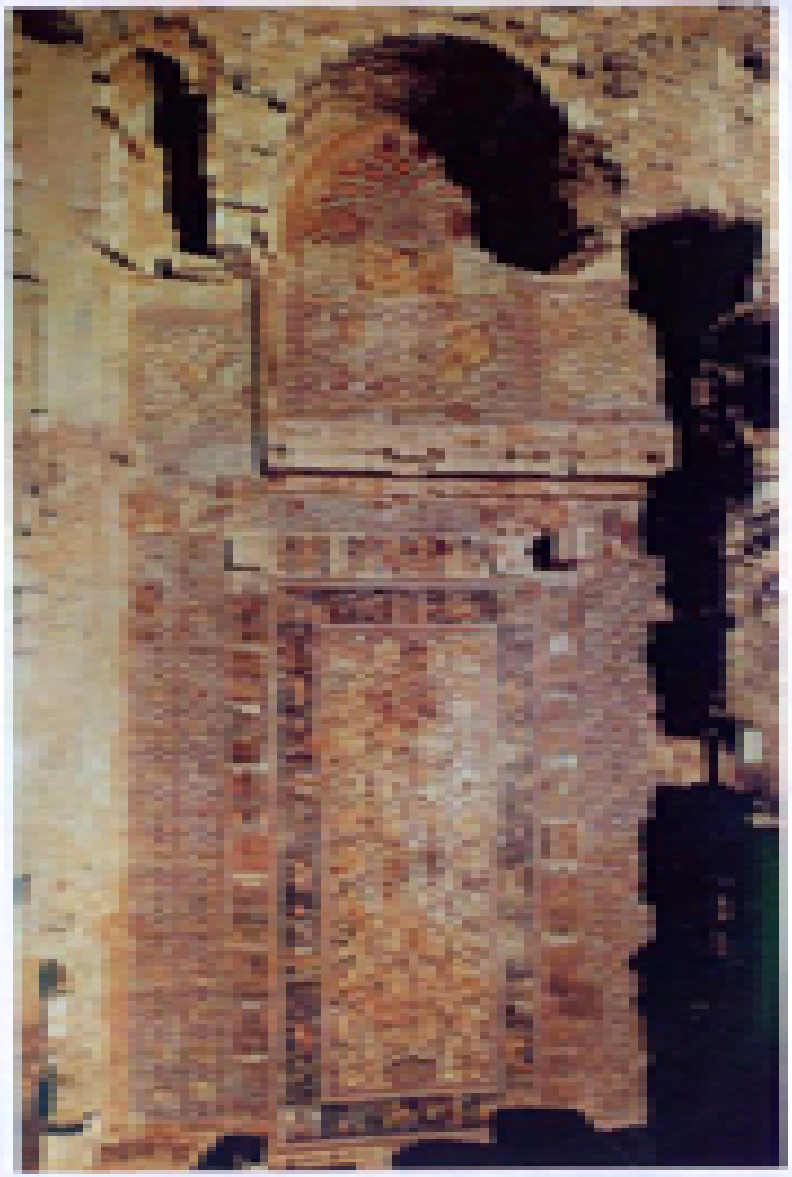
The Church of [illegible]



Central panel of the sanctuary around the Altar : Work of the Mosaicist Staurachios, son of Zada from Hesban , and Euremios (AD 756)

A Niche and cross on the Eastern facade of the Stylite Tower

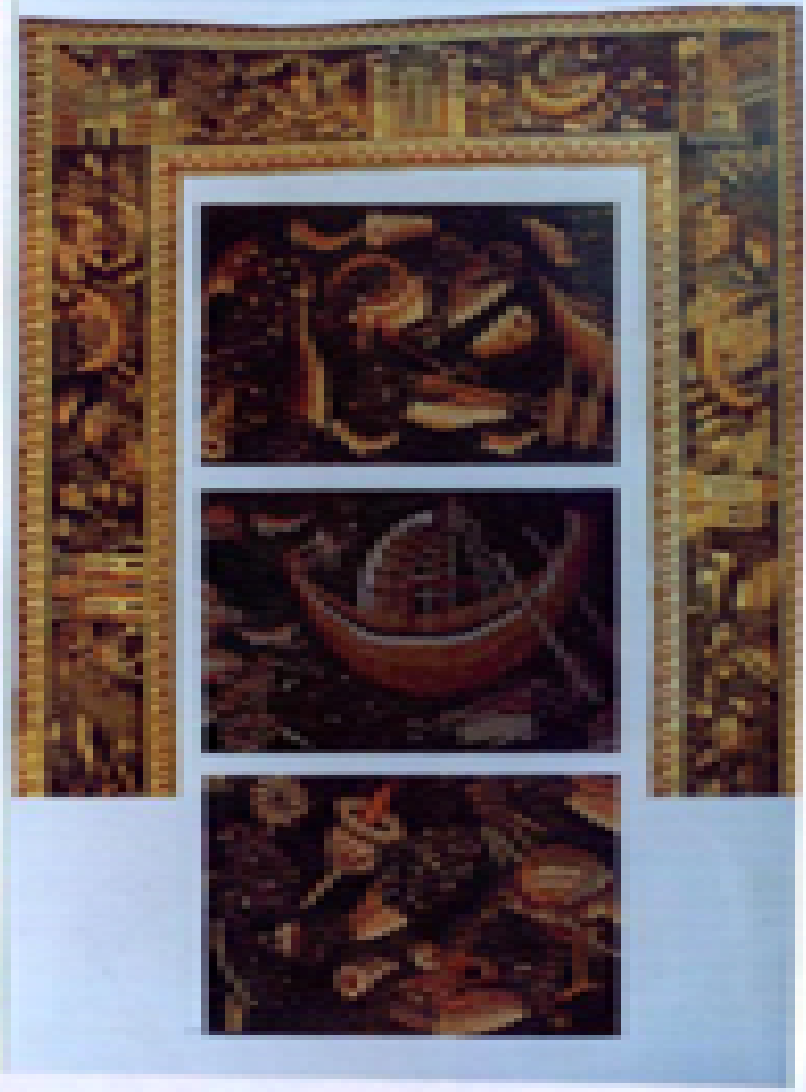
St. Stephen Church :-The eastern end of the northern aisle with the Portraits and names of the donors



Mosaic floor of the Church of St.Stephen

Dedicatory Inscription and Series of donors (St. Stephen Church)

Double Architecture representation in the carpet of the Nave of the Church of Bishop Sergius(AD 587)



Details of the Nilotic Scene(St.Stephen)

Esbeata (Esther of modern Jordan)-St.Stephen Church

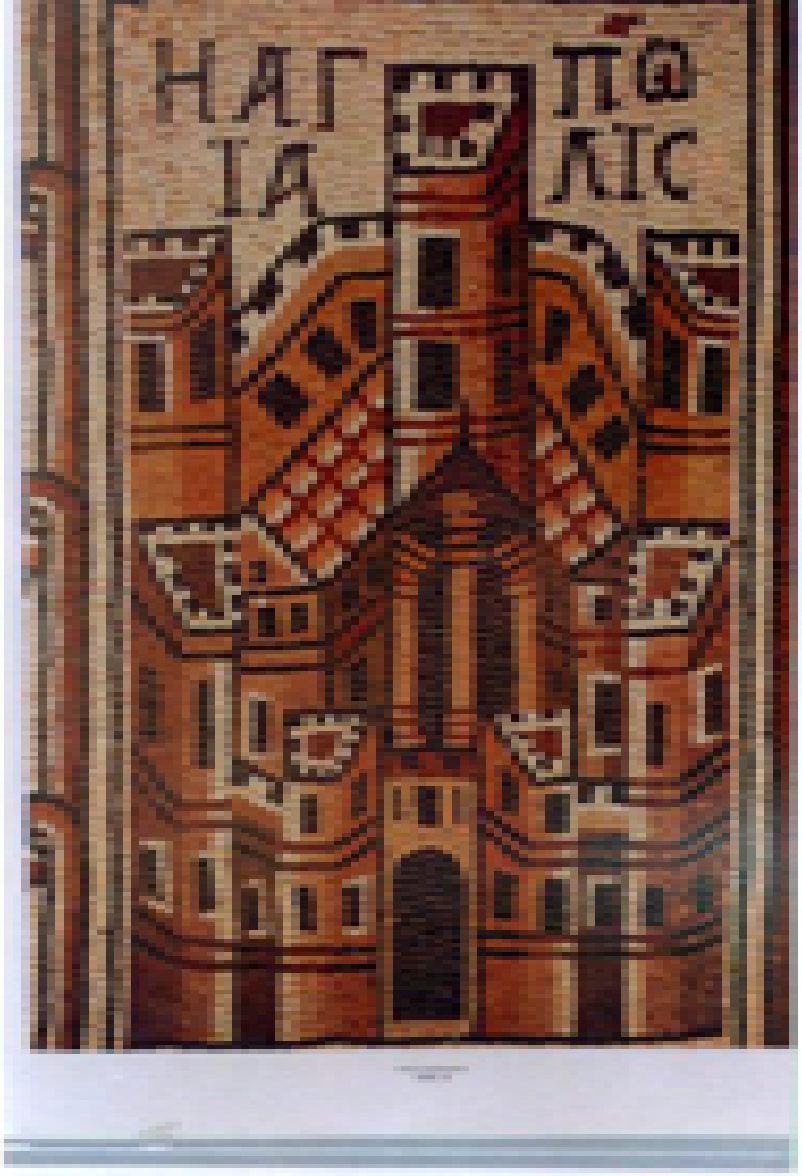
Lindora (Lilith of Jordan)-St.Stephen Church

Philadelphia(St.Stephen Church)

Madaba (Saint Stephen Church)

Caesarea on the Sea (Kesaria)

Lydda (Diospolis)



The Holy City of Jerusalem

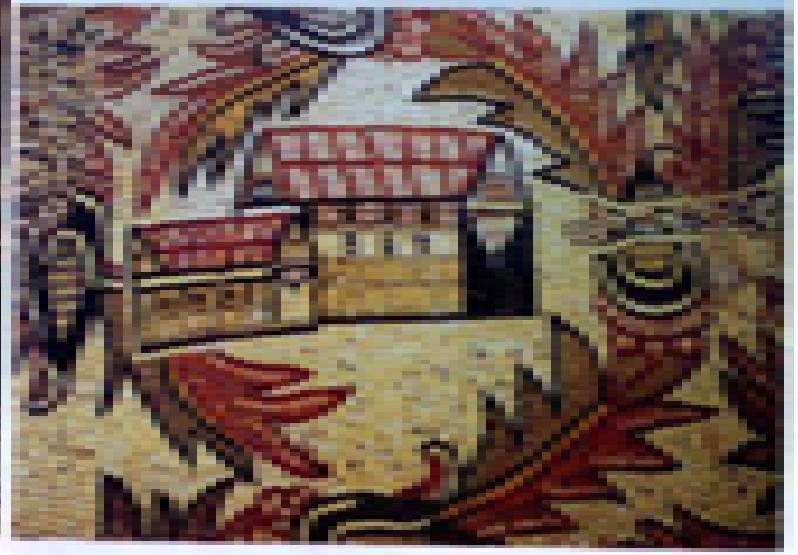
Al-Karak

Bishop Sergius Church :Detail of the carpet
The Central area of the Nave

Bishop Sergius Church :Detail of the carpet
The western area of the Nave

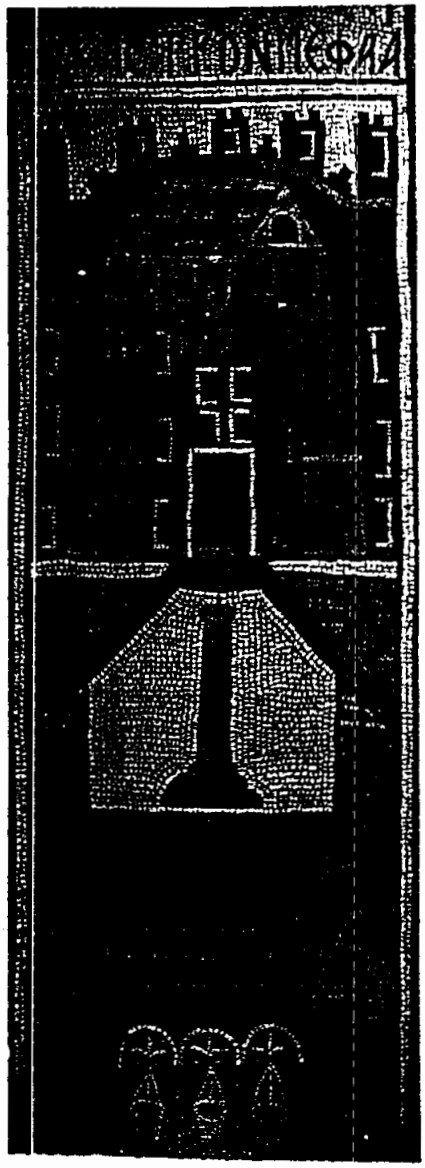
Sergius Church-Double Architecture representation

Sergius Church—The Eastern Area of Carpet



Sergius Church Architectural representation

The Hashemite Kingdom of Jordan



European Commission
Project n°JOR/B7-4100/IB/1999/190

Protection and Promotion of Cultural Heritage Project.
Preliminary design for Umm-Ar-Rasas

FINAL TECHNICAL REPORT

September 2001

COPY

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Table of Contents

I. Executive Summary

All answers to the questions concerning the site were obtained from various interlocutors and available documents

One important doubt remains however, concerning the land property, yet a fundamental issue for the future safeguarding of the Umm ar-Rassas vestiges. In spite of a variety of formal steps and requests this issue is still not clearly adressed. This is maybe due to the purchasing procedure which has been initiated by the Ministry of Tourism and Antiquities. However, the simple fact that this procedure of land acquisition is on going ensures there is a will to implement it . The formulated proposals, which are gathered in the chapter 'Management Prescriptions', will thus be based on the assumption that the entirety of the area of the so-called " Archaeological Park " has been purchased and owned in the name of the Department of Antiquities.

Works already undertaken on the site demonstrated the geological homogeneity of the underground which is made up of sub-horizontal layers of limestone rock of good mechanical qualities. However, the examination of the ruins and their surroundings reveals the existence of many artificial underground cavities, even under the pavements of mosaics (cisterns, graves...). The presence of these fragile zones are potentially dangerous for the visitors (fall risk) as well as for old and modern constructions (possible cracks, collapse). They justify the establishment of a detailed mapping of their location (this work being also of interest for archaeologists). This work should be carried out by the sole use of adapted, non destroying techniques (radar, magnetometer,...), making possible, in particular, to determine the volume and the state of conservation of the cavities. No work of restoration, installation or construction should be undertaken without such a detailed mapping of the immediate underground, especially within the St Stephen complex where prove of a large bottle type cistern under the Bishop Sergius mosaics and underground cavities (tombs ?) under St Stephen chuch, were provided.

Concerning site management issues, a consensus was achieved to consider the fencing of the whole "Archaeological Park "as not desirable. The selected option will preserve the open aspect of the landscape and allow a controlled land use by Bedouins in-between the two archaeological poles. Continuing traditional grazing and cropping activities in this area is essential for economic and human reasons, as well as for safety and site maintenance. Would this option jeopardise conservation of the archaeological vestiges and/or the tourist development in the near future, the decision will then be taken to enclose the protected area. If this occurs, 'natural' technical solutions with lower visual impact will be considered, such as a hedge of prickly pear.

In the same way, extrapolation from the current amount of visitors leads at the beginning to propose only limited tourist infrastructure for the site. This infrastructure (visitors' centre and annexes) will be designed according to a modular principle, therefore being developed if needed. The visitors' cente complex will be established to the west of the Castrum, along the Madaba.road side. This area appears as being the most suitable, offering the greatest number of assets : accessibility, proximity to the modern village, presence of various technical networks (water, MT and BT electricity, telephone...), over viewing the whole site as well as far beyond. Apparently, there is no antique structure in this area.. Moreover, the construction of the VC should be an opportunity to concentrate and reorganise a number of public service buildings for the modern village, such as the hospital and the post office. Existing obtrusive buildings within the archaeological perimeter should be destroyed.

The major problem relates to the safeguarding, restoration and presentation of the archaeological vestiges, more particularly the mosaics. Outlines emerges from the present study :

- respect of the international conventions and reversibility of installations (except whenever the safety of the visitors is concerned),
- as large as possible integration with the site environment by the use of local materials, colours, etc ;
- definition and specifications of a construction system for the shelters covering the mosaics : flexible and transposable, if needed, to all structures already excavated or to be excavated,
- respect of the general volumetry of the ancient monuments to be protected, without overlapping the bordering zones,
- appropriate technology for the light roofing structures for the shelters : easy made and inexpensive, feasible by Jordan manufacture.

Consideration of the preservation of the general aspect of the site, including the remarkable however dangerous " fields of ruins ", leads to emphasise the development of a precise and limited itinerary network, in order to secure the visit of the ruins. The civil liability of the Jordanian Service of Antiquities should clearly be restricted to these itineraries. Such itineraries will adjust as much as possible to the ancient urban physical structure, be adequately signposted and panelled, in consistency with the information dispatched in the VC. In particular, their design will allow to resist bad weather conditions, as well as human-related degradation.

II. Foreword

The SECA experts group, entrusted of the elaboration of the Preliminary design for Umm ar-Rassas, within the frame of the Protection and Promotion of Cultural Heritage Project in the Hachemite Kingdom of Jordan financially supported by the E.C. was composed with:

Mrs Anna OHANESSIAN, anthropologist
Mr Zaki ASLAN, architect, conservation design specialist
Mr Bernard BOUSQUET, tourism & management planning expert
Mr Morgan de DAPPER, geologist, geomorphologist
Mr Laurent DUFOIX, architect, heritage curator
Mr Rémi GROVEL, buffer zone socio-economic specialist
Mr Gaetano PALUMBO, archaeologist, conservation specialist,
Mr Nicolas PAULI, civil engineer, light structures specialist
Mr Jacques SEIGNE, architect restorer, team leader

III. Acknowledgements

The team members express their warmest thanks to Jacques BUJARD, director of the Max van Berchem founded Swiss mission, Padre Michele PICCIRILLO, director of the Italian mission of the *Studium Biblicum Franciscanum* and to Patricia and Pierre BIKAI, director of the American Center for Oriental Research in Amman. Without their support and information, the expertise as requested couldn't have taken place within the frame initially set up.

The members of the team want to thank the different officials and experts met in Jordan :
E.C. Representation in Amman
Mr Fernando GARCES DE LOS FAYOS, First Secretary
Mr Mario RIZOS, Expert MEDA TEAM
Land and Survey Department
Madaba erea Gouvernor
Mr Qasem ABUL-HEIJA
Meteorological Department at Amman Airport:
Mr Mohammad SAMAWI
Ministry of Municipal and Rural Affairs
MrsMervat Mamoun HAOBBSH, Director of Architectural Heritage Section
Ministry of Planning
Mr Ghaith H. FARIZ, Director, Social Productivity Program Unit
Mrs Nadia Mohammad JUHARI, Head of Environment Section
Mr Khaled TARAWNEH, Director of regional planning project
Ministry of Tourism and Antiquities
Mrs Aida BORAN HATOG, Under Secretary MoT
Mr Fouad AGHABI, Assistant for technical affairs MoT
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Mr Hazem JASSER, DoA regional director of Madaba area
Natural Resources Authority
Mr Majdi O. BARJOUS, Mineral Processing Engineer
R.J.G.C.
Mr Maher AL-HOSEINI
Mr Mohammad Fouad AL-SHEAKH
Mr Ahmad SHARANI
Umm ar-Rassasarea Gouvernor:
Mr Obeidallah al-SHAKHANBEH
Mr Hijazi SA'UD ASSAL
Umm ar-Rassas Municipality
Mr. Jazzaa al- Dleiman, Mayor, and members of the Municipa

Representatives of the Police and different local institutions in Umm ar-Rassas
The Umm ar-Rassas community members
All the friends and people who helped us during our mission, especially Mme Affaf MARAKAT and Mr Ghazi HIJAZI
... and, of course, Mr GARBO at Mount Nebo.

IV. Comments about LEHUN - UAR possible duality

Within the frame of the present project, the mission was requested to evaluate a possible tourism "integration" of two archaeological sites in the Jordanian Eastern Badyya : Lehun and Umm ar-Rassas. At a distance of only 17 km from each other, both sites have been widely excavated for years by Jordanian and European archaeological missions (Belgium at Lehun, Italian and Swiss at Umm ar-Rassas) making a priori feasible their integration within a common visit tour.

A. LEHUN

The potentialities for tourism development of the site of Lehun does not appear as obvious to the members of the mission. The offset situation of the site, at the end of a «bottom road», far from any active circulation axis (during last month of may none a visitor went to Lehun.), the limited «visibility" of the archaeological vestiges to non specialist visitors, (constructions of different periods only preserved at ground level) and the unfavorable general environment (uncontrolled development of the modern village completely surrounding the archaeological zone), do considerably reduce the interest of Lehun for tourism. In addition the site is very wide, fragmented, rocky and uneven, not easily worth visiting by inexperienced walkers and old people. On the other hand, it has an exceptional setting at the edge of the wadi Mujjib canyon which constitutesing a paramount asset whether specialised tourism is organised in Jordan (mountain walk, trekking, gliding ? ? ? ?, ...). Lastly, the already existing very detailed development plan, related to this archaeological site, brings the mission's members to concentrated their attention on Umm ar-Rassas.

B. UMM AR-RASSAS

On the contrary, there are obviously a number of tourism development possibilities for the site of Umm ar-Rassas (The "Mother of the lead"). The field of ruins offers here the seizing spectacle of a one thousand and a half years old village, quite untouched by modern urbanisation and constructions.

The antic settlement of UAR is known from excavations results as Kastron Mefaa, a toponym attested from the Roman and Arabic sources and from the Bible. The actual visible remains of a fortified camp of about 10 ha correspond to the fortress of Mephaat mentioned by Eusebius (Onomasticon) as the place where a unit of the Roman cavalry was stationed on the edge of the desert.. The military nature of the site is emphasised by the name Kastron, recorded four times on the mosaics recently uncovered in the churches. The walled area is limited to the north by an open quarter, the "Northern settlement", roughly the same size. Eleven of the fourteen churches of this tangle of archs, pillars, wall and blocks, were excavated. Several have delivered extraordinary pavements of mosaic, which make the fame of the site today. Additionally, an exceptional monument,the stylite's tower with more than thirteen meters height is still well preserved.. Located at 1,5 km north to the castrum, this monument is the only witness known still preserved monument of the monasticism movement symbolised by St Simeon " the Stylite ". This tower is associated with a small church and a series of additional constructions. Between this group of buildings and the castrum, all old agricultural fields are exceptionally preserved.
UAR main tourism assets are : homogeneity of a sizeable site, immediately identifiable monuments (castrum, churches, houses, wine press...), importance of preserved elevations, quality of the discovered vestiges, aesthetic, scientific and historical interest of mosaics and liturgical installations uncovered, stylite's tower, antique land use in a steppe environment, and last but not least, the site is established at the top of the highest point of that part of the plateau, offering a beautiful sight over the steppe of Moab. What is offered to the visitor is thus a unique archaeological testimony of the way of living in a small village at the edge of the desert, at the era of the finishing time of the Byzantine glory and the first centuries of the emerging Islam.

Located at the crossroads of two asphalt main roads connecting Dhiban and the old traditional Kings Highway to the new Desert highway and to Madaba, Umm ar-Rassas can be very easily integrated to overall archaeological tours in Jordan. For example, on their way to Petra, many busses do already stop at Umm ar-Rassas to visit St Stephen's mosaics. But, it might also be one of the keystone stops of a thematic tourist tour dealing with late Christian early Islamic times, including Madaba and Macheronte well-known sites and the newly discovered Nitl, (a small settlement, half the way to UAR on the road from Madaba) where a large paved mosaic church was built by the first Christian Arab prince.

V. PHYSICAL CONDITIONS OF THE SITE

A. LOCATION

Umm-Ar-Rassas is located 26 km to the south-east of Madaba, 13 km to the east of Dhiban , 9 km to the north-east of Lehun and 34 km to the east of the Dead Sea. It lies on the fertile plateau of Madaba at an elevation of + 760 m in between the Wadi el Wala and the Wadi el Mujib. Small local wadis drain towards the Wadi el Wala. The Wadi el Mujib, which empties in the Dead Sea at an elevation of - 400 m below sea level, has developed a complex of very deep canyons. At Lehun, (13 km to the south-west) which is located at the rim of the plateau at an elevation of + 720 m, the canyon reaches a local depth of 580 m, offering spectacular views. (figs 1 to 5 - § X).

The site of Umm ar-Rassas, situated at the highest point of the plateau, is visible from the distance.

B. GEOLOGY AND SEISMOLOGY

1. Lithostructure and stratigraphy

The geological substratum at Umm-Ar-Rasas consists of sub-horizontally layered marine sediments belonging to the Maestrichtian Stage of the Late Cretaceous Period. Those sediments were deposited some 80 million years ago in a calm, shallow marine sub-tidal environment. Two litho-stratigraphical units occur near the surface (fig. 6 - § X):

1. The upper Qatrana Phosphorite Member (QP): 18 m thick; composed of alternating thin layers of marls, micro-crystalline limestone and chert and thicker banks of phosphatic chert. The latter are very hard, contain 14 - 21% of P_2O_5 and provide an excellent building material.
2. The lower Bahiya Coquina Member (BC): 30 - 40 m thick; composed of thick banks of shelly limestone alternating with thin layers of marl; the limestone is composed of mega cross-bedded layers of bivalves (oyster) and gastropods and shows a mega-crystalline structure; the coquina contains 60% of carbonates and 40% of phosphates and silica; the coquina is easily hewn and provides an excellent building material.

2. Hydrology

Umm ar-Rassas is located on the highest point of that part of the plateau, at the edge of the desert steppe, between two main wadi's structures, wadi Wala and wadi Mujib deep valleys. There is no permanent running water, nor spring. The only important underground water originates in an important aquifer developed in the 125 m thick Wadi as Sir Limestone Formation (WSL) resting on the marls of the upper Shu'ayb Formation (F/H/S) that play the role of aquiclude. The aquifer/aquiclude boundary is exposed on the escarpment of the Mujib Canyon at an elevation of around + 420 m and there gives rise to a number of springs and Late Pleistocene travertine deposits. A deep well in the vicinity of Umm-Ar-Rasas draws water from a depth of 300 m with a capacity of 120 m^3/hour.

At Umm-Ar-Rasas an important local and seasonal aquifers may develop in wadi bottoms. However they are not sufficient for a large population. For that reason the water supply must be assured by the construction of watertight cisterns and by water conservation practices such as the construction of culture terraces in wadi bottoms. Both structures are very well represented all over the antique site. The enormous number of underground cisterns shows that f water collection was one of the main problem of the site in the antiquity.

All these cisterns were supplied during the rain season, which was, most probably like today, short and unpredictable. Most of the water was generated by storms, short in time but strong in sudden quantity.

The network of cisterns (for human uses) and large open air water tanks (for animal use and eventually for agriculture) was an efficient solution to solve the problem of water supply.

3. Seismicity

Umm-Ar-Rasas lies 34 km to the east of the North-South oriented Dead Sea Transform fault zone. The Siwaqa Fault, a significant east-west fault, which has been associated with basalt extrusions, lies 12.5 km to the south.

The Dead Sea Rift, along with its associated perpendicular faults, such as the Siwaqa Fault, is the predominant earthquake generator of the region. The majority of these earthquakes have low magnitudes, although infrequent events occur with a local magnitude in excess of 6 on the Richter Magnitude Scale. All earthquakes with a magnitude in excess of 6 have occurred along the Dead Sea Rift.

According to the' Map of Natural Hazards' of the 'Munich Reinsurance Company', the area of the Mujib Dam, which is currently under construction and which is located at 11 km to the south-west of Umm-Ar-Rasas, belongs to 'Zone 3' with intensity VIII on the Modified Mercalli Intensity Scale. Intensity VIII, corresponds to 6.2 - 6.9 on the Richter Magnitude Scale and is described as follows: "Panel walls thrown out of frame structures; fall of chimneys, factory stacks, monuments, walls; heavy furniture overturned; sand and mud ejected in small amounts". The risk is defined as "the probable maximum intensity with an exceedance probability of 20% in 50 years, equivalent to one occurrence in 225 years (return period) on average, for medium soil conditions" (Jordan Valley Authority-Amman, personal communication).

As an illustration the earthquakes with a local magnitude of 6 or more on the Richter Magnitude Scale registered by seismographs in the region for the period 1900 - 1998, as well as all earthquakes (major and minor ones) for the sample year 1998 are listed in Annex 1 (Natural Resources Authority-Amman, Seismological Department, personal communication).

A list of yearly tremor intensity is given in annex 1.

4. Subsoil

In all observation points the hard unweathered geological substratum was at shallow depth. In most cases the geological substratum is covered by a thin saprolite (= rotten rock) of 1 to 1.5 m thick. The soft and loose saprolite is the result of chemical weathering of the geological substratum. In most cases the saprolitic layer is covered by a hard calcrete of 0.5 to 1 m thick. The calcrete originated from superficial carbonate concentration by superficial and subcutaneous waterflow. In case of exploitation of the bedrock, the calcrete often forms overhanging roofs ensuing typical rocky shelds offering shelter for man and cattle.

C. CLIMATE

Situated at the edge of the Arabian desert steppe, Umm-Ar-Rassas benefits from a dry continental climate with two seasons: summer, very sunny, dry and hot and winter, cold and rainy. Spring and autumn are limited to a few weeks. Even those The rains are very scarce: the limit of the 100 mm isoyet pass just near, allowing only very specific cultivation, sometimes without success for a succession of years (see socio-economic chapters).

Rains occur in December, more frequently during January/February and cease in may, sometimes earlier. They are mainly issued from sudden storms. Snow is expected to occur (a few cm in one hour, once in 30 years).

Winds mostly blow from west. They can be violent (40/50 knots). Blowing from the east, more exceptionally from the south, they may be dusty, sometimes carrying red soils from Egypt.

Temperature varies from about 0°C in winter (frost is exceptional) to 40°Cand more in summer. Temperature will be one of the most important parameter to take into account for the sheltering and restoration of the different churches.

Graphics of the yearly rainfalls, highest and lowest temperatures, humidity and winds are displayed in annex 2

water tanks covered with arches and slabs and large debris mounds created by accumulation of the cisterns' silt removed from them, and of the towns refuses

4- The agricultural fields created in antiquity by terracing the wadis flowing towards the North, North-east and North-west of the castrum. This unit comprises two groups of buildings. The first is a watch tower and a small church with associated quarries and cisterns, and the second a building whose function is still undetermined, with an associated cistern

5- The Tower complex, which is a discrete unit, 1,5 km North of the castrum, comprising a huge well preserved tower and a small church annex, two ruined buildings, quarries, cisterns and a wine press

6- The cemetery, which has not been located, but according to de Savignac existed to the west of the castrum. Old aerial photos possibly show its presence to the west of the road to Madaba, where the modern village is presently growing.

2. Chronology of excavation works

Excavation works focused on vestiges of area 1, 2 and 5 (with more or less intensity since 1986), by Jordanian teams (DoA), Italian (Studium Biblicum Franciscanum) and Swiss teams (Foundation Max von Berchem). The chronology of the excavations is provided in annex 3.

3. Description and provenance of ancient building materials

Following types of building materials were observed in different places of the site. These materials were used separately but most of the time mixed together. Characteristics of materials are given in annex 4.

Coquina, phosphatic chert and *limestone* are found in abundance in the geological substratum at Umm-Ar-Rasas. They were extracted from numerous large and small quarries all over the site area. *Black shale* and *gypsum* are not found at Umm-Ar-Rasas. The *gypsum* is found at the boundary of the lower Wadi as Sir Limestone Formation and the Upper Shu'ayb Formation. The *black shale* occurs in the lower members of the Shu'ayeb Formation. Both stone types are quarried in the canyon of the Wadi el Mujib. We observed f.i. a modern gypsum quarry at position X = 0768057, Y = 3483532 at + 330m.

4. Construction techniques

a) Structures

Apart from some very specific buildings (eg., the Tower) and parts of some other ones (eg., central apse of some churches), the walls built at Umm ar-Rassas were made with undressed raw materials of all kinds and nature put one over the others without any lime mortar The internal filling, between the two faces of the walls, were made of simple earth mixed with chip stones. The solidity of such structures was therefore ensured only by the roof protection (for the heads of walls) and the general side gypsum plaster coating. Nowadays, all the buildings have lost their roof protection and most of their mortar coating. Rain and still more wind erosion have destroyed the unprotected walls earth filling. The protection/restoration of the excavated structures is one of the most urgent and important works to be implement at Umm ar-Rassas.

The doors jambs, the arches supporting the stone roofs (or wooden ones in most of the churches), the churches conchs, were made of well cut rectangular stones. All these blocks where put together in dry masonry construction way.

Most of the roofs (even for some lateral naves of churches) were flat, stones arches supporting rows of stone slabs and earth covering.

b) Floors

Different types of floor were found during the excavations:

- simple earth floor type,
- plastered floor type, such as in the Tower church,
- stone slabs paved floor type, such as in the annexes of St Stephen church (irregular uncut stones) or in the Aedicula church (rectangular alabaster slabs),
- mosaic floor type, such as in Bishop Sergius, Lion, St Stephen, ...churches and in the wine press.

VI. CURRENT SITUATION, ANALYSIS

A. BRIEF HISTORICAL REMINDER

The modern village, actually known as Umm ar-Rassas (« The Mother of the lead ») gathers a few tens of houses, of breeze blocks and concrete, aligned along the road from Madaba to Jizza passing by Nitl. The village is drawn up not far from the vestiges of an important antic site, known from excavations results as Kastron Mefaa, a toponym attested from the Roman and Arabic sources and from the Bible. The military nature of the site is emphasised by the name Kastron, recorded four times on the mosaics recently uncovered. The remains of a fortified camp of about 10 ha correspond to the fortress of Mephaat mentioned by Eusebius (Onomasticon) as the place where a unit of the Roman cavalry was stationed at the edge of the desert. This walled area is limited to the north by an open quarter with roughly the same size. The most visible monument of the site is visible 1,5 km far from the north of the Castrum, where a tower, probably built for a stylite, still stands more than 13 meters high.

B. SITE MANAGEMENT

The UAR site is under management and control by the Inspector of Antiquities for the Madaba Region (figs 7 Plans 1& 2 - § X). There are 5 guards on site, part from the MTA, part from the UAR village Police Station.

Guards are accommodated, on a rotational basis, in the small nearby very obtrusive concrete building. The task of guards is to control the visit of the St Stephen mosaics by visitors and to ask them fulfilling the visitor book at the exit. There are no guide. Entrance is free, as the MTA considers site enhancement not sufficient to justify a fee.

At the moment the UAR site is currently under-exploited by tourism. On the other hand there is only very poor tourism infrastructure (the St Stephen shelter) and management (see §. 'Socio-economic and tourism context').

Occasionally, the Inspector authorises (or asks for) archaeological excavations at UAR. At the period of the mission one Jordan team was working on the restoration of the small Byzantine church and altar near the stylite tower (Zone II) and started two new excavations in the ancient fields area (small tower an undetermined building).

Despite gaps in site management and equipment, the key UAR archaeological remains are only slightly degraded by human activities. For example, out of the sheltered St Stephen complex very few mosaics have been looted (Peacock's church, Lions' church, ...), albeit the protective earth cover is very thin in some areas. This situation demonstrates the local will to preserve the UAR cultural heritage, not only because it is protected under the Antiquity Law, but also because local people (Beni Sakhr tribe) considers this site to be an opportunity for the future.

C. ARCHAEOLOGICAL REMAINS

1. Site Typology

The archaeological area of Umm Ar-Rasas is about 2 km² (fig. 7 Plans 3 to 11 - § X) . It includes several components that will be considered separately because of different issues and constraints affecting their management, conservation, and presentation. Proceeding from South to North these are :

1- **The castrum**, an almost square fortified settlement which includes relatively well preserved fortifications and towers and a densely built interior area where three excavations have already been conducted : the south-east area is the most extensive, comprising the so-called Twin Churches. The other two excavations have exposed the North and South gates.

2- **The northern settlement area** (300x200m) consisting of collapsed structures, where 4 areas have been excavated. The Church of the Priest Wa'il and the Church of the Tabula to the South-west; the St. Stephen complex to the North-east, and the area including and around the Chapel of the Peacocks, Church of St. Paul and the Church of the Lions to the East.

3- **The cisterns and town debris**, which surround the entire site and include bell shaped rock-cut cisterns, a large rock-cut rectangular open-air basin, several large rectangular underground

Only standard and well-known techniques were used. A special attention should be given to the mosaic floor supports ; they were likely built rapidly, using mortar of poor quality, over uncompacted materials. The conservation of these important testimonies will need attentive care and precise investigation studies before implmenting any restoration work.

5. State of conservation of the remains

a) The Castrum

The fortress of Kastron Mefaa, built at the end of the III° or the beginning of the IVth century A.D., appears as a large quadrilateral of 158m by 139m, surrounded by a solid wall 2m thick, reinforced by quadrangular towers and with only one one gateon the northern side. The walls, of cyclopean size , are made of large undressed blocks of stone, without any mortar and wedged with stones of smaller size
At the beginning of the IV° century, an indigenous wing of cavalry is stationed there. After the demilitarisation of the camp, during the Vth century, a settlement remained within the enclosure. Then, the internal fortress organisation originally structured around two orthogonal ways is gradually modified by constructions built above courtyards and streets. Out of the four churches within the enclosure, have been excavated (Twin churches). There are two other excavated spots : the North gate and the South gate areas.

(1) Walls and gates

The top courses of the fortifications are lost. Nowhere has the original height of the wall been preserved. In annex 4 are grouped observations related to the physical condition of fortification stretches. The single number refers to a tower (number 1 is the north-east corner tower), while the hyphenated numbers to the portion of wall in-between two towers. Both are represented on the plan, with recommendations for presentation.
No restoration work was done on the whole enclosure excepted limited work by the Swiss team near the Twin Churches.
The excavations of the North gate were conducted by Swiss mission in the years 1991 and 1992. Excavations have exposed the passage and the guard rooms. Consolidation of walls has taken place in the form of repointing, but it is insufficient as regarding the use of insufficiently prepared cement and lime mortars. As well have the debris been thrown around the outside walls and presently hide large parts of the external r ramparts. Earth mixed with architectural fragments and blocks is visible among the debris.
The gate provides access to a street which is now completely blocked with ancient collapse (2-2.5 meters of depth).
That street should be the normal access to the Twin Churches complex.
This structure is different from the North gate, as there is a small postern gate to the left of it, and a less clear use of the towers controlling access to the castrum. It is clear from the excavation that that gate didn't exist in the initial setting. There has been some consolidation of this structure, but the site needs considerable conservation efforts would the intention be to open it to the public.
A detail state of preservation of the castrum walls and towers is given in annex 5.

(2) The Twin churches complex

Successive excavations of this complex were conducted in 1988-1992 by Swiss archaeological expedition founded by the Max van Berchem Foundation and directed by Jacques Bujard.
Both churches have mosaic floors, poorly preserved, now covered by a layer of earth, although some shruby vegetation is growing on it, raising doubts on the current conservation condition of the mosaics.
There are traces of plaster on the wall, which is detaching and generally in a bad state of conservation.
The north church has capitals and columns in the portico area that show advanced weathering phenomena in the form of cracking, spalling and exfoliation.
Large restoration work were done in that area where all the exposed structures were consolidated (even the general remarks on the quality of mortar used are also valid here).
Vandalism or clandestine excavation have taken place in this area, namely in a small room south of the southern church, and in one of the rooms to the north of the northern church.

A detailed state of preservation conditions of these churches is given in annex 8.

The Northern Settlement

The Northern settlement includes most of the excavated areas. The area extends over 6 ha and is covered by the «extra-muros» part of the town (it is however possible that a secondary wall enclosed this section of the site). It is densely built, containing number of churches, houses, handicraft dwellings, ... Some Bedouin families have occupied this area, living during the past 100/150 years, in some of the structures with their animals sheltered beside. In some cases the reused structures are the ancient ones, readapted through the construction of extra walls or the plastering of internal surfaces. In some other cases typical arched houses (characteristic of Jordanian vernacular architecture) have been completely rebuilt using the ancient foundations and construction materials. 37 recent traditional houses are remaining on site. No detailed plans and/or elevations exist for these structures, which form an important element of a little investigated component of Jordan's cultural history. One of our proposals is to preserve and, if possible, display to the public a small group of these structures. Unfortunately, most of these small and narrow houses are in a bad state of preservation. Whereas all of them could (and should) be studied, only few will be open to the public after restoration.

(1) The Churches

There were 9 churches (8 excavated) and 2 chapels (both excavated) lying in that part of the ancient city. Constructed in all parts of the settlement, these religious buildings are sometimes grouped by two or more, in large complexes. Their architectural development covered hundred years and most of the churches are remarkable due to their mosaic pavements, some of them dated from the Abbasid period according to clear and readable inscriptions.
All these churches were destroyed by collapse of their upper structures (earthquake ?). All their walls, more or less built according to the same way, suffered different structural disorders.

A detail statement of the different churches is given in annex 8.

(2) The others structures:

General observations on St. Stephen complex:

Although this is one of the best known sectors of the site of Umm ar-Rasas, this complex is not fully excavated: the three rooms and the courtyard east to St. Stephen are only partly excavated and many areas around the churches need final clearing (especially St. Stephen's south side and the area east of Bishop Sergius' apse). The entire west sector of the complex is not fully excavated. There is a large debris area abutting and partly covering the north east corner of the complex, anotner to the west of the complex, and two large open soundings along the northern wall.

Baptistery:

This sector of the complex is unfortunately in a very deteriorated condition: the mosaics are now covered but were found with many lacunae; the basin is visible only as a trace (also covered), and the walls have lost their cohesion.

General observations on St Paul's area:

This is still an open excavation which is confusing and difficult to interpret, but also extremely dangerous as some of the pits are more than 7 meters deep. In the western sector between the two churches, there is an area 3 floors deep which is being excavated. Without proper dismantling or consolidation of the upper structures, the entire pit is threatening to collapse . Immediately to the west of the complex there is a courtyard area with three structures used until recently by the local Bedouins. This is a well preserved «modern» complex, which should be properly documented and possibly displayed.

A large debris area, partly covering the vernacular structures, is accumulated to the west of the excavation pits. Open soundings are also found to the south of the church of St. Paul.

Wine press:

This is a unique structure, very well preserved, composed of nine small cells, three per each side of a central courtyard, all covered with a white tesserae mosaic floors, where grapes were pressed, with the juice then flowing to the courtyard and then into vats. The structure is not completely excavated and is in need of consolidation, as both plaster and walls are in precarious conditions.

The area between the Church of Saint Paul and Chapel of the Peacocks

Michele Piccirillo between XXXX and the present has conducted excavations at this location, which covers an area of approximately 1200 m2. Excavations are still being conducted at the location, which includes several features: a church, a chapel, a unique winepress, and a deep subterranean feature, partially excavated, which likely corresponded to a three storeys underground store rooms.

c) Cisterns And Water Tanks

Some cisterns are still visible and a few are still in use in the settlement's surrounding area . In this area can be found most of the cisterns as well as a large rock-cut pool that collects water from a small wadi. It has been recently fenced by the Department of Antiquities. Several elongated and half-circular mounds surround the settlement, especially in its northern and eastern sides. As far as we know, no explanation, has been provided related to these mounds, some supporting Bedouin graves at their top. In our opinion, (confirmed by the geological analysis of the deposits carried out by Dr De Dapper) they are constituted with the town refuse and the result of centuries of cisterns cleaning. We feel that the most obvious ones, with a ring of debris surrounding a central depression where water accumulates in winter, hide a filled or collapsed cistern (visible for some of them).

A GPS survey of these structures has been conducted. The UTM coordinate given in appendix corresponds to the centre of the depression, or the mouth of the cistern with a +/- 5m accuracy. 74 of these structures have been mapped : 48 are depressions that may hide a cistern, 6 are completely filled cisterns with a still visible mouth; 7 are empty cisterns, 6 cisterns still in use contain water, 4 are collapsed cisterns or tombs, 1 a cave (tomb?), 1 is a cistern supported by built arches and 1 is a pool covered by arches and stone slabs.

Many of these structures are lying within the protected area, but the fact that they have not been neither fully recognised nor studied is a major problem for the conservation of the vestiges (risk of collapse) and for the security of the visitors. We should also consider that not all of them have been located. From a security point of view, most of them do represent a potential danger as they are unchecked underground cavities, their size is unknown as well as the structural resistance of their roof.

Some of them have been discovered inside the churches (Bishop Sergius, Lions...). They were operational at the time the churches were utilised as cultual places, as this is demonstrated by the the fact that mosaic pavements adjust cisterns' mouths. They may represent a major risk for the future conservation of the churches mosaic floors (see also the problem of the tombs under the mosaic of St Stephen, St Paul, ...).

The list of coordinates in annex 6 derives from a quick GPS survey of the water collection structures observed around the castrum and northern settlement area. Depressions surrounded by debris have been interpreted as filled cisterns surrounded by silt resulting from their regular cleaning. For practical purposes, 5 types of cisterns are catalogued:

1. Bell-type cistern with plaster, in use and containing water
2. Bell-type cistern with plaster but without water
3. Bell-type cistern filled almost completely to the rim by debris
4. Possible cistern, largely collapsed
5. Centre of depression surrounded by debris.

d) Man-Made Hills

A number of low man-made hills lie in the southern part of the site around the Castrum and the city (fig. 7 Plan 4 - § X). Their origin whether natural or artificial (partially or entirely) was longly discussed. Their restricted distribution just around the antique site is a first element in favor of their human origin.

Some of them are also clearly related to underground cisterns or open air water tanks (for example the ones located to the east of the castrum). Examination of their debris shows a fine sandy silt mixed texture with many ceramic sherds and angular stone fragments. This heterogeneous material most probably originates from cistern cleaning or/and other activities of waste dumping from the village.

e) Ancient Fields

No proper documentation work (with the exception of a topographic survey) has been conducted on the impressive network of terraces which covers much of the land to the north of the town of Umm er-Rasas. The fields were terraced or perhaps lying down behind dams crossing the small wadis that flow from the plateau where the castrum is located. The assumption of small dams is validated by the presence of small rectangular structures in the middle of each wall possibly wasteweirs. Rather than for collecting water, however, such dams were built to trap silt and enough water to allow a slow soil impregnation, an effective substitute to irrigation. None of these features have been so far excavated or properly investigated in Jordan. As far as we know, the group of Umm-ar-Rassas ancient fields (such dam-like structures can also be observed along each wadi around the site, within and around the archaeological park perimeter) are the best preserved of this type in Jordan and constitute a comprehensive ancient agricultural system

Erosion is a matter of fact , since in many cases the small wadis have cut channels through these dam-like structures. On the other hand, easy stratigraphic studies of the «dams» can be undertaken.

In the same area, and in relation to the antique fields, groups of ruined buildings are visible. Two of them are presently being excavated by the Madaba Office of the Department of Antiquities under the direction of Hazem Jasser (May-June 2001). The first is a tower, or guard post, with an internal bottled shaped cistern and a nice 1,60m large circular stone as door lock , associated with a church (?) (it may be an antique oil press), quarries, and at least one large open-air rectangular cistern. The function of the second building is still unknown. A cistern still in use is associated with the latter. Most of the fields are in the protected area (outside the two sanctuaries), but several also lie down beyond its boundary, especially to the west and north-west of the castrum.

Some remarks are given in annex 9.

f) The North Tower Complex

The North Tower complex includes a high standing « Stylite tower » (more than 13 m hight), a small three naves church with simple plastered floor, with annexed premises and different dwellings around : wine press, cisterns, ancient quarries, two story building... Excavation have targeted the small church near the standing tower, and areas around it. Conservation work has been conducted on the two-story building north to the tower, and is currently in progress on the church (directed by the Madaba office of the Department of Antiquities). The tower was never restored.
Plans and elevations of most of this area's buildings are available.

A description and detailed state of preservation conditions of the Tower Church is given in annex 8.
A detailed state of preservation of the Tower is given in annexe 10

g) Cemetery

The discovery during the XVIII°/XIXth centuries, of lead made coffins in the cemetery may explain the actual name of Um ar-Rassas ('Mother of the lead'). The precise location of the large cemetery (entirely looted during the 19th century) is not known today. According to de Savignac, it was located to the west of the castrum. Aerial photos may confirm that location at the west side of the actual asphalt road to Madaba. That part of the antique site, now under construction with the new village, might well be considered as lost.

h) Semi Subterranean Houses

Since the last century the local population has occupied several houses in the site.. We spotted them on a general layout (figs. 7 – Plans 5 to 7 - § X)). Such dwellings mainly reused ancient structures, in the way they were for some of them or sometimes only partially reusing former Byzantine structures (mainly

still standing arches). The usual distribution of these permanent nomad houses is quite simple: one or two independent rectangular rooms, exceptionally four or five, are spread around a large courtyard, closed by a perimeter wall. Rows of arches supported the terrace roof, covered with a layer of earth. Each room has one door; a unique opening to the courtyard, the building being buried along three others sides.
These subterranean houses are not in a good state of preservation: walls and terrace roofs, except in a few cases, collapsed as well as the supporting arches . Even for the few not too much degraded , access is difficult and dangerous for workers and archaeologists, a fortiori for tourists.

Quite not a single study has been carried out on such traditional modern reoccupation of ancient structures. The second interest of Umm ar-Rassas is to have preserved a complete village of that recent dwellings.

Complementary information is supplied in annex 11.

D. SOCIO-ECONOMIC AND TOURISM CONTEXT

1. The region and the lack of economic resources

The UAR district with its Bedouin population is situated in the middle part of Jordan, south of 'Amman. Due to this localisation, the district is on the periphery of main and important tourist sites like Madaba (40 km,) Karak, the Dead sea or the Jordan valley and even Petra and thus it has no profits from this tourism economy. In the same way, the district lies on the periphery of the country's main economic and industrial regions that are mainly concentrated in and around Amman-Zarqa, the north and Aqaba in the south.
The southern regions of the country have encountered important economic development these last decades and specially on a tourist ground with sites like Petra, Wadi ar Ram, Aqaba etc. In the eighties important development projects, mainly agricultural, but also socio-economical and the Bedouin's sedentarisation projects have also drawn into this region changes and some economic wealth.
On the other hand, Madaba and the northern parts of the high plateau are witnessing important economic development these last ten years due to the valorisation of the archaeological and historical sites and the creation of the archaeological park. For instance, Madaba counts today some ten hotels since 1994. Before, the town had none.
Surrounded by other regions and towns that are living economic development, the district of UAR is quiet isolated, peripheral to all. It is also a place where tourists pass by and seldom stop. Too close to Madaba to create its own interest, too far from Amman-Zarqa to take part in the industrial movements, and also, too far from the south in order to have some profit from the tourists activities. The inhabitants of the district are lacking all these economic opportunities.

With the absence of any economic activity and job possibilities, UAR's tourism development appears as the only opportunity and economic potential for the local population to rely on.

2. Administrative context

UAR Archaeological site is located on Um ar Rassas municipality territory (Baladiyya). UAR municipality has been recently created (in 1999) and 6 villages belong to this municipality: Saliya, Mousaytbet, Thrayya, Rujm fheid (including Nahda district), Abou Hlelifet, Rujm 'Ogueib (including Mujamma' Akhou Sheinet district).
The UAR village is both chief town of UAR municipality and chief town of the governorate (Qadha'). UAR governorate encompasses 4 municipalities (that is 22 villages or settlements), including UAR municipality (encompassing UAR archaeological site) and Rama municipality (encompassing Lehun archaeological site).
UAR village shall be considered as the real centre for the governorate development, including a variety of archaeological sites to be enhanced; promotion of a regional development planning searching for a complementary between UAR, Lehun and the other archaeological sites spread over the district territory.
There are only a few administrative structures within the UAR Municipality territory :

- the social development centre (created in 1999),

- military and civil schools,
- post office,
- Royal Police center
- forage supply center.
- Administrative representations in Umm Ar-Rassas:
  - ⇒ Ministry of Interior : the governorate of the area, the police, the Municipality of Umm Ar-Rassas and the Post Office (postal services are to be privatised in July 2001 in Jordan),
  - ⇒ Ministry of Social Development: the social development centre
  - ⇒ Ministry of Health: the clinic.
  - ⇒ New offices for the Municipality are under construction (may 2001) along the main road, facing the archaeological site.

An urban planning has been designed in 1996 for UAR village by the Ministry of Planning, including zoning of already built areas and urban extension, which has initially been planned on each side of the road, but which will finally be limited on the opposite side to the archaeological site.

The mayor referred to a 50,000 JD loan obtained from the Bank of Urban and Rural Development. He also referred to the 58,000 JD granted by the Social Security Program Unit of the Ministry of Planning, which will be devoted to the improvement of road conditions and lighting.
There is no plan illustrating the future extension of the Municipality infrastructure.
Water is mainly supplied by the Swaga wells near Qatraneh. Water is available for human residential consumption on daily basis and for surrounding villages on a weekly basis.

Key data on UAR municipality and six villages are indicated in annex 12.

3. Population

The population of the UAR municipality amount about 4000 inhabitants, composed with 790 families shared among the six villages. Local populations living in UAR municipalities can be divided in two groups:

- Bedouins which have been recently settled in UAR village, from the Beni Sahr tribe ;
- Nomadic Bedouins from the 'Azazmet tribe.

Bedouins from the Beni Sahr tribe live in modern constructions (the modern village of UAR is currently developing along the site western boundary). They own all the land and the greater part of the sheep herds.
On the opposite, nomadic Bedouins from the 'Azazmet tribe live in tents and cultivate the Beni Sahr lands: Although they possess some livestock, they are extremely poor.
All inhabitants of the six villages in the UAR municipality belong to those two tribes, albeit members of the Bani Sakhr tribe are the most numerous. Azazmet tribe members are nomadic Bedouins throughout the district. No other tribes or families live in the district.

The Bani Sakhr :
It is one of the most important tribe of Jordan. Bani Sakhr's land covers most of the median part of the country stretching from the higher plateau in the west to the saoudian borders in the east.
The tribe is composed of 4 sections with an important number of descent groups.
The Hgueish form a descent-group belonging to the Al Ghufl section. All are established in the 6 villages of the municipality, which means the inhabitants of these villages are not only originated from the tribe of the Bani Sakhr, they belong to the same descent-group and forms a tribal unity. This is a very important fact, not only because the population is unified when internal problems are solved through customary law, but also an important solidarity exists among the inhabitants who are aware of their common origin. The region therefore represents a socio-economic-based unit to be taken into consideration ; the six villages are in fact only one.
This structural aspect of the social group has to be studied. Its solidarity and inherent social organisation will be the basis for the locally-managed tourism development.

The 'Azazmet :

It is an important tribe of Bir as Saba'a. They arrived in this part of Jordan in 1948 as refugees having lost all their lands in southern Palestine. As a result, the 'Azazmet is considered as a "landless" tribe in Jordan. The tribe is also composed with different sections and numerous descent groups. But, unlike the Hgueish, they are scattered all over Jordan and within the district of UAR, they do not form any additional unit if not the tribe as a whole, although they are the only nomadic tribe within the district. The link among the different families is the tribal one. The 'Azazmet are nomads. They move to the eastern parts in winter with their black tents and herds for pasture land. In summer, they exchange the goat-hair tent for a lighter one made of jute and they roam around the villages. The direction of their movement is east-west mainly, but the herdless move down to the Jordan Valley in search of daily work. In spring and summer they settle around the Hgueish villages for harvesting.

The 'Azazmet live in this region since 1948, practicing rain-fed agriculture as they used to do in Bir as Saba'a. They are also shepherds and have herds of sheep and goat. In Jordan, they crop within the tribal territory of the Bani Sakhr whose fields were surveyed in the fifties and registered as private parcels. The latter are the landowners. The Azazmet cultivate the Hguesh land on a share-holding system.

Nomads, shepherds but also daily workers, the 'Azazmet do not have any other opportunity. Landless, they do not have the financial capacity to buy land or to build their own house. They are obliged to remain nomad people, although their children attend village public schools and they participate to elections of the mayor.

Relations between Hgueish and 'Azazmet are those of "share-holders" (shouraka') only and not those of "harras" (who plough land). The latter type is quite frequent in the Jordan Valley being relevant of a strong social hierarchical situation, that is not found in the UAR district. It is important to point out that relations between shareholders and landowners are those of "sharing" and not of "services" or dependencies.

According to the local development potential and the keystone role played by the present archaeological and tourism UAR project in such a development, three types of stakeholders are distinguished :

- the sedentary Bedouins (Beni Sahr), living in hard dwellings in UAR village and owning the whole land, in and outside the archaeological site ;
- the nomadic Bedouins ('Azamet), living in tents and cultivating the lands. Although nomads, they stick to the site and to the owners land in UAR ;
- all other inhabitants of the UAR municipality distributed in the 6 villages scattered around UAR village. They wish to benefit from the project.

4. Socio-economic background: farming, production system and income generation

The district covers great portions of desert that extends eastwards to the Saoudian borders. Since 1992-1993 the country is recording a drought cycle. Rain-fed agriculture that used to be a significant activity, together with pastoralism, are no more profitable with costs higher than benefits. Shepherds are continuously indebted. The region is overgrazed and the number of herds has considerably decreased alike the agricultural products. It is

It is revealing that Army and General Security have become the main economic generators in the UAR municipality. For example, within the Naef family, one of the two large families from UAR village, 10 have a member employed by the army, 7 in the Security and 6 other employees. 5 families altogether possess 100 donums of olive trees orchards and vegetable gardens.

The fact that there is no movement to towns nor any emigration to other countries is noticeable.

Employment opportunities are very scarce. Main sources of income for the locals are issued from agriculture and dairy products.

5. Land tenure

UAR archaeological park encompasses 120 ha, from which 24 ha belong to the Government (Ministry of Antiquities). This area is divided into two sub-areas :

- 132 donums (13 ha) around the Tower ;
- 107 donums (11 ha) around the Castrum.

This is the only government-owned land in the site, all remaining land being private (mulk) and seem to belong to 2 families of UAR village: Al Neifh and Al Mor families.

om a rapid survey and meetings with the local population, private lands likely belong to only one nily composed with 8 brothers, Dha'ban's sons ('ial Dha'ban), the main part of the Al Mor family.
people should be involved in land tenure in UAR archaeological park, albeit this information needs to confirmed by the Land and Survey Department, especially because site boundaries are not exactly own by local population. The mission members were unable to obtain precise and documented formation from administrative services about the very pressing issue of land ownership in and around e site.
ne Antiquities Department has declared to the local population it will buy the entire land within the chaeological park boundaries, including current buildings. Given the archaeological restrictions put on is land by the MTA, owners are interested to sell. For example, they can no more build any houses or anting trees. All land reclaimation being under the control of the Department of Antiquities, local vners alternatives are restricted.

Urban development and physical planning

ne village of Umm ar-Rassa is under construction. Some 10 houses are built mostly along the main ads, especially the road to Madaba. They are simple one or two storeys concrete houses mainly sociated with a garden, or at least with a courtyard. They form a quite linear village built without pre annir.g design. Only few buildings are located inside the archaeological perimeter:

- the post-office, near the main cemetery
- the first aid hospital, in the south-west corner of the archaeological park,
- the police station, on the north-eastern limit to the park, out of view from the site
- the guard house/toilets in front of St Stephen complex
- three private houses, one in the south-west corner, the two other ones near the Tower (all of these building are under purchase by the Ministry of Tourism and antiquities).

he two most important buildings of the area are the schools, located in front of the castrum to the south f the Dibhan/Jizza road. They are highly visible from the inner site.
1999, the Ministry of Planning and Public Works prepared a general Master Plan for the town xtension and reorganisation. That document stated authorised constructions to be built on both sides of ne Madaba road and in the south-western part of the site. Currently, only construction to the west of the oad are being developed (eg., new Baladyeh). All constructions planned on the east side (archaeological ark) are apparently cancelled and the land put under the archaeological Law.

. Tourism

rom the tourism point of view the UAR site is currently under-exploited. The lack of tourism anagement and organisation (except under the St Stephen's shelter) does not incite the (few) tour-operators and individual visitors to spend more than one hour at UAR. There are no signposting and the anitary facilities are out of work most of the time . In addition, lack of security conditions does not ncourage Tour-Operators to guide their groups across the ruins area. They generally restrict the visit to ne St Stephen's mosaics complex.
he annual number of visitors varies between 8000 and 12000 (source : Inspector of antiquities). But rom other sources the average number might amount 8500 visitors (700-720 / month, reaching 870-900 n May). Peaks are in winter and during vacations in spring and autumn. The table in annex 13 shows a reakdown of visitors spread over a 13 days peak period. The great majority of tourists only visit the St tephen mosaics, staying less than one hour on site.

A list of Visitors data is given in annex 13.

On-site tourism-related commercial activities

At the moment there are no tourism-related commercial activities (no shops, no restaurants) and therefore no income for the local communities. Information policy is reduced to the poorly designed panels of 'Museum without Frontiers' (general information on the Ommeyads and very simple map on the Madaba region historical sites).

Existing tourism circuits :

Visited sites in the region are presently Madaba (Museum, byzantine churches and mosaics,...), Mount Nebo (mosaics, view over the Dead Sea, ...), where Moise is supposed to have seen the "Promise Land"), Machéronte (where John the Baptist lost his head), Dhiban and the view over the wadi Mujib. Given the Iam's construction on the wadi Mujib (King's Road), tourism buses go to Kerak and Petra using the Desert Road. Quite all these sites are related to biblical tourism.
Today about ten hotels or/and Bed &Breakfast exist in Madaba. A four stars hotel is now under construction taking into account the growing demand for biblical sites. Nowadays, UAR is only rarely planned by Tour-Operators and Lehun is never visited (despite an outstanding view over the wadi Mujib), essentially because a difficult access road, its situation in a "cul de sac", and the poor state of preservation of its vestiges, in a very uneasy place for unhealthy people.

E. LANDSCAPE

The major and most interesting scenic points are situated at the top of the tumuli (especially the easternmost cemetery), the Kastrum (northern wall) and at the top of the Byzantine tower within sanctuary II.
The most preserved visual axis are towards the east. At the moment, the most obtrusive elements spoiling the landscape are : the existing shelter of St Stephen, the guard post near St. Stephen, the new post office, the first-aid building, the line of UAR's houses along Madaba road, the telephone and power lines along roads, buildings south to the Kastrum, various concrete-made houses within the proposed archaeological site boundary (see map), a warehouse near the NW boundary and the agro-industrial compound a few kilometres to the north (bright white roofs and walls).

VII. PRESCRIPTION FOR MANAGEMENT AND RESTORATION

A. SITE MANAGEMENT

1. Administrative Protection Of The Site

The first and key condition towards an effective site protection depends on land property. Currently, only two pieces of land belong to the Ministry of Tourism and Antiquities. Extending that ownership to the whole area, considering at least the whole Archaeological Park, is an absolute priority (see §. Executive summary). The whole land will be registered under the name of the Department of Antiquities.
It is also expected that a broader general landscape regulation could be implemented with the aim of protecting the overall view to the North and to the East, providing construction autorisation solely to the west of the site, where the new village is under construction.

2. Site Zoning

Zoning is considered as an essential mechanism for managing a protected area whatever it is natural or cultural (fig. 7 – Plan 12 - § X). Site zoning forms the basis for any further conservation and tourism development. It is a prerequisite to an efficient implementation of the project and the future site management plan. Zoning will be adjusted to the cultural, ecological and socio-economic situation of each type of land. The carrying capacity of the site and zones with archaeological concerns (sanctuaries) is discussed in the section 'Tourism development'.

Zoning related to tourism and to research activities can not be considered as a definitive statement. Periodic findings will necessitate zoning adjustment over time. For example, if new key archaeological discoveries occur in the agricultural and grazing zone, a new sanctuary might be established with specific regulations and possible tourism development (with subsequent increase of site carrying capacity).

The proposed zoning of the UAR site is based on the distribution and importance of the archaeological remains, on the current land use (refer to the socio-economic section) and on the landscaping values of the site. The land tenure constraint is expected to be defeated through the MTA's land purchase

...tion, therefore it is not taken into account in the present zoning proposal. The current land tenure ... described in the socio-economic section of this report.

...Boundary and Zoning map is tentative, designed from the consultant team's investigations ... about the site. The site boundary was initially proposed by the Fransciscan excavation team directed ... Pierre Picirello ('Archaeological Park)'. Such a boundary is acceptable.

...he proposed zones can be distinguished as follows :

...ype of zone	*Proposed locations (see map)*	*Size*	*Objectives*	*Regulations*
...ecological ...ary (core	Sanctuary I : antic religious city, Kastrum, large fenced rock-hewn cistern Sanctuary II : Stylite's tower, Byzantine tower, rock-hewn cisterns	10 ha 5 ha	• Conservation and restoration of the antic remains. • Sustainable tourism development • income generated through entrance fees	• Strict protected zone • Restricted & controlled tourism development (carrying capacity, no walking off demarcated trails) • archaeol. research • controlled educative activities • monitoring of tourism impact • Restricted use of official service • No other activities allowed
...vation & ...ch zone	Kastrum, central zone (byzantine tower and rock-hewn cistern), other ?	5 ha	• Improve understanding of the site. • Restoration of vestiges (enhancing site value, improving security)	• Human access, agriculture, grazing and tourism prohibited
...olled zone	sanctuary I inside sanctuary II	15 ha	• Natural recovery of vegetation	• Grazing prohibited • Cropping prohibited
...ing and ...g zone	Central and Northern part of the site		• Keeping the traditional way of rural life. • Soil erosion control • landscape improvement • income to local communities • marketing of handicraft and local products	• Traditional agriculture and pastoralism, • research (archaeological, antic farming systems, ...) • landscape architecture • No infrastructure development (houses, power lines, ...) besides existing unpaved roads and paths • possible stone-made restoration works (small dams, embankments, ...) • Nomad tents allowed.
...sive ...ne	Parking area, entrance gate, VC, market area	3 ha	• Concentration of tourism-related nuisances in restricted areas: parking lots, ... • Control of tourist numbers • Income to local populations • Information, public awareness	• Allocated to the sole licensed traders (local association to be created) • Controlled access of parking lots • Entrance gate and VC have specific internal regulations • Strict protected zone (no human access, no grazing) • Boundary: grazing prohibited until plantations get the right size
...tery	Out of the AP	3 ha		refer to : Ministry of Aqwaf

A sustainable resource management zone should be defined in-between the two archaeological sanctuaries (core zones). This sustainable resource management zone which is called "cropping and grazing zone" can be divided into two sub-zones :

- *Extensive grazing management area*: including potential archaeological remains in the ground, this area must be preserved from agricultural and plantation reclamation. That the reason why only grazing activities (during the spring grazing period) will be allowed here. Some cisterns located nearby can be used as watering point for livestock.
- *Agricultural terraces area*: located in the bottom of the small wadis the have to be reclaimed because they represent the old agricultural field pattern which is part of the whole archaeological site management. Archaeologists agree that no archaeological remain could be found inside these old terraces (obviously, no building has been set in wadi bottoms, except little dams and cisterns). Reclamation of such agricultural terraces will help Bedouins (ie., 'Azazmet tribe) supplying some agricultural (food and livestock) based products and to sustain their livelihood.

For each zone specific regulations will be set up by the Ministry of Tourism and Antiquities.

3. Fencing and Boundary Development

At the moment livestock is freely grazing within the site, including within the two proposed sanctuaries. Some ancient cisterns are currently used by pastoralists to water their livestock. Overgrazing is general outside enclosures (walls or metallic fences delineating private gardens and olive tree plantations) and the soil cover very thin if non existant. As a consequence of soil erosion in this semi-desertic area, sand and dust winds are frequent. As already stated humans looting and vandalism is not a real problem at UAR given the solidarity and interest in conservation shown by the local society.

Given the strong traditions and links governing the social life in the area and the capacity of the local society for self-regulating movements, walls and metallic fences do not appear as the most efficient solution for protecting the UAR site. Nevertheless, some form of boundary development is necessary. Access restrictions should be limited to the sanctuaries, as well as to some other areas under cultivation in the multiple-use zone (this under the responsibility of the leaseholders).

A suitable form of land and zone demarcation could be :

- a **visual green demarcation of the site** everywhere land uses are radically different : along the Madaba road and the southern limit road (urban development). It is proposed to maximise the use of strip plantations (10 m wide) along boundaries, composed with local species of trees and shrubs (refer to §. 'Landscaping Preservation & Improvement').
- the establishment of a **vegetal thorny fence around the sanctuaries**, only in case arrangements with the local nomads cannot prevent animal divagation or other kinds of disturbance to sanctuaries (2 years testing period).

Once land will have been purchased by the Government (fig. 7 – Plans 13 to 14 - § X)), the site boundary needs to be delineated along some stretches, without physically becoming an enclosure. Most of the site area (central and northern areas) will be reclaimed or remain extensively used by the local communities, so that no obstacle to movements of people and herds is envisioned (with the exception of tree and shrub plantations during the earlier stages of growth). Preserving the landscaping value is another reason for avoiding the artificial fencing of the site and sanctuaries. Moreover, the total length of the site external boundary exceeding 8 km, the cost of such a fence would be high (investment, recurrent costs).

Several information workshops and meetings will be held in order to achieve an acceptable local control over the site during a pilot period of 2 years and to strengthen the social acceptance of site restrictions.

In case of poor implementation of the contractual specifications to be agreed upon by the community (a local association could be created -refer to socio-economic section-), in particular the failure of self-regulated movements control of humans and herds, it could be decided to establish a natural thorny fence around the sanctuaries (see map), and to effectively control such a fence during the sensitive period of 5 years (to reach plant maturity).

. RESTORATION AND PRESENTATION OF THE ARCHAEOLOGICAL EMAINS :

estoration and display of the archaeological remains face different problems that can be grouped in main sections, from the basic ones to the more elaborated, the last ones including part or totality of the commendations of the first one.

Consolidation, restoration, cleaning : a general policy and technical recommendations have to be aborated and applied. For example no restoration will be implemented if complete architectural study as not been carried on, only specific mortar will be used, after composition tests implementation (the onstruction of a lime kiln is recommended), mosaic restoration will be monitored by specialists...

Works to be done : for each type of vestiges ;

Anastylosis : if many parts of monuments could be rebuilt as they were in the Antiquity (using original aterials), only few buildings could be entirely anastylosed The chapel of the Peacocks is one of them.

Shelters : most of the ancient monuments need modern sheltering structures to be safeguarded as well s correctly displayed to the visitors. St. Stephen complex, churches of the Lions, of Peacoks, of Priest Va'il , of the Tabula are in this case.

. Consolidation, restoration, cleaning

) Overall policy and technical recommendations

rchaeological works have been conducted for years with great success at Umm ar-Rassas, then reparing a suitable basis for the present project. Nevertheless, while the archaeological discoveries were f paramount importance from the scientific, historic, aesthetic, ... points of view, the conservation of he uncovered remains was not undertaken as it could be expected. Great efforts were spent for the reservation and presentation of some monuments : shelter over St Stephen church and apse of Bishop ergius church mosaics, systematic consolidation of Twin churches area vestiges, on-going work at the ower church, ... Unfortunately, systematic post-excavation conservative and protective works were not arried out. For a site such as Umm ar-Rassas, all the walls and structures have to be taken into onsideration. Would some particular vestiges be of great interest, the whole site becomes unique, herefore forcing to preserve it.

t is highly recommended to proceed to the systematic protection and consolidation of all the uncovered estiges. That work will be conducted only after a comprehensive study and registration of the remains work devoted to archaeologists). Then, case by case, each monument will be considered and the most ppropriate conservation solution implemented (including restoration or anastylosis wherever these olutions are feasible). Tentative or permanent sheltering will be studied too. Taking into consideration he great number of structure in need of consolidation works (as a minimum), it is proposed to reduce as nuch as possible the number of new excavations, which will also have to integrate the requirements temming from the proposed tourist management scheme, and in particular clearance/excavation of the ntique streets the visitors may walk on.

The work should focus on the restoration of the already excavated parts of the site. It will need a ermanent team of trained workmen (labourers, masons, stone cutters, and supervisors) working in co-rdination with archaeologists and with architects and other specialists whenever necessary. A substantial part of this staff should be originated from Umm ar-Rassas.

A general restoration policy and techniques will be prepared by specialists and a chart of restoration adopted before being implemented. For example, it is strongly recommended to precisely define the mortar to be used for the restoration (composition, ...), as well as strictly follow specified conditions for using it.

A particular attention will be paid to the security of the visitors and the monuments filling back all studied soundings and looted spots. A list of these «dangerous cavities » is given hereafter.

It is also highly recommended that a general policy will be adopted for the excavation dumps, in order to avoid the current situation of new debris hills all over the site (see hereafter a preliminary list of such

cavation debris to be removed from the site). While digging, it is proposed to separate earth from ones in the debris , both materials been reused, earth for filling back the antique fields, stones for the alls restoration of the site's buildings or the broken agricultural «dams».

List of archaeological soundings to backfill

g. 7 – Plans 8 to 9 - § X)

pproximate size of sounding is indicated, in meters. It is assumed that proper documentation of the unding has been made, but this need to be verified prior to backfill, as some of these soundings reveal portant stratigraphic components essential for the understanding of the evolution of the settlement.

List of the clandestine excavations to assess and backfill :

ig. 7 – Plan 11 - § X)

cluded hereafter are clear clandestine excavations, leaving behind debris and traces of digging carried t with the purpose of discovering objects, and signs of activities, maybe vandalism.

List of excavation debris areas to be removed

ig 7 -- Plan 10 - § X)

all excavation debris there are stone blocks that could be useful for conservation and wall nsolidation purposes. These need to be retrieved and arranged in each area, to maintain a certain lationship with the original area. In some cases there are decorated stones and architectural elements at need to be recorded and correctly stored. The earth could be reused for filling back the ancient fields fter their complete study), as rubbish stones should be reused in restoration work and/or in rebuilding e "dams" of the old fields. Dump materials will have to be selected directly from the excavation (see eneral recommendations) and reused in a proper way.

Suggested conservation actions (ranked by priority per each area)

1) General remark

Most of the uncovered structures have not been fully recorded, especially as regarding their elevation. his preliminary work has to be carried out for all excavated structures, prior to any other work. In the ame time, systematic study of all the architectural remains will be done («étude du bâti»). As a priority, urther research work will have to concentrate on these two aspects.

2) Castrum

The walls:

1. Restore the entire wall, eventually with reconstruction, with the goal to prevent from any further collapse and to access to the interior not from the north gate.
2. Remove excavation debris and architectural fragments

North gate:

1. Complete excavation work
2. Remove excavation debris and sort stone blocks and architectural fragments
3. Complete walls consolidation

Southern gate complex:

1. Complete wall consolidation
2. Excavate postern gate to understand its relationship to the main gate.

Twin churches complex:

1. Monitor mosaic conditions
2. Assess and monitor wall conditions, especially in the southern church
3. Repare damage caused by clandestine excavations
4. Remove stones blocking the passage between the southern and northern church
5. Eliminate steps that facilitate visitors entering the excavation area from southern fortifications (between towers 8 and 9) and from room near tower 4.
6. Eliminate debris from along the castrum walls
7. arrange the «lapidarium»
8. raise the wall between towers 4 and 5 to make it inaccessible

9. excavate 3 more rooms and possibly a courtyard to complete the study of the complex.

(3) Church of the Priest Wa'il and of the Tabula

1. Consolidate the walls of both churches
2. Monitor the decay of plasters (especially in the church of the Priest Wa'il) and eventually substitute cement plasters with more compatible lime plaster. Provide better protection for the decorated walls
3. Remove chancels from the Church of the Tabula, as well as from other weathering decorated stones, and store them in closed atmosphere , except if a general protection of the church is proposed (roofing as for St Stephen complex)
4. Remove the debris from around the churches, and organise the stone blocks by type and size in an open area to the west of the complex
5. Restore the alabaster floor in the church of the Tabula (area of clandestine excavations in Northwest sector), and over the channel that during the antiquity brought water to the cistern
6. If the shelter project is developing , document the current conditions of the mosaics and conduct a full programme for their consolidation and conservation
7. Complete the excavations of the three rooms abutting the church of the Tabula and of the tower-like building
8. If the footpath proposed in this report is further developed , clear the rubble and consolidate the walls of the structures besides the passage, open the blocked passage in the south wall of the church of the Tabula, and reconstruct the arched passage.

(4) Church of the Lions

1. Consolidate walls
2. Backfill deep sounding in room to the south of church
3. Consolidate walls, arches and roofs of rooms to the south of church. Rebuild roofs
4. Monitor mosaic conditions and carry out appropriate conservation and maintenance programs
5. Consolidate tombs west of the church and replace displaced tomb slabs. These should then be appropriately presented or backfilled
6. Clean debris, complete excavation and consolidate walls of rooms to the north of the church
7. Complete excavations of annex to the west of the church
8. Properly document nave collapse. Study the feasibility of leaving it in situ, or complete excavation and reconstruct using the archaeological evidence for arch span and height

(5) Area of church of Saint Paul and chapel of Peacocks

1. Consolidate existing walls, especially in chapel and church
2. Fill up large excavation between two churches: walls are in very precarious state and in immediate danger of collapse (except if a complete program of excavation and restoration is planned).
3. Carefully eliminate vegetation growth above the buried mosaics, after verifying their actual impact on the decorated surface
4. Fill up clandestine trenches in both churches and restore damaged mosaics
5. Remove decorated stones and capitals, presently outdoor , and store them in a room .
6. Fill up soundings to the south of Church of St. Paul
7. Remove debris and avoid damage to the vernacular houses immediately to the west of the excavation area
8. Complete excavation of the wine press, consolidate walls and plasters.

(6) St. Stephen complex

1. Assess detailed condition of mosaic floor in St. Stephen and Bishop Sergius, including a geomagnetometry or radar survey to reveal channels and/or passages under the floor.
2. Consolidate mosaics and continue conditions monitoring
3. Stop water infiltration presently damaging the mosaics in the Church of Bishop Sergius.
4. Clean and stabilise the mosaics in Bishop Sergius.
5. Consolidate walls and complete excavation of area to the east of the St. Stephen

6. Restore alabaster floor in Church of Aedicula
7. Repair damage for clandestine excavation in room south of same church
8. Fill up sounding north to the Church of Bishop Sergius and the long sounding located in the northern wall of the complex.
9. Restore or backfill the tombs and consolidate the small chapel at the end of the right aisle of St. Stephen
10. Consolidate the passage below Church of the Aedicula, restore floor.

2. Works to be carried out

a) Castrum

A general detailed study over the entire wall has to be done. All the sections which are in immediate danger of collapse should be restored and/or consolidated. In a more wide objective, the wall should be restored in such a way that any passage from outside to the interior of the castrum is prevented, except from its natural North gate. The temporary stairway set up by the Swiss archaeological team should be dismantled. It is prematured and too costly to plan for a tourist visit inside the fortification, albeit developing a platform over the ruins (see Annex 5) following the ancient street axis is feasible.
All the excavation dump accumulated along the Eastern side will be removed and it is expected that the excavation of the North Gate will be completed.

The Twin churches complex

The walls of the church have been fully restored by the Swiss team. The general remarks about the quality of the mortar used and its implementation are valid here, but that church is one of the two monuments at Umm ar-Rassas which are already fully consolidated and actually in a quite good state of preservation. All the area has been fully excavated. Would the mosaics be shown to the public, the construction of a shelter is proposed (see technical proposal), although such a solution is not required for tourism purpose. Indeed, there is no direct access from the Castrum North gate. This shelter will not only aim at protecting the building, but also the mosaics which are, at the moment, simply covered by a few centimetres of earth.

Church of the Palm Tree

With the church of the rivers, it is one of the two monuments at Umm ar-Rassas actually in a quite good state of preservation, all the structure been fully restored by the Swiss team members. All the area has also been fully excavated. The general remarks about the quality of the mortar used and its implementation are valid for the restoration done on that monument. If the mosaics have to be shown to the public, the construction of a shelter is recommended (see above remarks on church of the rivers and general technical proposal).

Annexes

All the excavated structures were restored and/or consolidated, but many of the carved blocks found (lintels, capitals, some of them still plastered,..., special mention to a beautiful « alabaster » base of column datable from Roman time) were left in situ. They may be protected from weathering and visitors.

b) The northern settlement

The Churches

Excavation to be completed, mainly along the outside limits of the church : to prevent humidity and over weight from accumulated earth and debris on one side of the wall and to allow their restoration
Restoration of the walls
Removing ancient dump from excavation
Presentation of the surroundings
Second step : building a shelter in connection with the one necessary over the Tabula church,
Restoration of the plasters and mosaics
Restoration of the ambo and chancel
General cleaning.

Church of the Tabula :

Large restoration works have to be carried out in that church : wall conservation and restoration, clearance around the building, ... It is expected that all the church will be sheltered, the chancel and ambo anastylosed (after implementation of a stone consolidation process), the mosaics and stone floor presented after restoration... The restoration and sheltering of that church should be planned together with that of Priest Wa'il.
Until l the sheltering becomes operational , it is recommended, as for the other mosaics of the site, that regular inspections are organised, such as cleaning the cover earth layer from herbs growth and animal incursions.

Church of the Lions
The archaeological exploration has to be completed, the fallen arches first dismantled then restored, or kept as they are but fully protected. A general restoration of the walls is required prior to the construction of the shelter. The North wall, and, in a smaller scale, the South one have greatly suffered , resulting in the collapse of the internal arches. The reconstruction of the arches is quite possible, yet unnecessary for the construction of the light protection structure. A general consolidation of the walls, built of pseudo square more or less similar blocks for the apse, and from the double irregular with internal pocket for the others parts, is needed . The construction of the modern shelter will follow the general procedure (see general explanation.)

Chapel of the Peacocks:
This monument is actually the only one at Umm ar Rassas which could be anastylosed. Sufficient elements and blocks insure the restitution on paper as a material one. There are nine capitals (out of likely 10) among some stones arranged to the west of the chapel, as well as many stone slabs belonging to the original roofing. This building could be theoretically reconstructed, as most of its original building material seems to be present, although the original height of the pillars is questionable () (archaeologists have been requested to provide this information). Reconstruction (anastylosis) of that monument will be proposed, after general consolidation of the *in situ* structures

Church of St. Paul:
A lot of work remains to be done :
- complete clearance of the neighbourhoods,
- excavation and dismantling of the collapsed arch still *in situ*,
- consolidation of the walls,
- restoration of the plasters and the mosaics...
- Rebuilding the walls and construction of a protection roof.

Church of St. Stephen:
- research and determination holes size under the mosaics (radar, magnetometry...), reasons of decay...
- protection of the mosaics and disassembling of the current shelter,
- completion of the excavation, in particular along the external wall of the apse,
- fill back the soundings (south-eastern passage), -
- restoration and consolidation of the existing structures, in particular the vault and walls of the south-eastern passage,
- general rejoining of the structures,
- construction of the new shelter,
- restoration of the mosaics, general presentation.

Church of Bishop Sergius
The northern wall, in critical condition, was partially rebuilt some years ago. The restoration should be pursued . The West wall and the closing partition, build between Bishop Sergius and St Stephen, are in a very bad state of preservation. Overall consolidation of the structure is necessary.
The whole church should be protected by a new efficient shelter. This new structure will take place on restored walls (see general layout for such structures) and will be part of an overall protection and restoration of the area which will include sheltering of the four churches and the baptistery of Bishop Sergius church. The St Stephen complex should be restored has a whole.

The main restoration problem will be the conservation of the mosaic pavement. As there is a cistern inside the nave, under the main mosaic floor, it is recommended, prior to any other work and as for St Stephen church, to undertake a non destructive exploration work (radar, magnetometriy...).

Church of the Aedicula

The main problem concerns the restoration of the existing structures, in particular those of the southern wall, preserved on more than three meters high . This wall shows many clues of instability (swelling, cant, compressions, cracklings, disintegration of the rocks, broken lintel ...), amplified by the presence of the underground corridor and the aedicula. Recent consolidation works have prevented from the collapse of the structure but did not solve any of the structural problems. A shelter could not be built until the entire wall is dismounted and rebuilt, reinforced and rectified. The underground corridor should be entirely restored, as well as the whole of the pavement of the nave and the apse. For more legibility, the pillars of the nave will have to be rebuilt up for two or three rows .

Church of the Courtyard

- Consolidation of the walls,
- rebuilding of the two arches of the North nave...
- restoration of the stone floor.

As the building is directly connected to the church of Bishop Sergius, roofing is a need to insure the protection and the continuity of the volumes within the St Stephen complex.

The other structures

Wine press : The structure is not completely excavated and is in need of consolidation, as both plaster and walls are in precarious conditions

c) Cisterns and water tanks

- general survey and study, including research with non destructive adapted techniques (see churches of St Stephen and Bishop Sergius).
- Cartography of all underground structures

d) Ancient Fields

Cultivated terraces were build by damming the bottom of local wadis with low terrace walls. The bulk of the terrace infill consists of colluvium composed of angular gravel in a matrix of fine sandy silt. In most cases the colluvium is topped by a 30 cm thick cover of fine sandy silt. The colluvium is very similar to the dirt originating from the excavations.

This dirt could be used to restore the cultivated terraces provided a cover of fine material on top of the dirt layer is applied, after comprehensive study and documentation of the whole system and identical reconstruction of the ancient walls..

A general survey and study of the structures is a preliminary need. These structures have to be protected and possibly restored (including the excavated ones), and prepared with the view of future investigations, tourist presentation and agricultural use (antique rural life theme). After a comprehensive study, they could be used again as fields for agriculture and grazing to fulfill local Bedouins requirements.

Restoration of such structures will be easy while simultaneously being a good solution for recycling the debris found during the excavations: rubbish stones could be used to rebuilt the walls and the earth to fill back the fields. Under the condition to keep their ancient configuration and utilisation this action will : 1) illustrate tourists' understanding of an antique village's agro-economy in arid lands, 2) improve site cleaness and avoid summer dry fallow land fires, and 3) generate income for local populations. Additionally, this action will maintain a local interest for Bedouins to control the area.

e) North tower Complex

The Tower

Although cracks do not effect any key stones but their joints, monitoring the tower is recommended, especially because a clandestine excavation has destroyed –and destabilised- the lower part of the inner core (large hole opened in the northern façade). This tower may be also the place where general and detailed in situ studies on local stone weathering degradation could be monitored. An overall and comprehensive detailed drawing and study should be carried out.

The Church of the Tower

The church has masonry work problems. Presently, the conservation works conducted by the Department of Antiquities consists of wall consolidation and reconstruction, but the use of cement mortars of untested type may create future problems linked to mechanical and chemical incompatibility with the used type of stone.

Area around the Tower

- registration and study of the existing remains before implementing any restoration work (for example the courtyard limiting walls were recently cleared without any prior stratigraphic expertise and recording).
- complementary excavations , mainly around the «farm» building
- restoration of the unearthed structures
- general cleaning of the whole area's dump
- restoration and protection of the stone slabs roofed cistern still under use.

f) Semi-subterranean Houses

A thorough examination should be lead on a selection of two houses prior to start any restoration work. Prior to this step, consolidation will be executed and excavation conducted. A general survey and comprehensive study of this recent conversion of the antique remains are also expected.

3. Anastylosis

Reconstruction of part or totality of a building in the exact way and shape it was before destruction, and using the original materials requires to:

- discover all the necessary elements during the excavation ;
- design the restoration project of the building demonstrating that anastylosis is possible ;
- be sure that, from a technical point of view, the remains will allow rebuilding (state of preservation of the discovered elements, conservation and solidity of the different components, ...).

Nowadays, out of all the excavated monuments of UAR only the church of the peacocks reasonably appears to be completely anastylosable (Fig. 7 – Plans 15 to 18 - § X). All information and elements needed for its reconstruction are likely available : pilasters capitals, voussoirs of the arches and stone slabs from the roofing are preserved. The graphic restitution of the whole monument seems possible. Therefore, it is recommended to prepare a complete and precise study of this building. Anastylosis (if feasible), of that chapel could be a very interesting opportunity to display to the visitors the ancient method of the roofing construction technique used in the city.

In some other buildings, only partial anastylosis is possible (see for example the fallen down arches of the church of the Lions). On an other hand, reconstruction in situ of the ambo, of the chancels... of the churches must be studied, especially as regarding the monuments to be sheltered.

4. Shelters

The St. Stephen's complex consists in a group of churches including the church of St. Stephen and adjacent areas, the church of Bishop Sergius, with the baptistery and the Diaconicon, the church of Courtyard, the Church of Aedicula, and adjacent areas .The floors of churches of Saint-Stephen and of the church of Bishop Sergius are paved with exceptional ancient Byzantine mosaics, the two other edifices being covered with paving stone.

The churches of St. Stephen and the choir of Bishop Sergius have been protected by a closed covered superstructure. So far, this decision has helped to protect and conserve the mosaics, but also to authorize visits. Constant and regular visits have emphasised the celebrity of the site as regarding its religious

ngs and beautiful mosaics. The ongoing increase in the number of visitors from various phical origins demonstrates the wide interest shown by the international community.
nosaics of the others churches (churches of the Lions, Peacocks, Priest Wa'il, and twin churches) wadays buried under 20 cm thick sand layer, protecting them from potential damage by weather sitors.
urpose of the project is to deal with tourist demand, by seeking a solution for protection, in the long ather than in the short term, in integration of the site and enabling discovery and conservation of all osaics.
stently, the existing superstructure covering Saint-Stephen will be demolished and removed letting to a new and relevant structure.

urrent situation

metal shade in place, a temporary installation, awaiting the arrival of a global project, has allowed ublic to admire the mosaics of Saint-Stephen, along with part of the choir of Bischop Sergius' ch (see Annex 8.8 & 8.9).
composed with a steel frame made with columns and lattice trusses, approx. 4 m from each others. covering is made of a saddle roof, in thin steel plates. The supporting columns are founded on the ide of the original walls, within unexcavated zones. Elevations are pierced with large glass openings. y one access allows visitors to come in, using footbridges, 1.20 m distant from the floor. The building n the gable, 7.5 m high. All the shade are coloured in light yellow-green. There is no signposting de.
shade is used to play a role protecting from bad weather conditions (winds, rains, etc...). However, r issues have not been addressed, such as water-tightness and air-tightness, air circulation and light. well, should the issue of the presence on the site of this huge and obtrusive shelter as well as the chitectural quality of the interior volume be adressed.
reover, the presence of outer claddings of the antic walls, in unexcavated zones has so far prevented archaeological work in the surroundings.
ther negative characteristic is that the indoor walkways are built too high and too far away from the saics.
beams are conventional lattice truss and iron corners. Parts are welded on the site. The ageing of the ter parts is noticeable (fallen lattices, broken welding, worn fixings) and replacement work will be uired in a very short time.

Proposal: general policy

eral constraints are guiding the choice of the shelter's shape and roofing r system :

ntegration to the site obliges to adopt a construction system respecting the general volumetric of the rotected buildings, and the use of materials whose nature and colour could adapt the ensemble of the vestiges, or/and to be dissimulated to the sight ;
espect of the archaeological, dense and complex environment, obliges to conceive structures which are strictly limited to the vestiges to be covered, only means of preserving any possibility of excavation and presentation of the possible vestiges bordering. This solution does not allow to operate on the underground basis since the old structures are used as foundations for new constructions. However, this system obliges to design a structure of a total weight lower than the overall mass of the destroyed parts of the old buildings ;
adjustment to any type of structure in potential need of protection (in the future it may be necessary to cover and protect the wine press, dwelling houses, shops, ...) obliges to adopt a simple and modular system ;
costs of manufacturing should be as low as possible obliging to conceive a simple system, with the use of inexpensive and at the national scale marketed materials ;
implementation must be as simple as possible, without requiring highly qualified workmen nor an exceptional equipment (large crane special tools, ...). « Who more is this implementation has to be able to be done in difficult to reach zones (huge hip of ruins), which resulted in conceiving modular structures, easily transportable, easy to assemble and implement »;

nd increasing discovery pleasure : , bringing tourists closer to the touching ;
nationally-recognised recommendations of the Venice Convention and

ages

plane lattice work system distant of 2.5m, carrying a large translucent covering above the central part and a corrugated thin steel sheet above the ng structure will be supported by simple masonry walls built over the antique minimises its visual impact on the site while simultaneously clearly ure from antique vestiges.

rious interests :
central part ; no need of specific electric devices for the lighting
rom rigid bodies (steel plate) of small span of 1.75m max. (no need of heavy ilitating rain water drainage and supporting the sand and dust accumulated

ing in the vertical part of the frame
can be adapted to each buildings without extra cost of engineering
ng and erecting
he anchoring points on masonry walls in respect of their carrying ability
materials (galvanised steel – PES/PVC fabric)
e using ditches down to cisterns.

provided by archaeologists, it has been proposed to restore the load-bearing cover them with a structure of light fabric. The difficulty being, in detail, to ls that may be reconstructed, and in the spacing of any windows to be bored. ecific iconographical, or archaeological element, it is proposed that the lower ucture will be at the level of the extrados of the nave arcades in case they are

proposals, designed to illustrate a concept. All works should be of course eological analysis of the remains .
installed, at about 50 cm above the finished floor. Such walkways (1.20m m the beams, so as to keep the floor clear and to cause no damage to the w over all the important and interesting features.
installation such as electricity or water in those premises.
resolved is to supply the structure inside an archaeological area where ches of Lions, of the Tabula, Twin churches, etc..) (fig. 7 – Plans 19 to 36 -

led inside each sheltered structure.

u walls are in poor condition they are about 90 cm thick, in order that they off the existing copings. The existing walls need to be reinforced using the materials (stone and lime) .
will be placed about 10 cm away from the faces. A simple trip of grey nastylosis.
hick, and 30 cm high for the new stone layer.

antic stones to reconstruct the outer walls, with the same finishing lime

hewn stones, different to the old masonry, in rubble stone. While work is f face finish will be executed (sawn, polishing, ...). There will be no

of 25 cm can be created, the highest part also 25 cm thick.
ded in the facings, to air the enclosed volume. Sand and dust will be

drain water to the outside from the cover . These waterspouts will consist
of about 30 cm.

remains, the levelling of the new walls, and clearing of some elements
ed to the setting up of a light covering structure.

sorting of materials, stock, nearby arrangements .
parts and occultation of holes in existing walls .
walls by reemployment of materials with mortar and light lime.

ortar, with a light brushing of the facings .
isting plaster .

ion : supply and installation of wood protections on the grounds .
e of stone faces of local cuttings 0.50m thick, 0.31 high, 0.60m long, supplied
nd sawed ...Facing layed on all visible sides . On the higher points, wall of 0.25m
al structure . Reservations in new walls to create waterspout, ventilations...
exterior and interior siphon groutings .
en the ancient and new parts of a terracota bricks 0.01m thick .
ation of scaffoldings .
different doors .
steel door, supply and installation .
fter work is terminated.

llation of metallic footbridges on the ground or fixed to the beams, all elements,
etc... being included .
llation of marge signposts . 1.20x0.80m.
llation of steel doors .
be delivered with special anti corrosion paint, brown finish, with rusted protective

ucture of the buildings : a modular concept

lar concept consists to use an unique truss system for all the buildings. However as the
m (Church of the Aedicula) to 13.50m (Church of the Lions), it has been decided to
gths for the vaulted central part in order to use a peripheral self-supporting corrugated
y sub structure witch can be adjust directly on site on the peculiar borders of the stone
case of a delayed building, the initial engineering work will be still appropriate.

gth	Concerned building
	Church of Saint Stephen - Church of the CourtYard – Church of the Lions – Church of the Tabula
	Church of Sergius Bishop - Twin churches - Church of the Priest Wa'il
	Church of the Aedicula

ptistery

cept of the baptistery is identical to the other buildings. It will receive a lattice work
the adaptation of half type 3 truss. Its bay is also of 2.5m. Its peripheral edge is realised
elf-supporting with folded steel plate eaves for the rain water drainage to cisterns.

calculation, assumptions, proposal

mean speed from the weather report of Madaba, Q.A.Airport, Er-Rabbah, 91 to 2000, shows a maximum speed of 20 km/h (10.5 knots) at Q.A.Airport

a poor average, and in lack of peak values insufficient. Therefore, it has been ch regulations (Zone II corresponding to the whole inner land). In that system, nots) corresponds to a load intensity of 105 daN/m². The wind coefficients to , corresponding to an extreme uniformly distributed load of 85 daN/m².
now loads, it is common to take into account a vertical gravitary load of 30

ocal regulations , the standard frame will be :

concerning wind speed and snow load: N.V.65 completed by N.84 modified 95, ques Unifiés », especially D.T.U.32.1 of June 1984
OR, European Norms
de l'Art des Structures Membranes Textiles Tendues » (CRAST)
pour la conception des ouvrages permanents de couverture textile » - *Annales vaux Publics, n°4, septembre 1997 + modifications septembre 98.*

ure : description

ll be made of galvanized steel. All the different steel components will be welded workshop and bolted on site. No welded joint will be allowed on site.

truss

s composed of :
hord : Ø101.6x3.6
IPN200
03x2.9
fasten at the bottom of the vaulted top chord allows the lacing of the peripheral

e corrugated sheet with light secondary structure.
of the truss allows the fastening of a venting system, U-bend type, to prevent This system is reinforced by a grid to avoid entrance of reptiles, birds and

p along sides using a folded steel plate aisles, welded to the bottom chord of

hinge for the first and a sliding bearing for the second. This principle onry walls and allows thermal dilatation .
in the plane of the bottom chord is adopted in order to transfer horizontal

tephen complex

complex, some of the waterspouts can not be put in place because they (St Stephen / Sergius – St Stephen/Courtyard – Sergius/Baptistery). The ng into account the rainfall data and the surface of the incident covering.

ween the two coverings

ngs (Church of Bishop Sergius / Church of the Courtyard and Twin height replace the masonry wall to be rebuilt in all other cases. The end kling support in order to absorb sufficient thermal dilatation.
duct rain waters to the extremities (gable).

top chord by a Vierendeel type horizontal beam in order
ane. Furthermore, it will be stabilised by a set of oblique

dentical to those already describe behind (U-bend + grid

ilding with 50 cm thick walls (see above). They must receive
ensure stability under lateral buckling, and to support the

on anchoring has to be avoided.
5 daN/m² (see § hypothesis of calculation) for a 2.50 m bay, is
ly be absorbed by the proper weight of the walls themselves (for
by the admissible stone stress (for the vertical gravitary efforts).

mbrane is an inverse double curvature prepared technical product. It
nder climatic loads (reducing displacements of the membrane, fatigue
h an excellent life span of over 30 years.

duct ensures a zenith type lighting, avoiding use of electric devices.

must be at least :
ence to «French Recommendations»
Polyester
PVC double face anti U.V. anti crypto
1000 g/m²(NF G 37 102)
Warp : 420 daN/5cm - Weft : 400 daN/5cm (NF G 37 103)
12 daN/5cm (NF G 37 107)
M2
ery technical product are exclusively from the western countries .

cording the specific design and drawings, ensuring a double curvature
facturing process uses the High Frequency Welding technology, the
nufactured in Europe, and carry to the site.
opts a simple principle of saddle shape textile carried on arches with
ve reinforcement for the contact area on arches and peripheral eyelets for

Jordan
ents (political will, accidental collapse of a membrane ...), a substitution
Jordan. In fact, the concept of small 2.50 m bay, allows to use a membrane
gainst uprising of the membrane is placed under it. The disadvantage is the
mbrane to 5 - 10 years .

bility
he use of this kind of membrane in the Mediterranean countries with very high
onstrates the relevance of this choice which brings about a great comfort and
bility (over 30 years)
ured through simple yearly maintenance (namely a stretching of the lacing ropes
(or mending if needed). The full -day- presence of the VC keeper is a sufficient
intenance and monitoring.

(5) Velum fabric

The quality of this membrane is : Grid or Screen with a permeability of about 25% . It is stretched by lacing upon specific tubes welded under the bottom chord of the trusses.
The modularity Side / Nave / Side is adopted in order to enhance the existing shape of the mosaics.
Translucent, this technical product ensures a zenith type lighting, avoiding use of electric devices.

Constitution of the membrane must be at least :

- Fabric Type Screen
- Support — Polyester
- Coating — PVC double face anti U.V. anti crypto
- Total weight — 380 g/m²(NF G 37 102)
- Tensile strength — Warp : 230 daN/5cm - Weft : 160 daN/5cm (NF G 37 103)
- Fire reaction — M1 .

Manufacturers of this kind of very technical product are exclusively from western countries.

(6) Secondary structure

A secondary structure must be added to the mains elements :

- a set of « I » beam IPN 100 or corner L50 x 5 must be used for supporting the corrugated sheets.
- a set of tubes Ø101.6x3.6 with bracing must be used to ensure the vertical stability of the lattice works.

(7) Erection

The main trusses can be realised with 2 different ways, according to the erection principle adopted :

- The trusses are manufactured in one welded piece in the workshop, carried on site and hoisted in place using «semi-heavy» lifting device. The approx. max. weight of the heaviest piece is about 500 to 600 kg (Church of the Lions) inducing the use of a 6 to 10 tons crane for a 10 meters long span.
- The trusses are pre-manufactured in disjoint elements in order to be bolted on site with light lifting devices. The heaviest parts is about 300 kg, limiting the need to a light crane or even more hand carrying using hoist.

The choice has to be fitted at each building according to access criteria to the site, stationary area, man disposal, carrying time, ...
The membrane (weight : 400 kg in case of Church of the Lions) can be hoist as a bag upon the frame using the lifting devices or can be hoist manually if the lifting device are disable. Final lacing is done by hand.

5. Exhibition Of Valuable Architectural Pieces

Some nice and valuable architectural elements were found during the successive excavations. They are on display or stored in the Madaba Museum or/and at Mount Nebo Franciscan Institute. Some remain in situ.
Some of these pieces are very representative of the Umm ar-Rassas history, so that their exhibition is recommended on the spot. The different findings can be divided into two groups :

- Huge stone pieces, such as carved lintels, chancels ambons, ...
- Small pieces, such as polycandilon, bronze plates, bronze crosses, ceramics, glass, ...

Exhibition of these objects doesn't require a complete equipped museographic installation and structure. Heavy stones of the first group can not be easily movable and robbed, although they should be protected against weathering and other risks. Theycan be aesthetically displayed and cleverly interpreted. If archaeological evidence and architectural remains justify it they will be replaced at their original setting within restored and sheltered monuments (eg., ambo and chancel in churches of Priest Wa'il and of the Tabula). May the anastylosis operation be not possible, such pieces will be deposited all together in a protected area such as in the Bishop Sergius baptistery. Exceptionally, some of them will be presented together with the small pieces (e.g., Iron Age column base). A detailed proposal will be prepared only

after exhaustive inventory of the carved blocks by archaeological teams, analysis of their state of preservation and degree of interest for visitors, have been carried out.

Representatives of the second group could be displayed in show-boxes, in the exhibition room of the Visitors' Centre (see §. 'Visitors' Centre'). Illustrated with photographs, drawings and models, they will contribute to the visitors' information upon their arrival at UAR. They might be contemplated once more after the visit, stored in a safe place, under direct supervision of a guard. Only a few, carefully chosen items will be exhibited. Accompanying illustrations, such as on the daily life and the environment, the know-how of the ancient UAR's inhabitants. A showcase from the Byzantine-Omayyad collection of the future National Museum in Amman could be lent to the VC.

C. LANDSCAPING PRESERVATION AND IMPROVEMENT

In order to improve the quality of the site landscape, the following measures will be taken :

1. Destruction of obtrusive in-site buildings

See figure 7 – Plan 37 - § X

2. Use of vegetation

a) Climate constraints

Key climatic data for UAR (720 m elevation) show that (in average) temperature drops to 3°C in winter, raising up to 40-45°C in summer. Dominant winds blow from the West and the NW.

b) Objectives

Vegetation should be considered as a useful mean to achieve several objectives, but mainly for landscape improvement and zone demarcation. A variety of trees and shrubs are proposed not only for improving the landscape, but as well to reduce soil erosion, to reduce the wind consequences (wind break effect) - such as plastic bags blown from the NW (UAR village)-, to demarcate the site boundary and zones, to provide shadow to small market areas and parking lots, and to generate income to leaseholders of the socio-economic zone.

c) Selected species

For this area, most commonly adapted tree species are : cypress *(Cupressus sempervirens)*, oriental pine *(Pinus brutia)*, thuya *(Thuya orientalis)*, *Casuarina equisitifolia*, caroub *(Ceratonia siliqua)*, tamarix, olive tree, black mulberry tree, almond tree, pomegranate tree, juniper. In addition, oleander, jujube *(Ziziphus jujuba, Z. spina-christi)*, prickly pear (*Opuntia*), vine (*Vitis*), are possible shrub species. Thorny shrub species (*Opuntia, Ziziphus, Crataegus*) are livestock-proof once reaching a certain density and height. Years after they are able to greatly limit human access.
Besides their landscaping role, fruit tree species have additional socio-economic advantages : olive, black mulberry, pomegranate, almond, apricot and apple trees, can usefully improve the local farming system in the socio-economic zone. However, apricot and apple trees are more expansive (2.5 JD/plant) and require regular watering over time (refer to socio-economic section).

required planting density :	300 plants / ha
1 plant olive tree (60 cm high, 1-2 years nursery) :	1 JD
1 ha plantation (10 donums) equipped with drip irrigation (not including soil preparation + labour):	700 JD
cost unit labour :	3-5 JD/day

NB : A private nursery is located at Madaba. Nearest state-owned nurseries are at Wala (60 km) and Yajouz.

d) Watering

Yet, given severe droughts, all plantations should be watered during the first years after planting. A locally commonly used watering system such as the drip irrigation is convenient. Once watered the plantation growth is relatively fast, as it has been observed in the UAR area (olive tree plantations, cypress and pine-made row plantations).

e) Thorny fence

Prick y pear *(Opuntia)* and jujube (*Ziziphus*) are ideal shrubs for restricting access to livestock and humans, so are able to provide an effective barrier protecting the sanctuaries provided they have reached the mature stage. They are thorny plants and drought-resistant when enough rooted.
The weakness of this kind of fence, while compared with metallic fence, is the time required to achieve this goal. Plants should be protected as long as they are young and watered during earlier growing stages. However, once effective (after 5 years minimum) this natural fence is maintenance-free and unobtrusive in the landscape.
The prickly pear has to be watered during the 2 earlier years every 2 weeks, then watering will be definitely stopped. Fruits (pear-like) can be collected but green succulent parts should not be cut (used as fodder for livestock, especially during droughts), as the plant growth must be fast. Propagation is by cuttings. Initial planting is about 100 cutting / 150 m and the cost : 0.3 JD/cutting.

Cost of 1 km of 1 single row (not including watering and labour for plantation) : 200 JD

f) Tree row plantations

They will be discontinuously developed along the western and southern boundaries of the AP, both to demarcate the Park (visual demarcation, not physical fence) and to hide the most obtrusive components of the landscape.
Mediterranean cypress *(Cupressus sempervirens)* mixed with oriental pine (*Pinus brutia*) are tree species to be planted. If correctly watered (drip irrigation system) they will reach 5-10m high at the age of 8-10 years. Such species will be planted preferably along the Madaba road and the southern boundary (see map) to hide obtrusive elements (discontinuous plantation). During the young stages herds (especially goats) should graze at a distance from this plantation getting in or out through non planted passages. Olive tree, black mulberry tree, almond tree, pomegranate tree can also be used along different stretches of the boundary where the height is not determinant. Olive trees are particularly well developed when 8-9 years old.

g) Aromatic and medicinal herbs

As grazing will not be allowed within the sanctuaries, it is expected natural vegetation to recover. Among the steppe species several aromatic and medicinal herbs may develop such as *Artemesia herba-alba.* Vegetation will be monitored after 2 years of protection. In case of failure, several species of aromatic and medicinal herbs will be planted. Most suitable herbs are : sage (*Salvia officinalis*), *Artemesia* spp., savory (*Thymus satureioides*), gaysun, camomile, lavender *(Lavandula* spp.), rosemary (*Rosmarinus officinalis*). The objective of such plantation is to cover the soil in and closely around the archaeological sanctuaries, to create a contrast between the mineral ruins and their natural setting, as well as to provide a source of seeds for surrounding areas. This plantation is to be distinguished from the cultivation of herbs by leaseholders on the terraces with meagre soil cover in the agricultural zone of the site (see map) (refer to socio-economic section).

1 donum plantation requires 800-900 plants (8000-9000 plants/ ha). Artemesia can be sowed at a reasonable price, but sage is very expensive (300 JD/kg of seeds !). Plantation of sage plants seems preferable. It is advisable to water plants during first years of plantation, yet in that case the cost of equipping several hectares with drip irrigation is excessive. Therefore, the solution is to equip the site with a mobile water tank (§. 'Site Maintenance').

h) Mixed tree and shrub plantation

This type of plantation will provide shadow to the market stalls and parking areas. Plantation shape will be irregular. A variety of species will be planted : olive tree, cypress, pine, juniper, almond tree, black

mulberry tree, pomegranate, caroub, etc. This plantation will be watered with a subterranean drip irrigation system (to avoid damages brought about by human movements).

(a) Table : Plantation characteristics.

Zone	(i) Objective of plantation	Action	Main species	Location	Size	Watering	Cost (investment)
nctuary I d II	• create a visual contrast with ruins • reduce sand blown across site • reserve of seeds	no grazing ; plantation of aromatic, medicinal, decorative herbs (in case natural recovery fails)	sage, *Artemesia* spp., savory, gaysun, camomile, lavender, rosemary	around complex of vestiges	8 ha (exclud. vestiges)	manual (2 years) then rain-fed	8000 JD 1000 JD/ha
te undary	• natural demarcation of site • hiding obtrusive infrastructure • landscape improvement	triple row tree plantation (10 m wide)	cypress, pine, juniper, olive tree, ...	W and S boundary (discontinuous)	3km/3ha	drip irrigation	6000 JD (2000 JD/ha)
ndary ctuaries	• visual demarcation of core zone • controlled access	double row of thorny shrubs (700 cuttings/km)	Opuntia, Ziziphus	sanctuaries I & II	2.3km	manual (2 years)	1500 JD
urism tensive e zone	• shadow • decorative plantation	tree plantation	olive tree, cypress, pine, juniper, almond tree, black mulberry tree, ...	near entrance gate & VC, parkings and market stalls	3ha	drip irrigation	9000 JD (3000 JD/ha)
ropping d grazing ne	• Keeping the traditional way of rural life. • Soil erosion control • landscape improvement • income to local communities • marketing of handicraft and local products	*see SE section*	*see SE section*	Central and Northern part of site	*see SE section*	*see SE section*	*see SE section*

The cost of all plantations (investment alone) amounts about 25 000 JD. Recurrent costs are mainly composed with the salaries of the two employees in charge of watering and general plantation maintenance during the two first years following the plantation, then with only one labourer's full-time salary.

D. SOCIO-ECONOMIC DEVELOPMENT

1. Introduction

UAR archaeological site is unique, showing a large ancient village and its land on the desert fringe. Presence of these vestiges justifies some controlled tourism development that may represent a source of income, especially for the people living around the site and the landless tribes. Local population should probably be more involved in restoration and maintenance works than in direct tourism development activities, but this is uncertain due to the regional policy context.

On an other hand, the old agricultural field pattern located in the bottom of the small wadis has to be enhanced, specially because ruins are located on Bedouins tribal land which were recently sedentarised and because of the weaknesses of the local farming production system. In such difficult agro-climatic conditions, barley production and livestock feed (as supplement for the long bridging period) must be supported by the project.

This project for the Protection and Promotion of the Cultural Heritage of Umm ar-Rassas is expected to generate a major economic development in this semi-desert area. The proposed action plan put the greater attention on this issue, emphasising the necessity to understand the needs of the local community and municipality plans, with prior agreement of the local stakeholders.
The management plan has to focus both on restoring and enhancing the archaeological remains, as well as on the consideration of other stakeholders and plans of governmental organisations.

2. Land purchase of the whole site

Field pattern should be purchased by the MTA for the whole site.
The Department of Antiquities is in the process of acquiring land around the archaeological area and the area extending from the tower to the fort, thereby solving zoning issues related to site protection.
In the first step, land and property plans (cadastral field plans) have to be agreed by the landowners, the Municipality, the Department of Lands and Survey and the Department of Antiquities. In order to fit the needs, a local Committee will be set up including all the stakeholders after site limits designing. As the cadastral field plans do exist and because land owners agree to sell their lands inside the archaeological site limits, the purchasing process may succeed in a short term.

After landowners identification, the second step will define areas and costs for each field or plot.
However, one should pay attention to the following elements inside the archaeological park:

- the cemeteries still in use for one of them; they should be out of the agreement because they belong to the Ministry of Awqaf.
- cisterns and traditional water tank (stoned made) are private owned and used for livestock watering: their purchase should be justified in agreement with local shepherds.
- buildings and houses: 6 houses are located near the tower and one in the south-east (that is to say they are inside the limits of the park). Purchasing these houses need a previous design of their use and of their potential contribution to local development. for example, part of them could be used for archaeological park guards housing and for a restaurant managed by a local association.

Purchasing these land is very important fot MTA as it will allow:

- a real control of human activities inside the AP in a sustainable way (escaping from private and economical pressures)
- to avoid conflicts between private owners and MTA about types of activities which could be allowed within boundaries and those which are prohibited.
- to substantially improve nomads' production systems, especially those for the Azazmeh (the poorest Bedouins tribe) located in and around the AP site, through contractual agreement for land reclamation.

Action :

- Land-ownership assessment and cadastral field pattern purchasing (MTA, Department of Lands and Survey).
- Purchasing all the AP site lands could be one of the Jordan compensation to the European funding for the tourism development of the site.

3. UAR municipality development plan and urban development

Planning guidelines for vthe illages inside the UAR municipality (physical planning) have been established.
The current zoning plan for Umm Ar-Rassas town, (prepared in 1997) ,currently used by the Ministry of Municipal and Rural Affairs, should to be updated.

In addition, refering to the Social and Economic Development Plan prepared for the country for the period 1999- 2003 (in Arabic),. a new overall land-use draft policy is also under-preparation at the Regional Planning Office of the Ministry of Municipal Affairs.
There is a project for the area of Umm- Ar-Rassas funded in the range of 58,000 JD focusing on developing better roads and lighting fixtures for the inhabited areas of the town of Umm ar-Rassas, as well as dealing with social aid and training.

Some changes in the zoning of the area around the archaeological sites should be studied. Some of them are being under preparation by the MTA, although they should be fulfilled. Several aspects should be taken into consideration, not only buildings and tourism activities. For example, the adjacent cemetery to the archaeological area; where no action appears to be possible, unless another area is found in the town to replace it.

The UAR Baladiyya (municipality) is the appropriate entity to design an area's tourism development project. It gathers 6 villages of the same tribe (Beni Sahkr) and the same nomadic Bedouins (Azazmeh). Moreover, several archaeological sites are spread over the 6 village lands. All these small archaeological sites have to be considered as part of a whole and may contribute to strengthen and balance local and tourism development of this area, so far focusing on the exclusive UAR village.

Lastly, the fact that Lehun has a smaller community than Umm ar-Rassas and that tribal political influence is larger at Umm ar-Rassas, must be taken into account.

For all theses reasons, a local development plan has to be set up for the whole municipality territory, taking into account the several tourism sites (including Lehun for its landscape and tourism potential), their potentialities and complementarity.

The purpose of this action is to propose guidelines and standards dealing with settlements and buildings in the UAR municipality, especially around the archaeological park of UAR and Lehun site.
An urban planning view would replace the present urban plan providing urban zoning for the villages and building regulations for each type of zoning: people and regulations are key factors in the development planning of the area.

4. Community development and contractual agreements for site management

Tourism development in and around UAR site (and Lehun site as well) should contribute to generate income for local population and stakeholders of the UAR municipality. To do so, local population has to be involved in all steps of the tourism project preparation and implementation. Moreover, they should benefit from tourism activities and from the revenue generated by visitors' entrance fees.
Several activities could be developed consistent with this local population participatory strategy:

a) A socio-economic survey as a mean to define a local community participatory process

A study based on the needs and values of the local community and stakeholders is proposed as the right approach leading to a successful site management. The goal of such study is to objectively address local needs, thereby, being less imposed by planners or decision-makers.
Local population participation in the planning process of the site development is a key issue. All also show great concern on the economic development and involvement of local Bedouin groups.
Namely, the local community and the municipality agreed upon to be the main stakeholders for the future success of the physical planning of the whole area.
Issues of local community participatory process has to be discussed in order to define and prepare the way of managing the site and the contractual agreements to be signed between the local stakeholders, the UAR municipality and the MTA.

b) Contractual agreement for agricultural plots management inside the AP

It is recommended to reclaim the old terraces system located in the bottom of the small wadis inside the AP (taking into account that no archaeological remains could be found in such areas). This reclamation plans to reach the three following goals:

- landscaping management of the archaeological site in order to insure land maintenance where no excavation will be carried out: agriculture should also be considered with the view of maintaining the landscape of the whole area.
- generating local revenues from agricultural development benefiting to the local population (especially the poorest)
- integrating the agricultural terraces to tourism development project through the terraces reclamation.

Other local revenues will be generated by the agricultural development within the archaeological site, through a land leasing contractual system between the MTA and the association and involving the Ministry of Agriculture (refer to socio-economic section). Similarly as with tourism, agricultural activities will be specified in the contract with the association, as agriculture should also be considered with the view of maintaining the landscape of the whole area. The proposed animal husbandry improvement system will mainly benefit the poorest, namely the Azazmeh nomads (refer to socio-economic section).

With this view, a multi-annual contract should be signed between the MTA (Department of Antiquities), new landowner on the one hand, and the people in charge of the development and the maintenance of these grounds on the other hand. The contract will envision investment starting phases (in particular trees and, fruit-bearing seedlings and irrigation equipment if needed) to the load of the project and carefully indicate conditions and responsibilities of the owners specifying methods for agricultural settings and maintenance obligations (in time and space). Products and by-products of the exploitation and the maintenance of these grounds will be left to the farmer.
With regard to the uncultivated lands or open areas a contract specifying the use conditions could be designed as well, allocating pasture lands being annually re-considered insofar if no new excavation is planned. The authorisation have however to consider resting and regeneration periods of the steppe vegetation.

c) Contractual agreement for tourism activities and income management

The local population should benefit more adequately from tourism. Regarding the revenue generated by the entrance fees paid by visitors the current antiquities Law is unfortunately not compatible with a sharing mechanism, as such fees are entirely allocated to the MTA.
In the current situation, local revenues can only be those created by employment (guides, guards...), shops (curios, handicraft, tea shops...), restaurants, on-the-spot services.

However, without changing the Law a possible solution should be to create a local association with the aim of developing tourism at UAR. This association would be agreed upon by the MTA and registered by the Ministry of Social Affairs. A contractual agreement will be signed between this association from UAR municipality and the MTA (Madaba Department of Antiquities) which will stipulate:

- the percentage of entrance fees to be allocated to this association,
- planning of tourism activities in and around the site,
- obligations and commitments of the tourism promoter.

Entrance fees will be allocated to the association assuming it respects prior tourism activities planning and commitments.

The association status seems to be the best legal tool for local community development and tourism activities management. This association should gather all representatives of traditional and legal authorities, technical and administrative services for this area and local population representatives as well. The aim and the field of activities of such association might encompass not only the tourism development but the agricultural, handcraft and social development as well. This association might be

under the umbrella of UAR municipality and managed by a steering committee gathering all 6 villages to be involved in UAR area tourism development.
Once a year the steering committee will assess and plan the tourism activities and define the way of sharing revenues for local project in the municipality area.

d) Participation in restoration and maintenance works

Future digging and excavation
The Madaba Mosaic school and its contribution
Restoration works done by the students.
Training of young persons from Um ar Rassas municipality for the conservation in situ of the mosaics.

e) Social development

Interest in collaborating for future work of micro social development for the area in an integrated manner
The UAR social development center :
This center, attached to the Ministry for the Social Development, was created in 1999. It does not rely on the Baladia albeit its range of intervention is the UAR district (gouvernorat comprising a core of localities). The objective of this center is to support young people and women for implementing small projects in various fields such as: health, family planning, school crib, bordery and weaving, data processing, hair dressing, etc.

Two training activities are in the pipe in that center, both with direct connection to the tourist development of the UAR site :

- Training of tourist guides in relation with the Ministry of Tourism : this formation address young UAR people in order to open them with a step of reception in the tourist places, in particular through English training. This formation contents and precise objectives would require clarifying.
- Training on the maintenance (and the conservation) of the mosaics : still at the idea level, it would allow UAR's young people to be initiated with cleaning maintenance and conservation of mosaics as a preparation to work for the UAR project. It would be carried out by the Madaba Mosaic School according to methods which remain to be defined. The center plans to train about 20 UAR young people (men and women).

Lastly, the center is also planning to develop in the area a domestic garden project (between 2 and 4 donums per family) targeting agricultural systems, practicising agro-foresters and market-gardeners.

f) Local handicraft development and traditional know-how enhancement

Jordan is a tourist country unsufficiently known yet for its traditional and professional handicraft, much lesser then Egypt or Syria.
Nowadays two types of tourist handicraft items can be found in Jordan. The first type concerns new objects made from ancient techniques basis–especially embroidery –, such as the products from the Queen Noor foundation, or the "Bedouin" carpets of the Bani Hamida. These products are often very beautiful and decorative, but quite expensive. The second type, more from individual initiative, concists in creative and modern artefacts of individual artists. This concerns objects made from pottery, embroidery, carpet weaving. An example of this is the "Handicraft Center" on the way to Mount Nebo, near Madaba. Usually, these artefacts are sold together with products like jewellery, copper objects and other made in India.
In most tourist sites we find more often this second type of "handicraft" that is a mixture of modern creations and commercial "Indian" imported products. These latter are of course found in every other country.
This situation shows on one hand that there is an extreme poverty in this matter and on the other hand, it expresses the lack of giving any value or of recognising as of "tourism" value the Jordanian know-how, that are traditional, local and used in everyday life. This is because, as we mentioned above, there has not been any industrialised and specialised production of handicrafts.

For Um ar Rassas project, it is very important to make a study of the local know-how, the traditional handicrafts even if the region seems at first hand to be poor in this respect.

For example, the black tent weaving from goat hair can be reorganised and weaved in much smaller dimensions, as well as the saddlebags and all other weaving that is done by the Bani Sakhr. The same concerns the embroideries of the 'Azazmet women's dresses. There is an important embroidery making with the 'Azazmet that can represent important inputs as tourism goods.
All these will soon be forgotten if they are not valorised

There are also important know-how related to medicinal and aromatic herbs, in this arid and desert environment.
The Bedouin way of life is based on pastoral economy. We underlined above the difficulties that these shepherds face today. A revalorization of the diary products is necessary: yogurt, butter, cheese, goat-hair and sheep wool etc.
The Bani Sakhr were important camel and horse breeders and they still continue to have some. This may be also valorised on a tourist ground.
The valorisation of local know-how together with the tourist development of the archaeological site is important for it implies the valorisation of a whole cultural way of life – that of the Bedouins – and it also implies the recognition of a culture which is disappearing very quickly these last decades. This valorisation is important because it helps revive traditions through tourism. And even more, the integration of the local population through the valorisation of its own cultural artefacts helps create links and responsibilities with the site and insure, locally, its protection.

5. Land use and rural activities inside Archaeological Park

a) Reclamation of agricultural terraces

Agricultural terraces (see Archaeological park design from Piccirello) should be reclaimed and enhanced. These terraces can be divided into 3 areas each with a specific objective :

(1) Aromatic and medicinal herbs terraces

These terraces are lying on the bad and arid soil of the western part of the AP. Unoccupied, there are not very visible. They will be cultivated with aromatic and medicinal plants, such as sauge, Artemesia, sariette (thymus),... and will be managed and exploited by a women group within the framework of the UAR social development centre, « which will make it possible to imply more people apart from the village of UAR ». A contract should be passed between the MTA and the Social Development Centre. Harvested aromatic plants could be prepared and marketed by the women together with Bedouin embroideries.

(2) Agricultural terraces

Located in the middle of the AP at the wadis bottom and junction, such type of terraces encompasses the best agricultural land (deep and moist soil). An agroforestry scheme will be developed here associating afruit tree plantation and cereals (wheat and barley). Fruit tree plantation will be consist in olive , almond, fig , apricot, pistachio and possible caroub trees. A single row will be set up along the border of each terrace in order to control erosion and improve terrace stabilisation, as well as benefiting from moisture.

(3) Fodder terraces

There are located in the eastern part of the AP, where Bedouins of the Azazmeh tribe use to settle with their tents and herds.
Animal husbandry is the income generator for these Bedouins, who periodically know problems of fodder supply (high cost). Fodder species could be developed on terraces by the project for the benefit of their users. Fodder crops will be irrigated using the large ancient water tank located in the eastern part of Castrum. Fodder will be composed with (non exhaustive list) :" Balsim ", *Sesbania sesban*, *Acacia cyanophylla* and *A. cyclops*, *Atriplex halimus*, retam, ...

Concerning these two types of terraces (agricultural and fodder) a contract of exploitation should be signed between the MTA and the association. The cultivation development, maintenance and exploitation of the various crops and trees should be consistent with contractual specifications established by the

MTA and assisted by the Ministry for Agriculture. The association should therefore redefine the exploitation rights for the nomadic Azazmeh farmers benefitting in priority from the harvested products.

b) Use of water cisterns

Within the AP a lot of cisterns and water tanks are visible. Some are still under use by the nomads for the herd watering, whereas the majority of the cisterns are no more usable (filled collecting water channels and/or cisterns). However, there are 3 important cisterns that deserve restoration with the aim of being used again : 1) cisterns in the Tower complex (one still stores water and is used by Bedouins), 2) a large collapsed cistern in the central area of the site (near the north gate) and, 3) the large water tank located to the east of the Castrum.
The latter with a large-size (24m x 24 m) and impluvium is probably very deep also (6m, according various interlocutors). Although with no more plaster protection, it apparently never dries up and may contain as much as 3500 m3. The use of this water for agricultural purpose (eg., irrigation of the fodder plantation) is likely feasible water being pumped by means of an electric-driven pump (important head of discharge) and delivered by gravity to the fodder terraces thanks to a network of channels.

E. TOURISM DEVELOPMENT

1. Tourism potentialities

The UAR site undoubtedly contains a high potential for tourism development : mosaics of the churches and several other vestiges such as wine press area, three-stored cellar, subterranean rock-hewn cisterns, stylite tower, castrum area, houses... are the main components of this potential, to which we have to add exceptional antique fields and agricultural installations, preserved landscape and view on the desert steppe.

However, turning the archaeological site into a tourist attraction will raise several constraints. The tourism-associated infrastructure and amenities will take into account the archaeological remains which have not yet been excavated, as well as the dangerous areas where visitors' circulation may be risky without prior consolidation (e.g., castrum, cellar, ...).

2. Visitors' Carrying Capacity

Putting into effect the visitors' carrying capacity for the site will facilitate the implementation of the above-mentioned strategy.
The carrying capacity for a site (whatever it is natural or cultural) is the sustainable threshold above which visitors' impacts on the site are no more acceptable. It is recommended to start with a number of visitors over the site which is below the estimated carrying capacity and steadily adjust this number to the upper limit of acceptable change, given the cultural and natural values (cultural / ecological impact), the local population (socio-cultural impact) and the visitor satisfaction (psychological impact).

The method used is empirical. The carrying capacity is defined here as the number of visitors per time unit within each core zone of the UAR site.
Stemmed from the experience gained in other similar sites, the small size of the site and the restricted range of possible itineraries (with only one entrance gate for each core zone) determines the carrying capacity to be defined from the actual capacity of the most sensitive areas which, in the case of UAR, are undoubtedly the complex of 12 churches and their mosaics.

It will reasonably be difficult without significantly impacting the vestiges or stressing and frustrating the visitors themselves (large compact groups and short visit time) to accommodate more than 20-25 visitors together inside St Stephen's church, which is considered to be the core (and simultaneously the bottleneck) of the site. We assume the time to be allocated to an average visit is 20' (refer to annex 13 & 14 'Visitors Carrying Capacity'). Given that all visitors will more or less use the same itinerary, a time interval should be respected between the waves of visitors. We assume this time interval is 15' to 20'.
Assessment of the UAR site carrying capacity strongly relies on the number of entrance points. Two entrance points are a minimum, as the site is divided into two parts requiring two separated visits (Sanctuaries I & II : high protected areas).

There is no great advantage for visitors to walk from one sanctuary to the other, except if the central area reveals (after being excavated) interesting remains and/or if the ancient agricultural features (irrigation system, terraces, crops, ...) are enhanced and promoted. In that case new itineraries could be developed in-between and the duration of the visitation extended. Nevertheless, research activities should be carried out prior to any development in that area.
At the moment, and according to the logic of tour-operators which is to minimise the duration of the visit, tourists will most likely go by vehicle to sanctuary II after the visit of sanctuary I.

The magnitude of the tourism development as well depends on the socio-economic activities developed in the site.

3. Strategy for tourism development

a) Form of tourism

The strategy for tourism development to be encouraged for UAR will be based on the approach of sustainable cultural tourism. This form of tourism should prevail over mass tourism. The key characteristics of such a form of tourism can be summarised as follows :

- main motivation of the tourists is the observation and appreciation of antic remains and traditional cultures prevailing in the area;
- it contains educational and interpretation features;
- it is organised for small groups;
- it minimises negative impacts upon the cultural, natural and social environment;
- it supports the protection of the cultural area by : generating economic benefits for host communities and relevant authorities in charge of site management, providing alternative employment and income opportunities for local tribes, increasing awareness towards the conservation of cultural assets, both among locals and tourists.

b) Packaged regional circuits

The strategy will also take account of the current tourism operators' timetables and programmes (see above). A full day 'biblical circuit' from and to Madaba can be developed. Main stopovers would be : UAR (4 hours including the lunch at or near the Visitors' Centre), Dhiban with a view over the wadi Mujib, Macheronte and/or Mount Nebo. The R'Meil site (Moabite / Nabatean palace) on the road from Madaba to UAR may be planned in the future as an interesting stop over once enhanced. In this perspective, tourists will spend one or two nights at Madaba (20' from the international airport) where hotel number is growing (10 hotels at the moment) .
Given its location between the King's Road and the Desert Road, UAR can as well be easily added to the commonest circuits of most TOs in Jordan : Amman-Kerak-Shobak-Petra-Wadi Rum. In that case and for time constraint, only Sanctuary I would be visited.

c) Duration of visit

A half day visit is the appropriate time duration for a normal visit of the UAR site. It does not appear realistic for visitors spending overnight here, whatever the level of diversification of products that can be reasonably achieved. Therefore, the development of hotels should not be encouraged around the site. Madaba is the right platform for discovering the biblical sites of the region.

d) Groups' size

One of the main problem to be solved at UAR is the size of the visiting groups. Several TOs are using large buses with a capacity of 30 to 50 tourists, and for various reasons such groups will be difficult to split for the purpose of the visit. A compromise might be in the mid-term that TOs accept smaller group sizes (limited to 20-25 people) on some circuits, increasing the quality of the visit (cultural tourism vs. mass tourism). In the short-term, it is suggested to test various

e) Ticketing policy

Visitors will pay at the entrance gate to Sanctuary I. There will be no ticket delivery at Sanctuary II. The ticket will be delivered with a simple folded pamphlet and a map of the site (design and editing comprised in the fee). Guiding will not be compulsory for individual tourists and small groups (5 persons max.). For the same price visitors will be free to enter the various closed shelters. In order to avoid the same person to visit the same spot several times the ticket will comprise one detachable coupon for each key spot (1 guard appointed at each one). Trespassing will be strictly prohibited. Signs will be placed at different locations to inform visitors about the site regulations.

f) Expected local benefits

As a pilot project, a component of the UAR development strategy is that the local population should benefit more adequately from tourism and that the needs of tourism should be integrated with the aim of protecting architecture and landscape.
Regarding the revenue generated by the entrance fees paid by visitors the current antiquities Law is unfortunately not compatible with a sharing mechanism, as such fees are entirely allocated to the MTA.
In the current situation, local revenues can only be those created by employment (guides, guards,...), shops (curios, handicraft, tea shops, ...), restaurants, on-the-spot services.

A possible alternative solution to changing the Law might be to create a local association with the aim of developing tourism at UAR. This association would be agreed upon by the MTA stipulating the percentage of entrance fees to be allocated to this association, the planning of tourism activities in and around the site, obligations and commitments (see socio-economic section for more details).

Other local revenues will be generated by the agricultural development within the archaeological site, through a land leasing contractual system between the MTA and the association and involving the Ministry of Agriculture (refer to socio-economic section). Similarly as with tourism, agricultural activities will be specified in the contract with the association, as agriculture should also be considered with the view of maintaining the landscape of the whole area. The proposed animal husbandry improvement system will mainly benefit the poorest, namely the Azazmeh nomads (refer to socio-economic section).
Besides traditional Bedouin handicraft, specific local agricultural products could be sold to tourists by women, such as aromatic and medicinal herbs, dried fruits, olives, etc. (refer to socio-economic section).

4. Visitor Circulation within UAR Sanctuaries

The proposed visitor itineraries within sanctuaries I and II (see map) are designed for the discovering of the most valuable vestiges within a reasonable period of time. Walking off designated circuits should be prohibited. It is suggested that the itinerary within Sanctuary I plans a viewing point at the top of the tumulus (if the cemetery is removed to another place) (see map). From the Visitors' Centre, the successive key spots along the itinerary are displayed on the relevant map (refer to map section).

The itinerary within the tower complex will be much simpler as the area and the number of key spots are reduced here. The foottrail will start at the parking area to the small recently restored Byzantine church and altar, the stylite tower, the byzantine military tower, the rock-hewn cisterns, then back to the market and parking area.

Average time visit for Sanctuary I will be about 3 hours and ½ hour for Sanctuary II.

a) Principles of design for the footpaths

The team's members have agreed upon several principles as regarding objectives, design and installation of the footpaths. Among them are :

- Need of respecting historical ways (eg., implying the removal of recent unofficial paths in the eastern part of the Castrum and use of the castrum's original gate) ;
- Prevent traffic from unstabilised sections, especially the Castrum's enclosure, which would create important security problems unless security is put into effect ;

- Possible reversibility, with or without loop circuit (difficulty being proportional to groups size). Several circuits are envisaged, one of them avoiding the ruins of the church in the Castrum.
- Conservation of the external aspect of the Castrum's walls without modern additions .
- Creation of the shortest possible circuit towards the twin churches, where the mosaics are in very poor condition .

b) Circuits

The circuit will start at the visitors' center . Visitors will walk towards the north-west corner and the northern wall of the castrum, which are located in the outskirts of the old city . On the right, they will find the antique and only entrance to the castrum. From this point they will have to choose between :

- a round trip across the old quarter passing by the most interesting buildings : churches of Lions, of Peacocks, the Saint-Strephen complex, churches of Prior Wa'il and Tabula ;
- an extension to the outer Castrum's basis, with a high point at the top of the ancient cemetery, where an orientation table will be set up ;
- a second extension entering the Castrum, to visit the Twin churches (without loop) ;

(1) Castrum

Admittance of visitors into the castrum is questionable, given the constraints, the minor interest of visiting the Twin churches compared with the other churches and the poor state of the mosaic conservation here. Moreover, 90% of the Castrum grounds have never been excavated therefore deserving protection as a potential archeological site .

Several circuits are envisaged, one of them avoiding the ruined facade of the church. All these circuits are based on the assumption that the external shape of the city walls are conserved without any modern additions .The shortest possible circuit towards the Twin churches, where the mosaics are badly damaged, is given priority. Layout of the ancient streets in the castrum will be restructured. Bearing in mind that streets are filled with fallen ruins and the need of reducing works magnitude in this sector (scientific and financial reasons). it is proposed to create a separate two-way footpath. A platform over the ancien street is suggested, to be easily constructed using light modular elements (materials : wood and steeel). The work will be carried out in two steps : ground preparation, platform manufacture, assemblage. For the first step , several possibilities can be envisaged :

- remnants clearing on 1 m max.., to give the visitors a better view of what existed before. To the right of the church, maintenance of the ruins with the creation of treads. The footbridge will be wedged on a stable support, levelled either with sand bags or packed directly with sand, which is more difficult to put into practice . No mechanical system is possible .
- or maintenance of the current levels : The ruins area will be packed way as above and the footbridges installed without clearance or excavation .

For the second stage, work will be made easier by prefabrication, fitting, and assembly of the parts outside the site . The footbridges can be delivered in pieces of about three metres long . Particular attention will be paid to fitting the levels of the contact points .

The width of the passage will be approx. 1.40m . Protective fences will ensure safety and mark out the passage . All metall parts will be treated against corrosion .

(2) The circuit across the open quarter

Few works are needed to open the passage to visitors walking across the centre of the old residential quarters. Such works will mainly consist in removing the old boulders and ruins from the antique streets. Additionally, given the dangerous presence of a lot of very deep cisterns at ground level along itineraries, a added metallic cover on each opening will be set up.

The looping circuit links together the well known buildings of Umm ar Rasas, crossing the ancient residential quarters. Some subterranean housesare to be found along the itinerary, so that visitors will be enable to discover an example of this kind of dwelling.

(3) Circuit around the Castrum

This circuit is feasible only if the prior delocation of the old cemetery is achieved (to a nearby hill). Using this circuit, visitors will access to the overlooking point over Umm ar Rasas site, where an

orientation table will be installed. Visitors will then be invited to walk around the Castrum back to the visitors' centre. No works are planned except signposts to guide visitors and a well-trodden way.

(4) Circuit across the Tower complex

This circuit is simple and short. From the car parking area, the visitor walks around the stylite tower, looking at the small church nearby, then visits the "farm", the cisterns, the quarries and come back. The "farm" needs to be excavated and the area cleaned. The roof of the water cistern (still used by people) will be restored including a protective disposal preventing people from falling down into the cisterns or the quarries.

c) The Visitors' Centre

(1) Purposes

The Visitor centre will be :

- the unique entrance gate to the site (for the visitors)
- a resting place
- a place where visitors will buy their tickets
- a place where to find necessary information on the site, before or after the visit.

The poor legibility of the antique city is a fact which must be remedied, as it leads to misinterpretation. The most important themes which should be explained in this centre in order to acquire a frame of reference for understanding the site, are :

- the regional geographical context : UAR plateau, Wadi Mujib canyon;
- the successive periods of occupation;
- the modern sociological context : the Bedouins' tribal distribution and tribal way of life;
- the explanations of the UAR urban religious settlements;
- the water supply network and management : antique (subterranean cisterns, rock-hewn cisterns, ...) and modern (forages, cisterns,...) vis-à-vis the needs and the physical / ecological constraints
- the characteristics of the Byzantine religious buildings and mosaics;
- the Byzantine religion;
- itineraries for archaeological discovery and for discovery of natural sites (eg., wadi Mujib).

The possibility for hiring a local guide (individual tourists and small groups) whatever the goal : interpretative visit of the site, visiting an archaeological dig, will be indicated precisely in the VC (possibility of reservation).
The major themes would be developed in the form of maps, panels, showcases housing selected objects from each historic period. The VC would be equipped with a permanent audio-visual show (12' long video tape).

d) Revenue Estimate

Refer to table in annex 15.
The revenue estimate can be derived from the carrying capacity (3 assumptions) and the assumptions that can be made on the distribution of visitors (age class, nationality).
A possible 500 000 JD could be reasonably expected annually from entrance fees alone. Plus an additional 15% income from indirect activities (75 000 JD).

e) Visitors' Monitoring

The level of visitation should be monitored and visitor impacts evaluated. Visitors number can be monitored at the entrance gate. Forms should be fulfilled every day providing data on the number of groups, groups' size, daily number of tourists, nationalities, and age classes (this kind of information which is already collected by the guards on the visitor's book). One of the two controllers appointed at the entrance gate will be responsible for collecting the information.

Whether the impacts on the site are considered to be too high and the sources of impacts identified, measures will be taken such as : reducing the daily number of visitors, modifying their overall distribution, reducing max. groups' size (e.g., splitting the groups), increasing the number of guards, etc.
The index of visitor satisfaction should be known. A random sample of visitors will be enquired over the year.
Dissatisfaction among visitors should be evaluated and the reasons identified : overcrowding, too large group, security conditions, scarcity of activities, lack of tourist services and facilities, abuses, etc.
Monthly data will be entered into a data base then processed and interpreted at the Madaba office. A short training session (two staff) will be conducted by the project.

f) The Guides

Local guides should be trained including on deontology in order to avoid abuses (minimising time and service to increase turnover and maximise profits). A maximum of 5 local guides will be appointed.
Guiding will not be compulsory to individual visitors and small groups. Groups of 5 or more than 5 persons should be guided. Compulsory guiding (local guides) for accompanied tourist groups is questionable.

g) Publications

Cheap brochures and pamphlets as well as fold-out map and guide with itineraries need to be developed. A comprehensive individual guide book of a high-standard could be designed as well although with less urgency. We must point out that such a guide could be rapidly designed from the available information sources (Father Piccirello's 'Mosaics of Jordan' and 'Gli Scavi del Complesso di Santo Stefano', the latter edited with E. Alliata).
Handicraft
See : Socio-economic section.

5. Site Maintenance

Although the area's dryness alleviates the problem, plastic bags and other materials (scraps of metal, old rags, refuse, ...) are polluting the site. Part is generated by the nearby village of UAR, part by in-site dwellers (nomad tents). As dominant winds blow from the north and the north-west, it is expected that in the future proposed row tree plantations will make an effective barrier. Simultaneously, and despite recommendations related to the visitor's behaviour, there will be as well daily rubbish left behind in the site.

The maintenance of the site's cleanness is therefore an important issue to be dealt with. One full-time labourer would be appointed to this task, equipped with a donkey towing a simple trailer. A solution must be found at the municipal level as regarding this problem : garbage dump, public awareness of the UAR inhabitants, etc.

One full-time and one part-time (summer) gardeners will be hired during the first 2-3 years of plantation. The site will be equipped with a water tank trailer towed by a tractor.
From year 3 onwards only the full-time gardener will be employed with the task of plantation maintenance.

F. Infrastructure Development

1. Design Of The Visitors' Center

a) Architectural Concept

Prior to the site development and reception of a growing number of visitors and to manage it, suitable infrastructure will be developed, especially in the entrance gate area. The keystone element of such infrastructure will be a small sized visitors' centre (Fig. 7 – Plans 38 to 50 - § X). This size will correspond to lower assumptions on visitors frequency (see : §. 'Visitors' carrying capacity). At the moment, there is no justification to oversize infrastructure, albeit the proposed programme is planned to be enlarged if needed (possible extension of the infrastructure). Components of the VC are :

- Waiting room, ticketing office, with craftshop approx. 120m²
- Exhibition room 100m²
- Administration office 13m² x 2
- Public toilets (handicapped included)
- Store room 30m²
- Laboratory office with a working unit 20m²
- First Aid approx.12m² .
- Guard house (to be a separate building) approx. 100m².

Questions have been raised, such as whether to install a cafe, restaurant and shops in the visitor centre or leave such activities initiated by the local community as a source of income.
The visitor centre will be located at the edge of the protected area, near the urban area and the main roads (reduced costs, respect of site integrity). The VC must be clearly visible. It should be noted that the south-eastern extremity of the site is also the junction area of the Madaba, Dhiban and Desert roads.
Subsequently, all amenities and facilities for visitors will be grouped near main roads. The existing obtrusive buildings (post office, first aid hospital, ...) will be demolished and re-built outside the AP, or on the contrary build in connection with the Visitors' Centre (café, restaurant...).

Advantages of this choice are :

- Better respect of the site integrity, avoiding building in several different types of area. Any construction in this exceptional site raises questions about surrounding areas and the landscape vis-a-vis the architecture and the natural environment ;
- To develop an area of unobtrusive institutional presence adhering to instead of breaking the site historical continuity ;
- To provide a contemporary solution developing a functional working environment with suitable welcoming and information conditions towards the public. A modern way of life will be displayed through a balanced architectural design .
- To unify a range of various activities, thereby facilitating the site managemen through a clear and well-adapted layout ;
- To limit investment costs, while offering quality services through clear technical choices ;
- To integrate the tourist facilities with the modern settlement making easier potential contacts between tourists and local inhabitants.

The design of the building is deliberately modern. Indeed, there should be no confusion between ruins and new buildings. The construction will fit the landscape through a balance between mineral and vegetal, between artificial and natural, rather than imitation or camouflage. The slightly undulating horizon will be reproduced in the building design. Accordingly, walls will fit into the ground, as a melting process where architecture and nature separately exist, each one enhancing the other. Straight lines will cut through the land and sky with purity, like vast parallelepipedes, with higher geometric outlines, without any curves, similar to Bedouin tents rooted into the ground. Visitors and users would have the feeling of merging with the environment, rather than being enclosed in the monument.

Buildings will be deliberately low, developed on one floor, creating various atmospheres :
- On the south end entrance side, the building like a wall will open onto an olive grove and a formal garden. A partition, sometimes vertical, sometimes horizontal, will serve as a guide or conducting thread, with few openings, to show the way to the building's entrance ;
- On the north end, the building will open widely onto the site, offering a broad view over the remains, thanks to large outlets.

The visitor centre will occupy a strategic position, between the roads and ruins. From here, the public will have an outstanding view, over the roman Castrum, the open quarter and the tower in the distance. At this point, the visitor has entered into history .
The personnel will also take advantage of a pleasant environment, with several views overlooking the site, not the parking area.

The architectural design option combines large vertical and horizontal planes, with opaque and transparent surfaces, on which light and wind play. The edifice spreads and stretches downwards, differentiating the various zones open to the public. It will generate a feeling of comfort, of peace and quietness.

The VC will contain an area to answer the public requirements, an administration zone, a first aid and accommodation zone. The restaurant service zone will stand apart, being considered separately as to ensure the greatest flexibility in the overall operating conditions. The information building will include : a reception hall with sale counter, ticket office, access control, exhibition room and washrooms. From the hall, visitors will have a panoramic view over the site. The reception counter will play a central role linking the various areas, making easier to staff their management and control. The exhibition room will open straight onto the hall, as well as onto the site beyond its terraced extension. The administration offices, laboratory, and services are grouped in the east wing building aisle with separate access to each, and oriented to let entered as much light as possible:

b) Rooms area size

- Visitor center :		**401.74m²**
	- Entrance Hall	93.53m²
	- Public Toilets	51.92m²
	- Exhibition room	106.78m²
	- Entrance office	25.90m²
	- Office 1	11.57m²
	- Office 2	16.73m²
	- Firstaid	1 1.74m²
	- Laboratory	21.53m²
	- Reserve	33.70m²
	- Toilets	5.68m²
- Guard Housing Premises :		**101.99m²**
	- Living room	31.48m²
	- Kitchen	10.30m²
	- Bedroom 1	13.76m²
	- Bedroom 2	15.44m²
	- Bathroom	9.20m²
- Restaurant :		**129.28m²**
	- Reception	71.27m²
	- Kitchen and toilets	29.96m²
	- Storage	28.05m²

c) Materials and Construction

Proposed key materials are stone and uniformly trated glass. The selection criteria are : material, patina, durability, and local origin (as far as possible).

Stone, the statutory building material in Jordan, is extracted in the very country at Ajlun (pinkish colored) and at Hallabat (grey-beige), Maan, ...a colour and a pattern better fitting the natural landscaping composition. Stone will be used for its resistance and inertia,both indoors and outdoors. It will be operated in accordance with the traditional methods, which mainly consists in a single thickness of 50 cm appropriate to local temperature conditions. Various stone facings will be produced : surface finish, joints, size of blocks.

Glass is used in large sheets which are heat and burglar-proof.

The use of mosaics in modern architectural context underlines an attachment to local materials and skills. Cun-surfaced oncrete can be used as a complement. Its composition will be clearly defined to produce a final colour as close as possible to that of the local stone, along with specially treated steel, in relation with local climatical conditions.

The colour of the building will reproduce the landscape's general colour, the whole complex in grey-beige and enhanced by the mosaics.
Textile, which reflects the local nomadic presence will be used as a complementary material in the outdoor areas, forming an interface between the building, the vehicle parking and the site sensu stricto.

d) Technical summarised description

Indoor exhibition arrangement and equipment is not considered here. Works will be broken down into different lots:
Concerning the visitors' centre, restaurant, and guard-housing premises, all are built using the same techniques.
The following lots are grouped in annex 16 : 1) excavation and masonry, 2) carpentry, 3) metal work, 4) painting, 5) mosaics, 6) plumbing, heating and air conditioning, 7) electricity, television, telephone networks, 8) green areas and outdoor areas, 9) the covered way in the Visitors' centre.

2. Public equipment

It should first be stated that no plan or drawings of the supply networks within the AP were available. The present study has therefore been conducted on the basis of visual information gathered in situ.

Electricity telephones and water supplies:
There are electricity poles along the roadside and exposed main water piping near the site boundary. All houses on both sides of the road are connected to the existing supply network. The site can similarly be supplied. In order to alleviate the visual pollution of such installations, it is recommended : 1) either to move the poles to the other side of the road, or 2) to bury networks along the archaeological site boundary.
All poles and main pipes within the site will be withdrawn. Only the buildings close to the road will be connected (reception building, restaurant, accommodation, post office, clinic). The archaeological remains will not be supplied. The church shelters will be lit using daylight.

a) Drainage network:

There is no drainage network to collect wastewater and sewage from the planned buildings (reception building, restaurant, accommodation, post office, etc.). Therefore, assuming archaeologists agreement, a septic tank with a disposal field could be set up.

Networks supplied to all buildings and burying of the main water network beside the site (alteration of above-ground electricity and telegraph network costs are not included in this project). Water supply connection should be provided for the Tower complex vehicle parking :

- all kind of preparatory work (clearing, earthworks, installation)
- earth working and excavation for trenches in dry ground
- supply and installation of prefabricated concrete manholes with cast iron covers, connections, etc.... Diameter 1.00m, depth 2.00 max approx .
- Trench filling and ground levelling .
- Loading and removal of excess earth over a 1 km radius.

b) Sewage drainage piping :

- Supply and installation of PVC piping, waste water and sewage series, cuts, fixing, settings, points, etc... Diameter of 153/160 .
- Supply and installation of septic tanks, including earthworks, piping and connection of all equipment for 25 users, x 5 units (visitor centre x2, restaurant x 2, accommodation, + post office + clinic x 1), grease removal tank, purifier .
- Construction of disposal field .

* Cold water supply :
Supply and installation of piping for cold water supply, all fixings, joints, settings, connection to existing network, in high density polyethylene, pressure - 10kg , diameter 42/63 . For all buildings + ten water outlets for car parks .

* Low voltage electricity network :

- Supply and installation of PVC ducts (diameter 130/142), all clamps, supply and spreading of sand for cable installation, warning grid .
- Supply and installation of aluminium + neutral conductor cables .
- Supply and installation of meter boxes (1 per building) .
- Street lighting network, pedestrian crossings, supply and installation of cables .
- All adjacent network connections .

* Telephone network :

- Supply and installation of PVC ducts, supply and spreading of san, warning grid, cable chambers, manholes with cast iron covers, etc....

On access roads : Two-layered asphalt surface and construction of natural stone-coloured concrete pavements .

- Cavities for trees with borders .

c) Vehicle parking

Umm ar-Rassas is divided into two distinct sanctuaries, about 1.5 km far from each other. Designing two vehicle parkings near the remains is therefore advisable to limit the duration of the visit and risk generated by the very hot summer weather. The main parking is planned to the right of the visitors' centre, at the entrance gate and the other one near the Tower complex area (Fig. 7 – Plan 51 - § X).
Space requirements for each are limited : 3 for buses and..... for private vehicles. The parking areas will greened with trees planted to provide the maximum shadow and coolness, while being environmentally integrated. No gate entrance checking is planned at the parking level (free access).

Work description

Works will include :

- Excavation works on road and vehicle parking areas
- Asphalt road work
- Tracing of buried networks
- Concrete ground work for footpaths
- Tree planting (see : §. landscaping)
- Signposts (panels) providing general information on the whole site.

d) Access ways

Various access ways are planned on and around the site :

- Asphalt road towards Madaba , Dhiban and the Desert
- A permanent paved road to be created linking the tower with the north west
- in-site unpaved roads, currently used for maintenance and servicing
- Footpaths.

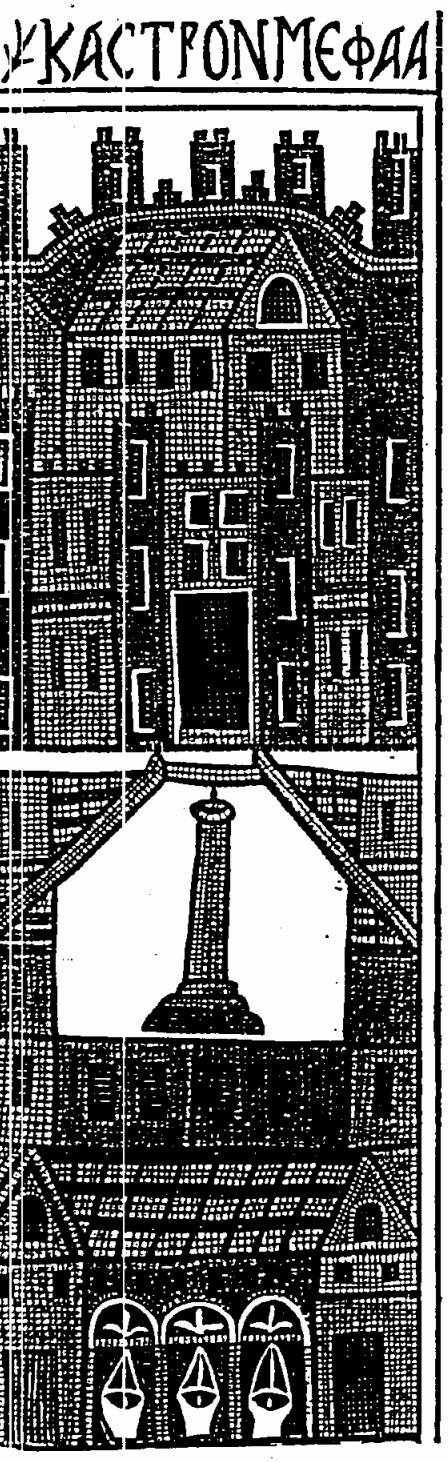
It is advisable to keep the natural shape and surface of in-site existing ways, without introducing any additional environment-unfriendly surface materials. Existing tracks will be maintained and a new double lane paved service road will be constructed parallel to the main road connecting the Tower area and the VC.

3. Footpaths

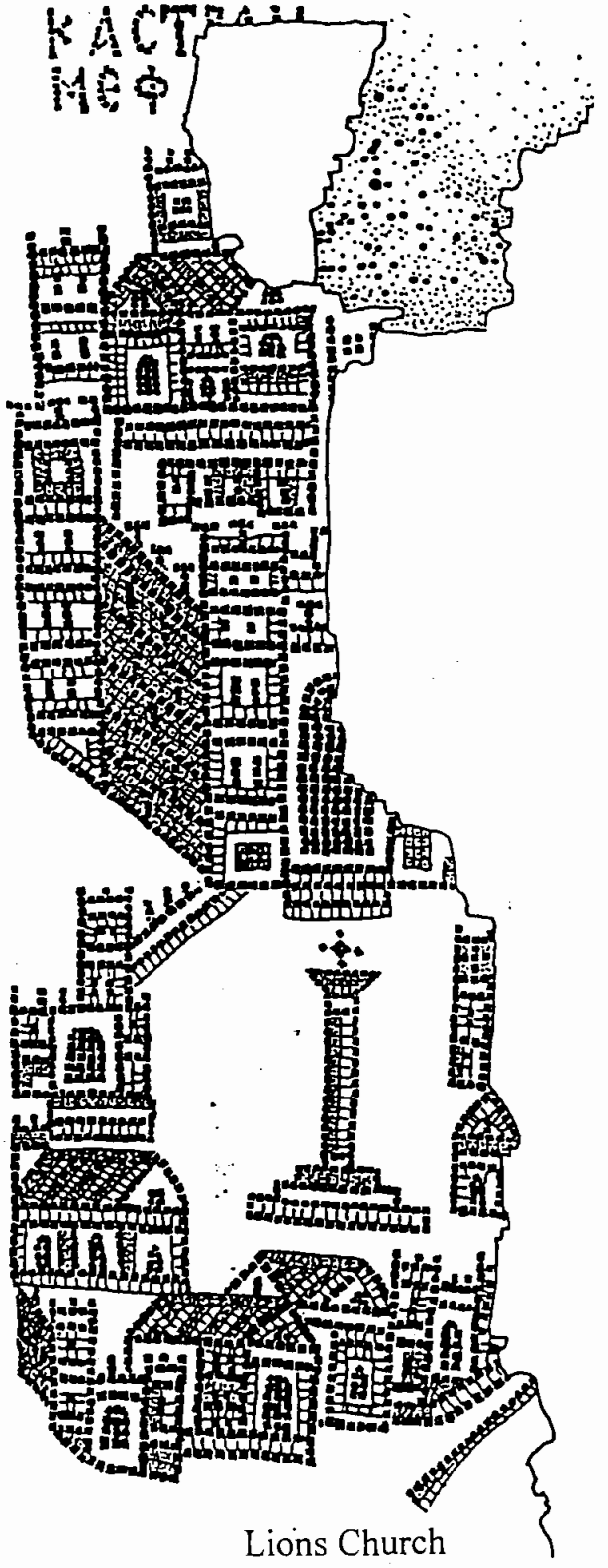
The whole site is free and accessible as no fence encloses the monuments. Visitors are therefore free to roam across the ruins, including the most dangerous ones such as the semi- subterranean houses and the Castrum (Fig. 7 – Plan 41 - § X).

Objectives to achieve are to channel visitors, to inform them while adequately protecting the major remains, and proposing a comprehensive visit opportunity. With this view, the walkways will be enhanced through the clearing of some stretches, avoiding level changes, setting up light removable equipment, facilitating access (such as entrance into the Castrum). The linking way between the information point and the site sensu stricto can be surfaced with concrete (local sand colour) about 1.40 m wide, to better guide visitors towards the starting point. Sun protection made with a light textile structure is also planned along this way. These structures will reproduce the grey-beige textile material used for tents. Metal poles will form the framework and stake out the path.

IX. Annexes



St Stephen



Lions Church

From M. PICCIRILLO

1. *Annex 1 : Seismicity*

Earthquakes (dates, geographical co-ordinates of the epicenter) for the sample year 1998 (all registered local magnitude values on the Richter Magnitude Scale)

ate	Latitude	Longitude	Mloc
8 01 05	29,374	34,926	3,29
8 01 07	29,383	34,908	2,72
8 01 07	29,365	34,922	3,2
8 01 08	29,178	34,846	2,38
8 01 09	29,173	34,836	2,42
8 01 09	29,383	34,955	2,85
8 01 10	29,226	34,694	2,68
8 01 10	29,353	34,947	2,3
8 01 13	29,363	34,94	2,52
8 01 14	29,924	35,172	2,57
8 01 14	29,379	34,926	3,23
8 01 18	29,002	34,833	3,37
8 01 20	28,816	34,745	3,23
8 01 20	28,735	34,814	3,12
8 01 24	29,187	34,898	2,49
8 01 25	28,962	34,876	2,47
8 01 25	28,921	34,882	2,81
8 01 25	28,899	34,877	2,99
8 02 01	28,818	34,795	3,04
8 02 13	29,18	34,908	2,8
8 02 13	28,808	34,78	3,16
8 02 14	28,763	34,765	3,11
8 02 20	28,917	34,792	2,95
8 02 26	29,521	35,005	2,94
8 02 27	28,431	34,699	3,5
8 02 27	28,649	34,946	2,99
8 03 01	28,891	34,755	3,27
8 03 02	28,819	34,839	3,14
8 03 04	29,235	34,787	3,1
8 03 04	29,293	34,807	2,36
8 03 06	29,709	35,214	2,53
8 03 07	29,974	34,488	3
8 03 11	29,222	34,756	3,16
8 03 22	29,233	34,736	2,46
8 04 03	29,482	34,939	1,85
8 04 07	28,781	34,57	4,09
8 04 10	28,19	34,514	4
8 04 13	28,962	34,86	2,83
8 04 13	28,995	34,844	3,01
8 04 13	28,93	34,922	2,62
8 04 16	28,873	34,848	3,07
8 04 17	28,835	34,748	4,19
8 05 02	29,399	34,867	2,36
8 05 02	29,821	34,567	3
8 05 04	28,809	34,828	2,83
8 05 09	29,45	34,954	2,81
8 05 10	29,943	35,154	2,26
8 05 12	31,638	34,662	3,09
8 05 21	28,988	34,774	3,78
8 05 24	30,216	35,048	3,26

98 05 31	28,353	34,686	3,64
98 05 31	30,207	35,075	3,3
98 06 02	29,363	35,018	2,11
98 06 04	29,259	34,791	2,86
98 06 04	29,201	34,8	3,7
98 06 05	29,127	34,869	2,86
98 06 05	29,169	34,883	2,4
98 06 06	29,396	35,334	2,58
98 06 07	29,865	35,113	2,45
98 06 12	29,408	34,965	2,24
98 06 12	29,412	34,978	2,34
98 06 12	29,413	34,949	2,18
98 06 12	29,41	34,945	1,76
98 06 12	29,416	34,946	2,07
98 06 14	29,766	34,634	3,02
98 06 14	28,711	34,579	3,52
98 06 14	29,199	34,797	2,72
98 06 14	29,242	34,794	3,08
98 06 15	28,812	34,767	3,44
98 06 18	29,15	34,876	2,64
98 06 19	29,157	34,876	2,93
98 06 19	28,976	34,894	2,56
98 06 24	29,007	34,873	3,1
98 06 25	29	34,915	3,52
98 06 26	29,351	35,017	2,78
98 07 07	29,479	34,986	3,14
98 07 12	31,831	36,519	2,8
98 07 20	29,256	34,987	2,76
98 08 17	31,921	35,56	3,07
98 09 03	28,396	34,737	3,58
98 09 06	31,68	35,624	2,21
98 09 27	28,83	34,734	3,61
98 09 27	28,83	34,795	3,03
98 10 09	28,783	34,76	3,57
98 11 03	29,799	34,54	3,28
98 11 06	29;187	34,816	3,58
98 11 06	28,881	34,849	3,27
98 11 19	29,642	34,489	4,11
98 11 29	31,114	35,166	3,17
98 12 01	28,823	34,831	2,99
98 12 14	31,117	35,202	2,93
98 12 14	31,314	35,562	2,09
98 12 14	31,323	35,582	2,46
98 12 14	31,335	35,602	3,38
98 12 14	31,332	35,537	3,46
98 12 15	32,712	35,81	3,33
98 12 25	29,389	34,884	3,2

3. *Annex 2: Climatical parameters*

Graphs of yearly rainfalls, max. and min. temperatures, winds, humidity...

201 MEAN MAXIMUM TEMPERATURE°C
202 MEAN MINIMUM TEMPERATURE°C
203 MEAN TEMPERATURE°C
203 TOTAL MONTHLY RAINFALL (MM)
253 MEAN MONTHLY RELATIVE HUMIDITY %
534 MEAN WIND SPEED (KNOT)
263 MEAN SUNSHINE HOURS
533 PREVAILING WIND DIRECTION °

ATION_	ELEMENT_CODE	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
DABA	201	1991	13,2	15	20	26	27,9	30,8	30,5	30,6	29,8	27,8	22	10,7
DABA	201	1992	7,9	8,2	14,5	22	28,3	29,9	30,6	32,7	30,1	30,3	19,6	10,8
DABA	201	1993	11,3	11,8	17,8	24,9	26,6	32	31,4	33	31,4	29,8	19,3	18,2
DABA	201	1994	14	13,7	17,4	26,8	29,3	30,4	31	34,2	32,1	29,4	16,4	10,5
DABA	201	1995	12,4	13,1	17,1	20,6	27,3	30,2	29,9	31	30,2	25,6	18,7	13,3
DABA	201	1996	11,7	14,9	14,9	21,2	29,1	30,2	32,1	32,1	30,3	25,5	20,5	16,7
DABA	201	1997	14,1	11,5	13,7	20,8	29,4	30,4	31,3	28,3	28	26,5	20,1	14,1
DABA	201	1998	11,5	16,1	15,5	24,4	28,6	30,3	32,5	34,2	32,1	30	26,3	17,9
DABA	201	1999	16,2	17,2	21,4	24,8	31,2	30,2	32,3		30,2	27,2	21,4	18,6
DABA	201	2000	11,9	14,7	17,3	24,6	26,5	30,2	34,1	30,5	29,1	24,3	20,9	14,8
DABA	202	1991	3,6	5	9,1	11,9	14,7	16,4	18,5	18,7	16,5	14,4	9,4	3,6
DABA	202	1992	1	2,1	3,7	8,3	14,4	15,9	16,4	17,9	15,8	12,9	8,2	3,6
DABA	202	1993	1,1	1,9	6	9,1	13	17,4	19,1	20,5	18,4	16,2	9,4	8,6
DABA	202	1994	6,3	4,8	7,1	12,5	15,4	17,3	19,3	20,5	18,5	15,7	8	2
DABA	202	1995	1,6	2,6	4,1	6,1	12,2	15,9	17,1	17,3	16,3	11,7	6	2,4
DABA	202	1996	3,1	4,5	4,6	7,3	14,6	16,6	20	18,6	16,4	12	9,5	4,1
DABA	202	1997	2,7	0,3	3,4	6,7	13,8	16,6	19	16,2	14,7	11,7	7,4	3,9
DABA	202	1998	2,6	3,8	4,2	9,2	14	16,3	18,7	20,6	18	13,5	10,2	5,2
DABA	202	1999	3,2	3,9	7,2	10	16,1	17,3	19,9		16,9	14	7,8	4,7
DABA	202	2000	2,3	2	4,1	9,9	12,7	17,3	21,7	19,4	17	12,8	8,6	5,2
DABA	203	1991	8,4	10	14,6	19	21,3	23,6	24,5	24,7	23,2	21	15,7	7,2
DABA	203	1992	4,5	5,2	9,1	15,2	21,4	22,9	23,5	25,3	23	21,6	13,9	7,2
DABA	203	1993	6,2	6,8	11,9	17	19,8	24,7	25,3	26,7	24,9	23	14,3	13,4
DABA	203	1994	10,2	9,2	12,2	19,6	22,3	23,8	25,1	27,4	25,3	22,5	12,2	6,2
DABA	203	1995	7	7,9	10,6	13,4	19,8	23	23,5	24,2	23,2	18,7	12,4	7,8
DABA	203	1996	7,4	9,7	9,7	14,2	21,9	23,4	26	25,4	23,3	18,7	15	10,4
DABA	203	1997	8,4	5,9	8,6	13,7	21,6	23,5	25,2	22,2	21,3	19,1	13,8	9
DABA	203	1998	7	9,9	9,9	16,8	21,3	23,3	25,6	27,4	25,1	21,7	18,2	11,5
DABA	203	1999	9,7	10,6	14,3	17,4	23,7	23,8	26,1		23,6	20,6	14,6	11,7
DABA	203	2000	7,1	8,3	10,7	17,3	19,6	23,8	27,9	25	23	18,5	14,7	10
DABA	208	1991	94,8	38,4	91,1	9,7	0	0	0	0	0	4,4	48,8	202,4
DABA	208	1992	119,3	273,9	38	0,3	2,5	0,5	0	0	0	0	62,5	69,8
DABA	208	1993	64,5	68,1	27,2	0	10,9	0	0	0	0	3	13,8	30,5
DABA	208	1994	102,5	47,2	23,9	7	0	0	0	0	0	6,1	154,3	116,9
DABA	208	1995	4,3	39	19,5	18,6	0	0	0	0	0	0	23,7	13,9
DABA	208	1996	94,8	23,7	98,8	15,4	0	0	0	0	0	17,7	12,7	12,8
DABA	208	1997	93	105,1	75,1	1,4	0	0	0	0	0	9,2	2,9	84,9
DABA	208	1998	89,5	48,3	50,5	2,6	0,6	0	0	0	0	0	2,3	3,2
DABA	208	1999	51,3	106,5	16,8	17,1	0	0	0		0	0	5	3,3
DABA	208	2000	146	68,3	0	0	0	0	0	0	0	0,4	3,5	114,5
DABA	258	1991	61	60	57	42	37	33	41	45	43	56	49	73
DABA	258	1992	72	76	55	43	36	36	40	44	45	38	49	66
DABA	258	1993	58	64	49	35	36	27	31	32	39	38	42	48
DABA	258	1994	67	73	62	43	43	51	51	52	54	50	83	94
DABA	258	1995	84	83	70	63	59	62	71	69	63	68	63	85

ADABA	258	1996	89	78	82	63	53	57	65	61	65	67	76	78
ADABA	258	1997	78	76	77	58	49	59	64	66	61	66	82	88
ADABA	258	1998	92,4	86	72,9	69,5	63,1	65	62,2	65,2	70,5	64,4	68	78,9
ADABA	258	1999	79,2	77,5	64,1	60,4	48,9	69,2	61,3		63,8	73,6		71,2
ADABA	258	2000	91	83	76	62	61	61	61	75	76	80	78	93
ADABA	534	1991	3,9	6,1	6,1	6,3	3,9	4,6	3,6	4,2	4,5	5,4	5,3	5,2
ADABA	534	1992	5,6	7,7	6,7	6	4,4	3,6	3,8	2,8	4,2	3	5,2	5,7
ADABA	534	1993	5,2	4,1	7	5,2	3,1	3,3	3,5	4	5,7	5,4	5,4	2,9
ADABA	534	1994	5,6	6,3	6,5	5,2	3,9	4,8	5,4	4,3	4,3	3,7	6,5	5,8
ADABA	534	1995	3,1	4,5	3,9	4,4	3	3	2,6	4,1	3,8	3,7	3,6	3,1
ADABA	534	1996	4	3,5	4	3,5	1,9	4,3	3,4	3	2,9	3,6	4	3,2
ADABA	534	1997	3,3	5,2	5	4,3	4,1	4,1	4	3,5		3	6,5	4
ADABA	534	1998	5,6	4,8	5,4	4,5	5,6	4,1	4,2	2,3	3,6	4,6	4,2	4,6
ADABA	534	1999	5,3	5	6,6	7,1	6,9	6,2	5,7		6,1	4,8		5,3
ADABA	534	2000	6,3	5,9	6		5,5	5,4	5,5	5,3	4,7	6,9	6,9	8,5
A.AIRPORT	201	1991	13,2	15,3	20,1	25,7	28,2	32,1	31,9	31,9	31,6	27,9	22,3	11,5
A.AIRPORT	201	1992	9,2	9,6	15,3	22,1	27,5	31,4	32,5	33,8	31,2	30,2	20,3	11,8
A.AIRPORT	201	1993	12,1	12,6	18,2	25,3	27,4	33,2	33,4	34,8	32,5	29,3	20,4	18,6
A.AIRPORT	201	1994	14,7	14,4	18,3	27,3	30,5	31,8	32	34	33,5	29,8	17,8	11,8
A.AIRPORT	201	1995	14,8	15,5	19,8	23,9	30,6	33,9	33	34,2	33,1	27,8	19,4	14,8
A.AIRPORT	201	1996	13,8	16,6	16,7	22,8	31	32,1	34,8	34,4	32,3	26,2	21,3	17,4
A.AIRPORT	201	1997	15,2	12,4	15,2	22,2	30,4	31,9	32,8	30,9	30,4	27,7	21,2	15,5
A.AIRPORT	201	1998	12,5	15	16,5	25,7	29,4	32,6	34,6	36,5	32,8	29,3	24,9	17,7
A.AIRPORT	201	1999	15,9	16,7	20	24,7	31,3	31,3	33,4	34,8	31,8	27,8	22,3	18,3
A.AIRPORT	201	2000	12,4	15	17,7	26	28,9	33	37,7	33,7	31,4	25,4	20,7	15,3
A.AIRPORT	202	1991	0,6	2,7	6,9	8,8	10,5	12,5	13,9	13,6	12,1	11,2	6,3	1,9
A.AIRPORT	202	1992	-0,5	0,9	2,1	4,6	8,6	11,5	12,5	13,5	12,1	9,4	6,2	2,1
A.AIRPORT	202	1993	-0,4	-0,4	2,7	5,3	10,2	12,4	13,1	14,3	11,2	11,7	6	4,8
A.AIRPORT	202	1994	4,1	2	3,7	8,6	10,8	12	14,1	13,4	14,4	13,8	6,8	1,9
A.AIRPORT	202	1995	1,1	2,5	2,9	5,3	10,6	13,4	14,2	13,8	13,4	9,1	4,1	2,2
A.AIRPORT	202	1996	2,8	3,3	4,3	6,6	11,9	11,9	17,1	14,9	13,1	8,9	8	3,5
A.AIRPORT	202	1997	2,2	-0,2	2,8	5,5	11,2	12,7	14,5	13,6	11,5	10,9	6,1	3,5
A.AIRPORT	202	1998	2,3	2,6	3,2	8	11,9	12,2	14,7	16,3	14,5	10	7,4	3,7
A.AIRPORT	202	1999	2,4	2,1	4,2	7,3	12,6	13,2	15,3	16,1	13,9	10,6	5,5	2,7
A.AIRPORT	202	2000	1,9	0,7	2,7	8,5	9,5	12,7	17,1	15,5	12,9	10,4	6,2	4,2
A.AIRPORT	203	1991	6,9	9	13,5	17,3	19,4	22,3	22,9	22,8	21,9	19,6	14,3	6,7
A.AIRPORT	203	1992	4,4	5,3	8,7	13,4	18,1	21,4	22,5	23,7	21,7	19,8	13,3	7
A.AIRPORT	203	1993	5,8	6,1	10,4	15,3	18,8	22,8	23,3	24,6	21,9	20,5	13,2	11,7
A.AIRPORT	203	1994	9,4	8,2	11	18	20,6	21,9	23,1	23,7	23,9	21,8	12,3	6,8
A.AIRPORT	203	1995	8	9	11,4	14,6	20,6	23,6	23,6	24	23,2	18,5	11,8	8,5
A.AIRPORT	203	1996	8,3	10	10,5	14,7	21,4	22	26	24,7	22,7	17,5	14,6	10,5
A.AIRPORT	203	1997	8,7	6,1	9	13,9	20,8	22,3	23,6	22,3	21	19,3	13,7	9,5
A.AIRPORT	203	1998	7,4	8,8	9,8	16,9	20,7	22,4	24,6	26,4	23,7	19,7	16,1	10,7
A.AIRPORT	203	1999	9,2	9,4	12,1	16	22	22,3	24,4	25,5	22,9	19,2	13,9	10,5
A.AIRPORT	203	2000	7,7	7,8	10,2	17,3	19,2	22,9	27,4	24,6	22,1	17,9	13,5	9,8
A AIRPORT	208	1991	31,1	15,4	34,2	2	1,7	0	0	0	0	2,1	17,8	92,2
A.AIRPORT	208	1992	47,6	148,6	16,4	0,2	0,8	0	0	0	0	0	36,2	25,3
A.AIRPORT	208	1993	25,9	28,9	19,6	0	6,2	0	0	0	0	9,6	6,4	26,5
A.AIRPORT	208	1994	58,7	12,7	23,1	1,3	0	0	0	0	0	6,6	66,3	55,5
A.AIRPORT	208	1995	0,6	19,6	3,9	5,8	0,5	0	0	0	0	0	13,2	13,3
A.AIRPORT	208	1996	54,3	17,6	49,6	6,1	0	0	0	0	0	5,3	13,1	11,7
A.AIRPORT	208	1997	56,2	51,7	24,8	0,4	1,2	0	0	0	0	18,2	2,4	37,8
A.AIRPORT	208	1998	38,9	21,3	17,3	3,6	1,2	0	0	0	0	0	0,5	0,3
A.AIRPORT	208	1999	11	34,7	3,5	5,8	0	0	0	0	0	0	1,1	1,4
A.AIRPORT	208	2000	49,4	3,9	23	0	0	0	0	0	0	24,3	0,8	50,2
A.AIRPORT	258	1991	78	75	72	51	47	48	55	60	59	58	64	84
A.AIRPORT	258	1992	82	88	75	66	46	53	55	57	56	47	65	89
A.AIRPORT	258	1993	83	85	75	61	64	57	65	64	73	72	76	83
A.AIRPORT	258	1994	88	82	83	54	57	59	62	66	72	71	87	89
A.AIRPORT	258	1995	83	83	73	62	57	57	63	63	62	67	62	84
A.AIRPORT	258	1996	84	71	81	58	41	47	43	46	47	51	61	73
A.AIRPORT	258	1997	72	71	72	54	37	44	47	56	52	54	70	78
A.AIRPORT	258	1998	81,4	74,4	67,9	50,6	45,1	48,1	47,6	48,9	50,9	47,1	49,2	59,1
A.AIRPORT	258	1999	68	68	53	47,7	44,7	57,3	55,5	56,9	57,5	63,5	57,1	54,1
A.AIRPORT	258	2000	78	73	70	53	50	48	46	64	68	70	64	86

A AIRPORT	268	1991	5,7	6,7	6,3	8,2	9,5	12,2	12	11,3	10,3	8,6	8,2	4,7
A AIRPORT	268	1992	4,5	4,1	7,1	9,1	9,3	11,1	11,9	11,5	10,5	9,8	7	4,6
A AIRPORT	268	1993	6,1	6,3	8,1	9,7	9,1	12,4	12,4	11,8	9,8	9,2	6,7	6,2
A AIRPORT	268	1994	5,3	6,7	7,7	9,7	10,7	12	12,1	11,9	10,1	7,4	5,3	6,1
A AIRPORT	268	1995	7,6	6,9	9	9,6	10,5	12,3	11,9	11,3	10,4	9,5	8,2	6,4
A AIRPORT	268	1996	5,5	6,5	7,5	9,2	10,8	12,4	11,5	11,8	10,3	9,1	6,9	6,3
A AIRPORT	268	1997	6,4	7,6	6,5	8,8	11,5	12,1	12	11,3	10,5	7,9	7,5	5,8
A AIRPORT	268	1998	4,4	7	6,8	9,4	9,4	12,3	12,6	11,9	10,4	9,9	8,4	6,2
A AIRPORT	268	1999	6,2	7,2	9	9,8	11	12,5	12,4	11,8	10,8	9,3	8,5	7,3
A AIRPORT	268	2000	5,4	7,7	8	9,1	11,8	12,2	11,7	11,6	10,6	8,6	8,1	5,1
A AIRPORT	534	1991	5,8	6,1	6,6	8,6	9	8	9,8	8,3	5	5,3	5	7,1
A AIRPORT	534	1992	7,5	10,2	7	7	7,1	7,6	7,1	5,8	6,5	4	8,4	7,5
A AIRPORT	534	1993	7,3	6,3	8,2	7,6	8,1	8,1	9,9	8,4	7	7,1	8,6	8,6
A AIRPORT	534	1994	10,5	10,2	7,4	8	7,8	10,2	11,7	6,9	4,9	4,8	7,3	6,5
A AIRPORT	534	1995	4,4	7,2	5,8	5,7	6,7	7,8	8,5	7,4	6,4	4,9	7	6,6
A AIRPORT	534	1996	7,8	7,5	8,2	8,5	7,1	7,2	8,9	7,9	7,7	7,8	10,3	6,1
A AIRPORT	534	1997	7,6	9	9,7	9,6	7,9	8,7	11	10	6,5	4,9	7,8	7,2
A AIRPORT	534	1998	8,2	7,4	10,3	7,3	8,6	7,3	8,2	5,1	5,1	3,4	3,5	5,1
A AIRPORT	534	1999	5,1	5,1	6,4	6,1	5,7	6,4	6,6	4,1	3,7	3,1	3,7	4
A AIRPORT	534	2000	6,3	5,4	5,2	5	5,9	5,2	5,2	6,8	2,3	5,4	4,4	3,8
A AIRPORT	538	1992	202	251	290	298	298	282	285	289	295	333	75	228
A AIRPORT	538	1993	268	276	287	280	271	281	280	284	289	66	28	74
A AIRPORT	538	1994	201	275	294	313	297	295	280	304	308	98	257	174
A AIRPORT	538	1995	97	287	322	303	323	310	314	322	311	308	86	110
A AIRPORT	538	1996	201	283	274	306	302	306	301	307	301	311	100	205
A AIRPORT	538	1997	83	274	273	270	300	293	301	300	313	306	126	239
A AIRPORT	538	1998	233	9	278	266	277	287	280	287	297	263	332	97
A AIRPORT	538	1999	157	261	295	293	306	297	295	293	302	306	17	92
A AIRPORT	538	2000	246	283	283	280	298	310	320	322	316	323	125	214
R-RABBAH	201	1991	11,3	13,6	17,3	23,1	25,4	28,8	28,8	28,8	28	25,5	20,6	10,2
R-RABBAH	201	1992	7,8	7,7	13,2	19,8	24,5	28,1	29,1	30,2	27,9	27,4	18,5	10,7
R-RABBAH	201	1993	10,8	10,2	15,8	21,8	24,7	29,8	30	31,4	29	27,1	18,8	17,2
R-RABBAH	201	1994	13,3	12,5	15,4	24,1	27,1	28,3	29,3	30,6	29,8	27,8	16,6	11
R-RABBAH	201	1995	13,3	13,5	17,4	21,1	27,1	30,5	29,9	30,6	29,7	24,7	18,2	13,9
R-RABBAH	201	1996	12,6	14,8	14,9	20,9	28,5	29	31,7	31	29,5	24,4	20,7	16,3
R-RABBAH	201	1997	14,3	10,3	13,2	19,7	27,4	29,4	30,4	28,8	27,8	26,1	20,1	14,3
R-RABBAH	201	1998	11,2	13,5	14,7	23,2	27,1	29,7	31,8	33,2	30	27,2	23,5	16,7
R-RABBAH	201	1999	14,4	15,2	18	22,2	29	28,7	31,4	32,9	29,5	25,7	21,2	17,8
R-RABBAH	201	2000	11,5	13,4	15,5	24,1	26,7	30,3	34,4	30,7	28,8	23,7	20,4	14,2
R-RABBAH	202	1991	2,1	3,4	7,3	9,7	11,5	14,6	16,5	16,5	15	12,8	8,7	3,2
R-RABBAH	202	1992	0,8	1,6	3,3	7,3	11,1	14,5	15,7	17	14,8	13	8,2	3,2
R-RABBAH	202	1993	1,5	1,2	4,5	8	11,4	15	16,2	17,6	15,2	13,9	8,3	6,8
R-RABBAH	202	1994	4,9	2,9	4,8	9,1	11,7	14,6	16,5	16,8	17	15	8,1	2,8
R-RABBAH	202	1995	2,8	4	5,2	6,5	12,4	16,3	17,1	17,2	16	12	6,7	4,1
R-RABBAH	202	1996	3,8	4,6	4,7	6,9	13,2	14,5	18,6	17,5	16	11,4	9,6	5,8
R-RABBAH	202	1997	4,4	1,1	4	6,7	13,1	15,2	17,5	16,1	14,7	13	8,7	5,2
R-RABBAH	202	1998	3,5	3,9	4	8,8	13,2	15	17,9	19,1	17	13,3	10,1	6,2
R-RABBAH	202	1999	4,5	4,1	6,6	9	14,5	15,3	18,1	18,4	16,1	13,1	8,9	6,6
R-RABBAH	202	2000	3,6	2,9	4,2	10,1	11,5	15,9	20,4	17,6	16,1	12,1	8,6	5,7
R-RABBAH	203	1991	6,7	8,5	12,3	16,4	18,5	21,7	22,7	22,7	21,5	19,2	14,6	6,7
R-RABBAH	203	1992	4,3	4,7	8,3	13,6	17,8	21,3	22,4	23,6	21,4	20,2	13,4	7
R-RABBAH	203	1993	6,1	5,7	10,1	14,9	18	22,4	23,1	24,5	22,1	20,5	13,6	12
R-RABBAH	203	1994	9,1	7,7	10,1	16,6	19,4	21,5	22,9	23,7	23,4	21,4	12,4	6,9
R-RABBAH	203	1995	8	8,8	11,3	13,8	19,7	23,4	23,5	23,9	22,9	18,3	12,5	9
R-RABBAH	203	1996	8,2	9,7	9,8	13,9	20,8	21,8	25,1	24,3	22,8	17,9	15,1	11
R-RABBAH	203	1997	9,3	5,7	8,6	13,2	20,3	22,3	23,9	22,4	21,3	19,6	14,4	9,7
R-RABBAH	203	1998	7,4	8,7	9,4	16	20,2	22,4	24,8	26,2	23,5	20,2	16,8	11,4
R-RABBAH	203	1999	9,5	9,7	12,3	15,6	21,8	22	24,8	25,7	22,8	19,4	15,1	12,2
R-RABBAH	203	2000	7,5	8,1	9,8	17,1	19,1	23,1	27,4	24,1	22,4	17,9	14,5	9,9
R-RABBAH	208	1991	129,2	38,3	246	1,8	1,7	0,1	0	0	0	13	29,8	178,9
R-RABBAH	208	1992	135,3	194,7	21,2	0	2,8	0,2	0	0	0	0	101,1	119,5
R-RABBAH	208	1993	47,4	63,8	18,8	0	7,5	0	0	0	0	0,6	54,1	46,4
R-RABBAH	208	1994	143,6	76,8	42,5	12	0	0	0	0	0	16,9	133	93,4
R-RABBAH	208	1995	0,9	72,9	4,1	10,2	0	0	0	0	0	0	17,8	17,6
R-RABBAH	208	1996	93,6	19,8	102	3	0	0	0	0	0	11,5	6,9	49,4

R-RABBAH	208	1997	119,3	123,2	63,9	7,6	1,7	0	0	0	0	5	3	86,1
R-RABBAH	208	1998	109,9	49,7	65,2	9,5	5	0	0	0	0	0	1,1	3,5
R-RABBAH	208	1999	37,2	92,3	6,8	18,8	0	0	0	0	0	0,8	0,2	7
R-RABBAH	208	2000	77,7	30,4	45,2	0	0	0	0	0	0	11,5	4,5	87
R-RABBAH	258	1991	85	81	80	59	50	50	59	63	63	60	64	79
R-RABBAH	258	1992	80	83	71	60	52	48	54	54	58	46	68	85
R-RABBAH	258	1993	77	77	69	54	56	48	47	51	59	57	70	74
R-RABBAH	258	1994	82	74	77	50	46	51	51	51	59	56	80	77
R-RABBAH	258	1995	71	75	60	52	46	45	55	58	54	60	53	79
R-RABBAH	258	1996	79	70	76	58	40	48	50	51	52	58	66	73
R-RABBAH	258	1997	72	75	69	48	36	42	43	51	49	48	58	71
R-RABBAH	258	1998	76,5	73,6	67,3	47,1	45,2	43,2	36,1	41	48	47,7	56,5	65,8
R-RABBAH	258	1999	75,5	72,7	58,5	54,3	47,6	67,3	62,7	63,4	64,5	69,8	57,5	68,5
R-RABBAH	258	2000	90	88	99	53	42	52	58	70	65	62	51	75
R-RABBAH	268	1991	5,4	6,4	6,4	8,1	9,7	12,2	11,9	11	9,9	8	7,4	4,4
R-RABBAH	268	1992	4,1	2,9	7,3	8,9	9,4	11,1	11,8	11,4	9,9	9	6	4
R-RABBAH	268	1993	5,4	6,3	7,8	10,1	8,5	12,3	12,3	11,6	10,2	9	6	5,8
R-RABBAH	268	1994	5,1	6,4	7,4	9,3	11	12,2	12	11,6	9,8	8	5,5	5,3
R-RABBAH	268	1995	7	6,5	8,6	9	10,6	12,3	11,9	11,7	10	9,2	7,5	5,8
R-RABBAH	268	1996	4,8	5,7	7	8,4	10,2	12,1	10,9	11,3	10,4	8,9	6,6	5,4
R-RABBAH	268	1997	5,7	6,8	6,1	8,8	11,2	11,8	11,7		10,2	7,9	7,1	4,8
R-RABBAH	268	1998	3,8	7	7	9,3	9	11,8	11,9	11,2	10	9,1	6,9	5,1
R-RABBAH	268	1999	5,4	6,4	8,5	9,5	10,9	11,8	12,1	11,3	10,3	8,9	7,6	6,1
R-RABBAH	268	2000	5,2	7,9	6,9	8,7	11,5	12,1	11,3	11	9,9	8	7,2	4,5
R-RABBAH	534	1991	4,5	4,9	5,6	5,4	6	5	7,3	6,4	2,8	1,8	2,3	5,1
R-RABBAH	534	1992	5,3	9,1	4,2	3,2	3,2	3,3	4,4	4,5	4,2	2,1	4,3	3,7
R-RABBAH	534	1993	4,9	4,8	7,6	5,3	7,1	5,5	6,7	3,3	2,4	2,2	3,3	1,6
R-RABBAH	534	1994	4,9	6,6	3	2,6	2,1	3,2	4,7	1,9	1,2		3,4	3,8
R-RABBAH	534	1995	1,4	2	3,1	2,3	1,9	2,7	2,8	1,7	1,4	1,1	2	0,8
R-RABBAH	534	1996	2,3	1,8	4,1	2,6	1,2	2	3,9	1,7	1,6	0,9	2,2	0,7
R-RABBAH	534	1997	0,8	4,3	3,5	4,1	1,4	1,2	2,6	1,6	1	0,5	1	2
R-RABBAH	534	1998	3	1,7	3,3	1,8	2,4	2,1	2,2	1,4	0,8	0,5	0,3	1,2
R-RABBAH	534	1999	1,5	4,4	6,5	5,7	4,4	4,4	3,5	1,2	1,5		2,1	
R-RABBAH	534	2000		2,5	2,3	4,5	3	3,3	4,6	6	1,6	5,3	2,8	4,7
R-RABBAH	538	1992	252	235	243	241	265	328	283	265	261	254	189	223
R-RABBAH	538	1993	216	240	238	257	242	258	262	257	259	196	235	125
R-RABBAH	538	1994	214	245	255	243	278	283	281	284	279		265	264
R-RABBAH	538	1995	260	258	269	263	273	284	285	283	284	252	267	169
R-RABBAH	538	1996	259	266	257	235	252	255	258	260	261	249	85	228
R-RABBAH	538	1997	258	250	254	255	250	260	265	267	256	194	169	265
R-RABBAH	538	1998	249	253	251	260	255	267	262	263	261	200	117	246
R-RABBAH	538	1999	192	268	272	274	268	270	279	279	276	250	120	260
R-RABBAH	538	2000		256	264	266	269	274	280	287	287	279	144	249
QATRANEH	201	1991	12,4	15,6	19,9	25,5	27,6	31,1	30,9	30,9	30,4	27,2	22,4	12,4
QATRANEH	201	1992	9,6	10,2	15,4	22,4	27,2	30,3	31,4	32,5	30	29,3	20,4	12,5
QATRANEH	201	1993	12,4	13	18,1	24,6	27,1	32,2	32,2	33,8	31,4	28,6	20,3	18,8
QATRANEH	201	1994	14,9	14,5	18,2	26,8	29,7	30,5	31,1	32,8	32,4	29,4	18,4	12,5
QATRANEH	201	1995	15,3	15,7	19,8	23,4	29,7	32,4	31,8	32,6	31,7	26,7	19,6	15,3
QATRANEH	201	1996	14,1	16,9	17,2	23,5	30,9	31,2	33,9	33,3	31,3	25,8	21,5	17,9
QATRANEH	201	1997	15,7	12,5	15,8	22,2	29,9	31,8	32,4	30,6	29,8	27,7	21,1	15,7
QATRANEH	201	1998	12,8	15,4	16,9	25,7	29,1	31,6	33,9	35,5	31,8	28,9	25	17,9
QATRANEH	201	1999	15,9	17,3	20,1	24,5	30,9	30,7	32,9	33,9	31,1	27,2	21,9	18,5
QATRANEH	201	2000	12,8	15	17,7	26	28,4	32,4	36,4	32,4	30,7	25,2	21	15,7
QATRANEH	202	1991	2,4	3,2	7,7	10,7	12,7	15,2	16,5	16,6	14,5	12,4	7,1	2,2
QATRANEH	202	1992	0,6	2,1	3,9	7,7	12,5	15	16,1	16,8	14,7	10,6	6,9	2,5
QATRANEH	202	1993	0,4	0,5	4,8	8,5	12,4	15,6	16,2	17,5	14,5	13	7,6	5,2
QATRANEH	202	1994	4,4	3	5,2	10,3	13,1	14,9	16,8	16,3	16,3	14,9	7,8	2,2
QATRANEH	202	1995	1,7	3,3	5	7,5	13,2	16,8	17,6	17	15,6	10,7	5	2,2
QATRANEH	202	1996	2,9	4,2	5,5	7,9	14,6	14,9	19,1	17,7	15,1	10,5	8,6	4,8
QATRANEH	202	1997	3	0,6	4	8	13,8	16,1	17,4	16,2	14,5	12,1	8	4,1
QATRANEH	202	1998	2,9	3,9	5	10,5	14,3	16,2	18,5	19,6	17,1	12	8,1	4,3
QATRANEH	202	1999	3,4	3,4	5,7	8,9	14,4	15,9	18,5	18,6	15,9	12,3	6,6	3,2
QATRANEH	202	2000	2,3	2	3,8	10,5	12	15,6	20,3	18	15,4	11,3	6,1	4,2
QATRANEH	203	1991	7,4	9,4	13,8	18,1	20,2	23,2	23,7	23,7	22,5	19,8	14,8	7,3
QATRANEH	203	1992	5,1	6,2	9,7	15,1	19,9	22,7	23,8	24,7	22,4	20	13,7	7,5

QATRANEH	203	1993	6,4	6,8	11,4	16,5	19,8	23,9	24,2	25,7	23	20,8	13,9	12
QATRANEH	203	1994	9,7	8,7	11,7	18,6	21,4	22,7	23,9	24,6	24,3	22,1	13,1	7,3
QATRANEH	203	1995	8,5	9,5	12,4	15,4	21,5	24,6	24,7	24,8	23,7	18,7	12,3	8,8
QATRANEH	203	1996	8,5	10,5	11,4	15,7	22,8	23	26,5	25,5	23,2	18,1	15	11,3
QATRANEH	203	1997	9,3	6,6	9,9	15,1	21,8	24	24,9	23,4	22,2	19,9	14,6	9,9
QATRANEH	203	1998	7,9	9,7	10,9	18,1	21,7	23,9	26,2	27,5	24,4	20,5	16,5	11,1
QATRANEH	203	1999	9,7	10,4	12,9	16,7	22,7	23,3	25,7	26,3	23,5	19,8	14,3	10,9
QATRANEH	203	2000	7,6	8,5	10,8	18,3	20,2	24	28,4	25,2	23,1	18,3	13,5	9,9
QATRANEH	208	1991	31,5	8,3	46,6	0	0	0	0	0	0	3,6	6,5	25,7
QATRANEH	208	1992	28,8	64,3	13,6	0	0,8	0	0	0	0	0	5,5	22,4
QATRANEH	208	1993	16,9	8,1	10,6	0	3,1	0	0	0	0	0	29,8	23,8
QATRANEH	208	1994	41,8	20	5,6	0	0	0	0	0	0,9	12	41	15,2
QATRANEH	208	1995	0	14,9	2,1	1,4	0	0	0	0	0	0	0,3	3,6
QATRANEH	208	1996	27,8	9,7	27,4	0	0	0	0	0	0	0,1	21,3	3
QATRANEH	208	1997	30,8	15,9	12,9	0	0,2	0	0	0	0	6,5	1,4	19,2
QATRANEH	208	1998	41,7	26	25,4	6,3	1,8	0	0	0	0	0	1,3	1,2
QATRANEH	208	1999	8,7	11,1	0,3	2,1	0	0	0	0	0	0	0	1,3
QATRANEH	208	2000	27,8	0,7	16,3	0	0	0	0	0	0	3,7	0	18,5
QATRANEH	258	1991	64	55	53	37	38	36	40	42	44	46	49	68
QATRANEH	258	1992	72	77	59	51	44	43	47	48	50	38	55	75
QATRANEH	258	1993	68	66	55	40	39	36	42	38	47	44	61	68
QATRANEH	258	1994	79	73	70	39	40	47	50	55	56	56	72	69
QATRANEH	258	1995	58	60	48	44	41	39	46	50	42	46	40	68
QATRANEH	258	1996	69	58	61	43	29	35	35	41	44	42	58	62
QATRANEH	258	1997	64	63	60	27	30	36	36	48	47	59	64	72
QATRANEH	258	1998	74,2	66,3	58,2	43,3	38,2	39,9	34,7	41,6	47,6	44,6	45	50,1
QATRANEH	258	1999	61,8	58,7	44,7	42,9	31	38,3	40,9	45,6	52,3	54,7	48,2	47,6
QATRANEH	258	2000	69	64	60	44	41	41	40	47	52	58	50	74
QATRANEH	268	1991	6,1	7,7	7	9	9,4	11,3	11,2	11,4	10,4	8,3	8,2	5,3
QATRANEH	268	1992	4,7	5,1	8,1	9,2	9,5	11,4	11,9	10,9	10,3	9,6	7,3	5
QATRANEH	268	1993	6,3	6,8	8,8	10,3	8,8	12,5	12,4	11,7	10,7	9,2	7,2	6,3
QATRANEH	268	1994	6,1	7,3	8	9,7	11,1	12	12	11,5	9,9	7,7	6,5	6,2
QATRANEH	268	1995	7,6	7,2	9,4	9,5	10,4	12,2	12,2	11,7	10,3	9,4	8,1	6
QATRANEH	268	1996	5,5	6,6	7,4	9	10,3	12,2	11	11,6	10,1	9	6,7	6,8
QATRANEH	268	1997	7	8,5	6,8	8,6	11,2	12,2	12,1	11,4	10,7	8,3	7,6	5,4
QATRANEH	268	1998	5,2	7,8	6,9	9,2	8,7	11,7	11,7	11,3	10,3	9,6	7,8	6,2
QATRANEH	268	1999	6,1	7,4	9,1	9,8	10,9	12,2	12,2	11,5	10,8	9,6	8,6	7,2
QATRANEH	268	2000	6,6	8,7	8	9,4	12,1	13	12	11,8	10,8	8,9	8,1	6,2
QATRANEH	534	1991	5,8	6,6	8	7,3	6,5	5,1	6,3	5,9	2,6	2,1	2,4	5
QATRANEH	534	1992	4,2	9,3	5,2	3,9	5	5,4	6,2	5,2	5,6	2,1	5,6	8,5
QATRANEH	534	1993	5,9	5,2	8,3	4,9	6,9	6,9	5,6	3,7	5,4	5,2	6,4	4
QATRANEH	534	1994	6,9	6,1	5	5,3	4,8	5,2	6,8	4,1	2,7	2,6	6,5	6,9
QATRANEH	534	1995	4	5,1	5,4	6,9	5,7	7,1	6,8	4,6	3,5	3,2	4	3,6
QATRANEH	534	1996	4,1	4	6	5	3,9	4,1	5,3	3,8	3,3	2,8	5,6	3,6
QATRANEH	534	1997	5,7	8	7,7	8,6	5,6	6,1	6,1	5,8	4,2	3,6	6,2	6
QATRANEH	534	1998	6,4	5,6	6,7	6	6,2	5,6	5,7	3,8	4,4	4	2,5	4,7
QATRANEH	534	1999	4,6	5,2	6	5,2	5,7	6,7	7,1	4	3,5	2	2,7	2,7
QATRANEH	534	2000	5,1	4,5	3,6	2,7	2,4	4,7	4,7	4,2	2,5	4,3	4,1	6,1
QATRANEH	538	1992	202	247	283	289	285	299	301	301	293	310	190	218
QATRANEH	538	1993	210	237	257	274	264	284	286	292	307	168	179	155
QATRANEH	538	1994	208	244	269	268	290	293	288	292	298	155	226	189
QATRANEH	538	1995	199	219	246	271	298	299	297	312	310	306	203	157
QATRANEH	538	1996	192	254	262	269	306	314	316	315	309	283	131	219
QATRANEH	538	1997	237	295	322	339	1	29	348	325	332	246	177	221
QATRANEH	538	1998	274	288	289	269	286	310	298	307	304	266	159	165
QATRANEH	538	1999	204	240	260	282	295	286	287	289	289	304	223	150
QATRANEH	538	2000	238	264	278	275	282	321	322		314	287	140	228

C. Annex 3 : Excavation chronology

1986 :	Church of Bishop Sergius
	Church of St Stephen
1987 :	Church of Bishop Sergius (north chapel)
	Church of St Stephen (north chapel)
	Church of the Aedicula
	Church of the Courtyard
	Church of the Tower
1988 :	Church of Bishop Sergius (funerary chapel and baptistery)
	Church of St Stephen (area to the East)
	Church of the Aedicula
	Twin churches (Swiss team)
1989 :	Church of St Stephen
	Church of the Courtyard
	Area south of St Stephen complex and some work around Lion's church
	Twin churches 'Swiss team)
1990 :	Church of the Courtyard : soundings
	Church of Bishop Sergius : soundings
	Church of St Stephen : soundings
	Church of the Lions
	Church of priest Wa'il (D.A.J., Taysir 'Attiyat)
	Twin churches (Swiss team)
1991 :	St Stephen complex : soundings
	Church of the Lions and surroundings
	Church of priest Wa'il
	Restoration works (funded by USAID) : walls of St Stephen, North wall of the Aedicula church, apse of the church of the Courtyard, North wall of Bishop Sergius church, walls of the baptistery. Filling large crack on the apse of priest Wa'il church.
	North Gate (Swiss mission)
1992 :	Church of the Lions and surroundings
	Chapel of the Peacocks
	Church of the Tabula Ansata
	North Gate and South Gate (Swiss mission)
1993 :	St Stephen complex : excavation of the north-west angle of the complex
	Church of the Aedicula : architectural survey and study
	Project of the Archaeological Park
1994 :	
1995 :	Church of St Paul
1996 :	Church of St Paul
1997 :	Church of St Paul and vicinity.
	Vine press and surroundings
1998 :	Church of St Paul south-east flank
	Vine press complex and northern area
	Church of the Lions : soundings and architectural studies
	St Stephen complex : soundings
1999 :	Church of the Tabula Ansata
	Area between St Paul church and the chapel of the Peacocks
	Church of the Lions : tombs and soundings

Sources : That list gives only the main lines of the different operations done at Umm ar-Rassa. It is not exhaustive on the works done on the site. From : M. Piccirillo, Ricerca storico-archeologica in Giordania Liber Annuus 1986-2000. A.D.A.J., M. Piccirillo, SHAJ IV, 1992, M. Piccirillo, Umm al-Rasas Mayfa'ah I , Gli scavi des complesso di Santo Stefano, S.B.F. Maior 28, Jerusalem 1994.
Bujard J. : A.D.A.J. 32, 1988, p. 101 113, A.D.A.J. 36, 1992, p. 291-306

D. Annex 4 : characteristics of building materials

Following types of building materials were observed in different places of the site. These materials were used separately but most of the time mixed together:

Coquina:
- mega-crystalline accumulation of oyster shells
- 60% carbonates, 40% phosphates and silica
- reaction with HCl: strong
- hardness: not easily scratched with a steel knife
- typical color : 5 YR 7/2 (light brownish gray)
- easily hewn
- excellent building stone used in most buildings
- sensible for pitting by acid chemical weathering and granular disintegration by physical thermoclastic weathering

Phosphatic chert:
- micro-crystalline accumulation of phosphates (14 - 21% of P_2O_5 derived from phosphatic mud of fish fragments and faecal pellets) and silica
- reaction with HCl: none
- hardness: not scratched with a steel knife
- typical color: 5 RP 3/1 (dark purplish gray)
- not easily hewn
- mostly used for wall construction (wall of the Kastron, culture terrace walls)
- sensible for cracking and flaking by physical thermoclastic weathering

Limestone:
- micro-crystalline structure
- reaction with HCl: strong
- hardness: easily scratched with a steel knife
- very limited use
- typical color: 7.5 YR 8/3 (light yellow orange)
- sensible for flaking by physical thermoclastic weathering

Black shale:
- micro-crystalline structure
- reaction with HCl: weak
- hardness: easily scratched with a steel knife
- very limited use
- typical color: 2.5 Y 3/1 (brownish black)
- sensible for flaking by physical thermoclastic weathering

Gypsum:
- macro-crystalline structure
- reaction with HCl: very strong
- hardness: very easily scratched with a steel knife
- slabs are used as pavement
- typical color: 10 Y 6/1 (gray)

Provenance:
Coquina, phosphatic chert and *limestone* are found in abundance in the geological substratum at Umm-Ar-Rasas. They were extracted from numerous large and small quarries all over the site area.
Black shale and *gypsum* are not found at Umm-Ar-Rasas. The *gypsum* is found at the boundary of the lower Wadi as Sir Limestone Formation and the Upper Shu'ayb Formation. The *black shale* occurs in the lower members of the Shu'ayeb Formation. Both stone types are quarried in the canyon of the Wadi el Mujib. We observed f.i. a modern gypsum quarry at position X = 0768057, Y = 3483532 at + 330 m.

E. Annex 5 : Castrum : state of preservation of walls and towers

The single number refers to a tower (number 1 is the north-east corner tower), while the hyphenated numbers to the portion of wall in-between two towers. Both are represented on the plan, with recommendations for presentation:

1.Good preservation. Remove collapse on the east side to make it inaccessible. Thamudic inscription.
1-2. Two meters of collapse (2 courses). Thamudic inscription
2. Collapse on North corner (to fill); collapse on south side (to rebuild)
2-3. Entire wall to consolidate and rebuild
3. Missing blocks to replace; blocks cracking under the weight of upper courses. Thamudic inscriptions.
3-4. Top 5 courses missing. Partly consolidated with mortar and stone filling
4. N wall is consolidated, East wall collapsed
4-5. Rebuild 4 or 5 courses
5. Three Thamudic inscriptions. South corner collapsed and to reconstruct.
5-6. Top stones missing for a length of 2/3 meters, 3 courses high.
6. Missing stones to replace, empty areas between stones to fill.
6-7. At the base, stones cracked to be repaired and reinforced
7. Stones missing on East wall. Very deteriorated stone in South wall to be replaced. Danger of collapse of this corner.
7-8. The entire wall has moved and should be consolidated to avoid collapse.
8. North wall has collapsed. To be rebuilt for at least 5 courses. East wall is inclined. It should be dismantled and rebuilt. South wall displaced and partly collapsed (5 courses to rebuild). Traces of mortar on exterior wall.
8-9. An access to the courtyard of the twin churches has been built here by the Swiss mission. If the idea of limiting access to the castrum prevails, this access should be dismantled.
9. Collapse of East and West corners. 3 courses to rebuild.
9-10. 1.5 meter missing from top.
10. Conservation work following excavation not to standard. Need to dismantle and rebuild.
10-11. Postern gate: only lintel and top 50 cm of gate are exposed. Expand and complete sounding or backfill. Missing 2 courses in centre of wall.
11. Collapse of east corner.
11-12
12. Kufic inscription. West corner leaning and in danger of collapse. West wall cracked and displaced40 cm on top.
12-13. Collapse of upper 4-5 courses.
13. Tower collapsed on both corners.
13-14. Five meter wide collapse of top 5-6 courses. Wall deformed and leaning
14. Large collapse of East and West corners
14-15. Large collapse of top 5 courses. Differential weathering of different stone types: coquina stones are developing pitting, while phosphorite is spalling and cracking.
15. Three courses collapse of south corners
15-16. Well preserved section, although a number of stones is cracked and voids need to be filled.
16
16-17. collapse or voluntary opening of this sector in recent times: 4-5m wide, 5 courses high.
17. Small collapse on southern and northern sides, 4-5 courses high in the latter.
17-18. 6 meters wide 2 courses section of missing stones
18
18-19. Collapse in proximity of 19: 4-5 courses over three meters.
19. Shaken, especially north corner. Large collapse in centre of north wall.
19-20. Large collapse of top 3 courses on centre of wall
20. Tower has a small collapse, but has also lost verticality and is inclined to north
20-21. small collapse near tower 20. Large voids to fill in rest of wall.
21. Large collapse of west corner.
21-22
22. Large voids in lower part.
22-23
23. Covered by excavation debris. Top 4 courses missing.
23-24. Excavated north gate. Debris from excavation must be removed.
24. Needs filling of voids.
24-25. Many voids need to be filled.
25. Large collapse of western corner and north wall. 6 or 7 courses missing
25-1. Huge collapse of entire wall.

Work to be carried out:
A general detailed study of the entire wall has to be carried out. All the parts in immediate danger of collapse have to be restored and/or consolidated. Targeting a wider objective, the wall has to be restored in a way that avoids any passage from outside to the interior of the castrum, except through its 'natural' north gate. The provisional stairway placed by the Swiss archaeological team has to be dismantled. It is premature and too costly to foresee a tourist circuit inside the fortification, even if the construction of a platform over ruined ancient streets seems technically feasible (see proposal §.....).
All excavation dump accumulated on the eastern side will be removed. Hopefully, the North Gate excavation will be terminated.

F. Annex 6: Coordinates of water collection structures

Coordinates are UTM, zone 36R, European datum 1950, collected with a Garmin x-trek GPS with an accuracy of +/- 5m.

Elevation	East	North	Type
767	777454	3488911	5
772	777475	3488879	5
769	7777490	3488827	5
768	7777534	3488852	5
768	7777528	3488803	5
767	7777542	3488779	5
767	7777499	3488731	5
764	7777483	3488678	5
766	7777449	3488606	5
767	7777373	3488654	2
768	7777369	3488678	3
770	7777429	3488724	5
765	7777513	3488606	5
765	7777552	3488600	5
765	7777630	3488582	5
766	7777672	3488613	5
765	7777674	3488629	5
765	7777691	3488609	5
765	7777695	3488581	5
764	7777719	3488605	5
764	7777749	3488560	1
765	7777708	3488631	5
764	7777681	3488652	5
763	7777688	3488665	3
763	7777705	3488677	5
762	7777679	3488705	5
76	7777674	3488733	5
762	7777651	3488741	5
762	7777583	3488677	5
763	7777628	3488679	5
763	7777636	3488697	5
763	7777650	3488693	5
766	7777633	3488642	5
765	7777585	3488651	5
765	7777564	3488638	5
767	7777491	3488684	5
762	7777587	3488745	2
762	7777622	3488830	3
761	7777613	3488835	5
761	7777670	3488917	2
760	7777670	3488940	5
761	7777641	3488925	5
755	7777707	3489011	5 (swamp)
755	7777673	3489049	1
758	7777681	3489105	5
752	7777784	3489122	1
752	7777791	3489186	1
753	7777659	3489134	5
754	7777665	3489187	4
753	7777564	3489181	2
758	7777541	3489053	2
761	7777554	3488936	5

760	7777565	3488905	5
764	7777588	3488043	5
759	7777585	3488984	2
756	7777542	3489190	5
755	7777512	3489152	5
755	7777515	3489171	5
754	7777520	3489195	5
754	7777524	3489200	2
752	7777532	3489246	5
755	7777545	3489248	5
751	7777533	3489295	3
752	7777555	3489294	3
752	7777573	3489291	4
762	7777392	3489124	2
763	7777332	3489133	5
760	7777343	3489155	Arches
760	7777394	3489158	2
760	7777404	3489152	Tomb?
756	7777432	3489180	4
760	7777375	3489215	4
768	7777264	3489008	3
770	7777136	3488835	1
771	7777211	3488728	1
761	7777390	3489081	2

Work to be carried out :

general survey and study, including research with non destructive adapted techniques (see churches of St Stephen and Bishop Sergius).

Cartography of all underground structures

G. Annex 7 : List of archaeological soundings to backfill, clandestine excavations to assess and backfill, excavation debris areas to be removed (see Fig 7 – Plan 11 - $ X)

List of archaeological soundings to backfill

Deep sounding (3x1x1.5 deep) North of the Church of Bishop Sergius
Long sounding (20x1x1 deep) North of northern external wall of St. Stephen complex
Tombs in chapel at east end of right aisle of St. Stephen
2x1x1.3 deep sounding in a room south of St. Paul
2.5x2.5x 1 deep stepped trench between South wall of St. Paul and opposite wall (good stratigraphy here)
2.5x1.5x 1 deep trench at the base of wall opposite south wall of St. Paul's
Huge trench, 20x10x5 deep in a structure to the west of the wine press in St. Paul's complex. This is a current excavation.
Large sounding 2x3x 2.5 deep at the southern foundations of Church of the lions, in a small room adjacent the church
2.5x1x1 deep in front of a door along a street south of Lions complex. There is a tabula ansata lintel into it, possibly belonging to the same door
entire room west of the Church of the Lions. Displaced tomb slabs in situ
3x2x 1 deep. Slabs in situ. Partially exposed tomb, to the west of Church of the Lions
4x1.5x0.5 deep: Slabs in situ. Partially exposed tomb or tombs, to the west of Church of the Lions.
1x3x1 deep. Slabs in situ, possibly a tomb, to the west of Church of the Lions.
2x4x0.7. Partly backfilled trench, to the west of Church of the Lions.

List of the clandestine excavations to assess and backfill :

Room south of Church of Aedicula: floor slabs dislodged
NW corner of Church of St. Paul: 50 cm deep, 2m wide hole through mosaic floor. Tesserae in debris, but not in sufficient number to reconstruct mosaic. Was the mosaic stolen?
SW corner of Church of St. Paul: deep (1.5m) hole through a mosaic, 2m wide. A tomb was found, its capping stone displaced and left in situ. Debris to be sifted to recover tesserae.
Room N of Chapel of Peacocks: deep (>1m) hole through mosaic, 1.5m wide. Uncertain whether mosaic was stolen or destroyed. The debris should be sifted to recover tesserae.
Courtyard of modern complex north of Northern gate: large soundings across the courtyard, with stone paving visible throughout the area at an average depth of 40cm.
Interior of house east of the previously mentioned courtyard: 2m wide excavation which uncovered a paved area. Slabs partly dislodged.
Ancient structures transformed into house, abutting unexcavated church north of fortifications: Large excavation which uncovered stone slabs, possibly tombs.
Room north of northern twin church in the castrum
Area in front of northern door of northern twin church: slabs removed and displaced, column base displaced
Room south of southern twin church: displaced slabs
Courtyard complex north of unexcavated church in northern settlement: the house with the double arcade has an excavation that uncovered a paved floor, its slabs dislodged.
Church of the Tabula. Excavation in the Northwest corner of the church.

List of excavation debris areas to be removed

The presence of these excavated materials is indicated per each area. From North to South the areas are:

Tower complex: North of unexcavated building.
Tower at coordinates xxx: debris abutting the north wall of the tower
Tower at coordinates xxx. Debris abutting structure.
Large area, approximately 400 m2, North of St. Stephen complex, north of present track. In this area there are many decorated stones
Area immediately north of St. Stephen complex: this has been arranged by bulldozer, but stones need to be sorted out.

Area to the North-east of St. Stephen complex, East of present guard post: this debris area includes also fragments of chancels and pillars that need to be retrieved.
Area or the North-east corner of St. Stephen complex
Area to the west of St. Stephen complex
Area to the west of St. Paul's complex
Area to the west of Lion`s complex
Area to the north of North gate complex. This area includes decorated stones.
Vast area (at least 2000 m2) to the east of castrum ramparts. Some of the blocks from the Swiss excavation were already arranged in an area to the east of this debris, but many more exist in this debris and in another immediately to the south of this "lapidarium".
Small hill to the east of eastern ramparts, containing many blocks, also part of the Swiss excavations fill.

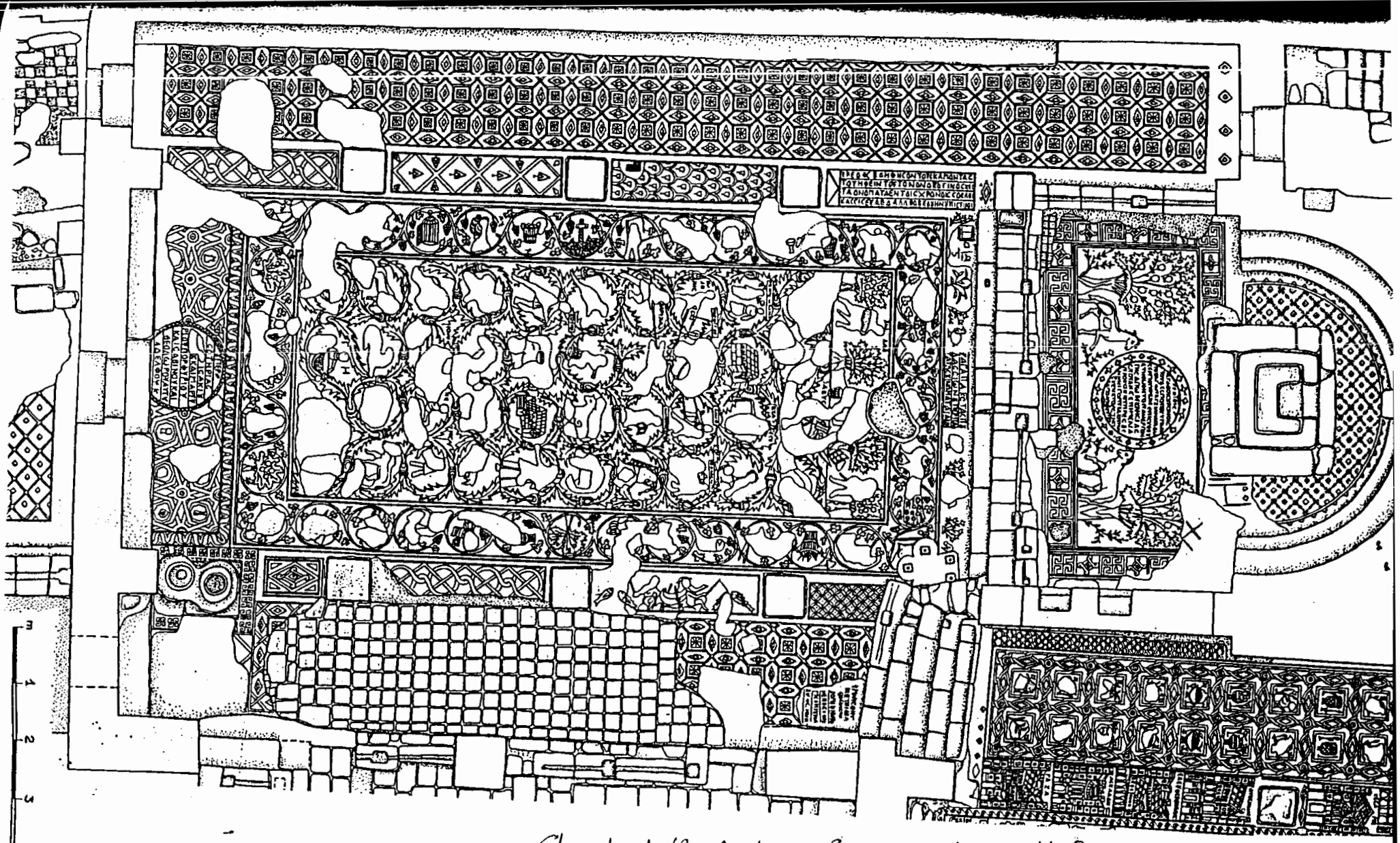
H. Annex 8 : State of preservation of the Churches

1. Church of the River

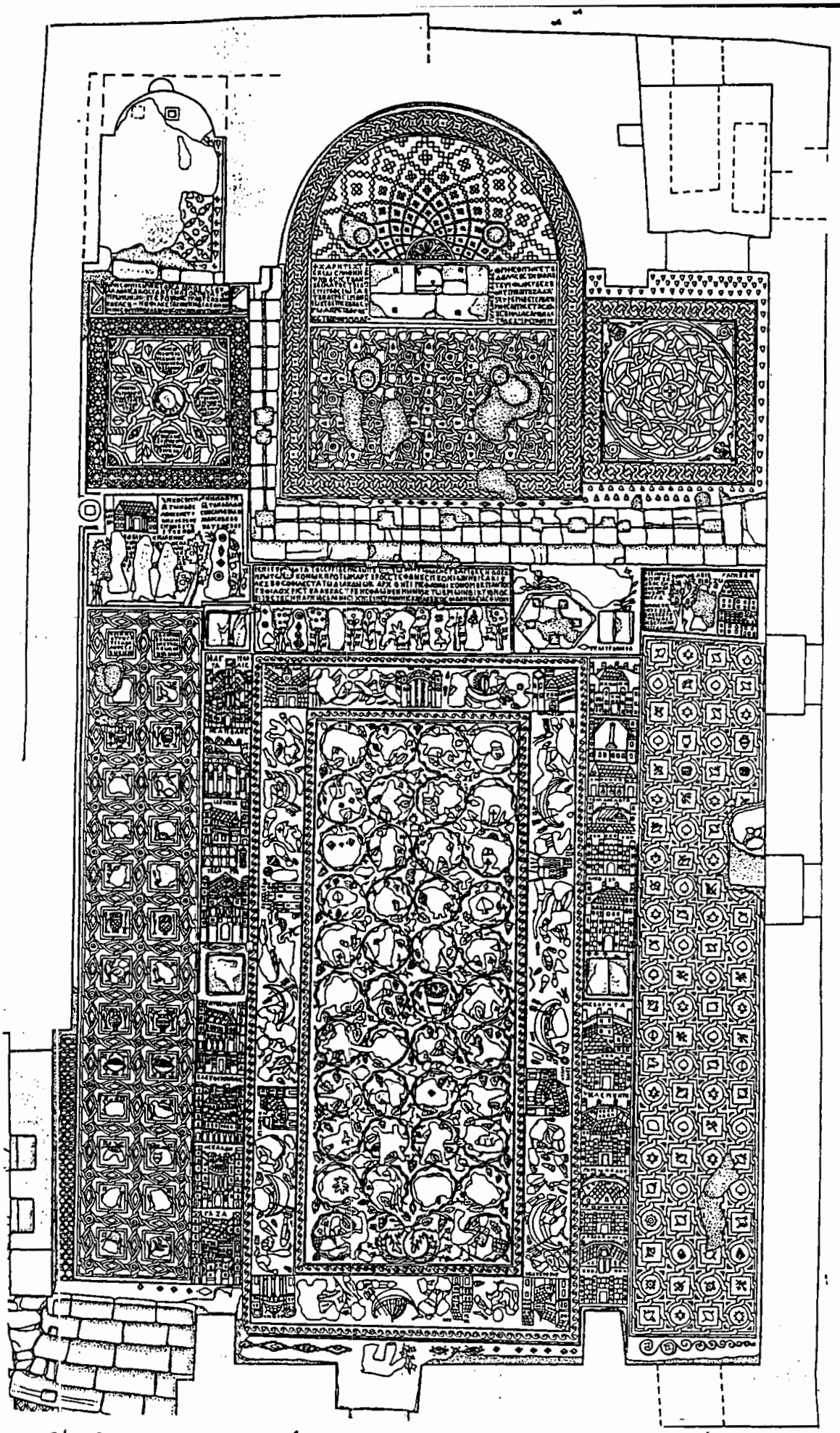
Excavation :
Swiss archaeological Mission, Max van Berchem Foundation (Jacques Bujard)
Date of excavations :
1988, 1989, 1990
Superficy :
125 m2
Plan :
Ear iest of the twin churches excavated by the Swiss mission members.
Mono apse church with three naves separated by two rows of three arches. Raised presbyterium, limited by chancel and flanked by two small rectangular chambers closed with doors. Three doors (one by nave) gave entrance through the western wall (from a kind of « narthex »). One another door, in the north wall, give access into a small rectangular chamber (« sacristy » ?) covered by two arches. In later times two of the west doors were blocked and benches build along the wall, inside the church.
Walls :
They are from the common double side of local uncut stones from different size and nature with medium filling of earth. Only the inner wall of the apse was built of well dressed and cut limestone blocks of pseudo isodome aspect. The first row of voussoirs of the « cul de four » is still in situ, over a small cornice crowning the apse wall.
The apse was partially over cut through the inner side of the city wall. The walls are quite well preserved, sometime over three meters high. All of them have been restored by the Swiss mission members.
Floor :
All the church was paved with coloured mosaics, half of which are still in situ, under 10 to 20 cm of dump and sand protection.
Datation :
The mosaic is dated of 578-579 or 593-594 A.D.. The church was probably built half a century earlier.
Bibliography :
J. Bujard : Les églises géminées d'Umm er-Rassas, A.D.A.J. XXXVI, 1992, p. 291–306.

2. Church of the Palm Tree:

Excavation :
Swiss archaeological Mission, Max van Berchem Foundation (Jacques Bujard)
Date of excavations :
1988, 1989, 1990
Superficy :
220 m2
Plan :
South to the twin churches which have been excavated by the Swiss mission, that church was the latest to be built.
Mono apse church with three naves separated by two rows of three arches. Raised presbyterium, limited by chancel and flanked by two small rectangular chambers closed with doors (in the original state, these chamber were completely open to the naves). Three doors (one by nave) gave entrance through the western wall (from a kind of « narthex »). Two others doors are visible in the south wall, the one situated in the east opening into a small rectangular chamber covered by two arches.
The apse was partially cut off from the inside side of the city wall.
Walls :
They are from the common double side of local uncut stones from different size and nature with medium filling of earth. The inside wall of the apse is of better quality, the stones use being more regular, of quite rectangular shape and put on horizontal courses. The first course of the voussoirs from the « cul de four » covering are still in situ over the crowning moulded layer. Benches were found along the north and south walls. Two small arched lintels found during the excavations prove that two small windows existed over the « triumphal arch ». Traces of plaster still subsist on the different walls.
Floor :



Church of the Bishops Sergius from M. PICCIRILLO



S.t Stephen Church from
M. PICCIRILLO

m 1 2 3 4 5

spite of an apparent unit, this church is extremely heterogeneous in its structure. Added to the south-east corner of the church of bishop Sergius. it encroaches partially on the latter which it covers the end of its southern nave. This organisation made it possible to have the two buildings communicating. The construction of St Stephen was also done with the site of former buildings whose walls were more or less integrated in the new place of worship. One penetrated there by two doors spared in the southern wall and two others in the western wall. In the Northwest angle, a flight of 6 steps gave direct access to the church of Sergius located at more than one meter downwards

Walls :

Because of the late construction of the church, in and above former buildings, its walls are very heterogeneous. They call upon the general system of the double facing in blocks of all natures and all sizes, cut as from the quarry, bound by an internal ground stuffing interfered spalls. In general the walls are well preserved but they will have to be systematically consolidated, their old lime coatings mortars protection being currently reduced to the state of traces. Only the northern apse, added, presents a regular facing of well dressed rectangular blocks. That chamber was to be covered by a « cul de four » proceeded by an also well dressed stones barrel vault, similar to the one still in situ above the southern passage.

The walls of St. Stephen have various problems, going from weathering of various types of stones, to cracking, loss of stability, deterioration of mortars, etc. The vault of the chapel at the end of the right aisle rests on minimal support and is in danger of collapse. Plaster are also in bad conditions, ands some of them have salts efflorescence .

Floor :

The floor of the church is entirely covered by an extraordinary carpet of geometric and figurative mosaics, which are at the origin of the celebrity of the site of Umm ar-Rassas. The images of the pavement were destroyed during the iconoclasm crisis but carefully restored at the same time. The pavements are well dated by inscriptions also mentioning the names of the mosaists. In spite of their appearance, the mosaics are not in a good state of preservation. It is generally detached. Recent damage occurred in the vignette of Kastron Mefaa, when a small area collapsed in a subterranean passage. This may indicate the existence of channels, tombs or passages under the floor of the church.

A cursory graphic documentation was made of the floor of St. Stephen: this shows the following damage occurring to the mosaic, in order of extent and importance of damage: detachment (generalised, but more evident close to walls and in the apse), erosion (grey and yellow shale tesserae used in borders, and red tesserae used to represent walls and roofs in the vignettes representing Madaba, Hesbounta, Belemonta, Areopolis and Karak), bulging (such as in the area to the left of the panels representing Gaza, Askelon, and Eleutheropolis and loose tesserae). Comparisons with photos taken shortly after the excavations show that the shale tesserae, while already showing some deterioration, were not in the advanced weathering shown today, where some of them have lost more than 1cm of surface compared to those in their proximity. It is possible that the microclimate of the shelter may have a role in this damage. Without proper investigation is not possible to advance hypotheses on the reasons of this behaviour. It is enough to say that more and detailed study is necessary in advance of shelter construction to understand the reasons for the almost total detachment of the mosaic from its support and for accelerated decay of a specific stone type.

It has also been observed that in the same church there are at least 3 or four types of modern lacunae filling. Besides being aesthetically unpleasant, the use of different mortars to fill lacunae creates a proliferation of methods and formulae, some of which untested.

Datation :

756 for the mosaic of the presbyterium

Bibliography :

M. Piccirillo, L.A., XXXVI 1986, XXXVII 1987, XXXVIII 1988..., M. Piccirillo, The mosaics of Jordan, Amman, 1993, p. 238 239, M. Piccirillo, Umm al-Rassa Mayfa'ah I, S.B.F. Maior 28.

10. Church of Bishop Sergius

Excavation :

Studium Biblicum Franciscanum and Department of Antiquities of Jordan

Date :

1986, 1987, 1988, 1990

Superficy :

320 m2

Plan :

The plan of that church has been changed after the construction of St Stephen and Courtyard churches. We may suppose, from the archaeological evidence, that primitively the church had three naves, the main one with an apse and raised presbytherium, the two lateral ones with small chambers. Only the northern chamber remains. It is of rectangular shape with central arch, still in situ, that supported the roof of covering stone slabs. Archaeological evidences shows that the lateral naves were roofed with stone beams and slabs supported by outside walls and rows of small arches separating the naves. Three doors (two actually in situ), one by nave, opened from the West wall. We know nothing from the South wall, to day totally demolished after the construction of St Stephen and substituted by a balustrade with central pillar .At the same time, the southern chamber was demolish and replaced by a group of six steps giving access to St Stephen church.

Walls :

East and North walls are built with the double rows of rectangular regular local limestone blocks (only the external face for the north wall), perhaps reused from an older building. The apse is entirely built with such stones, till the moulding and the first rows of voussoirs of the cul de four. All the others walls are of the traditional on site double irregular with internal pocket. The pillars were of good rectangular limestone blocks. The high of support is well known from the southern apse side pillars, still in situ, with their moulded capitals. The springing of the arches is well known and a restoration of all the southern row of arches could be done. as in the Church of St. Stephen the walls suffer various type of damage, from stone weathering (mostly cracks) to loss of cohesion and mortar deterioration. There are two aediculae in the wall separating this church from St. Stephen which are in need of stabilisation.

Traces of plaster protection are still visible. During the excavation fragments of painted decoration were found in the sanctuary. The remains of plaster are rapidly deteriorating.

Floor :

Entirely covered with mosaics. The central apse floor is raised and limited by chancel foundation. The mouth of a bottle shaped cistern is visible between the central and southern nave, at the level of the first arch. That cistern mouth was integrated in the mosaic pavement and was under use during the time of the church

Only portions of the mosaics of this church are visible today, but they were totally preserved. Those that are outside the shelter are covered by 10/20 cm of sand and dump. Those that are under the shelter, are in critical conditions: water penetrates at the base of the shelter, and stagnates on the paved floor. We have observed serious damage occurring in this area, including a recent, rapid phenomenon of pitting of white limestone tesserae, but also heavy crusts and salt efflorescence as the consequence of water infiltration. There are also lacunae formations that are of recent genesis, also perhaps the effect of water infiltration. Detachments, spalling, and exfoliation are the most common phenomena.

Datation :

586 A.D. Second in chronological order of the churches built in Umm ar-Rassas.

Bibliography :

M. Piccirillo, Ricerca in Giorania, L.A. XXXVI, XXXVII, XXXVIII, XL, M. Piccirillo, The Mosaics of Jordan,Amman 1993, p. 234 235.

11. Church of the Aedicula

Excavation :

Studium Biblicum Franciscanum and Department of Antiquities of Jordan.

Date of excavations :

1987, 1988, 1991, 1993

Superficy :

155 m2

Plan :

Single apse church with three naves and raised presbytery. Its name come from the small aedicula inserted in its south wall. Two rows of three large arches separated the nave in three parts. A portico of two columns supporting three arches preceded the entrance, by two doors in the west wall. On the south wall, a door with lintel and arch in situ, open on a small closed room the floor of which paved with large gypsum (alabaster ?) slabs.

It is the only church actually known in Umm ar-Rassas, which is not inscribed in a rectangle. The outside walls of the apse present a unique trapezoidal plan, and there are no lateral chapels.

Walls :

Except the pillars and the doors jambs which are treated in well cut limestone blocks, all the building is built with undressed stones, of different sizes, simply adjusted with small fragment, in double irregular with internal pocket of mixed earth and ships stones.

The north wall, which did not supported the ground push, was completely rebuilt in the summer of 1991. The wall facing south (where the aedicula is inserted) is preserved to the high of more than three meters, but it is also in the worst state of preservation. It presents accentuated loss of verticality and a state of complex cracking. The aedicula, build on a lintel (actually broken) spanning over the underground passage form a large bulging. The east doorjamb (which has been restored recently) may collapse rapidly (large cracks) due to the desegregation of the stone doorjamb.

The apse, constructed in pseudo square blocks, more or less similar, is the best-preserved wall. Statically it is more reliable, however some disjoints between blocks are visible.

Floor :

The entire floor was paved with local alabaster slabs. The pavement was discovered almost complete, excepted over the underground corridor passing under the floor at the level of the church presbytery. Today large parts of the pavement have been removed by archaeologists (soundings) and probably by robbers. It is in urgent need of restoration.

A clandestine excavation was conducted in the room to the South of the church, leaving dislodged floor slabs and debris.

There are many decorated stones lying on the floor of the church. They all suffer various degrees of weathering, including exfoliation and cracking

Datation :

No precise datation. It is supposed that that church is the oldest one from St Stephen complex. Its construction could be placed in the beginning of the 6th century.

Bibliography :

Piccirillo M. : L.A. XXXVII, 1987, p. 402, L.A., XXXVIII, 1988, p. 458-459.

Piccirillo M., Alliata E. : Umm al-Rasas I, Gli scavi del complesso di santo Stefano, Studium Biblicum Franciscanum, collectio Maior 28, Jerusalem 1994

12. Church of the Courtyard

Excavation :

Studium Biblicum Franciscanum, Department of Antiquities of Jordan

Date :

1987, 1990 (soundings)

Superficy :

150 m2

Plan :

This church has the particularity of having a reversed apse, located at the west. This unusual plan is due to the fact that the building (probably an old transformed court) was inserted a posteriori between the churches of the Aedicula, of Bishop Sergius and of St Stephen. It is thus about an additional building, adapted to the former structures. Its plan can be regarded as with three naves (separated by two lines of two arches each), if it is admitted that the southern side of the church of the Bishop Sergius could constitute his northern side. The apse presents a raised prebyterium, originally provided with a chancel. The access to this building was done by two doors bored in the medium of the southern wall and by the close churches. It is more probable than it served as " place of distribution " for the churches of St Stephen and of Bishop Serge of which it was separate only by two arches between which a chancel was established.

Walls :

Very heterogeneous, the building being inserted inside various pre-existent structures. The walls are of the general type with two irregular facings of blocks of various sizes and natures separated with an earth filling Only the quality of construction varies from one wall to another. They were originally covered with lime plaster, more or less thick, of which it remains important fragments in situ

Floor :

The floor was entirely covered with rectangular blue/grey " gypsum " flagstones, including for presbyterium. Several tombs were excavated under this last. It is possible that others existed in the vicinity. The floor of presbiterium is crossed by a series of water pipeline supplying the cistern of the church of the Bishop Sergius.

Datation :

Very late in relative chronology (posterior with the construction of the church of St Stephen whose pavements of mosaic are dated from the VIII° century)

Bibliography :

M. Piccirillo, Ricierca in Giordania, L. A. XXXVII, 1987 and XL, 1990., M. Piccirillo, Umm al-Rassas Mayfa'ah I, S.B.F. maior 28.

13. The Church of the Tower:

Excavation:

Department of Antiquities of Jordan and Studium Biblicum Franciscanum

Date of excavation:

1987

Superficy:

125 m2

Plan:

Three small naves separated by two rows of two arches. Central nave with apse and elevated presbyterium flanked by two small rectangular chambers completely open on the lateral naves. Two out of the three doors in the north wall were opening to the inside large enclosure surrounding the tower. The third one gave access to an annex. Remains of a door (which was blocked during the antiquity) in the axis of the western wall, are still visible.

Walls:

The walls are of irregular masonry erected with poor care and attention, using all kind of materials simply bounded by earth mortar. They were under collapse. They were primitively covered and protected by a plaster of muddy lime mortar, some patches of it still remaining.

Floor:

Simply plastered. Half of it was preserved. A large underground , covered by stone slabs was found in front of the presbyterium.

Datation:

? Unknown.

Bibliography:

M. Piccirillo, Ricerca storico-archeologico in Giordania XXXVII, 1987.

I. Annex 9 : Ancien Fields

Work to be carried out :

A general survey and study of the structures is a preliminary need. These structures have to be protected and possibly restored (including the excavated ones), and prepared with the view of future investigations, tourist presentation and agricultural use (antique rural life theme). After a comprehensive study, they could be used again as fields for agriculture and grazing to fulfill local Bedouins requirements. Restoration of such structures will be easy and, in the same time, a good solution for recycling the debris found during the excavations: rubbish stones could be used to rebuilt the walls and the earth to fill back the fields. Under the condition to keep their ancient configuration and utilisation this action will : 1) help tourists understand antique village agro-economy in arid lands, 2) improve site cleaness and avoid summer dry fallow land fires, and 3) generate income for local populations. Additionally, this action will maintain a local interest for Bedouins to control the area.

J. Annex 10 : The Tower Complex

1. The Tower

14,70 m high for a section of 2,5 x2,5m, this exceptionally preserved tower does not possess either internal or external stairs. The plain core support, at an elevation of 11m above ground, possesses a simple chamber, with a door on the northern side. The 2 x 2m chamber was domed.

This tower has already been studied. Since the absence of internal stairs and its location near a church exclude a military use, a more probable interpretation is that it served as a stylite's tower (high level meditating platform for a monk). If this interpretation is correct, it would be the only known erected structure of this type .

The blocks which come from a nearby quarry are laid on site dry, pseudo square more or less similar. The joints are always regularly stepped and the rows maintains almost constant height. The inside is filled with waste (?) material, and only a small vertical « channel » can be noticed on its southern side (toilets ?).

The tower is threatened by loss of verticality, bulging, rotation, cracks, and major phenomena of stone weathering, especially on its northern side where the wind, which blows with power in this area, has caused alveolization and superficial abrasion of the external surface.

Work to be carried out :

Although cracks do not effect any key stones but their joints, monitoring the tower is recommended, especially because a clandestine excavation has destroyed –and destabilised- the lower part of the inner core (large hole opened in the northern façade). This tower may be also the place where general and detailed in situ studies on local stone weathering degradation could be monitored. An overall and comprehensive detailed drawing and study should be carried out.

2. Area around the Tower

The excavation of the perimeter wall of the church and tower should be documented, as future reconstruction work may hide important evidence to understand its chronology and relationship to the buildings it surrounds.

The two-storied building to the North of the tower has been consolidated. The building however threats to collapse given large cracks and a visible bulging on its northern side.

Another building to the east of the previous one remains unexcavated, as are the quarries, cistern (still in use by local Bedouins, belonging to a rarely found type, consisting of a plastered pool covered by arches (supporting a slab roof) and an exposed rock-cut wine press, in relatively good condition

Work to be carried out :

registration and study of the existing remains before implementing any restoration work (for example the courtyard limiting walls were recently cleared without any prior stratigraphic expertise and recording).

complementary excavations , mainly around the «farm» building

restoration of the unearthed structures

general cleaning of the whole area's dump

restoration and protection of the stone slabs roofed cistern still under use.

K. Annex 11 : Semi Subterranean Houses :

Work to be carried out :
A thorough examination should be lead on a selection of two houses prior to start any restoration work. Prior to this step, consolidation will be executed and excavation conducted. A general survey and comprehensive study of this recent conversion of the antique remains are also expected. Quite not a single study (? ? ? ?) has been carried out on such traditional modern reoccupation of ancient structures. The second interest of Umm ar-Rassas is to have preserved a complete village of that recent dwellings

M. Annex 13 : Data on visitors frequency

Visitors data : April-May 2001 *(13 days)*

Day	Daily frequency of visitors groups																		Total number of visitors/day	Number of groups / day (> 2)	Mean size of groups/day
April																					
25	2	1	24	3	25	22	1	4	1										83	5	9,2
26	1	2	2																5	0	1,7
27	6	3	4	9	43	27	4												96	7	13,7
28	6	2	29																37	2	12,3
29	2	1	10	2	2	13													30	2	5,0
30	1	1	2	2	4	2	2	1	1	1	1								18	1	1,6
May																					
1	20	2	2	9	1	1	1	1	5	2	1	3	1	1	2				52	4	3,5
2	16	2	2	1	1	1	2	16	1	1	2	2	4	24	38	2	16	2	4	137	7	7,2
3	1	2	1	1	1	24	3	12	2										47	3	5,2
4	2	7	4	3	3	2	10												31	5	4,4
5	2	3	2	29	1														37	2	7,4
6	2	2	1	14															19	1	4,8
7	1	2	1	2															6	0	1,5
13 days																					

Mean number of groups / day (n>2 persons)	*3,0*
Mean number visitors / day	*46*
Mean size of groups / day	*6,0*
Max. group size:	*43*
Min. group size :	*1*

N. Annex 14 : Visitor carrying capacity Umm-Ar-Rasas

	Assumption 1			Assumption 2			Assumption 3			Assumption 4		
Group size (max.) (or number of visitors / 20')	15			20			15			20		
Time interval Between groups	30			30			20			20		
Max. Number visitors / hour at St Stephen	30			40			45			60		
Winter:												
Site opening hour	9:00 AM			9:00 AM			8:30 AM			8:30 AM		
Site closing hour	2:00 PM			2:00 PM			2:30 PM			2:30 PM		
		5:00	5		5:00	5		6:00	6		6:00	
Summer												
Site opening hour	8:00 AM			8:00 AM			7:30 AM			7:30 AM		
Site closing hour	3:00 PM			3:00 PM			3:30 PM			3:30 PM		
		7:00	7		7:00	7		8:00	8		8:00	
CC winter (n1 visitors/day)	150			200			270			360		
CC summer (n2 visitors/day)	210			280			360			480		
Average number of days / month		28										
Months of visit												
winter	6											
summer	6											
CC winter	25200			33600			45360			60480		
CC summer	35280			47040			60480			80640		
CC per year	**60480**	CC1		**80640**	CC2		**105840**	CC3		**141120**	CC4	

P. Annex 16 : Lots for the Visitors' Centre

1. Lot N°1 - Excavation, Masonry

a) Preliminary works :

- All suggestions (? ? ? ? ?) of the preparation of the working area, fences, equipment for workmen, storage for materials...

b) Plot preparation :

- General excavation of all ground levels after the plantation (? ? ? ?) of stakes
- Trenching for all networks.
- Excavation on full ground, raising up and level of the dig (? ? ? ? ? ? ? ?).
- Earth transportation, excavation
- Supply and set up sewerage and rainwater pipes, steading (? ? ?), all suggestions (? ? ? ? ? ?). Joining of the tracery (? ? ? ?) .
- Supply and set up polyethylene drinking water pipes. All suggestions (? ? ? ? ? ?). Joining of the tracery (? ? ? ? ?).
- Supply and set up floodgates in concrete boxing (5).

c) Walls, floor, face board, fake ceiling :

- Supply and installation of concrete foundation, for long timber. Approx . 0.50m.
- Supply and installation of stone surfaces, approx. 0.50m thick, 0.31m high, 0.70m long. Laying, size, and sawing handling. Assembly of thin joints to lime mortar. Fencing layer on all visual sides. Incorporation of mosaics.
- Preliminary samples and tries. The intern faces of the rooms reserved for the staff will have doubled partitions.
- All scaffolding prepared for the work.
- All suggestive (? ? ? ? ? ?) for openings, supports, and doorways.
- All suggestive (? ? ? ? ? ?) for the making of the inside palls and beams in strong concrete, frames include (positioning and taking up). Finished in rough concrete.
- Foundation blocks of 0.30m thick.
- Paving including forms of 0.10m thick, cement, joints, armatures, by welded wire-mesh. Screed smooths 0.12m thick. Finishing screed smooth 0.04m thick. Water repellent incorporated into the form and screed. Setting up of the ducts, tubes and diverse reservations.
- Joint dilatations.
- Supply and installation of the floor, full of concrete paving, framing, steel, support, ...Use cheviots for ventilation, or smoke tubes etc....
- Supply and installation of insulation 0.10m thick.
- Water-tightness of flat roof. Heavy protection. Lifting of water-tightness, cover joints of dilatation, water receptor...
- Masonry of bricks full from the mortar with cement to the interior separating walls (0.10m thick) posed on a phaltex platform. Making of lintel. Sealing of the doorframes furnished bay the carpenter, double compartments in brick of 0.07m, for the different offices.
- Grooves in the compartments include reblocking to incarcerate the tubes, girdles, and canalisations.
- Lintel on the opening provides, supply by two visible irons IPE, filling in with concrete.
- Supplying and lying down of stone to restore the ground dimensions. Making of doorway, of steps and ramp for exterior access, restoring stone the same. Shining, etc.
- Concern all areas reserved to the public, apart from sanitary.
- Supply and laying of grey tiles 20x20 for sanitary, for lab, reserve and storage, first aid. Decorating of the walls will be the same, 1.40m in height, and work surface.
- Work surface in concrete, including supports in mab.

- Smoke duets and ventilation of 40x20 in heat resistant cement. Stack of ventilation. Fumes extracting equipment's.
- Lime mortar coatings in all interior compartments.
- All exterior carpenters sealing.
- Supply and installation of suspended ceiling plasterboard in all rooms.
- Making of girdles in staff to air and ventilate.
- Gutters.
- Export of rubble, cleaning of the site.

2. Lot N°2 - Carpentry:

- All the carpentry will be delivered pre-painted.
- Supply and installation of block exotic wooden doors 40mm thick. Dormant frame included and sealing clay. To be painted. Handle lock in chromed cane. Bolts for bathroom doors, mixed locks in offices, approx. 0.93x2.04m.
- Joint covers.
- Supply and installation of plinth in exotic wood to be painted, in all rooms. 0.20m high.
- Supply and installation of the cupboard doors framed in exotic wood, exterior side coated in exotic wood. Chrome lock. Two leafed door.
- Supply and installation of a reception desk made of framework 22mm thick, 0.80m wide bench, coated with sanded glass. Vertical separation of service side, cash register....

3. Lot N°3 - Metal work:

All the metal pieces will be delivered in the finishing stages treated with anti erosion paint.

- Supply and installation of steel door 0.93x2.10 for the staff accesses.
- Supply and installations of several openings of aluminium extrude, in dark brown. Al water-tightness, security locks. Supply and installation of burglar proof glass, double-glazed.
- Supply and installation for steel entrance door, with burglarproof glass, doubled glazed.

4. Lot N°4 - Painting:

- Protection of all floors and stone walls.
- On wooden doors, plinths, and cupboard faces: Two coats of glycerophtalique paint on new carpentry including all preparations.
- On fake ceilings two coats of glycerophtalique paint.
- On metal works two coats of anti-rust fireproof paint .
- All interior walls are lime, unpainted.
- Signposts in the public toilets, and on each office door.
- Mirrors, brush carpets...

5. Lot n°5 - Mosaics:

- Supply and installation of mosaics in outer walls.

6. Lot N°6 - Plumbing / heating / air conditioning:

All ducts, pipes, etc ... to be buried in the floor, or hidden in compartments.

- Supply and installation of all sanitary, heating, air conditioning fittings.
- All connections, distributions.

7. Lot n°7 - Electricity, television, telephone networks:

- Supply and installation for all necessary circuits.
- All connections and distribution

8. Lot n°8 - Green areas and outdoor areas:

- Supply and installation of trees (olive trees, local pepper trees, etc.), staking, excavation on 2.50x2.50mm, 1.00m depth.
- Supply and installation for watering.
- Maintenance for two years
- Realisation of passive concrete path, with stone borders. Slope, benches....

9. Lot n°9 - The covered way in the Visitors' centre

Description

The covered path of the visitor centre reproduces the Bedouin's tent concept adopting the double inverse curving principle; already used for traditional tents. The main frame is composed with two oblique V masts using tube of Ø88.9x3.2 above the path. They carry on their common head the membrane witch is stretched on each side by lateral small mast shore up with shrouds. Membrane's sides between two frames are composed with garland-made cables. Their ends are bolted and fastened in a plate for the membrane end. Turnbuckles allow adjustments. The membrane is PES/PVC of type 2, alike the covering membrane of the churches. Its colour can be either black dominant (winter colour) or sand dominant (summer colour). The structure erection can be proceeded directly on the floor using light lifting devices, and even by hand (with hoist and specific hoist-frames). The membrane is hoist by hand on the frames, fasten on the anchoring points and then stretched until taking its shape.

The yearly maintenance (action on turnbuckle) is absolutely essential in order to ensure a life span of over 20 years.