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**ORGANISATION DES NATIONS UNIES
POUR L'EDUCATION, LA SCIENCE ET LA CULTURE**

CONVENTION CONCERNING THE PROTECTION OF THE WORLD CULTURAL AND NATURAL HERITAGE

CONVENTION CONCERNANT LA PROTECTION DU PATRIMOINE MONDIAL, CULTUREL ET NATUREL

WORLD HERITAGE COMMITTEE / COMITE DU PATRIMOINE MONDIAL

Thirty-seventh session / Trente-septième session

**Phnom Penh, Cambodia / Phnom Penh, Cambodge
16-27 June 2013 / 16-27 juin 2013**

Item 7 of the Provisional Agenda: State of conservation of properties inscribed on the World Heritage List and/or on the List of World Heritage in Danger.

Point 7 de l'Ordre du jour provisoire: Etat de conservation de biens inscrits sur la Liste du patrimoine mondial et/ou sur la Liste du patrimoine mondial en péril

MISSION REPORT / RAPPORT DE MISSION

**Abu Mena (Egypt) (C 90)
Abou Mena (Egypte) (C 90)**

18-23 November 2012 / 18-23 novembre 2012

This mission report should be read in conjunction with Document:
Ce rapport de mission doit être lu conjointement avec le document suivant :

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United Nations
Educational, Scientific and
Cultural Organization

World Heritage
Convention

International Council on
Monuments and Sites

Conseil International
des Monuments et des Sites

REPORT ON THE JOINT WORLD HERITAGE CENTRE / ICOMOS REACTIVE MONITORING MISSION TO THE WORLD HERITAGE SITE OF ABU MENA, EGYPT

18 – 23 NOVEMBER 2012

ACKNOWLEDGEMENTS

The mission would like to express its sincerest appreciation to H.E. Prof. Dr. Mohamed Ibrahim Ali Sayed, Minister of State for Antiquities, and to Dr Osama Moustafa Elnahas, General Director of the Department of Repatriation of Antiquities and International Organizations, for welcoming the members of the team. They also thank Mr Hassan Hammad, manager of the property, for his availability and contribution.

The mission would like to thank the Mar Mina Community, Bishop Mina, Fr. Taddaeus Ava Mena, Fr. Epiphanya Ava Mena, for their warm hospitality and express its congratulations for the Community's high commitment to the World Heritage site and its preservation.

The mission also wishes to thank Ms Ghada Gholam, acting Director, and Culture specialist Ms Tamar Teneishvili, from the UNESCO Cairo Office for facilitating all logistical aspects and arrangements under the special conditions dominant in the country at the time of the mission.

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EXECUTIVE SUMMARY AND RECOMMENDATIONS

Following the inscription of Abu Mena on the List of World Heritage in Danger in 2001, the World Heritage Committee has been monitoring its state of conservation and dispatched missions to the property. In 2012 the World Heritage Centre became aware of conservation/reconstruction activities underway at the main basilica, which appeared not to conform to internationally agreed standards for such works on World Heritage properties. As a result of this knowledge, the World Heritage Committee, at its 36th session (Saint-Petersburg, 2012), adopted Decision 36 COM 7A.20 by which it requested a new reactive monitoring mission to the property. The joint World Heritage Centre/ ICOMOS mission took place from 18 to 23 November 2012.

Abu Mena was inscribed at an early stage in the history of the World Heritage List when the requirements for a successful nomination were less well defined. No boundary to the site was definitively recorded and no buffer zone established, and no management or conservation plan was designed or implemented.

The site was inscribed under criterion (iv) for its architectural worth, and although acknowledged in the 1979 nomination documentation as a centre for pilgrimage in antiquity, its current role as a major centre of modern pilgrimage is not part of the justification for inscription.

The area included in the original nomination as defined on the map submitted to the World Heritage Centre, appears to have little relevance when compared to the archaeological remains.

With the implementation of a land reclamation/irrigation project in the 1980's the groundwater level on the property began to rise to a point where the property was saturated with lower areas and depressions permanently under water. This led to the suspension of archaeological excavation after the backfilling of deep excavations to protect the exposed archaeology.

As a result of this problem, the property was in 2001 placed on the List of World Heritage in Danger.

A de-watering project was proposed and after a number of modifications to the agreed methodology the first phase was implemented. The second and third phases of the project were however abandoned as the underlying methodology of electrical pumping was seen to be unsustainable in the long term. It is now proposed that the abandoned future phases of the project are replaced by a project of modifying the irrigation methodology used adjacent to the property to one using a "drip" method, therefore reducing the underlying problem and eliminating the root problem.

Although the water problem, at least in the central area, is now under control, the property remains on the List of World Heritage in Danger as to date there has been no tangible advance in the other problem areas noted by the previous missions and in completing the corrective measures.

- Revision of the boundaries and establishment of a buffer zone;
- Archaeological survey of the site;
- Conservation condition survey of the site;
- Management plan;
- Conservation plan.

Given the current political and economic situation in Egypt at present, it is the aim here to advise on conservation methodologies and treatments, appropriate to a World Heritage property which are realistically achievable, given the level of resource currently available.

The main recommendations are the following:

Boundaries

The current boundary clearly has no relationship to the ancient city or its environs. The need for a thorough archaeological survey is critical to determine the extent of the site following which the State Party is recommended to submit a request for boundary modification, including a buffer zone, so as to reflect adequately the Outstanding Universal Value of the property.

Security

There is at present no marked boundary for the World Heritage Property and roads and tracks criss-cross and approximately follow the interior extent of the agricultural ditch. If the boundaries of the World Heritage property were moved to the inner bank of the agricultural ditch, the ditch would form a natural barrier with only a limited number of crossing points which could be much easily monitored.

Construction on the Property

There needs to be a moratorium on all construction in both the property and the so called buffer zone i.e. the entire area enclosed by the agricultural drainage ditch. An inventory of all structures deemed historically significant needs to be made and a programme for their removal, renovation or reuse developed. All structures constructed since inscription should also be separately inventoried and a plan developed for their gradual removal as they become redundant or abandoned.

Within this context must be viewed the collection of structures that have grown up around and on the on main basilica, including the church over the altar and the pilgrims rest house. These permanent structures, tents and container cabins need to be removed, with the exception of the church and rest house as soon as possible.

The need for the site to be used as a major centre of pilgrimage in addition to it being an archaeological site of huge architectural importance needs to be acknowledged if further unwise projects, proposed in the name of conservation are to be avoided.

Flooding of the remainder of the property

Drainage of the water in the area previously flooded and now drying has resulted in the re-deposition of subterranean soluble salts at the ground surface with devastating results. The salt problem at Abu Mena is by far the most pressing problem affecting the site. It would be very unwise to risk further destruction of exposed archaeological material by draining further areas of the site before methods for mitigating the negative effects of drainage have been determined and the resources for their implementation secured. Exposed archaeological features in the flooded area are however at risk and the most cost effective method of eliminating this problem is by reburying the exposed structures. There are well tested methodologies for reburial of excavated material designed to both protect the remains and eliminate any future confusion as to what is original and what is later addition when the area is re-excavated. A specific reburial methodology should be developed and implemented wherever it is used in order to further aid interpretation in the future.

Previously Flooded Areas

The area and structures enclosed by the pump line are now dry or drying. This has resulted in a large deposition of soluble salts from the sub soil onto the surface and the exposed archaeology. This is an extremely serious problem, which needs immediate attention. A conservation condition survey needs to be carried out immediately to establish the level of damage and rate of deterioration of the constituent parts of the various exposed structures within the drained area. Once the survey data is collected it needs to be examined to establish a prioritized treatment programme for the exposed remains.

The Reconstruction project at the Great Basilica

The methodology of the reconstruction project at the main basilica site, which prompted the current mission, is completely inappropriate for any excavated archaeological structure, let alone an archaeological site inscribed on the World Heritage List for its architectural value. The work was being undertaken in the name of anastylosis, a much misunderstood reconstruction method, which is now only used only in very limited circumstances and under strict control. Anastylosis does not, except in the most exceptional of cases involve the demolition and rebuilding of remaining in-situ original structures. The only anastylosis work that might possibly be considered at Abu Mena would be the re-erecting of some of the marble columns. From a pragmatic conservation view, given the current standards for the conservation of archaeological sites, no reconstruction should be considered, just conservation of existing materials.

Visitor Management

It is crucial to consider Abu Mena as a pilgrimage centre on an archaeological site when planning future conservation and display strategies.

1. BACKGROUND TO THE MISSION

1.1 Criteria and World Heritage values

The ancient city of Abu Mena was inscribed on the World Heritage List in 1979 under criterion (iv):

2. to be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;"

The original justification for inclusion in the World Heritage List outlines the development of the site as a place of pilgrimage in the late classical period and how -

"Rich donations from several patriarchs in Alexandria and emperors from Byzantium contributed to make of the place a very flourishing city."

The justification goes on to state that-

"No other place in Egypt has such a vast and fine collection of marble sculpture in general of the highest quality manufactured in Alexandrian workshops. In the same time the early Christian architecture in Abu Mina, even in its ruined state, gives an excellent idea of the architecture of that time ~ which unfortunately is [now] *covered completely by the modern town* [of Alexandria]*. "*

"it is the unique artistic character, of Abu Mena as the place where truely Egyptian architecture of the Christian period meets with the architecture of Europe and Asia Minor that makes it outstanding."

In short the city of Abu Mena was inscribed on the World Heritage List for its architecture, standing even in its ruined state as a unique example of early Christian architecture when the Egyptian culture had its closest association with Europe.

Within the framework of the second cycle of Periodic Reporting for the Arab States, the World Heritage Committee requested all States Parties to draft Retrospective Statements of Outstanding Universal Value for those sites which were inscribed without such a statement. Egypt prepared a statement which was revised accordingly by ICOMOS and then returned back for final approval. Should this approval be notified to the World Heritage Centre in due time, the statement would be presented for approval to the World Heritage Committee at its 37th session in 2013. The draft is as follows:

Brief Synthesis

Abu Mena is located south of Alexandria, between Wadi el-Natrun and Alexandria itself. It represents the development of an early Christian pilgrimage centre from the 5th to the 7th centuries AD. Growing up around the tomb of Saint Menas, which was thought to cause miracles, the ancient pilgrimage centre developed into an unparalleled, sprawling complex of early Christian monastic architecture. The archaeological site shows the remains of a large ecclesiastical complex built which encompasses an area 183 ha, at its centre a baptistery and two churches and located, along with the Tomb church with the cave of the Saint and the cruciform shaped pilgrim's church form one large architectural complex. Two other churches are situated in the northern and eastern neighbourhoods. The so-called Eastern Church represents the spiritual centre of the monastic settlement in the area. Besides these churches, several public buildings serve as pilgrims' rest

houses. Two public baths, several workshops and cisterns are to be found at the site as well as the remains of the civil settlement around the ecclesiastical buildings. These buildings were constructed with ashlar masonry of limestone set in lime mortar, the columns were usually made of marble and evidence exists of mosaic decoration. Simpler buildings were erected using mud bricks covered with a fine lime plaster.

The site was important in attracting Christian pilgrims in antiquity and represents a mixture of religious, funerary and living architecture. In addition to the remains in situ, papyrus and ostraca found at the site are exhibited in several museums around the world. The role of the site as a pilgrimage centre is still strong and an energetic monastic community still inhabits the area, and relics thought to confer blessing are still stored within its confines. The site has retained its significance for the Coptic community intact for over fifteen centuries.

Justification for Criteria (1977)

Criterion (iv):

The architectural elements of the sprawling pilgrimage centre of Abu Mena are important examples of early Christian architecture and practices, particularly of pilgrimage, and express the articulation of traditional Egyptian architecture with various other styles from the Mediterranean basin and beyond.

Integrity (2011)

The remains of the Abu Mena archaeological structures that express its Outstanding Universal Value are present within the property. However, the conditions of integrity of the fabric are extremely vulnerable due its fragile state of conservation derived from deterioration processes, in particular an increase rising of the water table which might, if uncontrolled, erode its character.

Authenticity (2011)

The attributes that sustain the Outstanding Universal Value of the property are the overall design of the monastery and its buildings. The site of Abu Mena preserves the original layout of an early Christian pilgrimage centre in the Mediterranean basic, complete with various sized basilicas, bathhouses, hostels and eateries for visiting pilgrims, and a baptismal font with a separate entrance and exit, indicating the large amounts of people the complex was able to service at its height.

Although complete historical structures are few, the lower portions, ground plans, and some vertical elements remain. The authenticity of these attributes is vulnerable due to incorrect conservation practices and development of the culture's lands allocated to the Egyptian youth and which is situated next to the monastery.

Requirements for protection and management (2011)

The protection of the inscribed property is ensured by the Antiquities Law of 2010. Since its inscription on the World Heritage List in 1979, the site has become a national heritage park which dictates strict measures for protection.

The archaeological site is the property of the Egyptian State and is managed by the Supreme Council of Antiquities (SCA), the branch of the Egyptian Ministry of Culture responsible for the conservation, protection, and regulation of all antiquities and archaeological excavations in Egypt. Abu Mena comes within the control and management of the Islamic and Coptic Sector of the SCA. The neighbouring Saint Mina Monastery is consulted informally on management aspects of the archaeological site, and is financing the construction of the substantial perimeter wall round the protected archaeological site and its buffer zone.

Moreover, the entire site and surrounding lands have been under the protective purview of the very careful Abu Mena monastic community for centuries that assure a great measure of security around the archaeological vestiges.

To address factors that threaten the property, efforts continue in managing the effects of rising groundwater tables and plans for continued maintenance efforts are underway. A final Management Plan is in the process of being completed to ensure the systematic and comprehensive conservation and management of the property.

1.2 Examination of the State of Conservation by the World Heritage Committee and its Bureau

In 1988 a large land reclamation/irrigation project was put into operation in the region surrounding Abu Mena. The irrigation project led to a dramatic rise in the groundwater level. Previously recorded at levels between 26-30 metres below ground surface, the level rose to just below ground level, with low lying areas becoming flooded and areas of standing water becoming permanent features

As a result of the effects of the flooding on the future preservation prospects of the sites in 2001 at the 25th session of the World Heritage Committee (Helsinki, Finland), Abu Mena was inscribed on the List of World Heritage in Danger.

Following this inscription, in 2002 a World Heritage Centre mission was undertaken to assess water related damage and adverse effects on monuments at Abu Mena. This mission concurred with previous observations that the water problems at Abu Mena were severe and that the main – and only – cause of the problem resulted from intense irrigation of the surrounding area. The mission observed that when the large scale irrigation project had been constructed a protective agricultural drainage channel system was constructed around Abu Mena to protect the area from flooding. The mission went on to observe that the drainage channel failed to fulfil its planned purpose, presumably because of an unexpected subsurface flow pattern negating its effect.

At this time a drainage project, designed to be the first phase of three, was being prepared to protect the central excavation area, forty hectares by lowering the water table to 6 metres below mean ground level. Phase two aimed to deepen the effect of phase on and phase three aimed to construct a combined drainage and pumping system along the perimeter of the area enclosed by the original protective agricultural drainage channel.

The 2002 report went on to say that the cost of both implementation and future operation of these systems may prove prohibitive and that a more passive solution should be considered. This thought was further reiterated in 2003 when the World Heritage Committee made the following recommendations in Decision 27COM 7A.18. -

“Stresses, however, that engineering solutions to the groundwater problems might prove not cost-effective and sustainable if the source of the problem is not addressed in a comprehensive and co-ordination effort;

Recommends to the State Party to halt the on-going engineering interventions and review Phases II and III of the project, taking into account the recommendations of the World Heritage Centre expert;”

In 2005 a joint World Heritage Centre / ICOMOS reactive monitoring mission was undertaken. The report of this mission touches on the case for removal of Abu Mena from the World Heritage List, most notable according to paragraph 192/a of the Operational Guidelines:

Where the property has deteriorated to the extent that it has lost those characteristics, which determined its inclusion on the World heritage List.

The report concludes that the characteristics for which Abu Mina was originally inscribed had not been lost.

The 2005 report elaborates on the 2002 report and further investigates the hydrology of the site and the suitability of the proposed former phase one flooding mitigation project of which it is complimentary and supportive. The report also emphasises the need for a full archaeological survey of the property prior to commencement of the project, the need for a conservation condition survey of the exposed remains and the development of a conservation plan as part of an overall management plan. Following the mission, the World Heritage Committee adopted, at its 31st session (2007), a series of measures which the State Party was to undertake in order to reduce the threats to the property:

a) Carry out a rapid condition survey of all excavated remains and urgent conservation measures in order to provide protection to structures against earth trembling and other forms of damage likely to result from the use of heavy earth-moving equipment;
b) Lower the water table by means of drainage ditches and pipes, inside and around the archaeological area;
c) Establish an efficient system for monitoring the water table in the archaeological site and in the surrounding zones;
d) Prepare a conservation plan, defining short-, medium-, and long-term objectives and establishing technical parameters (materials, techniques, etc);
e) Undertake consultations with stakeholders with the objective of preparing a management plan, to include research, presentation and interpretation, the role of stakeholders (e.g. the Mar Mena community), staffing, sponsorship, visitor facilities, access, etc.

The Committee also adopted the following benchmarks as the Desired state of conservation for the property:

a) Consolidated structures;
b) Water table lowered and monitoring system established in and around the property;
c) Management plan implemented.

In 2009 the same team who carried out the 2005 mission undertook a further reactive monitoring mission. This mission found that the groundwater lowering project formally described as phase one had been fully implemented and had significantly lowered the ground water level in the area around the archaeological remains that surrounding and including the Great Basilica. The mission also discovered that little progress had been made towards implementing any archaeological or conservation condition survey had been made and that both management and conservation plans were still very much in an early planning stage.

1.3 Justification of the mission

In 2012 the World Heritage Centre became aware of conservation/reconstruction activities underway at the main basilica, which did not conform to internationally agreed standards for such works on World Heritage properties. As a result of this knowledge, the World Heritage Committee, at its 36th session (Saint-Petersburg, 2012), adopted the following decision 36 COM 7A.20:

The World Heritage Committee,

1. Having examined Document WHC-12/36.COM/7A.Add,

2. Recalling Decision **35 COM 7A.19**, adopted at its 35th session (UNESCO, 2011),

3. Regrets that the State Party did not submit a report as requested and expresses its concern about the lack of information on the state of conservation of the property;

4. Urges the State Party to take all necessary steps to implement the corrective measures adopted at its 31st session in 2007;

5. Requests the State Party to submit a revised timeframe, previously announced for 2010, to complete the corrective measures so as to attain the Desired State of conservation of the property adopted at its 31st session in 2007;

6. Reiterates its request to the State Party to identify a buffer zone surrounding the property, together with regulatory measures for protection and to submit to the World Heritage Centre by **1 December 2012** the relevant information and map for consideration by the World Heritage Committee at its 37th session in 2013;

7. Also requests the State Party to submit, in accordance to Paragraph 172 of the Operational Guidelines, the technical specifications for proposed interventions projects, for review prior to implementation;

8. Reiterates its invitation to the State Party to submit a request for International Assistance to the World Heritage Fund to support the preparation of the requested conservation and Management Plans and to provide a basis for shaping and articulating priority needs;

9. Further requests the State Party to invite a joint World Heritage Centre/ICOMOS reactive monitoring mission to assess the state of conservation of the property prior to the 37th session of the World Heritage Committee;

10. Requests finally the State Party to submit, by **1 February 2013**, a detailed progress report on the implementation of the above, for examination by the World Heritage Committee at its 37th session in 2013;

11. **Decides to retain Abu Mena (Egypt) on the List of World Heritage in Danger.**

Following the decision of the World Heritage Committee, the current mission was organised in liaison between the State Party, the World Heritage Centre and ICOMOS, with the support of the UNESCO Cairo Office. The terms of reference for the mission were as follows:

- An indication of threats or significant improvement in the conservation of the property since the last report to the World Heritage Committee,
- Any follow-up to previous decisions of the World Heritage Committee on the state of conservation of the property,
- Information on any threat or damage to or loss of Outstanding Universal Value, including the conditions of integrity and authenticity for which the property was inscribed on the World Heritage List.

2. NATIONAL POLICY FOR THE PRESERVATION AND MANAGEMENT OF THE WORLD HERITAGE PROPERTY

2.1 Protected area legislation

The protection of the property is ensured by the Antiquities Law of 2010. Since its inscription on the World Heritage List in 1979, the site has become a national heritage park which dictates strict measures for protection.

2.2 Institutional framework and Management structure

The archaeological site is the property of the Egyptian State and is managed by the Ministry of Antiquities (formerly Supreme Council of Antiquities) responsible for the conservation, protection, and regulation of all antiquities and archaeological excavations in Egypt. Abu Mena comes within the control and management of the Islamic and Coptic Sector of the Ministry. Moreover, the entire site and surrounding lands have been under the protective purview of the Saint Mina monastic community for centuries that ensures care and security around the archaeological remains.

Early 2013, the Egyptian authorities established a National Committee for World Heritage sites management, through Ministerial Decree 19. It is expected that the Committee will define and enforce, through participatory processes, diverse strategies to ensure effective management systems for World Heritage sites in Egypt. In addition, it is expected that GIS will be utilised for the archaeological surveying of all sites to process geographic data and produce integrated maps that will be readily available to all stakeholders.

3. IDENTIFICATION OF ISSUES AND ASSESSMENT OF THE STATE OF CONSERVATION OF THE PROPERTY

Since the last mission to the property in 2009, Egypt has and still is undergoing dramatic political change almost unrivalled in living memory. For this reason it is understandable that little progress has been made at Abu Mina. It is however extremely commendable to all those involved with the running of the site to see that the pumps have been running continuously since their installation.

The groundwater level in the central archaeological area remains well below the bottoms of all the excavated archaeological features and this problem in this area appears to be very much under control.

There are however numerous other issues that raise concern. Some of these are longstanding other result directly from the flooding and subsequent draining of the area and some result from conservation measures employed at the site. These are:

- The security of the property;
- The proliferation of construction on the property;
- The flooding of the remainder of the property;
- The effect of drying of areas previously flooded;
- The reconstruction project at the Great Basilica;
- Visitor Facilities;
- The lack of an archaeological survey;
- The lack of a conservation survey;
- The lack of a management plan;
- The lack of a conservation plan.

The archaeological survey, conservation plan, management plan, monitoring system and state of consolidation of the structures all relate to the Corrective Measures and Desired State of Conservation

3.1 The delineation of the World Heritage property

The official published position of the property at Abu Mena is N30 51 0 E29 40 0. This position lies just north of the area enclosed by the surrounding agricultural drainage ditch on the road between the new monastery complex and the ditch itself (Figure 1). The property lies south of the N30 51 0 E29 40 0 position to the south of the agricultural drainage ditch.

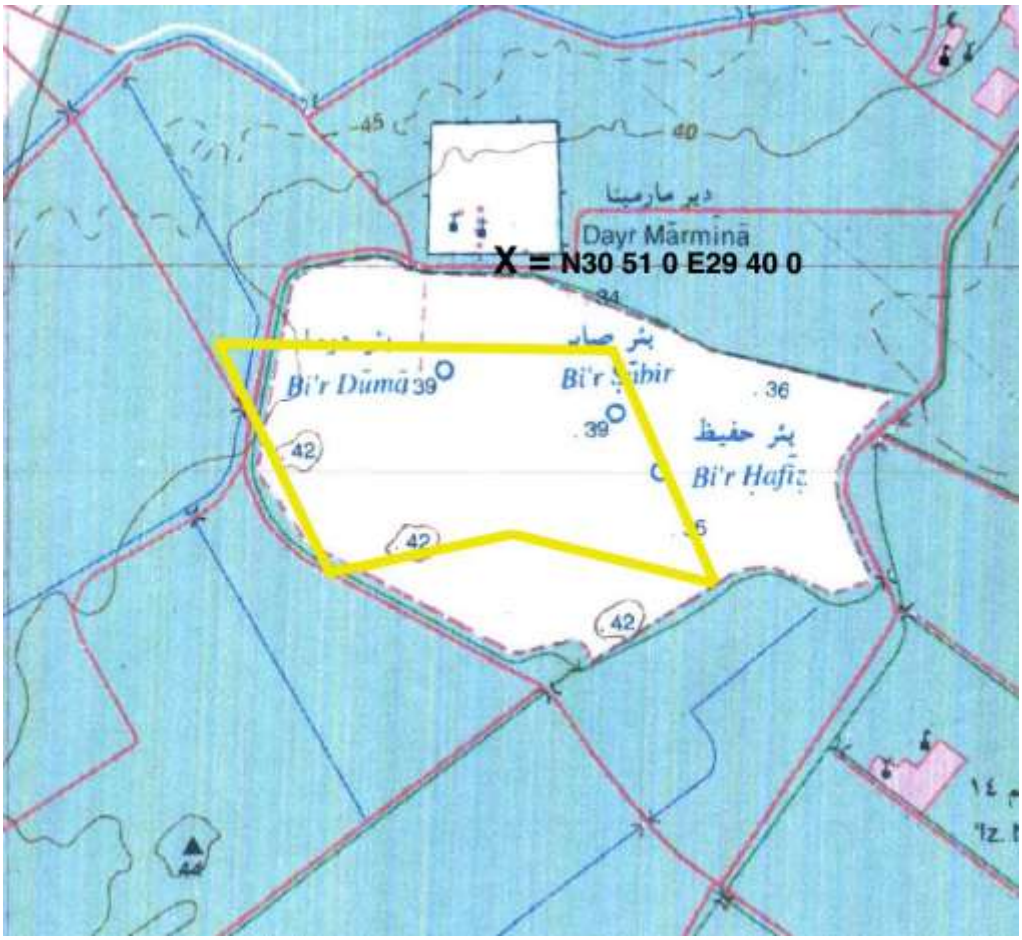

Figure 1. Published property boundary (enhanced from original)

When the published map of the boundary is superimposed onto a satellite image at the same scale, it is clear that the boundary of the World Heritage property refers more to the modern land distribution pattern than to the extent of the archaeology. A large section of the property lies outside the area enclosed by the agricultural drainage ditch on land that is now under cultivation and not subject to any kind of governmental control. It may well be that the original boundary choice reflects the parcel of land, which at the time of nomination was in public ownership (1959 official decree) and not to the position of the archaeological remains (Figure 2). On the site there is no indication of where the property boundary is located and it is near impossible, once within the enclosed area to know where the boundary is located.

Figure 2. Published World Heritage property boundary overlaid on satellite image

The hypothesis that the current boundaries of the World Heritage property do not refer to the archaeological remains is further supported when the area formally described as the central archaeological region, as designated by the area now enclosed by the groundwater lowering pump line is superimposed over the boundary map, when it can be seen that a

portion of the central archaeological region is actually located outside the current boundary of the World Heritage property (Figure 3) and that located north of the pump line, outside the current boundary there are significant excavated archaeological structures. (Figure 4).

Figure 3. Central archaeological areas enclosed by pump line road (Violet)

Figure 4. Archaeological remains outside property boundary

The Buffer Zone of the World Heritage property

The Abu Mena World Heritage property has no designated buffer zone. Those who regularly work at the property refer to the area enclosed by the agricultural drainage ditch, but outside the property, as the buffer zone. As there are no markings of any kind to designate the boundary it is impossible to distinguish one from the other and therefore comment on the effectiveness of the buffer zone. With some of the property located outside the area enclosed by the agricultural ditch, the area described as a buffer zone does not surround the property.

3.2 Security at the World Heritage property

The World Heritage property is not permanently staffed or patrolled. The surrounding agricultural drainage ditch has crossing points around is circumference and unrestricted vehicular access is available at all times. There is evidence of vehicles accessing all areas of the zone within the agricultural ditch and it would appear that an area adjacent to the northern most drainage channel is being used as a dumping ground for construction waste. (Figure 5)

Figure 5 Construction waste dump

The construction dump is located close to the boundary of the property, but it is not possible to determine if it is located on the property or in the area referred to as the buffer zone.

3.3 The proliferation of construction on the property

There has since 2009 been a proliferation of the erection of structures at the site.

Adjacent to the main Basilica at the culmination of the illuminated road, which was built for accessing the dewatering pumps and service buildings (Figure 6), a flat area has been developed. In this area, in addition to the wooden church built over the altar of the main Basilica, there is now a large pilgrims rest building and several other structures of varying degrees of permanence (Figure 7).

Figure 6. Illuminated access road leading to main basilica and one of several dewatering pump service buildings located along its length

Figure 7. Construction of structures at the main basilica

There is also a proliferation of building in both the ‘buffer zone’ areas and in the property: Figures 8 & 9.

Figure 8. Buildings adjacent to the property

Figure 9. Approximate position of new structures in relation to the property

3.4 Flooding of the remainder of the property

While the area enclosed by and adjacent to the pump line is now drained, the area east of the west end of the collection drains remains flooded. The groundwater level is clearly close to the surface and in depressions standing water still occurs (Figure 10).

Flooding still affects approximately twenty-five percent of the property and approximately thirty percent of the entire area enclosed by the agricultural drainage ditch.


Figure 10. Flooding of eastern end of the property

3.5 The effect of drying of areas previously flooded

For the past few decades the overriding problem at Abu Mena has been flooding. An extremely impressive drainage and pumping system has been installed to protect an area of the property surrounding the main basilica and associated archaeological structures. This system has had a profound effect on the groundwater level and it is now no longer possible to find standing water in any depression or excavated feature within the treated area.

The removal of water from the area has however led to the manifestation of other mechanisms of deterioration which are now having an extremely detrimental effect on the excavated archaeological structures.

When a structure is abandoned and no longer repaired it deteriorates until it reaches equilibrium with its environment. As the atmospheric environment is inherently unstable equilibrium is not normally reached until what remains of the structure has become buried. At this point the buffering effect of the burial matrix eliminates the unstable fluctuations of the atmosphere and deterioration slows to an almost undetectable rate as the buried material reaches equilibrium with the burial matrix. It is this effect that allows archaeological structures to survive buried for millennia.

On excavation the archaeological material is again exposed to the fluctuating atmospheric environment and again begins to deteriorate. Countering the effects of the fluctuating environment is the aim of conservation.

If the material composition of the burial matrix is altered during the burial period, again deterioration will accelerate until again equilibrium is achieved. Dramatic modification of a burial environment is very rare. Unfortunately this is exactly what has happened at Abu Mena. The once arid environment has been flooded and this has resulted in the manifestation of two mechanisms of decay that have never before been evident at the site.

1. the erosion of soils with the result of the creation of voids;
2. the dissolution and mobilisation of soluble salts within the burial matrix.

The erosion of soil has resulted in the creation of subsurface voids, which on removal of the water resulted in collapse of the surface. The erosion of the walls of cut features such as wells and shafts has resulted in the subsequent collapse of these walls at the time of drying (Figure 11).


Figure 11. Collapsed cut feature and collapsed subsurface void

The dry arid soil of Abu Mena contains a large proportion of soluble salts distributed throughout the depth of the soil. The relatively low average annual precipitation of 100–140 mm occurring in short-duration and high-intensity rainfall events would not result in deep penetration. The volume of soluble salts mobilized by these events would be a major cause of the gradual destruction of the exposed stone archaeological elements.

The flooding of the site would result in the mobilization through dissolution of all the soluble salts in the soil volume between the original ground water level (26 – 30 meters) and the new ground water level of 100 mm.

The existence of soluble salts is not in itself a cause of deterioration in porous materials. The problem comes when the salts crystallise out of solution as the material dries. Crystallisation occurs just below the surface and the resultant pressure caused by the formation of crystals causes the surface to be pulverised or to flake away. If the salts are then wetted they will again crystallise below the newly exposed surface and again this new surface will again be destroyed.

Crystallisation cycling does not occur only through wetting, but also occurs with fluctuating relative humidity. Each crystallised salt, or mixture of salts will absorb moisture directly from the atmosphere above a specific relative humidity. At this time the crystals will dissolve and become liquid, when the relative humidity drops again crystallisation will result. Relative humidity fluctuations can happen many times within a day with result that soluble salts can destroy stone artefacts even in areas where there is no rainfall. In arid areas salt crystallisation cycling is probably the most common deterioration process occurring.

At Abu Mena, as the ground water level fell as a result of pumping, the damp soil dried through evaporation from the ground surface. The result of evaporation was the transport of all the soluble salts in the wet ground being transported to the surface. In some areas of the site there is now a crust of salt over the ground surface and all the exposed stone is heavily contaminated and suffering badly from salt cycling deterioration (Figure 12).

A plant that looks like Golden Samphire (Limbarda Crithmoides) a perennial coastal species, which may be found growing on salt marsh or sea cliffs, was growing on the site, which indicates the level of salt contamination occurring.

Figure 12. Extremely aggressive soluble salt deterioration of building blocks

3.6 The reconstruction project at the Great Basilica

Between late 2010 and early 2011 a project of dismantling and rebuilding archaeological walls was undertaken at the Great Basilica. The reason for this work is unclear. It may have been a stand-alone project or the precursor to a larger project of replacement to act as a foundation for a new building or cover.

The project appears to have included the following actions (Figure 13):

- The complete dismantling of the walls with blocks being numbers as the demolition took place;
- Removal of all historic mortar and other original construction materials from the stone blocks;
- Discarding of blocks not deemed to be in “usable condition”;
- The rebuilding of the walls with modern mortar and new blocks to replace those discarded;

- The cutting back of the original face of the retained original blocks in order that they match the new material.

Original excavated wall

Dismantling an original wall

Determining new elevation for wall

Re-facing of original blocks to new elevation

Figure 13. Replacement wall. Retained original refaced blocks can be identified as slightly darker in colour. Presumably the new stone is from a different source to the original.

3.7 Visitor Facilities

Visitor facilities at the property are limited to those supplied by the modern monastery. The monastery caters to the needs of pilgrims and does so admirably. Pilgrims tend to visit only the main basilica and surrounding archaeological structures, where they also worship at the altar of the main basilica. Upwards of two hundred thousand people visit the site on Christian holy days and services are held for these pilgrims at the main basilica.

The pilgrim facilities consist of a moderately substantial wooden rest house located at the end of the pump house service road and a small wooden chapel built over the ancient altar of the main basilica. The structures are vernacular in design and are not part of any larger organised scheme for visitor management. These facilities are not sanctioned and cannot be thought of as anything more than temporary.

There is however a complete lack of any information on or near the property regarding its historical significance, its World Heritage status or descriptions, maps or signage on or near the site regarding either the individual structures or the site as a whole. Apart from the road that follows the pump line there are no established paths between archaeological assemblages or monuments. There are no boundary markers on the property.

3.8 Archaeological Survey

There has been no further progress on initiating a survey of the extent of the archaeology within the boundary of the property since the mission of 2009.

3.9 Conservation Condition Survey

There has been no further progress on initiating a conservation condition survey of the exposed archaeological structures at the property since the mission of 2009.

3.10 Management Planning

There has been no further progress on the creation of a management plan for the World Heritage Property since the mission of 2009.

3.11 Conservation Planning

Other than the reconstruction work (now halted) at the main basilica, there has been no progress on designing and/or testing conservation methodologies for their suitability as treatment options at the World Heritage property. There is no formalised conservation recording system at the property.

3. CONCLUSIONS AND RECOMMENDATIONS

The current mission revealed many more problems than previously noted in the reports of the previous missions, which concentrated on the groundwater issues. Further problems have also become manifest in the intervening period. Some of the problems noted result directly from previous interventions and treatments, most notably drying the area on reduction of the water table and the reconstruction project undertaken at the main basilica.

Although vulnerable, the Outstanding Universal Value, including integrity and authenticity, for which the property was inscribed on the World Heritage List has not been lost. The main stakeholders of the site, the Government and the Coptic community, have clearly demonstrated their commitment to the preservation of the site. The expertise needed to correctly care for the site is not available locally and international help is needed if they are to use the resources they have to hand to the best result.

The following are recommendations based on the mission team's experience on other, similar archaeological sites, experiencing the same type of destructive forces. Given the current political and economic situation in Egypt at present, it is the aim here to advise conservation methodologies and treatments, appropriate to a World Heritage property which is realistically achievable, given the level of resource currently available.

Boundaries of the property

The current boundary clearly has no relationship to the ancient city or its environs. One area of the current boundary lies outside the agricultural ditch designed to surround the site, the boundary is not marked and plays no role in the administration of the site.

The logical boundary of the World Heritage property is the area enclosed by the agricultural drainage ditch that rings the site, or a proportion of the area with one clearly defined boundary. To the west of the site there would appear to be archaeological remains up to the agricultural ditch on the north, west and south sides. The extent of archaeology to the east of the pump drainage weirs is hard to categorise but there is a least one basilica showing above ground. The need for an archaeological survey in this area is critical to determine the extent of the site and therefore the position of a boundary if the agricultural ditch is not deemed the correct location. Once this is accomplished, it is recommended to the State Party to submit a request for boundary modification to the World Heritage Committee to reflect adequately the Outstanding Universal Value of the property.

Buffer Zone

The current buffer zone does not exist, the peripheries of the area within the agricultural drainage ditch are vaguely called the buffer zone, but no one at the site has a clear idea of what is where. If the core area were changed to include all the area within the drainage

ditch a more suitable buffer zone could be described outside. The buffer zone need not disturb the current land usage of irrigated agriculture. There are undoubtedly archaeological remains outside the area enclosed by the agricultural ditch and although now waterlogged it still remains. A useful buffer zone would be one in which only shallow rooting crops are sown to protect the underlying archaeology and one where there introduction of low water drip irrigation is encouraged and prioritised.

Security

There is at present no marked boundary for the World Heritage Property and roads and tracks criss-cross and approximately follow the interior extent of the agricultural ditch. Vehicles and individuals have free access to the site at all times. A project of fence building has been initiated around the circumference of the site inside the agricultural ditch but this has run out of funds with only two stretch of the barrier being completed.

If the boundary of the World Heritage property were moved to the inner bank of the agricultural ditch, the ditch would form a natural barrier with only a limited number of crossing points which could be much easily monitored.

The modern monastery authorities wish to control the access of pilgrims onto the site in order to preserve the fragile remains of the main basilica and its associated structures, the only area the pilgrims visit. With this in mind the monastery has co-opted the access road built to access the pump control houses as an access route. Access for pilgrims is through the monastery and the aim is that pilgrims will visit the basilica in accompanied groups.

It is not unfeasible for non-worshiping tourists to be controlled in the same manner, with a separate visitor entrance at one of the other crossing points of the agricultural ditch.

The local community could run transportation across the site, necessary in the summer months, in order that they profit from the site and therefore have a vested interest in its preservation.

A very good example of this has been running at Aphrodisias in Turkey for many years. Visitors have to park at the visitor centre some distance from the site and board a tram like vehicle pulled by a tractor to access the core area of the site. The tram is not optional and walking to the site is forbidden. The tractors of the local community driven by their owners pull the tram. The tractor owners get paid for the work and anyone with a tractor is eligible for the work. As tractors are owned jointly by farming families the work and therefore the reward is distributed across the community.

Construction on the property

There needs to be a moratorium on all construction in both the core zone and the buffer zone i.e. the entire area enclosed by the agricultural drainage ditch.

An inventory of all structures deemed historically significant (possibly those present at the time of inscription) needs to be made and a programme for their removal, renovation or reuse (possibly as interpretation/visitor centres) developed.

All structures constructed since inscription should also be separately inventoried and a plan developed for their gradual removal as they become redundant or abandoned.

Within this context must be viewed the collection of structures that have grown up around and on the on main basilica, including the church over the altar and the pilgrims rest house. These permanent structures, tents and container cabins need to be removed, with the exception of the church and rest house as soon as possible.

In the literal context of the World Heritage inscription of Abu Mena as an architecturally important archaeological site, the church and rest house have no place. But in the reality of the main basilica being a place of pilgrimage with a constant stream of visitors and inundation of visitors on holy days provision for these visitors must be made as part of the management system..

The design of many previous conservation interventions has been based not entirely on the conservation needs of the archaeological remains but also on the needs of visitors. The pump line does not surround the entire World Heritage property and in fact encloses part of the area outside the property. The pump line encloses the main basilica and its associated buildings and the substantial, illuminated access road, built to maintain the pumps and associated plant buildings lead directly to the main basilica.

Here the discrepancy between the needs for sympathetic conservation of an archaeological site in a barren landscape and the need to get a large number of visitors to a specific location on that site are at odds. From a conservation point of view one would never conceive of building a road directly to the centre of an archaeological site. From a mass visitor management point of view that is exactly what one would do.

This dichotomy needs to be addressed. In the reality of the situation the road protects the site from the mass concentration of visitors to a single point and gets them to and from their destination and so enhances the preservation of the site. The wooden church is said to protect the ancient alter, which it does, but also gives a focal point for worship.

The problem is that with other factors influencing the design and implementation of conservation plans and treatment design, both the standard of the conservation and, in this case the specific visitor experience, suffer.

The need for the site to be used as a major centre of pilgrimage in addition to it being an archaeological site of huge architectural importance needs to be acknowledged in its management if further unwise projects, proposed in the name of conservation are to be avoided.

Flooding of the remainder of the property

As described earlier, there is a large proportion of the area enclosed by the agricultural drainage ditch that remains flooded. As also described earlier drainage of the water in the area previously flooded and now drying has resulted in the re-deposition of subterranean soluble salts at the ground surface with devastating results. The salt problem at Abu Mena is by far the most pressing problem affecting the site; the relentless salt crystallisation cycling is slowly destroying every expose archaeological structure.

It would be very unwise to risk further destruction of exposed archaeological material by draining further areas of the site before methods for mitigating the negative effects of drainage have been determined and the resources for their implementation secured.

The buried archaeological material will by now have reached equilibrium with the flooded burial context and there is therefore no reason to rush to drain this area as to do so will threaten rather than preserve the archaeology.

Exposed archaeological features in the flooded area are however at risk as salts in the ground water will continually deposit on their surface through capillary action as water continually rises to replace that which evaporates from the surfaces. The most cost effective method of eliminating this problem is by reburying the exposed structures so that the water evaporates from a surface above the archaeological material and the resultant salt deposition happens in the archaeologically inert burial material, not the archaeology.

There are well tested methodologies for reburial of excavated material designed to both protect the remains and eliminate any future confusion as to what is original and what is later addition when the area is re-excavated. A specific reburial methodology should be developed and implemented wherever it is used in order to further aid interpretation in the future.

Previously flooded areas

As mentioned above the area and structures enclosed by the pump line are now dry or drying. This has resulted in a large deposition of soluble salts from the sub soil onto the surface and the exposed archaeology. The salts are destroying the ancient building materials through crystallisation cycles that result from wetting and drying and fluctuating ambient relative humidity. This is an extremely serious problem, which needs immediate attention.

A conservation condition survey needs to be carried out immediately to establish the level of damage and rate of deterioration of the constituent parts of the various exposed structures within the drained area. Once the survey data is collected it needs to be examined to establish a prioritized treatment program for the exposed remains.

The treatment of salt contamination is extremely difficult, especially in a context such as Abu Mena. As the salts are removed from the building materials they are constantly replaced as more move up from the soil through capillary action as drying of the sub soil continues.

A possible suitable treatment option for the remains at Abu Mena is the use of applied sacrificial layers applied to the masonry surfaces. As long as the sacrificial layer has porosity higher than that of the substrate, crystallisation will occur in the applied layer preferentially to the original material. The applied layer can range from simple reburial, as recommended for the structures in the un-drained areas, to meticulously applied conservation mortars applied to individual blocks in more prestigious and visited structures.

A range of treatments needs to be developed and applied to the various groups of structures dependent on their priority as determined by the conservation survey. It is unfeasible to attempt to individually treat each block of each structure individually and equally unfeasible to bury the entire site. Therefore it is of utmost importance to consider the available conservation resources when planning for conservation interventions.

Applied sacrificial layers are designed to be destroyed and will require continual monitoring and maintenance, again this needs to be considered when matching the conservation planning to the available resources. Applied material that subsequently becomes detached due to salt crystallisation needs to be removed from the area as if it remains the salt it contains will return to the cycle.

It is often assumed that sheltering archaeological structures will reduce the effects of salt crystallisation cycles. Precipitation contributes very little to the problem and its elimination will have only nominal results. Humidity fluctuations under the cover can however be greatly increased and this in turn will seriously exasperate the problem.

As the soil moisture content stabilises over the next few years, the up rise of salts will diminish and the application of sacrificial layers can be reconsidered. The problem will never be eliminated and therefore long term planning of conservation maintenance needs to be established.

The Reconstruction project at the Great Basilica

The methodology of the reconstruction project at the main basilica site, which prompted the current mission, is completely inappropriate for any excavated archaeological structure, let alone an archaeological site inscribed on the World Heritage List for its unique architectural value.

The work was being undertaken in the name of anastylosis, a much misunderstood reconstruction method, which is now only used only in very limited circumstances and under strict control. Anastylosis is only viable in a limited number of circumstances most notably when the structure is constructed from solid stone blocks that are worked to fit together in a specific order, which can be determined by the tooling, shape and most importantly original fixing that categorically prove that one block was originally placed on top of another. Anastylosis does not, except in the most exceptional of cases involve the demolition and rebuilding of remaining in-situ original structures. Original walls are more than just a stack of stones, the original mortars that hold blocks together is of equal historical significance to that of the stones and it’s lose or replacement a serious loss of the authenticity of the archaeological structures.

Under no circumstance would an original stone be re-shaped or resurfaced to match the new material being added, in fact the new material would be purposefully altered to make sure it did not match the original material and therefore cause confusion.

Many examples of anastylosis at other World Heritage sites are cited in the PowerPoint presentation justifying the project, such as:

- Acropolis, Athens (1902 for Parthenon and Erechtheion, by Nikolas Balanos)
- Teotihuacán Pyramids, Mexico (1905 - 10 by Leopoldo Batres)
- Agrigento (Temple of Heracles), Italy
- Ancient Thebes with its Necropolis (Karnak Red Chapel), Egypt
- Angkor (1930's Banteay Srai), Cambodia
- Archaeological Site of Delphi (Treasury of Athens), Greece
- Borobudur Temple Compounds, Java , Indonesia (1907 - 11)
- Mỹ Son Sanctuary, Vietnam
- Olympia, Philippeion, Greece
- Djoser Funerary Complex and Step Pyramid, Saqqara, Egypt (1926 - 2001 by J.P. Lauer)
- Stonehenge, United Kingdom
- Odeion in Troy, Turkey

It needs to be noted that on most of these sites reconstruction occurred before the sites were inscribed on the World Heritage List and most the work was undertaken over a century ago. It is highly unlikely that any of these works would be considered suitable on heritage sites given the present attitude towards reconstruction.

Reconstruction works undertaken before the inscription of a site are deemed part of the sites previous history and are therefore retained. This is the case with Abu Mena where the previous restoration works undertaken by the German archaeologists remain. The retention of these previous reconstructions does not however mean that even this style of reconstruction can be continued.

The only anastylosis work that could possibly be considered at Abu Mena is the re-erecting of some of the marble columns. Due to the fracture characteristics of the marble and the distinct marking of the stone it is possible to determine which fragments go together and from the fixing holes, which column goes with which base. Any such project and the methodologies used must conform to internationally agreed conservation standards and be submitted to the World Heritage office in Paris. There are in existence historic records (photographs) of the columns in position (figure 14). These and other historic documentation should be used as part of the justification for the project.

Figure 14. Historic justification for column anastylosis project

The mission was shown a power point presentation about the site, which included justification for the reconstruction project. This included the following options:

1. No reconstruction; just conservation of existing materials
2. No reconstruction; just conservation of existing materials + shelter
3. Reconstruction of existing columns and stones
4. Reconstruction of existing columns and stones + shelter
5. Reconstruction of existing columns and stones + shelter + external walls
6. Reconstruction of existing elements + reconstruction of the missing structures with different materials
7. Reconstruction of existing elements + reconstruction of the missing structures with similar materials

From a pragmatic conservation view, given the current standards for the conservation of archaeological sites the answer is straightforward:

1. **No reconstruction; just conservation of existing materials.**

To enhance site interpretation for visitors the following could be added:

3. Reconstruction of existing columns [without stones]

A structure will in no way enhance the preservation of the site in the form presented.

The Power Point Proposal went on to offer two scenarios for restoration and the erection of a shelter (figure 15).

Possible Scenario 1:

Restoration of stone walls and marble columns + shelter with separate structure

Possible Scenario 2:
Restoration, anastylosis and reconstruction of existing stone walls and columns + reconstruction of roof using strengthened existing foundations

- To restore by anastylosis and rebuilding the three ruined major monuments, by:
  - Recording building blocks and architectural elements,
  - Reassembling fallen original parts, by replacing decayed fragments,
  - Incorporating new building materials for stability,
  - Strengthening the existing foundations or providing new foundations,
  - Identifying the new materials so that they will not be confused with the original materials.
- To carry out comparative analysis with similar historic examples pertaining to similar context and to the same era, and having the same construction system and building materials.

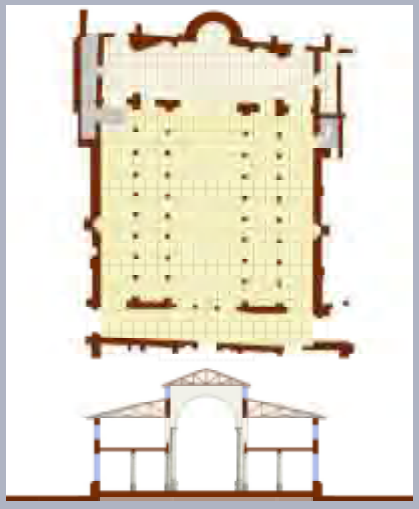

Figure 15 Proposed restoration and shelter options for main basilica

Clearly option two was chosen and it is the initial stage of this project, the rebuilding of the original walls, to a level where they can be included as part of a new building, that we are now seeing. The original walls have added integrity that makes them structurally sound and able to support the new building. Unfortunately the price for the structural improvement is the total loss of all authenticity or historic context.

Clearly conservation decisions have been made not solely on the conservation requirements of the site. There is no purely conservation justification to build a shelter over the main basilica, but there is reason to build a building to allow the control of mass visitation on a site of pilgrimage. By using conservation as the justification for building a visitor centre over the basilica both the conservation requirements and visitor requirements are being compromised.

The Proposed Design of the shelter building

As outlined above the design of the shelter building will probably not enhance the preservation of the site. There are however other buildings on archaeological sites that work well to both protect the archaeological remains within the enclosed structures and allow for large numbers of visitors to view the remains in comfort, while being informed about the site without causing any damage to the artefacts.

The National Trust of Great Britain has recently completed a shelter building over one range of the Chedworth Roman Villa site. The building covers remains of the building, which contain one of the finest sets of high status in-situ Roman mosaics in the United Kingdom. While Chedworth Roman Villa is not a World Heritage Site it is a United Kingdom Scheduled Roman Villa and as such is protected to the highest level under United Kingdom law for the protection of heritage. Every stage of the design, construction and conservation was scrutinised to the highest degree and the building conforms to all requirements. The building at Chedworth is constructed from engineered timber and is designed to sit on the original roman structure without attaching to it. The Roman walls were conserved and new, clearly visible additions were added to produce a level surface for the new building. The building contains a visitor interpretation centre along with walkways and viewing platforms. All the viewing platforms and walkways are suspended from the new building and none rest on the archaeological structures. The Chedworth building has computer controlled passive heating and cooling systems that constantly react to changing relative humidity and heat levels, automatically opening and closing vents and adding heat in response to real-time monitoring of the internal environment. Heat is supplied from ground source heat pumps and the building requires minimal electricity. The building can react to an influx of people by “seeing” the rise in temperature or relative humidity and reacting accordingly. The building reflects without mimicking the volume and position of the original Roman building and thus infancies the understanding of the site without misleading the visitor as to what is original or authentic (figure 16).

Figure 16. Cover Building, Chedworth Roman Villa, The National Trust, UK

Visitor Management and Visitor Facilities

Although inscribed solely under criterion (iv) for its architectural merit it is unrealistic for Abu Mena to be considered solely as an archaeological site in terms of the way it is managed. Pilgrims make up the large majority of visitors to the site, most of them with the aim of visiting firstly the modern monastery and then the main ancient basilica where they wish to worship at the ancient altar. The vast majority of visitors do not visit other areas of the site. **Abu Mena has to be considered as a pilgrimage centre on an archaeological site in terms of it management and when planning future conservation and display strategies.**

Visitor facilities have been discussed in various places above. Facilities for pilgrims are available at the modern monastery and it is the wish of the monastery to control access by pilgrims to the remains of the ancient main basilica, both casual visitation and the mass visitation of pilgrims on holy days. Facilities for those not visiting as pilgrims currently do not exist and the need for a visitor centre catering for these visitors is obvious. A visitor centre focusing on the historical, rather than religious significance of the site could be sited at a different to that through the modern monastery. . There are a number of old buildings on the site that date from the German excavations. One of these still contains equipment from these excavations and could be used as a site museum aimed at the historical and architectural history of the site rather than at its religious significance.

Archaeological Survey

As already stressed in the previous monitoring reports of 2002 and 2005, a full archaeological survey of the area enclosed by the agricultural drainage ditch is necessary if the real extent of the archaeological remains and by definition the extent of the World Heritage property is to be clearly defined.

Previous reports have suggested that the use of geophysical survey techniques should be employed. In reality it is unlikely that survey techniques involving magnetometers or electrical resistance meters would work on the site due to the large amounts of fallen building materials, the “noise” from which would obscure any meaningful results. Radar techniques would give a better result but are expensive and time consuming. The resolution of the result from radar is also questionable as it is normally used on a far smaller scale and would be too high a resolution for the initial survey of a large area. A simple “field walking “survey is all that is needed in the first instance. In this method a virtual grid is laid over the site and a person visits each square and notes the type and density of archaeological remains. The data is collated and conclusions as to the density and distribution of archaeological remains across the site can be made. There may be some useful information to be gained from obtaining high resolution commercial satellite imagery (much higher resolution than Google Earth) as especially that which records in spectra in addition to the visible can reveal archaeological remains otherwise not obvious.

A Geographic Information System (GIS) is an extremely useful tool in this and all other surveys required at the site and its establishment should be seriously considered.

Conservation Condition Survey

A conservation condition survey is a prerequisite for any conservation project. Without an initial close understanding of the condition of the material to be conserved it is impossible to correctly develop conservation treatments that truly address the problems occurring or assess their effectiveness.

The condition survey of large archaeological sites, which contain a large amount of exposed archaeology is extremely challenging and requires a strict methodology if it is to reveal and useful data.

On such methodology was developed by the author for the site of Chersonesos in Crimea, Ukraine. Chersonesos is very similar to Abu Mena as both are places of pilgrimage, archaeological sites, contain a large amount of exposed archaeology and are suffering from serious salt crystallisation damage of rough masonry walls.

An article explaining the development of the conservation condition survey method can be found in Appendix A.

Management Planning

As outlined above, the work required to secure the future of Abu Mena is extensive. Ongoing work and intervention will be required to maintain the site into the future. Resources are limited and if the future of the site is to be secured and then improved, a realistic, workable management plan is required. Conservation planning is a large part of the overall management plan and needs to be integrated into other aspects of management such as visitor management and site interpretation. There are numerous stakeholders at Abu Mena who all want to see the site preserved, but put different emphasis on different aspects of the presentation and usage of the site. The management plan needs to be compiled and implemented by representatives of all the interested parties working together in order that the limited resources can be used in the most productive way.

The management plan needs to be produced as the required emergency interventions are initiated. The deterioration is occurring at a fast speed and work needs to commence now, not after a management plan is gradually conceived.

5. Annexes

5.1 The mission

5.1.1 Terms of reference

As per Decision 36 COM 7A.20, the terms of reference for the mission were the following:

- An indication of threats or significant improvement in the conservation of the property since the last report to the World Heritage Committee,
- Any follow-up to previous decisions of the World Heritage Committee on the state of conservation of the property,
- Information on any threat or damage to or loss of Outstanding Universal Value for which the property was inscribed on the World Heritage List.

5.1.2 Composition of mission team and programme

The mission members consisted of Ms Veronique Dauge – Chief Arab States Unit on behalf of the World Heritage Centre and of Mr Christopher Cleere as ICOMOS expert.
They were accompanied in meetings and on the property by Ms Tamar Teneishvili, Culture programme officer at the UNESCO Cairo Office.

18 November:	Arrival in Cairo
19 November:	Meetings at the Ministry of Antiquities
20 November:	Departure for Abu Mena Meeting at the Mar Mena Monastery Visit of the property
21 November:	Visit of the property Return to Cairo
22 November:	Meeting at the UNESCO Office Meeting at the Ministry of Antiquities
23 November:	Departure

5.1.3 List of persons met

State Ministry of Antiquities

Mr Mohamed Ibrahim Ali Sayed, Minister of State
Mr Osama Moustafa Elnahas, Director of the Department of International Organisations and Focal point for World Heritage
Mr Mohamed Mohamed El Shekha, Chairman of Projects Sector
Mr Hassan Hammad, Director of the Inspectorate of Abu Mena and some of his staff

Mar Mina Community

Bishop Mina
Fr. Taddaeus Ava-Mina
Fr. Epiphanya Ava-Mina
Fr. Angelos Ava-Mina
Fr. Paphnotius Ava-Mina

Advisors (Consulting Firms / Architects / Engineers / Conservation specialists):

Prof. Dr. Mohamed Amer
Prof. Dr. Kamal Abu-al Hassan
Mr. Tharwat el-Shorbagi
Eng. Nazeih Younan
Eng. Gamal Sadik Ebaid
Eng. Ishak Fahmy
Dr Mourad Bakhoum
Dr Sami Sabri Shaker
Dr Adel El Menchawy
Eng. Mohsen Kamal
Eng. Raouf Annas
Eng. Nashat Georgi
Dr Hassan F. Imam
Dr Nabil Rofail
Dr Nazih Asaad Younan
Dr Fadel El-Komos
Dr Adel al-Menshawy
Dr Hany Hanna
Dr Dina Bakhoum

UNESCO Cairo Office

Ms Ghada Gholam, acting Director
Ms Tamara Teneishvili, Culture Programme Officer

5.2 Documentation

United Nations
Educational, Scientific and
Cultural Organization

World Heritage
Convention

International Council on
Monuments and Sites

Conseil International
des Monuments et des Sites

Report of
the joint ICOMOS-World Heritage Centre
Reactive Monitoring Mission to
ABU MENA (Egypt)
12–15 December 2009

Report of the joint ICOMOS-World Heritage Centre

Reactive Monitoring Mission

to ABU MENA (Egypt)

12–15 December 2009

Contents

6 ANNEXES

ACKNOWLEDGMENTS

The members of the mission are deeply grateful to the many members of the staff of the Supreme Council of Antiquities for their help and support during the mission, in both Cairo and Alexandria. Their special thanks go to Dr Gihane Zaki, who accompanied them throughout the mission and who answered every question that they raised.

They also greatly appreciated the friendly reception that they were given in Abu Mena, in particular by Bishop Mena and Abuna (Father) Taddeus.

This report benefited from the many discussions, both formal and informal, that the two visiting experts had with the local experts working in a range of disciplines on the Abu Mena project.

EXECUTIVE SUMMARY AND RECOMMENDATIONS

Executive Summary

The joint World Heritage Centre–ICOMOS mission went to Abu Mena at the request made by the World Heritage Committee at its 33rd Session in Seville (2009) "to assess progress in the implementation of all the corrective measures, to review the draft Statement of Outstanding Universal Value, to develop a proposal for the desired state of conservation for the removal of the property from the List of World Heritage in Danger, and to revise the timeframe for completing the corrective measures." The members of the mission, a water engineering expert and an archaeologist, had also undertaken a previous Reactive Monitoring mission to Abu Mena in 2005.

In the opinion of the mission, the State Party is to be congratulated on the progress that has been made with the implementation of the recommendations of the 2005 mission.

The World Heritage property and the contemporary Coptic Monastery of Mar Mena are indissolubly linked spiritually, since the archaeological site is a celebrated Coptic pilgrimage site. The Supreme Council of Antiquities (SCA) has worked closely with the Mar Mena Community in all the projects that have been initiated since 2006. It is essential that this should continue and become more formalized by equal representation on key groups such as the proposed planning group, the working group, and the eventual management group.

The SCA and the Mar Mena Community have set up working groups using national expert individuals and institutions. However, there are certain areas where international expertise is needed, and these have been identified. The State Party should explore these aspects of technological, scientific, and management expertise in association with the UNESCO World Heritage Centre and the Advisory Bodies, as well as individual national funding agencies and non-governmental organizations.

The property should remain on the List of World Heritage in Danger until the water management system and the management and conservation plans have been fully implemented and have been operating satisfactorily for at least two years.

Recommendations

A. Engineering aspects

A better knowledge of the hydrogeological aspects of the area has demonstrated the unlikelihood of the first project proposed in 2005 by the Ministry of Culture succeeding. The project consisted of a system of open draining canals, capable of lowering the water table and conveying the

drained water to centralized tanks, from where, by means of pumps, it could be removed from the site. It has been proved that the aquifer is contained in a semi-confined layer of sand in which the upper level is filled by the water moving upward vertically. When these considerations are taken into account, the open canals and subsurface pipes will affect only a very limited area. The efficiency of draining will be further decreased by the low permeability of the upper soil layer.

Because of these considerations, the Ministry of Culture appointed a team of selected experts to better examine the real situation of the site, promoting new data collection. A new project was developed, based on more suitable principles, and put immediately into operation. Advanced technologies have supported the development of the project, including mathematical models able to simulate the groundwater behaviour and evaluate the effects of the interventions.

The main characteristic of the new project consists of a vertical drainage, by means of a system of 170 pumping wells, located around the site and reaching a convenient depth in the aquifer. The wells are connected to subsurface pipes that convey the drained water into an open canal, which eventually discharges into the Mediterranean Sea.

The wells are equipped with a submersible pump and electrical motor supplied through a proper electrical network, with advanced control equipment.

The effect of the pumping wells is monitored by means of 40 observation wells located in the most significant points of the area.

The Ministry of Culture has appointed an Egyptian contractor in order to start the project implementation immediately. All the field works, begun in February 2006, are expected to be completed in June 2010. After completion the contractor will operate the existing facilities for one year.

In a parallel way, an intensive monitoring campaign has been developed. This will last several years and will involve collection of all the relevant meteorological and hydrogeological data to enable a detailed study to be made of the multidisciplinary aspects relevant to the area, in order to improve the working conditions of the project.

As a complementary measure, a suitable revision of the actual irrigation practices in the areas surrounding the Abu Mena site is recommended. The current watering procedure consists of use of ditches and furrows. This procedure requires a considerable amount of water, the largest portion of which is not beneficial to the crops and percolates through the upper soil layer, reaching the underground aquifer. Advanced research in the field of irrigation proposes watering procedures that involve using small quantities of water according to the growth stage of the crop. Using small quantities of water allows a better rational utilization of the available resources to take place.

B. Archaeological aspects

1. A complete **CONDITION SURVEY** of the entire inscribed site should be carried out without further delay. Serious consideration should be given to using this as the basis for an overall database for the site.

2. The **GEOPHYSICAL SURVEY** should be extended progressively to the entire site, including the buffer zone.

3. Work should begin on the **CONSERVATION PLAN**, using the specialist advice of experts, and programmes for regular monitoring and maintenance established, the resulting information being incorporated into the database (see 1. above).

4. Work should also be initiated on the preparation of the **MANAGEMENT PLAN**, using expert assistance from other institutions (national and international).

The following ***basic parameters*** must be established at the outset by a ***planning group*** composed of representatives of the SCA and the Mar Mena Community, plus selected expert advisors in such fields as conservation and research:

a) Identification of key decision-makers;
b) Definition of objectives (mission statement);
c) Outline timetable to be followed, with recognition of potential constraints and obstacles;
d) Agreement on procedures for consultation, evaluation, etc.;
e) Definition of time-limits (i.e. short-term alone; longer-term with periodic evaluation, revision);
f) Establishment of financial arrangements.

From this should emerge a broad ***outline plan for future action***, identifying budgetary constraints and a number of alternatives based on different levels of potential funding.

Essential elements in the procedure should involve the creation of a ***management group***, jointly with the Mar Mena Community, led by a project director with a small staff and supported by a ***consultative body*** comprising stakeholders in the form of representatives of the different interests likely to be involved – the SCA, representatives of relevant planning and tourism authorities, university and museum experts, and the local communities, both religious and secular.

An ***academic advisory structure*** should be set up, to analyse existing historical and archival data and formulate research project needed for better interpretation and presentation (including excavation, restoration, and reconstruction), in association with the relevant advisory body.

5. In the field of ***conservation, restoration, and reconstruction,*** the management plan should involve the initiation of a complete historical archive detailing all the interventions that have been carried out on the site (conservation, restoration, reconstruction, excavation, etc), the development of a conservation strategy (short-, medium, and long term) based on the

conservation survey (see 3. above).

6. This is linked closely with the preparation of prioritized and integrated ***monitoring and maintenance plans*** forming part of the integrated database (see 1. above).

7. It is essential that this World Heritage site should possess adequate ***interpretation*** facilities so that its significance is fully appreciated by the general public as well as by the academic community. The management plan must therefore take account of central on-site installations (museum or interpretation centre), signage, educational facilities, recruitment and training of guides, etc.

8. There is a need for the development of carefully planned ***tourist facilities***, and so the management plan should give serious consideration to relations with regional/local tourist development plans and agencies, adequate, acceptable, and adjacent car parks, toilets, shops, restaurants, etc, off-site facilities access, accommodation, shopping, links with local museums, etc

9. Tourism ***publicity*** (in national and local publications, hotels, transportation termini and timetables, guidebooks, etc) must be taken into account.

10. Agreement must be reached regarding the availability use of entrance fees and other ***revenues***.

11. A systematic ***review procedure*** is an essential component of a management plan, operating on a three- to five-year cycle and preferably involving outside consultants/experts, so as to take account of unforeseen problems and obstacles and the need to update facilities and staffing.

12. Once general principles and guidelines have been agreed the ***timetable*** for their implementation should be established, set against the background of actual and potential funding and perceived pressure for change, whether voluntary or reactive. This element forms the *raison d'être* for the review procedures described above.

BACKGROUND TO THE MISSION

1.1 Inscription history, criteria, and World Heritage values

Abu Mena (cultural property C 90) was inscribed on the World Heritage List by the UNESCO World Heritage Committee at its 3rd session, held at Cairo and Luxor in 1979. It was inscribed on the basis of criterion iv, currently defined as 'an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history.' However, at the time of inscription it was defined as being 'among the most characteristic examples of a type of structure, the type representing important cultural, social, artistic, scientific, technological or industrial development.'[1]

Abu Mena is located south of Alexandria, between Wadi el-Natrun and Alexandria itself (see Figure 1). The church, baptistery, basilicas, public buildings, streets, monasteries, houses, and workshops in this early Christian holy city were built over the tomb of the martyr Menas of Alexandria, who died in AD 296. Menas, an officer in Diocletian's army, refused to kill any Christians after they had been defeated by his army, and declared his Christianity publicly. Legend has it that after his martyrdom Menas's remains were brought back from Phrygia by camel and buried where the animal refused to walk any more. Water welled up in the desert there, making it possible to grow vines and olive trees, as a result of which it is known as St Menas's Vineyards.

Abu Mena grew rapidly in the course of the 5th and 6th centuries. By 600 the oasis had become a pilgrimage city, centred on the great basilica complex. An entire town with houses and cemeteries has been revealed by excavation. Constructed in the 5th century to accommodate the increasing number of Christian pilgrims, the Thermal Basilica was built to store the curative waters used for the heated baths and pools surrounding the Basilica. Pilgrims used to fill tiny flasks with water from the Basilica. These flasks have been found widely distributed in the Roman world. During the 5th and 6th centuries many buildings were erected around the Thermal Basilica, including a monastery on its north side.

Within the framework of the Second Cycle of Periodic Reporting in the Arab States and as requested by the World Heritage Committee, the State Party is currently drafting a Retrospective Statement of Outstanding Universal Value.

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[1] The ICOMOS evaluation was cryptically brief: 'Lucid and precise documentation on a particularly original and interesting site.'

Figure 1 Map showing the location of the Abu Mena site

1.2 Examination of the State of Conservation of the Property by the World Heritage Committee (see Annex V)

Further to the inscription of the property on the List of World Heritage in Danger in 2001, a mission was sent by the UNESCO World Heritage Centre in September 2002 to assess water-related damage and adverse effects on the World Heritage Sites of Ancient Thebes and Abu Mena The report of this mission expressed grave concern about the situation at Abu Mena, where the nearby land reclamation and irrigation project had created a severe problem which required a more drastic and costly solution.

Reports were submitted by the State Party to the Committee at its 28th and 29th sessions, in Suzhou (China) and Durban (South Africa) respectively. At the latter meeting, in 2005, the Committee expressed its concerns (in document *Decisions 29 COM 7A.17*) over the deterioration of the property caused by the rising groundwater levels and other threats. It invited the international

community to support the State Party in its efforts towards removal of the property from the List of World Heritage in Danger, urging the State Party to adopt long-term and sustainable measures along the lines of those recommended in the 2002 Report.

The Committee Decision went on to request the State Party to invite a joint mission of the World Heritage Centre and ICOMOS which took place in December 2005.

At its 30th Session (Vilnius, 2006), the World Heritage Committee (Decision 30COM 7A.19):

3. Congratulated the State Party for its efforts in addressing the issue of the rising ground water table;

4. Urged the State Party to implement the recommendations of the joint World Heritage Centre/ICOMOS mission of 2005:

a) Carry out a rapid condition survey of all excavated remains and urgent conservation measures in order to provide protection to structures during the vibration and other forms of damage likely to result from the use of heavy earth-moving equipment;

b) Lower the water table by means of drainage ditches and pipes, inside and around the archaeological area;

c) Establish an efficient system for monitoring the water table in the archaeological site and in the surrounding zones;

d) Prepare a conservation plan, defining short-, medium-, and long-term objectives and establishing technical parameters (materials, techniques, etc);

e) Undertake consultations with stakeholders with the objective of preparing a management plan, to include research, presentation and interpretation, the role of stakeholders (e.g. the Mar Mena community), staffing, sponsorship, visitor facilities, access, etc.

5. Requested the State Party to define urgently the boundaries of the property and of its buffer zone and to provide a map to the World Heritage Centre;

6. Further requested the State Party to submit, by 1 February 2007, a detailed progress report for examination by the Committee at its 31st session in 2007;

7. Decided to retain Abu Mena (Egypt) on the List of World Heritage in Danger

In Decision 31COM 7A.16 (Christchurch, 2007), the Committee reiterated the above requests, notably to implement the corrective measures by 2010.

In Seville at its 33rd session (2009), the Committee (33COM 7A.15) "urged the

State Party to continue its work on all the corrective measures adopted at its 30th session (Vilnius, 2006) and recognized the efforts made by the State Party to ensure the safeguarding of the site and encouraged it to continue such efforts in cooperation with the World Heritage Centre and the Advisory Bodies".

1.3 Purpose of the mission

The present reactive monitoring mission was requested by the World Heritage Committee at its 33rd session, in its decision 33 COM 7A.15. Its membership was the same as the previous mission, in 2005.

The objectives of the 2009 mission were as set out in the Committee decision above, *viz.* "...to assess progress in the implementation of all the corrective measures, to review the draft Statement of Outstanding Universal Value, to develop a proposal for the desired state of conservation for the removal of the property from the List of World Heritage in Danger, and to revise the timeframe."

The terms of reference, programme, and composition of the mission team are set out in Annexes I, II, and III respectively.

2. NATIONAL POLICY FOR THE PRESERVATION AND MANAGEMENT OF THE WORLD HERITAGE PROPERTY

2.1 Protection legislation

There is strong legislation for the protection of all antiquities in Egypt (Public Law 117/1983). According to this statute, the term 'antiquity' is applied to any building or movable object resulting from the different civilizations that span the totality of Egyptian history (reflecting human, artistic, technical, military, and religious aspects) and more than one hundred years old.

2.2 Institutional framework and management structure

The archaeological site is the property of the Egyptian State and is managed by the Supreme Council of Antiquities (SCA), the branch of the Egyptian Ministry of Culture responsible for the conservation, protection, and regulation of all antiquities and archaeological excavations in Egypt.

Abu Mena comes within the control and management of the Islamic and Coptic Sector of the SCA. The neighbouring Saint Mina Monastery is consulted informally on management aspects of the archaeological site, and is financing the construction of the substantial perimeter wall round the protected archaeological site and its buffer zone.

2.3 International treaties and conventions

Egypt has ratified the 1954 Convention for the Protection of Cultural Property in the Event of Armed Conflict and the First and Second Protocols, the 1970 Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property, and the 1972 Convention Concerning the Protection of the World Cultural and Natural Heritage. Egypt is also State Party to the Convention for the Safeguarding of the Intangible Cultural Heritage of 2003 and to the Convention on the Protection and Promotion of the Diversity of Cultural Expressions of 2005.

3 IDENTIFICATION AND ASSESSMENT OF ISSUES

The report of the 2005 monitoring mission (see Annex VI) made a number of comments and recommendations, covering the engineering and archaeological aspects respectively.

3.1 Engineering aspects

Protecting the Abu Mena site from rising groundwater requires the lowering of the water table that is at the present time rising as a result of intensive irrigation in the nearby areas, supplied by the main canals coming from the Nile. The water table should be lowered at least 5 m; it is equally important that threats from future rises must be avoided.

The projects are well designed and promise to be effective. Their operating conditions should be considered along with more general aspects of the management of water resources in a very large area of Egypt. Economic and political aspects must be considered because a large amount of financial resources will be required, not only in the implementation phase, but also during the eventual working conditions. Moreover, the projects will succeed only if the farmers involved ensure their active participation, while all the state and regional authorities responsible for water management and irrigation also confirm their cooperation.

The problem of the preservation of Abu Mena is very complex. Further complexities can be added by the nature of the hydrological events, as well as by the difficulty of forecasting the evolution of the economic and social aspects that can occur in the area. The responsible authorities should therefore continuously monitor the various components that make up the problem and its solution. Supplementary and alternative measures, both technical and managerial, may well become necessary.

An efficient system for monitoring the water table in the archaeological site and in the surrounding zones is essential, as its level will remain the most significant variable for assessing the effectiveness of the solution of the problem.

3.2 Archaeological aspects

1. As already mentioned in the 2005 report, three preliminary tasks must be undertaken with the minimum of delay:

a) A geophysical survey must be initiated, concentrating in the beginning on areas where it is planned to undertake earth-moving operations connected with the measures to be taken to lower the water table on the site, and before this work has been started.

Where archaeological deposits or structures are identified, two alternatives have to be considered: either a rescue excavation should be carried out, to record the archaeological material before work starts, or agreement should be reached with the earth-moving contractor on a diversion of the line of the linear feature or the re-sitting of wells.

b) A rapid condition survey of all excavated remains should be carried out and urgent conservation undertaken in order to provide protection to structures during the vibration and other forms of damage likely to result from the use of heavy earth-moving equipment.

c) Discussions must take place simultaneously with these emergency actions in order to establish the definitive boundaries of the World Heritage site and its buffer zone, taking into account the requirements of the World Heritage Committee as set out in the *Operational Guidelines.*

2. Once these three emergency activities have been successfully completed, the geophysical survey should continue over the entire site (including the buffer zone), to act as a guide to future research and management projects. At the same time, a conservation plan should be prepared, defining short-, medium-, and long-term objectives and establishing technical parameters (materials, techniques, etc).

3. Discussions should begin with stakeholders with the objective of preparing a management plan, to include *inter alia* research (including excavation and survey), presentation and interpretation, the role of stakeholders (e.g. the Mar Mena community), staffing, sponsorship, visitor facilities, access, etc.

4 ASSESSMENT OF THE STATE OF CONSERVATION OF THE SITE

The spiritual, cultural, and historical values of the site, which are implicit in the original inscription on the List, have in no way changed or been degraded: this is still one of the holiest places of pilgrimage for members of the Coptic Church. However, the problem relates to the physical conditions on the site resulting from the serious increase in the level of the water table.

The physical degradation has necessitated serious attention being given to the conservation and overall management of the site. The opportunity will be taken to improve the visitor experience and facilities, given that the volume of visitors and pilgrims is likely to increase significantly in the coming years.

It is these two points that were identified in the 2005 mission report, and these are set out in the preceding section. It was abundantly clear to the members of that mission on returning four years later that considerable attention had been paid to these recommendations and that substantial progress had been made over the intervening years, especially with regard to the water-table problem, which was properly recognized by those responsible for the management of the site to be of overriding importance.

The 2009 mission regrets that little systematic work has been carried out to implement all of these recommendations. The following actions have been taken in response to the preliminary tasks identified above:

a) The sites to be impacted by earth-moving operations have been the object of geophysical survey and archaeological excavation before this work began, the findings have been recorded, and there have been modifications of the sites and routes originally selected for the water-management system.

b) There has also been some consolidation and conservation work on the archaeological remains where the danger of damage from the use of heavy equipment has been identified.

c) The boundaries of the World Heritage site have been established and recorded (see Figure 2). However, a definitive boundary of the buffer zone is still awaited.

So far as the other proposals relating to the formulation of conservation and management plans are concerned, work is well advanced on this aspect and the draft proposal is acceptable in general terms.

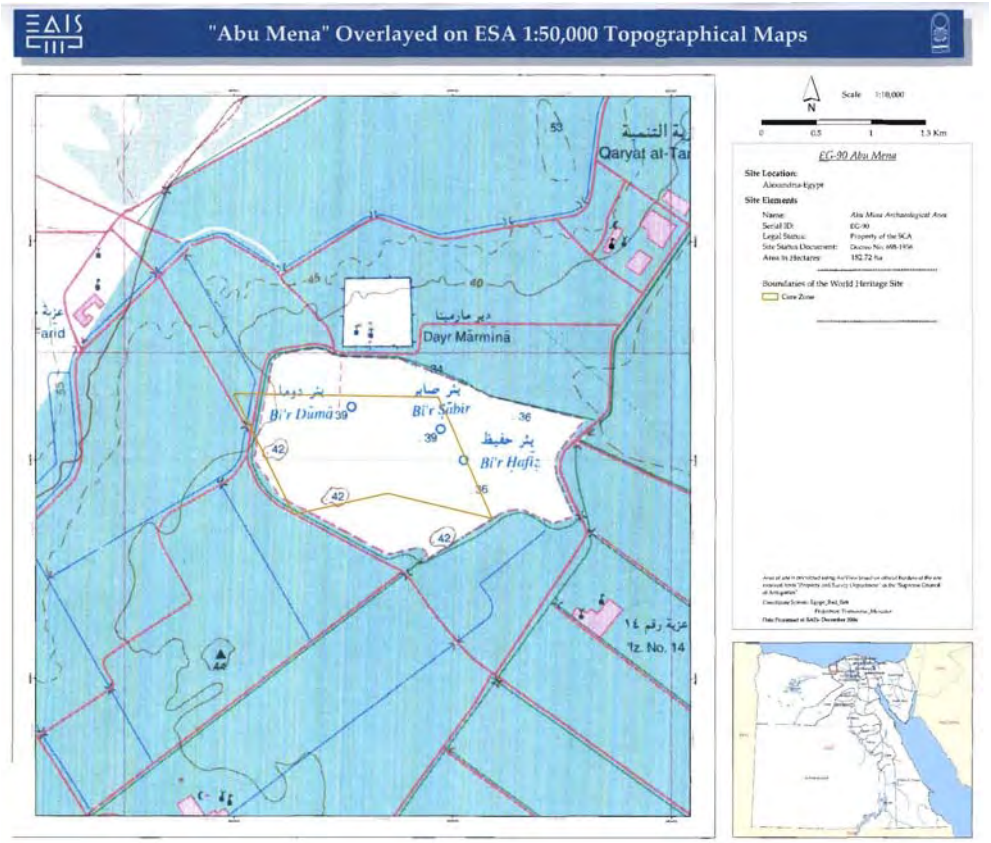

Figure 2 Map showing the boundaries of the Abu Mena site

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

5.1.i Engineering aspects

In the engineering field, one of the main goals of the World Heritage Centre-ICOMOS Monitoring mission of 12–19 November 2005 was the acquisition of knowledge concerning the general hydrogeological aspects of the Abu Mena site. The main source of information at that time was that provided by the local experts met in Cairo and at the site. This information was an essential step in the evaluation of the general project developed by the Ministry of Culture. The project consisted of a system of open-air draining canals, capable of lowering the water table and conveying the drained water to centralised tanks, from where it could be removed from the site by means of pumps.

All these aspects were summarized in the first report presented to UNESCO and ICOMOS in January 2006, pointing out the positive outcomes of the project. The report also contained some recommendations, focussing in particular on a more detailed evaluation of the natural characteristics of the zone, in relation to the existence of geological conditions that could interfere with the projected lowering of the water table. Mention was also made of the possibility of drilling some pumping wells, inside the site and around it. Such a possibility was also presented as an alternative to the project of the Ministry of Culture.

As a complementary measure the original project of the Ministry of Culture proposed the identification of a suitable buffer zone of convenient extent around the archaeological site, in which all irrigation activities should be forbidden or restricted.

The recommendations contained in the first report seem to have achieved consensus among the responsible Egyptian authorities, as ascertained during the second mission in December 2009. Many initiatives have been undertaken since the time of the first mission, in a way that underlines the special attention that is being given to a problem that is of capital importance for Egypt.

As a first step, the Supreme Council of Antiquities commissioned a detailed study from Prof. Dr. Hassan Fahmy Iman, an expert hydrogeologist, who in December 2006 submitted the *Technical Report on Abu Mina Monastery Site and Underground Water Problems*, which was sent to the UNESCO World Heritage Centre. So far as the hydrogeological aspects of the zone are concerned, Prof. Hassan's study, based essentially on the information available at the time, substantially confirmed the considerations formulated during the 2005 mission.

The original project of the Ministry of Culture, which was based on horizontal drainage by means of some open-air canals and porous subsurface pipes, was subject to some critical comment. This project had been developed on the assumption that the groundwater flow through the subsoil layers was horizontal, moving from the surrounding agricultural lands into the Abu Mena area. Therefore the open-air collectors located at depths of about 8m below ground

surface could intercept the horizontal seepage, working as a cut-off drain, and prevent ground water from entering the archaeological site.

As pointed out by Prof. Hassan, this is not the true situation at Abu Mena, because the groundwater is contained in a sand layer located at a depth of 15–25m below ground surface. This sand layer forms a semi-confined aquifer in which the upper level is filled by the water moving upward vertically. Moreover, the presence of man-made structures, consisting mostly of buried rooms, holes, and old wells, helps the water to rise. As a result the open-air canals and subsurface pipes would affect only a very limited area around them. Because a clayey silt with low permeability makes up the upper soil layer, the efficiency of the mechanism will be further decreased.

Furthermore, both the canals, some 20m wide, and the subsurface pipes will entail great excavation works, which might damage the archaeological remains hidden in the subsoil.

Prof. Hassan concluded that the project based on horizontal drainage was not suitable for the Abu Mena site, and maintained that, despite huge works and costly interventions, the groundwater would continue to rise, moving vertically in the sand layer towards the ground surface.

The proposed buffer zone was also criticized, since defining it would encounter practical difficulties, including an expected reluctance on the part of the farmers.

These considerations, supported by a proper evaluation of the real conditions of the site, are fully acceptable from the scientific point of view. They justify the initiatives taken by the Egyptian authorities in the years following the 2005 mission.

As a first step, the Egyptian Ministry of Culture appointed a team of selected experts, coming from universities and other highly qualified institutions led by Prof. Dr. Zahi Hawass, with the mandate to better examine the real situation of the site, launching new data collection, so as to devise more appropriate interventions. Taking into account also the recommendations of the 2006 report, a new project was developed, based on more suitable principles, and put immediately into operation. The development of the project was supported by the use of advanced technologies, including mathematical models able to simulate the behaviour of the groundwater and evaluate the effects of the interventions.

The main characteristic of the project consists of the adoption of a vertical drainage, by means of a system of pumping wells, located around the site and reaching a convenient depth in the aquifer. The wells are connected to subsurface pipes that convey the drained water into an open-air canal, some 30 km long, which discharges in the Mediterranean Sea. The outline and the working principle of the project are sketched in Figure 3.

The wells are equipped with a submersible pump and electrical motor, have high capacity and sufficient head for raising the water several metres above

the ground level. A collecting tank is located at the end of the pipes, with a weir in which the discharging flow rate can be measured. The weir discharges into the main canal, in which water flows by gravity, following the natural slope of the ground, as the average level of the site is around 30m a.s.l. A suitable electrical network, with advanced control equipments, supplies the pumps.

The project foresees 170 pumping wells with depth from 25m to 30m and lined up in seven groups, as shown in Figure 4.

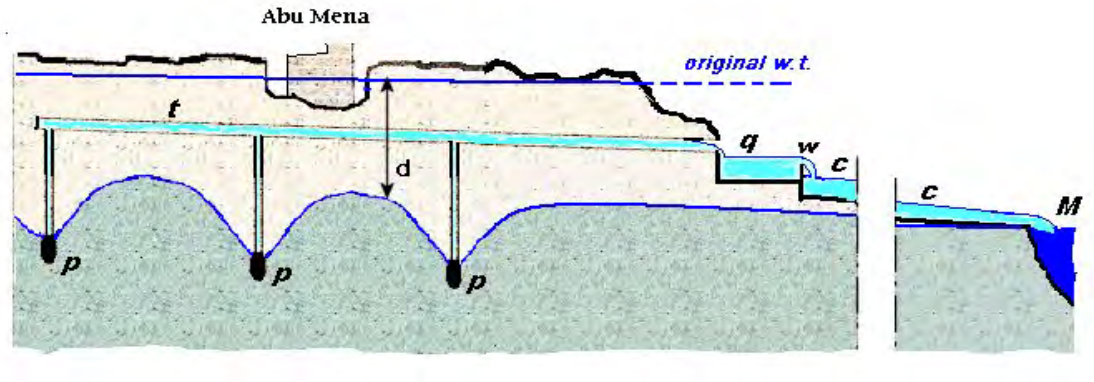

Figure 3 *Outlines and operational principles of the new project developed by the Ministry of Culture. The pumping wells p raise the water to the collecting pipe t that discharges in the tank q. Spilling over the weir w, water falls into the canal c, eventually reaching the Mediterranean Sea (M). The water table is lowered by* d.

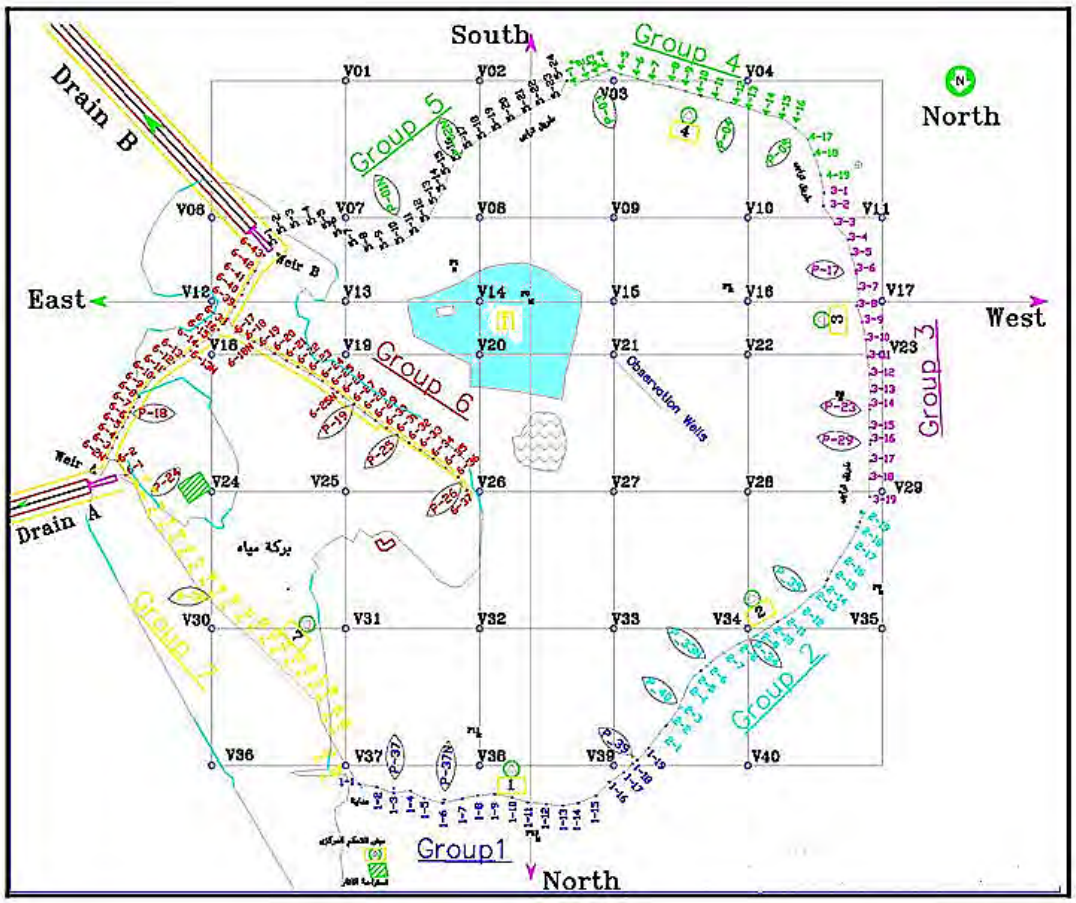

Figure 4 *Implementation of the new project. The archaeological site (light blue area) is surrounded by 170 pumping wells, arranged in seven groups (1-1 ,1-2.; 7-1, 7-2....). The water table is monitored at 40 observation wells (V1, ..., V 40). Water is conveyed to two open-air canals (Drain A, Drain B), which are connected to a main canal, about 30 km long, discharging in the Mediterranean Sea in the vicinity of Alexandria. [Document released by the Ministry of Culture]*

Figure 5 *One of the weirs discharging the drained water after two hours of pumping. The rate of flow is of the order of 0.05 m³/s*

Figure 6 *An attendant shows how the water level has lowered after two hours of pumping*

As an effect of the pumping wells, lowering of the water table will be monitored by means of 40 observation wells located in the most significant points of the area and provided with automatic and centralized recording equipment (see Figures 5 and 6).

The Ministry of Culture appointed an Egyptian contractor to start the project immediately and field works started in February 2006. The project is due to be completed in June 2010. After completion the contractor will operate the existing facilities for one year, providing maintenance and training the local personnel in charge of running the project.

The total cost of the project is estimated to be around €6,562,500, including all civil, mechanical, and electrical works, with a contingency fund of €625,000. In parallel an intensive monitoring campaign has been developed, lasting several years, with the objective of collecting all the relevant meteorological and hydrogeological data to support a detailed study of the multidisciplinary aspects relevant to the area.

5.1.ii Archaeological aspects

The report of the 2005 mission listed a number of matters requiring short- and longer-term attention. These were as follows (comments on the present situation follow each item):

Short-term requirements

– A GEOPHYSICAL SURVEY concentrating in the beginning on areas where it is planned to undertake earth-moving operations connected with the measures to be taken to lower the water table on the site, and before this work has been started. Where archaeological deposits or structures are identified, two alternatives have to be considered: either a rescue excavation should be carried out, to record the archaeological material before work starts, or agreement should be reached with the earth-moving contractor on a diversion of the line of the linear feature or the resiting of wells.

– *Comments*: Field-walking surveys have been carried out in advance of earth-moving operations and the lines of channels have been changed in several cases where large concentrations of objects (principally pottery sherds) have been discovered.

– A rapid CONDITION SURVEY of all excavated remains should be carried out and urgent conservation carried in order to provide protection to structures during the vibration and other forms of damage likely to result from the use of heavy earth-moving equipment.

– *Comments:* A limited amount of work of this kind has been carried out, principally the covering of floors with soil and sand to prevent damage.

– An important and urgent piece of research concerns the PHYSICAL AND CHEMICAL CHANGES TO MORTAR AND STONE as a result of water penetration from below, so as to identify appropriate stone treatments and mortar compositions.

– *Comments*: This is a case when a request might be made for international assistance from the World Heritage Fund to finance a study by a stone conservation expert.

– Discussions must take place simultaneously with these emergency actions in order to establish the BUFFER ZONE, taking into account the

requirements of the World Heritage Committee as set out in the *Operational Guidelines.*

– *Comments*: This has been done – see Figure 4.

Longer-term requirements

– Once these emergency activities have been successfully completed, the GEOPHYSICAL SURVEY should continue over the entire site (including the buffer zone), to act as a guide to future research and management projects.

– *Comments: The need for this has been recognized, though some doubts have been expressed regarding the efficacy of several common techniques on the subsoils of Abu Mena. Expert assistance will be needed.*

– At the same time, a CONSERVATION PLAN should be prepared, defining short-, medium, and long-term objectives and establishing technical parameters (materials, techniques, etc).

Comments: This is recognized and preliminary plans are being formulated. The need for expert assistance has been expressed.

– Discussions should begin with stakeholders with the objective of preparing a MANAGEMENT PLAN, to include *inter alia* research (including excavation and survey), presentation and interpretation, the role of stakeholders (e.g. the Mar Mena community), staffing, sponsorship, visitor facilities, access, etc.

Comments: Drafting of an outline for the management plan is already under way. Once again, the need for expert assistance has been acknowledged in certain fields, such as presentation and interpretation and the sitting and form of visitor facilities.

5.2 Recommendations

5.2.1 Engineering aspects

At the current status of the works and taking into account the evolution of the SCA initiatives since the 2005 mission, there is no question of possible engineering alternatives being explored. It is recommended that the responsible Egyptian authorities should exert their institutional powers in order to complete the Project according to the prescribed time-table and in a way that meets the goals and the solutions prospected.

The responsible authorities should also intervene in order to activate the proposed programme for running all the Project components as efficiently as possible and to carry out all the actions regarding data collection and appropriate research in all the interdisciplinary fields relevant to the Abu Mena

site.

Finally, some consideration should be given to the identification and the role of the buffer zone. Increasing the area of the project from 300 acres to almost 1000 acres creates an adequate territory around the archaeological site in which agricultural activities can be controlled and restricted. Such a territory can make up an efficient buffer zone, without invading other areas of intensive agriculture, also taking into account the fact that all of this area will be enclosed by the fence that is already under construction.

Following the discussion and the general consensus achieved during the meeting held in Cairo during the present mission, it is very important to underline the need for the suitable revision of the existing irrigation practices in the areas surrounding the Abu Mina site. Such an opportunity should be considered not merely as an alternative to the Project, but rather as an essential complementary measure for achieving the goals of the Project.

A revision of the current irrigation practice was mentioned in the 2005 mission Report. The current watering procedure mostly adheres to the traditional agricultural practices in this region, consisting essentially of open ditches and furrows, supplied by the main canals originating from the Nile. This procedure, frequently repeated along the year, requires large quantities of water, most of which is not used by the crop and percolates through the upper soil layer, reaching the underground aquifer. This is recognized as the principal cause of the water table rising.

The most advanced research in the field of irrigation confirms the validity of watering procedures that entail a small quantity of water. Moreover the quantity of delivered water is determined according to the growth stage of the crop, in order to meet the specific demand of the plant. Using a small quantity of water also reduces losses from evaporation, producing a clear rational utilization of the available resources.

The rational utilisation of the available resources suggests the possibility of recycling the water drained by the pumping wells, without wasting it in the sea. This can be an opportunity for the future, in view of continuously increasing demand. If this should be taken into consideration, proper attention to the quality of the recycled water will be necessary. An excess of irrigation water, which is not captured by the crops and percolates through the upper soil, may contain some chemicals resulting from the use of fertilisers and pesticides by the farmers which can contaminate the groundwater. Suitable control of the use of fertilisers and pesticides will then become necessary. Furthermore, control is also necessary for the wastewater discharged by the residential zones that will eventually be developed in the area.

5.2.2 Archaeological aspects

1. A complete **CONDITION SURVEY** of the entire inscribed site should be carried out without further delay. Serious consideration should be given to using

this as the basis for an overall database for the site.

2. The **GEOPHYSICAL SURVEY** should be extended progressively to the entire site, including the buffer zone.

3. Work should begin on the **CONSERVATION PLAN**, using the specialist advice of experts, and programmes for regular monitoring and maintenance established, the resulting information being incorporated into the database (see 1. above).

4. Work should also be initiated on the preparation of the **MANAGEMENT PLAN**, using expert assistance from other institutions (national and international).

   The following ***basic parameters*** must be established at the outset by a ***planning group***: composed of representatives of the SCA and the Mar Mena Community, plus selected expert advisors in such fields as conservation and research.

   a) Identification of key decision-makers;

   b) Definition of objectives (mission statement);

   c) Outline timetable to be followed, with recognition of potential constraints and obstacles;

   d) Agreement on procedures for consultation, evaluation, etc;

   e) Definition of time-limits (i.e. short-term alone; longer-term with periodic evaluation, revision);

   f) Establishment of financial arrangements.

   From this should emerge a broad ***outline plan for future action***, identifying budgetary constraints and a number of alternatives based on different levels of potential funding.

   Essential elements in the procedure should involve the creation of a ***management group***, joint with the Mar Mena Community, led by a project director with a small staff and supported by a ***consultative body*** comprising stakeholders in the form of representatives of the different interests likely to be involved – the SCA, representatives of relevant planning and tourism authorities, university and museum experts, and the local communities, both religious and secular.

   An ***academic advisory structure*** should be set up, to analyse existing historical and archival data and formulate research project needed for better interpretation and presentation (including excavation, restoration, and reconstruction), in association with the relevant advisory body.

5. In the field of ***conservation, restoration, and reconstruction,*** the management plan should involve the initiation of a complete historical

archive detailing all the interventions that have been carried out on the site (conservation, restoration, reconstruction, excavation, etc), the development of a conservation strategy (short-, medium-, and long-term) based on the conservation survey (see iii. above).

6. This is linked closely with the preparation of prioritized and integrated ***monitoring and maintenance plans*** forming part of the integrated database (see i. above).

7. It is essential that this World Heritage site should possess adequately ***interpretation*** facilities so that its significance is fully appreciated by the general public as well as by the academic community. The management plan must therefore take account of central on-site installations (museum or interpretation centre), signage, educational facilities, recruitment and training of guides, etc.

8. There is a need for the development of carefully planned ***tourist facilities***, and so the management plan should give serious consideration to relations with regional/local tourist development plans and agencies, adequate, acceptable, and adjacent car parks, toilets, shops, restaurants, etc, off-site facilities access, accommodation, shopping, links with local museums, etc.

9. Tourism ***publicity*** (in national and local publications, hotels, transportation termini and timetables, guidebooks, etc), must be taken into account.

10. Agreement must be reached regarding the availability use of entrance fees and other ***revenues***.

11. A systematic ***review procedure*** is an essential component of a management plan, operating on a three- to five-year cycle and preferably involving outside consultants and experts, so as to take account of unforeseen problems and obstacles and the need to update facilities and staffing.

12. Once general principles and guidelines have been agreed the ***timetable*** for their implementation should be established, set against the background of actual and potential funding and perceived pressure for change, whether voluntary or reactive. This element forms the *raison d'être* for the review procedures described above.

5.2.3 General

1. The State Party is to be congratulated on the progress that has been made with the implementation of some of the recommendations of the 2005 mission. However, it should take positive action on all those recommendations without delay and report to the World Heritage Centre that they are fully operational by 31 January 2011.

2. The World Heritage property and the contemporary Coptic Monastery are indissolubly linked spiritually, since the archaeological site is a celebrated Coptic pilgrimage site. The SCA has worked closely with the Mar Mena Community in all the projects that have been initiated since 2006. It is essential that this should continue and become more formalized by equal representation on key groups such as the planning group, the working group, and the eventual management group.

3. The SCA and the Mar Mena community have set up working groups using national expert individuals and institutions. However, there are certain areas where international expertise is needed, funded by UNESCO or through bilateral agreements, and these have been identified above. The State Party should explore these aspects of technological, scientific, and management expertise in association with the UNESCO World Heritage Centre and the Advisory Bodies, as well as individual national funding agencies and non-governmental organizations.

4. The site should remain on the List of World Heritage in Danger until the water management system and the management and conservation plans have been fully implemented and have been operating satisfactorily for at least two years.

ANNEX I Terms of reference

The terms of reference of the mission were the following:

In conformity with the Decision 33 COM 7A.15 by World Heritage Committee, taken at its 33rd session (Seville, 2009), concerning the state of conservation of Abu Mena, inscribed on the World Heritage List in 1979 and on the List of World Heritage in Danger in 2001, and taking into consideration the Operational Guidelines for the Implementation of the World Heritage Convention, carry out a joint UNESCO World Heritage Centre / ICOMOS reactive monitoring mission, in order to:

1. Visit the property and meet with relevant local and national authorities, to discuss and review:

    a) the current situation and the overall state of conservation of the World Heritage property;

    b) the implemented and/or on-going works aiming at solving the problems caused by the raise of the water table;

    c) the implementation of the last decisions of the World Heritage Committee, in particular of all corrective measures identified in 2005 and adopted by the Committee in 2006 (decision 30COM 7A.19);

    d) the progress in developing a draft Statement of Outstanding Universal Value for the property, including the conditions of integrity and authenticity, for approval of the World Heritage Committee.

2. Assist the State Party in developing a proposal for the "Desired state of conservation for the removal of the property from the List of World Heritage in Danger", and in revising the initial timeframe.

ANNEX II Composition of the mission team

The World Heritage Centre's expert on the mission was Professor **Marcello Benedini**, who spent thirty years with the Water Research Institute of the Italian National Research Council in Rome, retiring in 1999.

The ICOMOS expert was Professor **Henry Cleere**, who was Director of the Council for British Archaeology from 1974 to 1991 and World Heritage Coordinator of ICOMOS (International Council on Monuments and Sites) in Paris from 1992 to 2002.
These two experts also constituted the membership of the 2005 mission.

ANNEX III Itinerary and programme

Saturday 10 December		Travel to Cairo
Sunday 11 December	am	Transfer to Alexandria
	pm	Meetings with SCA officials, stakeholders, experts, etc
	pm	Site visit
Monday 12 December	am	Meeting with SCA officials, stakeholders, experts, etc
	pm	Return to Cairo
Tuesday 13 December	am	Free time
	pm	Meeting at Supreme Council of Antiquities Attend Winckelmann evening at German Archaeological Institute
Wednesday 14 December	am	HC return to UK
	pm	MB meeting with water experts
		MB return to Italy

ANNEX IV List of people met during the mission

Supreme Council of Antiquities

Professor Ali Radwan	Egyptian representative to the World Heritage Committee
Dr Sabri Abdel Aziz	Head, Egyptology Section
General Ali Hellal	Head, Projects Section
Mr Farrag Fadda	Head, Islamic Section
Dr Gihane Zaki	Director General for International Cooperation
Mr Gamal Mustafa	Director of Islamic and Coptic Monuments
Dr Hany Hanna Aziz Hanna	General Director of Conservation, Helwan, El-Saf, & Atfeh Sector

Abu Mena Monastery

Bishop Kirolos	Head of the Community
Bishop Mena	
Father Taddaos	
Father Epiphanious	
Father Samaan	

Consultants

Dr Mourad Bakhoum	Arab Consulting Engineers
Dr Sami Sabri Shaker	Scientific Centre for Architecture, Landscaping, and Environmental Planning
Dr Hassan Fahmy Iman	
Dr Kamal Aboul Hassan	
Dr Dina Bakhoum	Aga Khan Cultural Trust, Egypt
Dr Nabil Rofail	The Arab Centre for the Study of Arid Zones and Dry Lands
Dr Adel Elmenchawy	Arab Academy for Science and Technology and Maritime Transport

Egyptian National Commission for UNESCO

Dr Samir Ghabbour	(on behalf of Dr. Safwat Salem, Secretary-General)

German Archaeological Institute, Cairo

Dr Peter Grossman

Figure 7 *The members of the mission with the monks of the Mar Mena Monastery, Dr Gihane Zaki, and members of the Project team.*

ANNEX V Reports presented to the World Heritage Committee since the inscription of Abu Mena on the List of World Heritage in Danger in 2001

- **2001**

Document: WHC-01/ CONF.208/10
[…]
New information:
Further to an alarming report prepared in 2000 by an ICOMOS expert, the Director and Chief of the Arab Unit a.i. of the World Heritage Centre carried out a visit to the site in September 2001. A land-reclamation programme for the agricultural development of the region, funded by the World Bank, has caused in the past ten years a dramatic raise of the water table. The local soil, which is exclusively clay, is hard and capable of supporting buildings when in a dry state, but becomes semi-liquid with excess water. The destruction of numerous cisterns, disseminated around the city, has entailed the collapse of several overlying structures. Huge underground cavities have opened in the north-western region of the town. The risk of collapse is so high that the authorities were forced to fill with sand the bases of some of the most endangered buildings, including the crypt of Abu Mena with the tomb of the Saint, and close them to the public. A large banked road, moreover, was executed to enable movement within the site. The Supreme Council of Antiquities is trying to counteract this phenomenon by digging trenches, and has enlarged the listed area in the hope of lowering the pressure of the irrigation. These measures, however, have proved to be insufficient, taking into account the scale of the problem and the limited resources available.

Action required: The Bureau may wish to adopt the following decision:
"The Bureau recommends the inscription of Abu Mena on the List of World Heritage in Danger, and requests the Egyptian authorities to coordinate with all the competent national institutions, and the WHC, with a view to identifying rapidly the necessary corrective measures to ensure the safeguarding of the site."

- **2003**

Document: WHC-03/27.COM/7A
New Information:
WHC: At the request of the Egyptian authorities, a World Heritage expert hydrologist carried out a mission in September 2002 to the site, with the aim of evaluating the technical proposals made by the Supreme Council of Antiquities (SCA) in order to reduce the negative effects of the increased groundwater level on the historic monuments.

According to the expert's report, the SCA project is currently in its first phase of implementation out of three. A review of the project documentation and design suggested that the proposed measures are generally feasible and possibly adequate and that the groundwater level can be lowered through the proposed structural interventions made of combined installation of drainage systems and pumping wells. However, the newly proposed phase II and III of the project should take into account the flow pattern of the water coming from the irrigated areas and the implementation costs should be assessed, in order to implement engineering measures, which will be proved to be sustainable and cost-effective.

Considering that engineering methodologies and mitigation measures, although very effective in the short term, can quickly get outdated by sudden changes in urban development, new land reclamation projects, extended irrigation schemes, etc., two hierarchically related groups of remedial actions are suggested: long-term political/organizational measures focusing on the source of problems, and engineering measures for technical problems.

In fact, structural measures can be appropriate only if coordinated with other measures, namely the reorganization of the agricultural practice and careful planning of future land reclamation activities in the area. In order to overcome the present lack of coordination among various Government agencies and local authorities whose activities affect the site, the report

recommends the establishment of a Cultural Resources Planning Unit, within the SCA, which will be responsible for coordinating with the Ministry of Water Resources and Irrigation, the city planning authorities, the Ministry of Agriculture and Land Reclamation and the Ministry of Tourism, in order to review all infrastructure projects having a potential impact on major national heritage sites.

A draft framework for a Cultural Resources Impact Assessment procedure, which should be mandatory for any initiative that could affect the historic heritage, could be developed as a pilot project for Abu Mena. Moreover, a Management Plan for the site should be prepared in consultation with all institutions involved and, particularly, with the Groundwater Research Institute as well as with local farmers and representatives. The Plan should include a programme for regular monitoring of the state of conservation of the site, so as to allow a quick response to potential threats.

ICOMOS:
ICOMOS warmly endorses these proposals and congratulates the Centre and its expert for the prescient report. It furthermore urges the State Party to adopt the recommended courses of action without delay, given the urgency of the threats to the monuments and the certainty that they will continue unless firm action is taken.

DECISION 27COM 7A.18

The World Heritage Committee,

1. Having taken note of the information provided by the World Heritage Centre on the results of the mission to the property;

2. Commends the State Party for the efforts which are made in order to complete the programme for the protection of the area;

3. Stresses, however, that engineering solutions to the groundwater problems might prove not cost-effective and sustainable if the source of the problem is not addressed in a comprehensive and co-ordination effort;

4. Recommends to the State Party to halt the on-going engineering interventions and review Phases II and III of the project, taking into account the recommendations of the World Heritage Centre expert;

5. Recommends to the State Party to consider establishing a Cultural Heritage Co-ordination Unit within the Supreme Council of Antiquities (SCA), which would be responsible for maintaining contacts with all institutions involved in planning activities with a potential impact on heritage, as well as for promoting pro-active assessment, planning, monitoring and management of all activities within these properties;

6. Suggests to the State Party to consider requesting international assistance for technical co-operation, if necessary, with a view to set up this Unit and develop its operational procedures;

7. Requests the State Party to submit a report to the World Heritage Centre, by 1 February 2004, on the progress in the implementation of these recommendations for examination by the World Heritage Committee at its 28th session in 2004;

8. **Decides to retain the property of Abu Mena on the List of World Heritage in Danger.**

- **2004**

Conservation issues:
At the request of the Egyptian Authorities, in September 2002, a World Heritage expert hydrologist carried out a mission to the World Heritage property of Abu Mena in order to evaluate the solutions proposed by the Supreme Council of Antiquities to counter the negative impact on the property of the rising level of groundwater. The mission had produced some recommendations,

endorsed by the World Heritage Committee at its 27th session, including:

a) The establishment, within the Supreme Council of Antiquities (SCA), of a Cultural Planning Unit (CPU) responsible for liaising with other Governmental Agencies to coordinate, plan and control the impact of development projects on cultural heritage sites;

b) The review of the proposed engineering measures, taking into account the existing land reclamation activities and agricultural practices, to ensure that they are sustainable and cost-effective;

c) The development of an Action Plan for Abu Mena, including provisions for a monitoring system with appropriate indicators and benchmarks, in consultation with all institutions involved, in particular with the Groundwater Research Institute, local authorities and farmers.

The Secretariat received from the State Party, with an accompanying letter dated 27 February 2004, an undated report on the state of conservation of the site (in Arabic). According to this report, the property of Abu Mena faced a new rise in the groundwater level, which led to further sliding of the soil in unexcavated areas, as well as near the cistern of the Cathedral and the eastern part of the tomb of Abu Mena. Most of the lower parts of the site have been filled by small lakes, which now surround the warehouse of the Antiquities Department as well as the rest house of the German Archaeological Mission. The draining trenches excavated around the site have been deepened, in co-operation with the Egyptian authority in charge of the water supply, so as to reduce the level of the ground water and enable the access to the site for archaeologists and visitors.

The report submitted by the State Party did not provide information on the implementation of the recommendations made by the Committee at its 27th session.

DECISION 28COM 15A.17

The World Heritage Committee,

1. Takes note of the information provided by the State Party, and expresses its concerns over the deterioration of the property caused by rising groundwater levels and other threats;

2. Commends the State Party for the efforts made in order to solve the problems related to the rising ground water in the area;

3. Reiterates, however, the urgency to adopt more long-term and sustainable measures in coordination with the relevant national institutions and in accordance with the recommendations contained in the UNESCO Mission Report of September 2002;

4. Requests the State Party, in consultation with the institutions concerned and, if necessary, requesting assistance from the World Heritage Fund, to develop an Action Plan including provision for a monitoring system with appropriate indicators and benchmarks;

5. Further requests the State Party to submit, by 1 February 2005, a report on the progress of these recommendations for examination by the Committee at its 29th session in 2005;

6. **Decides to retain the property on the List of World Heritage in Danger.**

➢ **2005**

Document: WHC-05/29.COM/7A

Current conservation issues:
Two reports were submitted to the World Heritage Centre by the Egyptian National Commission for UNESCO: A report about the state of the monumental area of Abu Mina, submitted in

December 2004 and A technical report concerning the project of decreasing the underground water levels in the monumental area of Abu Mena (2 pages), submitted in January 2005.
The first report (which is undated) recapitulates in three pages the measures taken since the site was discovered in 1905 to address the problems associated with the rising underground water level. These problems have become more acute since 1990, and recognition in 1998 of the severity of the situation led to the initiation by the Supreme Council of Antiquities of a comprehensive analysis of the site and proposals for its solution. The project was put out to tender without response. Meanwhile, again quoting this report, 'the level of the underground water which threatens the monumental area of Abu Mena is still increasing as some monumental hills in the area collapsed.' This is accompanied by a poor photocopy of a map with a legend in Arabic referring to the 1956 decree of national registration of the site.
Attached to this report is a paper entitled On the water problems at Abu Mina by Peter Grossman (whose affiliation or qualifications are not stated) dated 12 November 2004, which sets out two alternative approaches to the problem: the first involves the digging of a series of shafts linked below ground by tunnels from which the water could be pumped, thereby lowering the water table by 1–2m (inadequate in the view of the author); the cheaper and more effective alternative would be to stop any further supply of water from a much larger area around the archaeologically sensitive area (entailing paying compensation to those farmers who would lose their land).
The second report (which is also undated) briefly summarizes twenty 'works' (including, inter alia, financial estimates) to be undertaken within a period of three years, which provide a minimal response to the Committee's request for an Action Plan to solve the problem of the rising groundwater.
However, these reports, complementing the alarming report received from the State Party in February 2004 and presented to the World Heritage Committee at its 28th session (Suzhou, 2004), increase the fears about the loss of the outstanding universal value for which the site was inscribed on the World Heritage List and its integrity, and add to the criteria which led to its inscription on the World Heritage List in Danger. Should the situation continue to deteriorate and should no concrete action be taken by the State Party as regards the implementation of the recommendations, the Committee could envisage, according to paragraphs 192 to 198 of the Operational Guidelines, the possibility of removing the site of Abu Mena from the World Heritage List in the future.

DECISION 29COM 7A.17

The World Heritage Committee,

1. Having examined Document ***WHC-05/29.COM. 7A***,

2. Recalling Decision **28 COM 15A.17** taken at its 28th session (Suzhou, 2004),

3. Takes note with concern of the information provided by the State Party of Egypt and expresses its concerns over the deterioration of the property caused by rising groundwater levels and other threats;

4. Invites the international community to support the State Party in its efforts towards removing the property from the List of World Heritage in Danger;

5. Urges the State Party to adopt long-term and sustainable measures with all the concerned national institutions, along the lines of the recommendations contained in the UNESCO Mission Report of 2002 and the Committee's Decisions **27 COM 7A.18** and **28 COM 15A.17**;

6. Requests the State Party to invite a joint mission of the World Heritage Centre and ICOMOS, within the next two months, to the property in order to:

    a) assess the situation of the property – both in terms of the state of conservation of the archaeological remains and in terms of the hydrological issue;
    b) evaluate the loss of outstanding universal value of the property and of its integrity;
    c) review the proposed project;
    d) determine the necessary steps towards the implementation of the

recommendation referred in paragraph 5, including the setting up of benchmarks with a time frame for their fulfilment, the setting up of an emergency plan while the project is taking place, and the formulation of proposals for a buffer zone ; and

e) provide the necessary elements to orient the Committee in recommending a program of corrective measures;

7. Further requests the State Party to submit, by **1 February 2006,** a report on the progress made in implementing the abovementioned recommendations for the examination of the Committee at its 30th session (Vilnius, 2006).

8. Decides to consider at its 30th session, in consultation with the State Party and on the basis of the information provided by the mission and the State Party, whether the property should be retained in the World Heritage List in Danger and the World Heritage List.

9. **Also decides to retain Abu Mena (Egypt) on the List of World Heritage in Danger.**

➢ **2006**

Document: WHC-30.COM/7A

Current conservation issues:
At its 29th Session in 2005, the Committee urged the State Party to adopt long-term and sustainable measures with all the concerned national institutions, and to invite a joint mission of the World Heritage Centre and ICOMOS to:

a) assess the situation of the property, both in terms of the state of conservation of the archaeological remains and in terms of the hydrological issue;
b) evaluate the loss of Outstanding Universal Value of the property and of its integrity;
c) review the proposed project;
d) determine the necessary steps towards the implementation of the recommendation, including the setting up of benchmarks with a time frame for their fulfilment, the establishment of an emergency plan while the project was taking place, and the formulation of proposals for a buffer zone ; and
e) provision of the necessary elements to orient the Committee for recommending a programme of corrective measures.

The joint World Heritage Centre-ICOMOS reactive monitoring mission visited the property in November 2005. The mission noted that:

Engineering aspects
Protecting the site from rising groundwater requires the lowering of the water table that is at the present time rising as a result of intensive irrigation in the nearby areas, supplied by the main canals coming from the Nile. The water table should be lowered at least 5 metres. The Egyptian Ministry of Culture has developed a project, aimed at lowering the water table by means of drainage ditches and pipes, inside and around the archaeological area. Completion is expected in about three years. The project is well designed and promises to be effective (work on the project began in December 2005). The operating conditions should be considered along with more general aspects of the management of water resources in a very large area of Egypt.
Economic and political aspects must be considered because a large amount of financial resources will be required, not only in the implementation phase, but also in the long-term working conditions. Moreover, the projects will succeed only if the farmers involved ensure their active participation, while all the state and regional authorities responsible for water management and irrigation also confirm their cooperation.
An efficient system for monitoring the water table in the archaeological site and in the surrounding zones is essential, as its level will remain the most significant variable for assessing the effectiveness of the solution to the problem.

Archaeological aspects
Three preliminary tasks must be undertaken as quickly as possible:

a) A geophysical survey must be elaborated, concentrating in the beginning on areas where it is planned to undertake earth-moving operations connected with the measures to be taken to lower the water table on the site, and before this work has been started;
b) A rapid condition survey of all excavated remains should be carried out and urgent conservation undertaken in order to provide protection to structures during the vibration and other forms of damage likely to result from the use of heavy earth-moving equipment;
c) Discussions must take place simultaneously with these emergency actions in order to establish the definitive boundaries of the World Heritage site and its buffer zone.
Once these emergency activities have been successfully completed, the geophysical survey should continue over the entire site (including the buffer zone), to act as a guide to future research and management projects. At the same time, a conservation plan should be prepared, defining short-, medium-, and long-term objectives and establishing technical parameters (materials, techniques, etc).

Discussions should begin with stakeholders with the objective of preparing a management plan, to include research (including excavation and site survey), presentation and interpretation, the role of stakeholders (e.g. the Mar Mena community), staffing, sponsorship, visitor facilities, access, etc.

As regards paragraph 6.a) of Decision 29 COM 7A.17, related to a possible loss of the outstanding universal value of the property and of its integrity, the mission clearly indicated in its report that "there can be no question of the characteristics for which Abu Mena was originally inscribed having been lost: within the broad justification used in 1979, which characterizes it as 'an outstanding example of an architectural ensemble which illustrates a significant stage in human history', nothing has been irretrievably lost and, indeed, much more has been learned about the site from excavations over the past two decades. Moreover, should the Committee consider the possibility of applying criterion (vi) to Abu Mena, the case for removing it from the World Heritage List on the grounds of loss of outstanding universal value would be further weakened. So far as loss of integrity is concerned, the case is somewhat stronger, though not sufficient to justify removal from the List".
Further to the reactive monitoring mission, four undated reports were submitted by the State Party in February 2006, in Arabic with attached translations or summaries, and technical maps exclusively in Arabic, thus impossible to assess. Three of these reports are related to hydrological issues, while the fourth is a short description of the site and an overall presentation of the programme of archeological studies to be carried out along with the engineering work related to the lowering of the water table. These studies will mainly consist of: architectural survey, soil mechanics study, chemical analysis, monitoring the state of degradation/conservation, recording the structures and preparing detailed restoration projects, designing a site museum, etc.
However, while it is estimated that the hydrology project will last for three years, there is no established timetable for the conservation, restoration and presentation process which will therefore need to be rediscussed with the concerned authorities in order to determine a precisely scheduled work plan to reach the benchmarks identified. This should be achieved more or less within the same time frame, which is before the end of 2009.

DECISION 30COM 7A.19

The World Heritage Committee,

1. Having examined Document *WHC-06/30.COM/7A,*

2. Recalling Decision **29 COM 7A.17** adopted at its 29th session (Durban, 2005),

3. Congratulates the State Party for its efforts in addressing the issue of the rising ground water table;

4. Urges the State Party to implement the recommendations of the joint World Heritage Centre/ICOMOS mission of 2005:

    - Carry out a rapid condition survey of all excavated remains and urgent

conservation measures in order to provide protection to structures during the vibration and other forms of damage likely to result from the use of heavy earth-moving equipment;

- Lower the water table by means of drainage ditches and pipes, inside and around the archaeological area;
- Establish an efficient system for monitoring the water table in the archaeological site and in the surrounding zones;
- Prepare a conservation plan, defining short-, medium-, and long-term objectives and establishing technical parameters (materials, techniques, etc);
- Undertake consultations with stakeholders with the objective of preparing a management plan, to include research, presentation and interpretation, the role of stakeholders (e.g. the Mar Mena community), staffing, sponsorship, visitor facilities, access, etc.

5. Requests the State Party to define urgently the boundaries of the property and of its buffer zone and to provide a map to the World Heritage Centre;

6. Further requests the State Party to submit, by **1 February 2007**, a detailed progress report for examination by the Committee at its 31st session in 2007;

7. Decides to retain Abu Mena (Egypt) on the List of World Heritage in Danger

➢ **2007**

Current conservation issues

The State Party supplied a "*Technical Report on Abu Mina Monastery Site and Underground Water Problems* by Dr. Hassan Fahmy Iman (Consultant to the Supreme Council of Antiquities)", which was received on 30 January 2007.

It was reported that the proposed conservation plan would concentrate on the protection of surface and below-ground archaeological elements during the lowering of the water table, to monitor the structural stability of all elements.Recent technological developments will be used to assess the structural efficiency of the building materials. An architectural documentation system is to be set up. Furthermore, a deterioration phenomena survey, geotechnical investigations, and structural analysis will be carried out.

The report indicates that a detailed soil investigation was carried out, including monitoring of the ground water level variations, field tests and the production of maps. Based on the data gathered, a proposal is included for the lowering of the water table.

A draft outline for a restoration plan is also included, reiterating the recommendations of the experts' mission of 2005.

In February 2007, in response to the request formulated within the Retrospective Inventory exercise, the State Party provided the World Heritage Centre with an appropriate map of the property, clearly indicating its boundaries. The next step is to adopt a buffer zone that would protect the area from development pressure, as the one included in the report is not clear enough nor confirmed officially.

Decision: 31 COM 7A.16

The World Heritage Committee,

1. Having examined Document WHC-07/31.COM/7A,

2. Recalling Decision **30 COM 7A.19**, adopted at its 30th session (Vilnius, 2006),

3. Congratulates the State Party for its efforts in addressing the issue of the rising water table;

4. Adopts the following, identified by the 2005 reactive monitoring mission, as the desired state of conservation for the property:

   a) Consolidated structures;

   b) Water table lowered and monitoring system established in and around the property;

   c) Management plan implemented;

5. Urges the State Party to implement the necessary corrective measures, by 2010, as follows:

   a) Carry out a rapid condition survey of all excavated remains and urgent conservation measures in order to provide protection to structures against earth trembling and other forms of damage likely to result from the use of heavy earth-moving equipment;

   b) Lower the water table by means of drainage ditches and pipes, inside and around the archaeological area;

   c) Establish an efficient system for monitoring the water table in the archaeological site and in the surrounding zones;

   d) Prepare a conservation plan, defining short-, medium-, and long-term objectives and establishing technical parameters (materials, techniques, etc);

   e) Undertake consultations with stakeholders with the objective of preparing a management plan, to include research, presentation and interpretation, the role of stakeholders (e.g. the Mar Mena community), staffing, sponsorship, visitor facilities, access, etc.

6. Requests the State Party to identify a buffer zone surrounding the core area of the property, together with protection regulations and to submit to the World Heritage Centre by **1 February 2008** the relevant information and map for consideration by the World Heritage Committee;

7. Also requests the State Party, in consultation with the World Heritage Centre and ICOMOS, to develop a draft Statement of Outstanding Universal Value including the conditions of integrity and authenticity, for examination by the Committee at its 32nd session in 2008;

8. Further requests the State Party to submit, by **1 February 2008**, a detailed progress report on the implementation of the above measures, for examination by the Committee at its 32nd session in 2008;

9. **Decides to retain Abu Mena (Egypt) on the List of World Heritage in Danger**.

➢ **2008**

Current conservation issues

The State Party reported, in a letter to the World Heritage Centre dated 25 January 2008, the following:

1. Regarding a conservation plan, the structures are now being consolidated. The restoration and conservation plans will take place following the stabilization of the water table. Short, medium, and long-term objectives have already been established;

2. With regard to the water table, a project for its reduction will be finished within one year. This project will include drainage ditches and pipes;

3. A monitoring system that will be in place during and after the completion of the project is also being implemented;

4. A buffer zone has been defined with the Department of Surveying in Egypt. This buffer zone will be on the official map of the property;

5. After completion of the project, a protective fence will be built around the area, including the buffer zone and the antiquities area. This fence will not obstruct the panorama of the property.

The World Heritage Centre and the Advisory Bodies consider that the threats identified above are still present, but it would appear from the brief report provided that the impacts of these are being mitigated by actions undertaken by the State Party. It is difficult, however, to evaluate the effectiveness and nature of these actions and to assess to what extent the threats remain current. A more detailed report with information on the timeframe for implementation is necessary.

The World Heritage Centre and the Advisory Bodies welcome the establishment of a buffer zone that the State Party has submitted as a minor modification for examination by the World Heritage Committee in item 8 of the Agenda (*Document WHC-08/32.COM/8B.Add*)..

Decision: 32 COM 7A.15

The World Heritage Committee,

1. Having examined Document *WHC-08/32.COM/7A,*

2. Recalling Decisions *30 COM 7A.19* ***and*** **31 COM 7A.16**, adopted at its 30th (Vilnius, 2006) and 31st (Christchurch, 2007) sessions respectively,

3. Takes note of the information provided by the State Party on the actions being taken to address the existing threats and urges the State Party to continue its work on the corrective measures adopted at its 30th session (Vilnius, 2006);

4. Invites the State Party to consider a request for International Assistance to support the preparation of the conservation and management plans;

5. Reiterates its requests to the State Party to develop, in consultation with the World Heritage Centre and the Advisory Bodies, a draft Statement of Outstanding Universal Value including the conditions of integrity and authenticity, for examination by the World Heritage Committee at its 33rd session in 2009;

6. Requests the State Party to provide to the World Heritage Centre, by **1 February 2009**, an updated report on the state of conservation of the property and the implementation of the above, for examination by the World Heritage Committee at its 33rd session in 2009;

7. **Decides to retain Abu Mena (Egypt) on the List of World Heritage in Danger.**

➢ **2009**

Current conservation issues

During its 32nd session (Quebec City, 2008), the World Heritage Committee took note of the information provided by the State Party on the actions being taken to address the existing threats, and urged the State Party to continue its work on the corrective measures adopted at its 30th session (Vilnius, 2006). As well, the World Heritage Committee invited the State Party to consider submitting a request for International Assistance to support the preparation of the conservation and management plans, and reiterated its requests to the State Party to develop, in consultation with the World Heritage Centre and the Advisory Bodies, a draft Statement of outstanding universal value including the conditions of integrity and authenticity, for examination by the World Heritage Committee at its 33rd session in 2009.
The State Party's report was received on 1 February 2009 and notes the following:

a) Statement of Outstanding Universal Value

The State Party report also includes what is presented as a Statement of Outstanding Universal Value, as requested by the World Heritage Committee during its 32nd session. However, although this section of the report provides an interesting account of the principal sources of interest in the history and archaeological excavation of this property, the account provided does not conform to the expectations of the World Heritage Committee (as described in the Operational Guidelines) in preparing a Statement of Outstanding Universal Value (reflecting articulation of the criteria identified for inscription, authenticity, integrity and management mechanisms).

b) Rise in the water table

The State Party report also provides an overview of threats posed to the property by the raising of the water table in the vicinity of the property, resulting from a land reclamation programme for agricultural development of the region, and by the building of a large road to facilitate movement through the site. The lowering of the water table has resulted in the property's dry clay soils becoming semi-liquid and the collapse of a number of structures. Measures taken by the Supreme Council of Antiquities .to counteract this phenomenon has thus far proven insufficient. The State Party concluded this part of its report by summarizing findings of the 2005 mission (which have been previously reported to the World Heritage Committee).and by describing current plans to respond to the problems.
The State Party report notes that a Ministry of Culture project for reducing the water table by 5m has been developed, scheduled to begin soon, has a three year time line for implementation. The report notes the importance of implementing this project in ways cognizant of economic and political aspects and integrating the full participation of the region's farmers, and which will ensure careful monitoring of hydrological results.

c) Other matters

The State Party report describes preparing a request for an international campaign for 4-5 million dollars along the lines of that the one launched for the Nubian monuments of Abu Simbel in 1959. This international campaign would « support the implementation of a more elaborate site management plan that will not only include restoration and rehabilitation, but also education, training, awareness, local community participation etc. for the conservation and management of the site and its vicinity ».

The World Heritage Centre and the Advisory Bodies would note that while the effort to launch an ambitious international campaign for the conservation of this property is laudable, that its definition and objectives will be shaped by development of the conservation plan and management plan previously requested by the World Heritage Committee at its 32nd session, and described in the State Party report as essential support for long term care of the property's archaeological resources. Realization of both plans would be best and most expeditiously accomplished by the State Party preparing a request for international assistance from the World Heritage Fund as previously suggested by the World Heritage Committee at its 32nd session.
The World Heritage Centre and the Advisory Bodies would also note that the preparation of effective conservation and management plans depends on the preparation of a Statement of

Outstanding Universal Value approved by the World Heritage Committee, and would urge that preparation of such a statement according to the requirements of the Operational Guidelines be given priority.

Decision: 33 COM 7A.15

The World Heritage Committee,

1. Having examined Document *WHC-09/33.COM/7A*,

2. Recalling Decision **32 COM 7A.15**, adopted at its 32nd session (Quebec City, 2008),

3. Acknowledges the information provided by the State Party on the actions being taken to address some of the corrective measures and urges the State Party to continue its work on all the corrective measures adopted at its 30th session (Vilnius, 2006);

4. Reiterates its invitation to the State Party to submit a request for International Assistance to the World Heritage Committee to support the preparation of the requested conservation and management plans, and to provide a basis for shaping and articulating priority needs within the context of developing an international appeal;

5. Requests that the State Party invite a joint World Heritage Centre/ICOMOS reactive monitoring mission to assess progress on the implementation of all the corrective measures, to review the draft Statement of Outstanding Universal Value including the conditions of integrity and authenticity, develop a proposal for the Desired state of conservation for the removal of the property from the List of World Heritage in Danger and revise the timeframe;

6. Also requests the State Party to provide to the World Heritage Centre, by **1 February 2010**, an updated report on the state of conservation of the property and the implementation of the above, for examination by the World Heritage Committee at its 34th session in 2010;

7. **Decides to retain Abu Mena (Egypt) on the List of World Heritage in Danger**.

ANNEX VI Report of the joint World Heritage Centre–ICOMOS reactive monitoring mission of December 2005

Report of

the UNESCO-ICOMOS Monitoring Mission to

ABU MENA (Egypt)

12–19 November 2005

by

Professor Marcello Benedini (Italy)

and

Professor Henry Cleere (United Kingdom)

Report of the UNESCO-ICOMOS Monitoring Mission to ABU MENA (Egypt) 12–19 November 2005

Annexes	A	List of people met during the mission
	B	Documentation

1 Background

1.1 The site

Abu Mena (Fig. 1) is located south of Alexandria, between Wadi el-Natrun and Alexandria itself. The church, baptistery, basilicas, public buildings, streets, monasteries, houses, and workshops in this early Christian holy city were built over the tomb of the martyr Menas of Alexandria, who died in AD 296. Menas, who was an officer in Diocletian's army, refused to kill any Christians after they had been defeated by his army, and declared his Christianity publicly. Legend has it that after his martyrdom Menas's remains were brought back from Phrygia by camel and buried where the animal refused to walk any more. Water welled up in the desert there, making it possible to grow vines and olive trees, as a result of which it is known as St Menas's Vineyards.

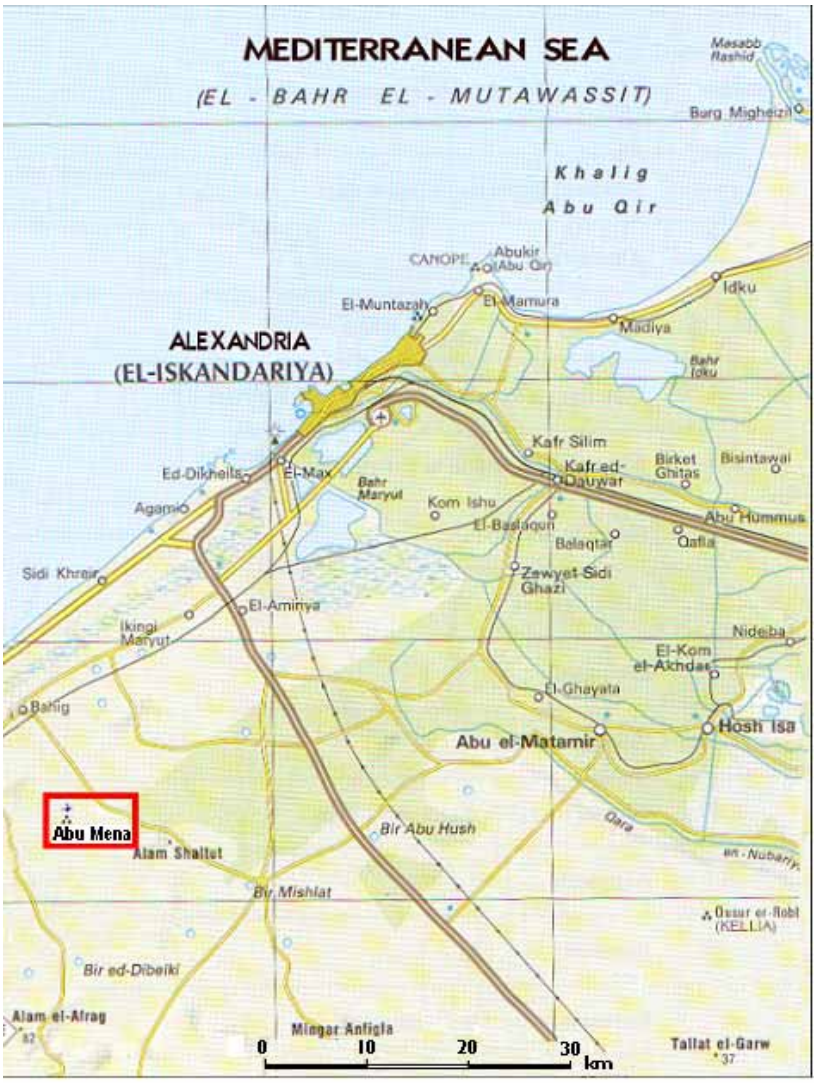

Figure 1 Location of Abu Mena archaeological site

Archaeological excavations since 1900 have revealed that Abu Mena grew rapidly in the course of the 5th and 6th centuries. By 600 the oasis had become a pilgrimage city, centred on the great basilica complex. An entire town with houses and cemeteries has been revealed by excavation.

Constructed in the 5th century to accommodate the increasing number of Christian pilgrims, the Thermal Basilica was built to store the curative waters that were used for the heated baths and pools surrounding the Basilica. Pilgrims used to fill tiny flasks with water from the Basilica. The flasks, which were stamped with the seal of St Menas, showing the martyr standing between two kneeling camels, have been found widely distributed in the Roman world. During the 5th and 6th centuries many buildings were erected around the Thermal Basilica, including a monastery on its north side.

Abu Mena was inscribed on the World Heritage List as cultural property C 90 by the UNESCO World Heritage Committee at its 3rd Session, held at Cairo and Luxor in 1979. At its 25th Session in Helsinki in 2001 the Committee inscribed Abu Mena on the List of World Heritage in Danger. It was reported that a land-reclamation programme for the agricultural development of the region, funded by the World Bank, had caused a dramatic rise in the water table over the previous decade. The local clay soil was hard and capable of supporting buildings when in a dry state, but became semi-liquid with excess water. The destruction of numerous cisterns, located in various parts of the city, had led to the collapse of several overlying structures. Huge underground cavities had opened in the north-western region of the town. The risk of collapse was so high that the authorities were forced to fill the bases of some of the most endangered buildings, including the crypt of Abu Mena with the tomb of the Saint, with sand and close them to the public.

1.ii Objectives of the mission

A mission was sent by the UNESCO World Heritage Centre in September 2002 to assess water-related damage and adverse effects on the World Heritage Sites of Ancient Thebes and Abu Mena (see Annex B for details). The report of this mission commented favourably on the work carried out at the Luxor and Karnak Temple sites, which has subsequently proved to have solved the problems there completely. The report, however, expressed grave concern about the situation at Abu Mena, where the nearby land reclamation and irrigation project had created a severe problem which required a more drastic and costly solution.

Reports were submitted by the State Party to the Committee at its 28th and 29th Sessions, in Suzhou (China) and Durban (South Africa) respectively. At the latter meeting, in 2005, the Committee expressed its concerns (in document *Decisions 29 COM 7A.17*) over the deterioration of the property caused by the rising groundwater levels and other threats. It invited the international community to support the State Party in its efforts towards removal of the property from the List of World Heritage in Danger, urging the State Party to adopt long-term and sustainable measures along the lines of those recommended in the 2002 Report.

The Committee Decision went on to request the State Party to invite a joint mission of the World Heritage Centre and ICOMOS to the property in order to:

a) Assess the situation of the property – both in terms of the state of conservation of the archaeological remains and in terms of the hydrological issue;

b) Evaluate the loss of outstanding universal value of the property and of its integrity;

c) Review the proposed project and assess its potential effects on the site;

d) Determine the necessary steps towards the implementation of recommendations made in the 2002 Report, including the setting up of benchmarks with a time frame for their fulfilment, the setting up of an emergency plan while the project is taking place, and the formulation of proposals for a buffer zone;

e) Provide the necessary elements to orient the Committee in recommending a programme of corrective action, identifying possible alternative technical solutions that would minimise the water problems in Abu Mena.

The World Heritage Centre's expert on the mission, which took place between 12 and 19 November 2005, was Professor **Marcello Benedini**, who spent thirty years with the Water Research Institute of the Italian National Research Council in Rome, retiring in 1999. The ICOMOS expert was Professor **Henry Cleere**, who was Director of the Council for British Archaeology from 1974 to 1991 and World Heritage Coordinator of ICOMOS (International Council on Monuments and Sites) in Paris from 1992 to 2002.

2 Organization and programme of the mission

2.i Organization

The nomination of experts and the funding of the mission were organized jointly by the World Heritage Centre of UNESCO (Arab States Section) and the World Heritage Secretariat of ICOMOS. Preparation and implementation of the programme was the responsibility of the Egyptian National Commission for UNESCO, working with the Supreme Council of Antiquities, the University of Alexandria, the Mar Mena Monastery, and other stakeholders.

2.ii Programme

Saturday 12 November		Arrival of experts in Cairo
Sunday 13 November	am	Initial briefing meeting with Abu Mena working committee at offices of Egyptian National Commission for UNESCO
	pm	Meeting at offices of Supreme Council of Antiquities with Dr Zahi Hawass (Secretary General)
		Travel by car to Alexandria
Monday 14 November	am	Travel by car to Abu Mena
		Visit to World Heritage site
		Lunch by invitation of Mar Mena community
	pm	Discussions with representatives of Mar Mena community and members of the Abu Mena working committee
		Return to Alexandria by car
Tuesday 15 November	am	Visit to archaeological sites in Alexandria
	pm	Return to Cairo by car, with facility visits* to Coptic monasteries of Wadi el-Natrun (Deir-al Surian, Deir Akua Bishoi, and Deir al-Bardamus) *en route*
Wednesday 16 November		Working meetings of experts to discuss results of site visits, to prepare for further meetings with working committee, and draft outline of eventual report

* 'Facility visits' were organized by the working committee to enable the mission experts to study comparable sites and monuments and to evaluate the conservation and restoration works in progress.

Thursday 17 November	am	Final formal meeting with Abu Mena committee, to clarify aspects of project and to request additional information
	pm	Facility visit to Citadel area
	eve	Working dinner on Nile boat with members of working group
Friday 18 November	am	Facility visits to Cairo Museum and Coptic churches in Coptic Museum area in Cairo, currently being restored
	pm	Free
Saturday 19 November	am	Meeting of Professor Benedini with hydrological experts
		Departure of Professor Cleere to London
	pm	Departure of Professor Benedini to Rome

3 The present position and the identification of the threats

3.i Hydrological issues

The hydrological characteristics of the site are strictly related to the geographical reality into which it is inserted.

Abu Mena is located at the border of Western Sahara, 48 km south-west of Alexandria, 17 km from the Mediterranean Sea and about 97 km from the Rosetta Branch of the Nile Delta. The main archaeological discoveries, which are concentrated in an area of about 100 ha, are at an average elevation of 40 m a. s. l., where the ground surface is in the form of flat land with some smooth dunes and depressions, slightly sloping towards the north-east.

As a result of such a location, the climatic pattern of the area can be explained as the combined effect of different climatic zones, and also having some particular characteristic subject to change over the centuries relevant to the past and present history of the site.

The vicinity of the sea guarantees sufficient mitigation of the extreme characteristics of the desert, while the Nile can be still exercising an influence by virtue of its beneficial environmental effects.

Since the area still maintains the Mediterranean climatic pattern, it is reasonable to assume that in the site of Abu Mena as well the actual conditions result from the changes experienced in the rest of the basin. They consist essentially of a reduction in annual precipitation with an increased number of short-duration and high-intensity rainfall events, and an increase of the average temperature.

Consequently, it is also reasonable to say that the environmental aspects of Abu Mena during the early centuries of the Christian era, the period of its most important development, were different from those of the present day, with positive effects not only on the living conditions, but also on the availability of water.

From the geological point of view the site belongs to the Egyptian Western Desert Groundwater System, flanked by the Mediterranean coastal zone to the north and the Wadi El-Natrun area to the south-east. The source of groundwater in the deepest layers is the Nubian Sandstone aquifer, common to a large part of northern Africa, with a movement normally in a northerly direction.

There are salt-water-bearing formations in the vicinity of Alexandria resulting from seawater intrusion from the Mediterranean.

The upper aquifer belongs to a Quaternary and late Tertiary formation, covered by a few centimetres of sand, silt and clay, and a layer of sedimentary rocks, mostly limestone, 80 m thick and based on the Moghra Formation of sandstone with clay. Rainfall is the main source of recharge for this aquifer.

All the area has an average annual precipitation of 100–140 mm, mostly in late autumn and winter. Three-quarters of the total amount of rainfall is from November to February.

Precipitation occurs normally in the form of short-duration high-intensity events, which give rise to a surface runoff that eventually accumulates in the local depressions, from where water is removed by evaporation and percolation.

The average daily temperature is 26°C in summer and 12°C in winter.

A reliable hydrological balance would require more information based on direct measurements relevant to both the soil and the precipitation. Some estimates carried out by the Egyptian Research Institute for Groundwater refer to high values of potential evapotranspiration, of the order of 1.5–7.5 mm/day, as an average including desert and cultivated land. Accordingly, in the uncovered desert the fraction of the total rainwater that percolates through the soil during the rainy days should be relatively small.

This meteorological pattern, typical of the southern Mediterranean coast, could be the ultimate result of a progressive climate change lasting some centuries. The archaeological discoveries have in fact brought to light the existence of activities such as wine production, which require the presence of crops that need a considerable quantity of water, which at that time was available only from rainfall. The climate change, together with the advancement of desert which still today characterizes all the Sahara zones, could have contributed to the decay of the ancient urban settlement.

The presence of groundwater in the area is related to the particular geology and climatic characteristics. The percolating water reaches the layer of limestone, which is 80 m deep and relatively permeable, giving rise to a free-surface aquifer. Some intercalated lenses of clay produce intercalated confined aquifers of limited extension. In normal conditions the water table settles between 15 m and 40 m below ground level, with a productive depth of the order of 50 m. Following some investigations carried out by the Research Institute for Groundwater, the transmissivity can be assessed between 500 and 5000 m^2/day. For the productive thickness considered, such values correspond to a permeability of between 10 and 100 m/day, characteristic of an aquifer with acceptable conditions.

The particular problem of Abu Mena preservation concerns primarily the physical and quantitative aspects of groundwater control. Direct measurements in surging groundwater, also repeated during the visit to the Abu Mena site, have highlighted a content of salt in the aquifer, the presence of which can be also confirmed by visible traces on the soil surface, after the evaporation of the water rising by capillarity. The salt content in water, which contributes to the degradation of buildings by activating chemical reactions in the stone and the mortar, originates from local interaction of percolating water with the mineral components in the subsoil.

3.ii Main threats to the archaeological site

The massive irrigation programme of the Egyptian government also includes the area surrounding the Abu Mena site, and more than 160,000 ha can already make use of water taken from the Nile and from the local aquifer. Irrigation is in practice the only means to improve agriculture, a fundamental activity for economic development, which also concerns the reclamation of large desert zones.

As indicated in Fig. 2, the agricultural zones with intensive irrigation around Abu Mena are:

- The *Bahig area*, consisting of the fields located to the north-east, to which water is conveyed from the Bahig Canal;
- The *Bangar el Sukkar area*, with the fields located to the south and south-west, where water comes from the El Nasr Canal.

Both canals originate from the Nile and belong to a complex network, equipped with pumps and able to convey several m^3/s.

In the agricultural districts the irrigation is carried out using traditional practices, and a large quantity of water is delivered to areas of intensive cultivation which are capable of producing two harvests per year. Sugar beet is the most common crop, for the cultivation of which there are subsidies from the government. The average annual water demand is of the order of 17,000 m^3/ha.

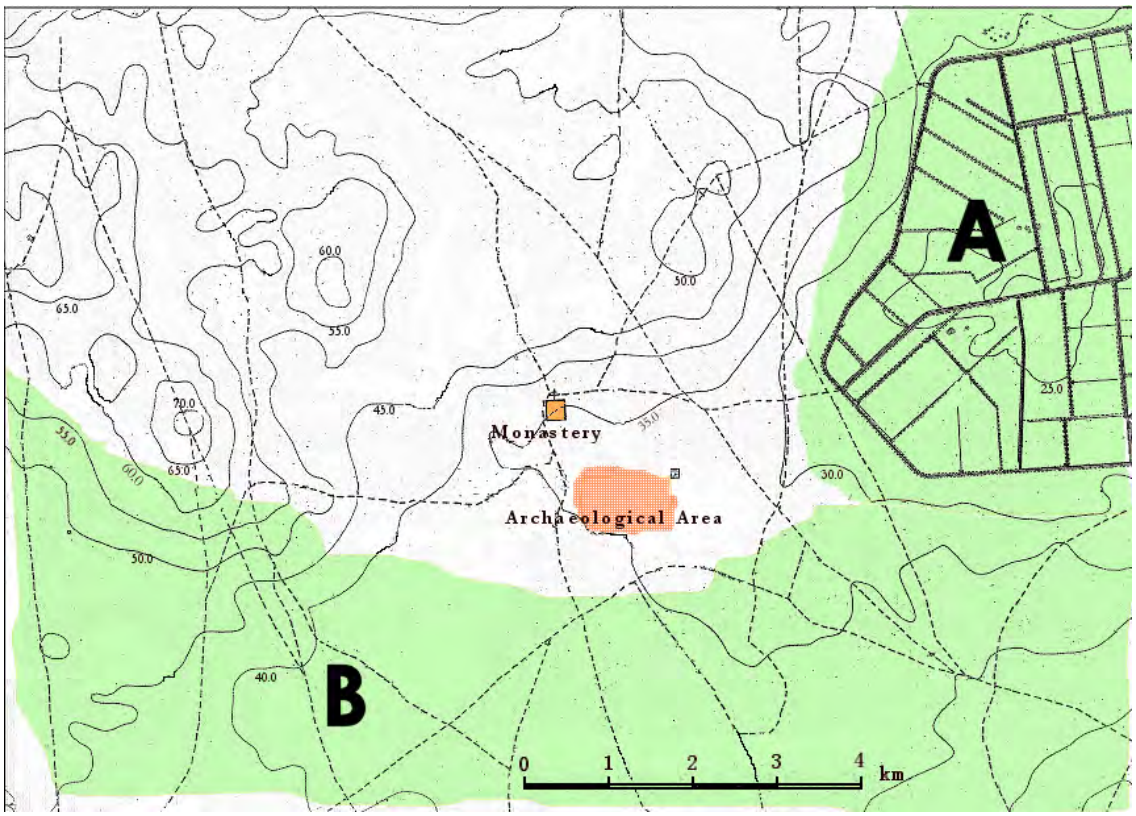

Fig. 2. Irrigation around Abu Mena: **A =** Bahig area; **B** = Bangar el Sukkar area

The most commonly used watering technique is flooding, water being released to the crop with little control. There is always a large amount of water that is not used by the plants, and this percolates through the upper soil layer. Other watering techniques, such as sprinkle and drip, with a lower water consumption, and an attempt to adopt more rational criteria for using the available water in the best possible way, have not yet been received favourably by the farmers. This is the main explanation of the increased water

replenishment of the subsoil. Another cause is seepage from the numerous canals, which have been dug without any form of lining. The effect of all these man-made interventions combines with the natural replenishment due to the percolation of rainwater.

Since the start of irrigation late in the 1960s, the water table has risen remarkably in all the areas of interest. Both inside and around the archaeological site a rise of 35 m has been observed and the actual water table can be found just 10 cm below the ground surface.

Accurate monitoring of the aquifer has been carried out, with measurements taken from several piezometers spread across the area. In late spring and summer 2001 the water table was almost stabilized between 36.00 and 34.00 m a.s.l., very close to the ground level.

Another survey has been carried out inside the Monastery,. In summer and autumn 2005 the average elevation of the water table was about 29.40 m a.s.l. where the ground surface is around 30.00 m a.s.l.

3.iii Archaeological issues

As a result of the disastrous rise in the level of the water-table below the World Heritage Site, there has been total or partial inundation of excavated structures. In those areas that are not inundated, there is evidence of the movement upwards by capillary action of groundwater, containing salts that can be seen to have an adverse impact on walling, flooring, and other materials (stone, fired bricks, mortar, plaster rendering, etc). This is particularly visible in those structures that were exposed by excavation in the earlier part of the 20th century, where hard cement mortar has permitted more serious damage owing to the low permeability of this material, thereby allowing the saline water to rise higher and attack the interiors of stone and brick, causing them eventually to disintegrate.

Some low-lying excavated areas have been completely submerged beneath the rising water, and it is inevitable that these will have undergone damage and deterioration. More recently excavated areas have been backfilled by the excavator, Professor Peter Grossman of the Deutsches Archäologisches Institut, Cairo. Whilst this action will have afforded some degree of protection to the excavated remains, it will not have returned them to the environmental near-equilibrium that protected them before excavation.

A further threat to the archaeology of the site relates to the inevitable disturbances to the buried structures and occupation layers from the forthcoming dewatering operations. The use of heavy equipment to sink wells and dig water channels will damage archaeological features unless prior geophysical survey is carried out, followed either by relocation of the engineering interventions to avoid archaeological structures or by full excavation and recording in advance of engineering works. It is essential therefore that there should be a full non-excavational survey programme using techniques such as radar, magnetometer, or resistivity (and preferably at least two of these methods) on all the areas where engineering interventions are planned. No engineering projects should be initiated until the geophysical survey has been carried out and any necessary rescue excavation carried out (or, alternatively, adjustments made to the lines of channels or the location of wells).

4 Justification for continued World Heritage Listing

4.i Criteria for inscription

Abu Mena was one of the earliest sites to be inscribed on the World Heritage List, in 1979. At that time the requirements of the World Heritage Committee were simpler than they are now. The nomination dossier is slight by comparison with those regularly submitted at the present time – a six-page form, a general map of the site, five plans of individual buildings, and a number of photographs. No evaluation mission was sent to the property, and the recommendation made by the cultural experts consulted did not justify the reason for inscription under the terms of cultural criterion iv. At that time this criterion required the nominated property to"… be among the most characteristic examples of a type of structure, the type representing important cultural, social, artistic, scientific, technological, or industrial development." (Following several changes in the intervening period, this criterion now refers to "… an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history.")

The justification for inscription in the report of the 3rd Session of the UNESCO World Heritage Committee held at Cairo and Luxor in 1979 reads simply: "Abu Mena is an outstanding example of an architectural ensemble which illustrates a significant stage in human history," without the detailed citation specifying how this criterion is met by the individual property, as is the case at the present time.

It is interesting that only criterion iv was used in this case. It is difficult to comprehend why criterion vi was not applied in support of the inscription on the World Heritage List. This criterion is defined as being applicable to a site or monument which is:

> directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance. (*Operational Guidelines*, 2005, para 77)

It might have been expected that this criterion, which has subsequently been applied to other pilgrimage sites such as Santiago de Compostela or Canterbury, was not used to justify the inscription on the World Heritage List of one of the most significant Christian pilgrimage sites in the Near East for many centuries.

4.ii Potential loss of 'outstanding universal value' and integrity

There is an implication in the terms of reference for the mission contained in Decision 29 COM 7A.17 of the 29th Session of the World Heritage Committee (see 2.i above) that the current threats to Abu Mena may have resulted in a significant loss of the "outstanding universal value" (the fundamental criterion for World Heritage Listing) of the property and of its integrity.

The report on the site prepared by the UNESCO World Heritage Centre that was presented to the Committee at its 29th Session in Durban ends with the following words:

> Should the situation continue to deteriorate and should no concrete action be taken by the State Party as regards the implementation of the recommendations [made in the 2002 Report], the Committee could envisage, according to paragraphs 192 to 198 of the *Operational Guidelines*, the possibility of removing the site of Abu Mena from the World heritage List in the future.

Paragraph 192 of the *Operational Guidelines* specifies the reasons for removing a property from the List as follows:

> a) Where the property has deteriorated to the extent that it has lost those characteristics which determined its inclusion on the World Heritage List;
>
> b) Where the intrinsic qualities of a World Heritage site were already threatened at the time of its nomination by action of man and where the necessary corrective measures as outlined by the State Party at the time have not been taken within the time proposed.

The latter situation is not relevant in this case, since the rise of the water-table is a phenomenon of the last decade, and so any case of removal from the List must be based on a) above. There can be no question of the characteristics for which Abu Mena was originally inscribed having been lost: within the broad justification used in 1979, which characterizes it as "an outstanding example of an architectural ensemble which illustrates a significant stage in human history," nothing has been irretrievably lost and, indeed, much more has been learned about the site from excavations over the past two decades. Moreover, should the Committee consider the possibility of applying criterion vi to Abu Mena, the case for removing it from the World Heritage List on the grounds of loss of outstanding universal value would be further weakened.

So far as loss of integrity is concerned, the case is somewhat stronger, though not sufficient to justify removal from the List. This quality is defined in the *Operational Guidelines* (para 88) as:

> a measure of the wholeness and intactness of the natural and/or cultural heritage and its attributes. Examining the conditions of integrity therefore requires assessing the extent to which the property:
>
> a) includes all elements necessary to express its outstanding universal value;
>
> b) is of adequate size to ensure the complete representation of the features and processes which convey the property's significance;
>
> c) suffers from adverse effects of development and/or neglect.

The next paragraph goes on the specify that:

> The physical fabric of the property and/or its significant features should be in good condition, and the impact of deterioration processes controlled.

It is indisputable that the physical fabric is not in good condition and that the impact of deterioration processes is not at present controlled. However, as this report will

demonstrate, active and effective steps have been taken by the State Party to reverse the impact of deterioration processes and plans are being prepared to restore the physical fabric to an acceptable level.

5 The projects currently being implemented

5.i Technical issues

In a joint effort with the Ministry of Agriculture and the Ministry of Water Resources and Irrigation, and with appropriate scientific support, the Ministry of Culture has developed an ambitious project, with the intention of lowering the water table in the archaeological site and keeping it under control.

The project is based on the possibility of draining groundwater by means of open ditches. Drained water will be brought to some centralised tanks, from which it will be raised by pumps and discharged again into the main canals originating from the Nile. The project outlines are sketched in Fig. 3. It concerns about 4.20ha in the core of the monumental area.

The draining ditches will be dug at an appropriate level to draw water around and below the basements of the monuments. The water collected will be conveyed to some intermediate tanks through a network of collection pipes, and then into a large primary tank at the end of the drainage area. Finally, a set of pumps connected to a 1.20 km long pipeline will discharge the water into the main canals of the Bahig Area. Special technical solutions will be adopted in order to facilitate the capture of water through the bed and banks of the ditches. Furthermore, the collection pipes over a total length of about 9.00 km will be made from porous material and placed in the ground at an appropriate depth, in order contribute to the drainage.

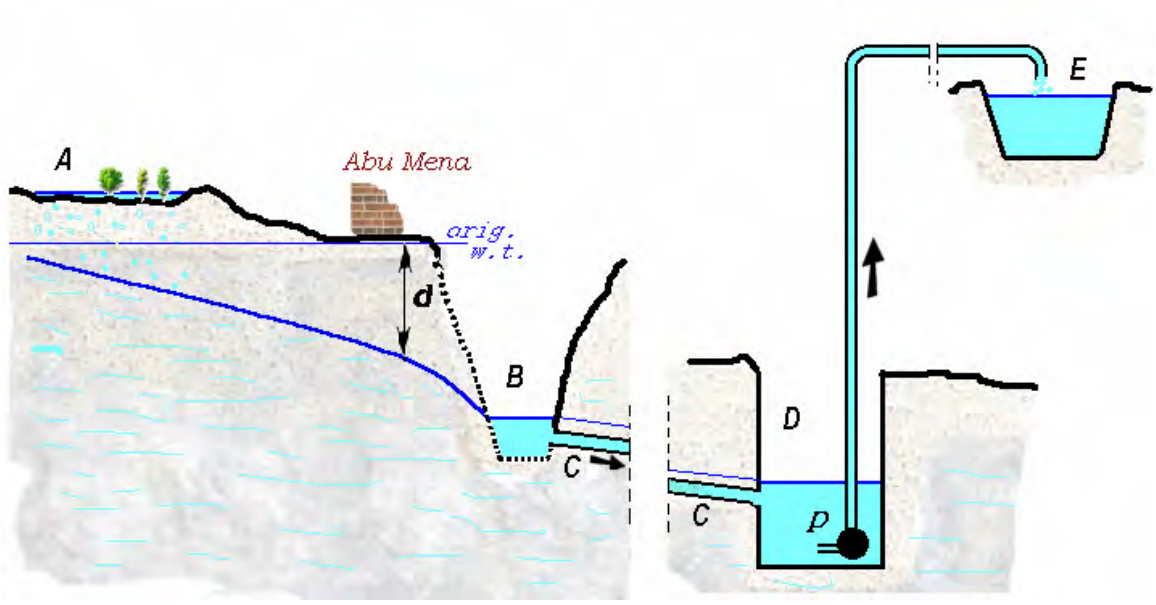

Figure 3 Outlines and operational principles of the project developed by the Ministry of Culture. In the irrigation areas ***A*** a large amount of water percolates through the soil and recharges the aquifer. The drainage ditches ***B*** produce the drawdown ***d*** from the original water table level. The drained water is conveyed through the pipes ***C*** to the collection tank ***D***, where the pump ***p*** raises it to the main canal ***E*** that supplies the irrigation area by gravity

The final flowrate to remove from the area is estimated at 0.42 m^3/s, corresponding to a total volume of 13 Mm^3 per year.

The project is designed in accordance with the local topography and elevation in order to benefit from the natural slope of the ground surface. It comprises all the directions for a correct implementation, taking into account the particular situation and all the constraints present in the area.

The construction of the various works will entail digging and moving about 180,000 m^3 of earth. Electrical equipment, connected to the main 500 kV distribution network, will provide the necessary power for the pumps and other relevant services. In case of emergency, a diesel generator of 250 kW will be available.

The full implementation of the project is expected to be completed in three years at a cost of 2.3 M€, entirely contributed by the Egyptian Government.

In parallel the Mar Mena Monastery has commissioned a qualified engineering firm to develop a project for its precinct. The project is based on accurate monitoring of the water table, which in this area is now very close to the ground level, creating a grave risk to the stability of the basilica and all the other buildings in the complex. The main buildings will be surrounded with a ring of porous pipes, connected to a collecting duct equipped with a pump and discharging into the drainage canals outside the Monastery. The discharged flow will be handled together with that covered by the general project of the Ministry of Culture for the archaeological site.

The goal of both the projects is to lower the water table to about 5m below the actual level. This measure is deemed sufficient to avoid any threats to the buildings, so as to make it possible to start archaeological excavations again in less hazardous circumstances.

The anticipated lowering of the water table will also remove all risk of deterioration of the basements and underground structures as an effect of chemical activity due to the presence of salt in groundwater.

5.ii Archaeology

The impression was gained that few, if any, steps have been taken to draw up a comprehensive conservation programme to be implemented once the water-level problem has been resolved and is in the course of coming into service. In a sense this is a wise precaution, since it would be inadvisable to begin elaborate conservation works that may be jeopardized as the drainage project progresses. A vague general impression was given that standard Supreme Council procedures would begin when the de-watering began.

A great deal of experience has been obtained in this field by the Supreme Council of Antiquities as a result of the successful work carried out at the Luxor and Karnak Temples. There are, however, significant technical differences between the archaeology and hydrological aspects of Upper Egypt and the Delta and so a group should be set up as soon as possible, perhaps involving foreign as well as Egyptian experts, to prepare an overall conservation plan for the Abu Mena site.

6 Potential effects of the projects and possible alternative solutions

6.i The efficiency of the project

From the documents collected during the mission, as well as from the information given by the technical experts of the Ministry of Culture, the project appears to have been developed with a high level of expertise. The proposed solutions reveal a knowledge of valuable technological innovations which will guarantee good working conditions. Groundwater drainage by means of permeable unlined ditches and porous pipes and canals could be very effective. If the water in the ducts can be kept at a low level, a sufficient drawdown in the aquifer can be obtained.

An accurate evaluation of the drawdown would require much more information on the subsoil and the groundwater, given that the behaviour of a free aquifer is always difficult to quantify. Following a rough estimate, in the typical conditions of the area, the design flowrate of 0.42 m^3/s will guarantee the anticipated lowering by 5 m.

The efficiency of the project is strictly dependent on the pumps, which must run permanently throughout the year. At an estimated cost of 1 € for 1 m of elevation, the achievement of the planned flowrate will necessitate considerable financial resources being available.

The insertion of the project into the overall irrigation schemes will activate a form of closed circle, as the water drained from the subsoil is returned to the main canals, from which, in turn, it is delivered to the crops in a way that enhances the percolation and the recharge of the aquifer. The risk of raising the water table again could be very high. The success of the project will be fully assured when the quantity of water extracted from the aquifer matches that brought in by the main irrigation canals.

6.ii Alternative solutions

As confirmed by the technical experts of the Ministry of Culture during the mission, the project has been already approved and its implementation will start shortly. The organizational machinery has been already put into motion and any proposal that might significantly change the actual method of proceeding would be likely to cause unpredictable troubles. It should be accepted that the Egyptian authorities have explored a number of possible solutions to the problem before developing the present project.

Nevertheless, it is reasonable to examine whether there are other feasible procedures which might be considered in order to achieve the principal objective, that of lowering the water table in the archaeological site. In this way a background that might well prove useful for future developments can be established, not only in case the present project experienced some failures, but also in order to provide a more general perspective for rational water management in the whole area.

In Egypt the available water resources are limited and the Nile cannot meet a demand that is continuously increasing. A number of physical and environmental constraints are imposed on water withdrawal. Scientific investigations on the future of Egyptian water

resources have predicted a possible shortage of usable water, and the Nile itself is expected to suffer from the effects of the frequent droughts occurring in its upper catchment areas in central Africa.

A general policy of water economy, combined with the need to reclaim the desert in order to create a prosperous agriculture, should be of supreme interest to the Egyptian authorities. The preservation of archaeological sites is also a part of this policy, in a larger context that associates water management with all the initiatives aiming at economic development and environmental protection.

The most effective alternative could be a radical change in agricultural practice, adopting 'dry' crops, at least in a zone around the site. This is mainly a political issue, to be implemented only after delicate and most likely prolonged negotiations between the government and the people concerned. This decision ought to be integrated with initiatives covering the entire territory of Egypt, handled by the national government for implementation over a long period of time, the benefit becoming apparent only after several years.

As an alternative to the cultivation of dry crops, a positive result might also be achieved with irrigation techniques capable of delivering a limited amount of water, to be applied only after the requirements of the chosen crops have been determined accurately. This would mean taking into account the availability of resources, the environmental conditions, and the economic aspects of a form of agricultural activity carried out using the best technological solutions. Sprinkle and drip irrigation can contribute not only to decreasing the percolation in the cultivated land but also to saving water.

An effective alternative can be the withdrawal of groundwater by means of pumping wells. Once again in this case, the lack of more precise hydrogeological information does not at present permit a reliable evaluation of the results that might be achieved. Several pumping wells would be necessary, working together simultaneously, in such a way that the result would be the combination of all the individual pumps, with the possibility of the overall cost being shared among the participating farmers.

In this way water extracted from the subsoil would be used directly on the spot, without any need for main conveying canals. Obviously, since the extracted water will percolate again into the water table, a new closed circuit will be created. In this case, the closed circuit will be controlled by the farmers themselves, who will withdraw the necessary quantity of water from the aquifer lying beneath their own crops alone.

The success of such an alternative depends upon the establishment of a correct water balance, because percolation must be less than withdrawal, at least in the transition phase, in order to lower the water table to the desired level and to achieve a sufficiently stable situation. After some years, the quantity of water extracted from the subsoil could become insufficient for the local crops: only in this case would an integration become necessary, involving the withdrawal from the main canal of a quantity of water which, in any case, would be much less than that removed at the present time.

This alternative involves persuading the farmers to rely upon their own ability to obtain water without the supply from the main canal. They will bear the cost of the amount of

water they use, and so some financial contribution on the part of the public authority might be necessary.

This alternative would be beneficial both for solving the local problem of preserving the archaeological site and, on a larger scale, for more general problems of water resources management. The amount of water delivered today in the surroundings of Abu Mena could be used for the reclamation of other desert areas.

In addition to the alternatives described above, which entail a radical change in the traditional practice of Egyptian agriculture, some minor intervention might also be considered in order partially to solve the problem of groundwater control. One very action would be to line the main canals with impermeable material: geomembranes and geotextiles can reduce bed and bank permeability by up to 80 %

7 Aspects of site management

7.i Buffer zone

Examination of the plans accompanying the nomination dossier lodged in the ICOMOS Documentation Centre in Paris gave no indication of the existence of a definite buffer zone at Abu Mena. This is not surprising, since in the early years of the Convention there was no requirement for the establishment of a buffer zone to protect the setting of nominated sites. The area nominated (and eventually inscribed on the World Heritage List) is defined on the basis of an area delineated by five fixed points on a 1:25,000 map, forming an irregular quadrilateral, one side of which consists of two sections on slightly varying alignments, but there appears to be no plan relating these points to the buildings established by excavation. The nomination dossier gives simple geographical coordinates to the site, but these appear to relate only to a central point, not the fixed points of a two-dimensional area. Recent planning documents supplied to the mission showed the 'Abu Mena Site' unhelpfully as a regular rectangle, which are no doubt adequate for the engineering project, but which expose the World Heritage site to possibly damaging interventions. Other plans and maps given to the mission show further variations of the boundaries.

When on the site, the mission was told that the World Heritage site was defined by the line of the walls of the ancient settlement, which were not easily identifiable on the ground. It was also clear that there is a substantial area lying outside these limits which contain important archaeological remains (for example, the excavated Eastern Basilica), indicating that the central monastery complex was the site of considerable permanent settlement and agricultural activities. This is roughly defined by the raised track and ditches created by the Mar Mena Monastery.

Whilst the main monumental area is of unquestioned significance, there is another area of equal significance, namely the settlement that grew up around the pilgrimage site. This represents an exceptional example of a very early pilgrimage centre, a type of urban site that is still imperfectly understood. Having been abandoned without later construction overlying it, the settlement will retain an unusual level of completeness.

It has already been stated that there is an urgent need for a detailed geophysical survey of the overall site before engineering works are initiated. This survey should serve a double purpose, since it makes it possible to redefine the area of archaeological significance and revise its boundaries, whilst at the same time permitting the establishment of an effective buffer zone.

7.ii Technical aspects of a buffer zone

A strip of land surrounding the archaeological site and providing the necessary control on groundwater presents an interesting solution. To ensure reliable protection, such a strip must be free from any agricultural activity capable of interfering with the aquifer. It makes no sense to devise a zone provided with its own drainage system in form of drainage pipes or ditches, which will of necessity be much larger than that foreseen in the

project of the Ministry of Culture. Alternatively, the strip could be equipped with an intensive set of pumping wells, combined with irrigation practices that would make it possible to lower and control the water table within the archaeological site.

The main problem from the technical point of view is how broad the strip should be. Only in the case of the use of pumping wells can some values be estimated, taking account of the influence radius of the pump. Tentatively, assuming that the effect of a pump can be effective within a radius of 200–300m, a reasonable number of wells, sited in several rows around the archaeological site, would be able to assure an efficient control of the water table.

7.iii Emergency measures

In general terms, there are two potential risks for the archaeological site:

- During the implementation of the project, estimated to take three years, if the delivery of water to the irrigation districts is carried out without any form of control, or if the irrigated area were to further increase;
- Once the project is completed, should there be a temporary failure (breakdown or reduced efficiency of the pumps, clogging of drainage pipes) or if the present conditions on which the project is based were to change (increase of the irrigation area, request for a further lowering of water table – for example, deeper excavation around one of the historic buildings).

In both the cases the water table would be likely to rise again to a level that would threaten the monuments. To deal with such an eventuality, a rapid intervention would be necessary, coupled with the modification of certain aspects of the project.

The emergency measures can be based on the alternative solutions already described, namely:

- Temporary interruption of all the irrigation actions in the areas closer to the site, long enough to permit more efficient and permanent works to be carried out.
- The drilling of a set of pumping wells capable of controlling and lowering the water table in the more sensitive zones.

Both these measures entail effective participation by the farmers and the existence of a strong authority able to convince those concerned of the need for action of this kind and providing, if necessary, financial compensation and incentives.

Events requiring emergency measures can suddenly occur at any time and there is no way of forecasting them. The responsible authority should be therefore prepared to intervene immediately and in the most efficient way. Continuous monitoring of the water table in the archaeological site could provide the information needed to plan the appropriate intervention. To this end, one of the piezometers already in operation should be equipped with a recording device that would raise the alarm as soon as the water level exceeds a safety threshold.

7.iv Management plan

It is clear that there is no management mechanism of the type prescribed in paras 108–118 of the *Operational Guidelines* in force at Abu Mena. Each World Heritage property is required to "have an appropriate management plan or other documented management system which should specify how the outstanding universal value of a property should be preserved, preferably through participatory means (para 109)." The purpose of such management systems is "to ensure the effective protection of the nominated property for present and future generations" (para 110). Such management systems "may vary according to different cultural perspectives, the resources available and other factors. They may incorporate traditional practices, existing urban or regional planning instruments, and other planning control mechanisms, both formal and informal" (para 110). Common elements of an effective "management system" could include:

a) a thorough shared understanding of the property by all stakeholders;

b) a cycle of planning, implementation, monitoring, evaluation and feedback;

c) the involvement of partners and stakeholders;

d) the allocation of necessary resources;

e) capacity-building; and

f) an accountable, transparent description of how the management system functions" (para 111).

A more comprehensive overview of managing World Heritage sites is to be found in *Management Guidelines for World Cultural Heritage Sites*, by B M Feilden and J Jokilehto, 2nd edition, Rome 1998 (ICCROM, UNESCO, and ICOMOS).

At the present time the site is somewhat forlorn. There is no interpretation or presentation of any kind, apart from that in the unsightly insubstantial building erected by the monks of the Mar Mena community at the Basilica. It is also not protected, and the mission was told that clandestine excavation and removal of architectural elements take place regularly.

Given the large number of pilgrims and tourists visiting the Mar Mena monastery complex, it is highly desirable that the management of the World Heritage site should be given high priority.

7.v Identification of stakeholders

The World Heritage site is the property of the Egyptian Supreme Council for Antiquities, part of the Ministry of Culture, which is entirely responsible for its protection, conservation, and management. However, there are other bodies that might be deemed to have an interest in the well-being of the site and who should therefore be involved in the preparation and implementation of an effective management plan.

At governmental level there are Ministries other than the Ministry of Culture, such as those for Agriculture, Tourism, and Water Resources and Irrigation. Lower-tier

governmental authorities (for example, the Burg al-Arab District) are also concerned with infrastructural changes relating to roads and other public services upon which developments at the World Heritage site are likely to have an impact.

It is very important also not to overlook the non-governmental sector. Local landowners and farmers are major stakeholders in that activities affecting the World Heritage site and its environs have the potential to make an impact on their lands and their sources of income. Another major stakeholders is the modern Coptic monastery of Mar Mena, which was created in 1959 by Pope Kyrillos VI to honour the martyr St Menas and to provide facilities for the many hundreds of thousands of the faithful who each year make a pilgrimage to Abu Mena, one of the most sacred sites for Coptic Christians.

Another stakeholder that should be closely involved in the preparation of management plans is the German Archaeological Institute (*Deutsches Archäologisches Institut*) in Cairo. Excavations and conservation works have been carried out by archaeologists from this Institute each year since 1961, and it is likely that this association will continue.

Experience at other major archaeological sites around the world has demonstrated the value of involving a wide range of stakeholders of this kind in various ways in the management of major archaeological sites. It is, furthermore, the policy of the World Heritage Committee to encourage the participation of local communities in all aspects of management planning on World Heritage sites.

For example, at the Monte Alban archaeological site in Mexico, local high-school students for an enthusiastic and well informed group of voluntary guides, whilst retired local men and women have for many years worked voluntarily as guides at the many historic properties owned by the National Trust in the United Kingdom. The monastic community at Mar Mena already provides excellent guiding services at Abu Mena, for both pilgrims and tourists.

It is suggested therefore that a working group with representatives from bodies of the kind listed above should be set up to assist in the preparation of a management plan and its implementation.

8 Conclusion and recommendations

8.i Engineering aspects

Protecting the Abu Mena site from rising groundwater requires the lowering of the water table that is at the present time rising as a result of intensive irrigation in the nearby areas, supplied by the main canals coming from the Nile. The water table should be lowered at least 5 m; it is equally important that threats from future rises must be avoided.

The Egyptian Ministry of Culture has developed an outstanding project, aiming at lowering the water table by means of draining ditches and pipes, inside and around the archaeological area. Drained water will be conveyed by gravity into collecting tanks, from which, by means of pumps and through a long pipeline, it will be returned to the main canals coming from the Nile. The drainage ditches and pipes will also collect the water drained in the precinct of the Mar Mena Monastery, for which an *ad hoc* project will be developed.

The implementation of the projects will start very soon, and development of the technical, managerial and financial aspects has already begun. Completion is expected in about three years.

The projects are well designed and promise to be effective. Their operating conditions should be considered along with more general aspects of the management of water resources in a very large area of Egypt. Economic and political aspects must be considered because a large amount of financial resources will be required, not only in the implementation phase, but also during the eventual working conditions. Moreover, the projects will succeed only if the farmers involved ensure their active participation, while all the state and regional authorities responsible for water management and irrigation also confirm their cooperation.

The problem of the preservation of Abu Mena is very complex. Further complexities can be added by the nature of the hydrological events, as well as by the difficulty of forecasting the evolution of the economic and social aspects that can occur in the area. The responsible authorities should therefore continuously monitor the various components that make up the problem and its solution. Supplementary and alternative measures, both technical and managerial, may well become necessary.

An efficient system for monitoring the water table in the archaeological site and in the surrounding zones is essential, as its level will remain the most significant variable for assessing the effectiveness of the solution of the problem.

8.ii Archaeological aspects

1. Three preliminary tasks must be undertaken with the minimum of delay:

– A ***geophysical survey*** must be initiated, concentrating in the beginning on areas where it is planned to undertake earth-moving operations connected with the measures to be taken to lower the water table on the site, and before this work has been started. Where archaeological deposits or structures are identified, two alternatives have to be

considered: either a rescue excavation should be carried out, to record the archaeological material before work starts, or agreement should be reached with the earth-moving contractor on a diversion of the line of the linear feature or the re-siting of wells.

– A rapid ***condition survey*** of all excavated remains should be carried out and urgent conservation carried in order to provide protection to structures during the vibration and other forms of damage likely to result from the use of heavy earth-moving equipment.

– Discussions must take place simultaneously with these emergency actions in order to establish the definitive boundaries of the ***World Heritage site*** and its ***buffer zone***, taking into account the requirements of the World Heritage Committee as set out in the *Operational Guidelines.*

2. Once these three emergency activities have been successfully completed, the ***geophysical survey*** should continue over the entire site (including the buffer zone), to act as a guide to future research and management projects. At the same time, a ***conservation plan*** should be prepared, defining short-, medium-, and long-term objectives and establishing technical parameters (materials, techniques, etc).

3. Discussions should begin with stakeholders with the objective of preparing a ***management plan***, to include *inter alia* research (including excavation and survey), presentation and interpretation, the role of stakeholders (e.g. the Mar Mena community), staffing, sponsorship, visitor facilities, access, etc.

9 Acknowledgments

The members of the mission wish to record their gratitude to the many Egyptian professional colleagues whom they met during their visit for the friendly reception and their readiness to answer questions and explain at length and in detail the projects on which they worked. A full list of these people in to be found in Annex A. Their special thanks go to Dr Samir Ghabbour and Mr Safwat Salem of the Egyptian National Commission for UNESCO, Dr Abdallah Kamel Moussa and General Essam Kamel of the Supreme Council of Antiquities, Dr Ahmed Khater of the Research Institute for Groundwater, and Father Paphnotios of the Mar Mena Monastery. They are also very grateful to Mr Ahmed Assaf and Mr Yasser El Zieb, their guide and driver throughout the mission, for their patience and helpfulness.

ANNEX A List of people met during the mission

Ministry of Education: Egyptian National Commission for UNESCO

Dr Samir Ghabbour	Chairman
Mr M. Safwat Salem	Secretary General

Ministry of Culture: Supreme Council of Antiquities

Dr Zahi Hawass	Director General
Dr Abdallah Kamel Moussa	Chair, Sector of Islamic and Coptic Monuments
General Essam Kamel	Head of Projects Sector, Sector of Islamic and Coptic Monuments
Mr Saber Selim	General Director, West Delta
Mr Mohamed Salah el-Din	Head, Central Administration for Lower Egypt, Sinai, and North Shore
Dr Gamal Mahgoub	Head, Central Administration for Maintenance and Preservation
Eng. Nady Abdel Sayed	General Director for Engineering, Lower Egypt
Dr Hany Hanna Aziz Hanna	General Director, Department of Conservation
Dr A. Shawarby	National Project Director, Egyptian Antiquities Information System

Ministry of Water Resources and Irrigation: National Water Research Center, Research Institute for Groundwater

Mr Mohamed Hussein Ahmed	Secretary General
Dr Ahmed Khater	Director
Professor Alfy Morcos Fanos	Director, Coastal Research Institute

Coptic Monastery of Mar Mena

Father Elia Ava Mina	
Father Paphnotios Ava Mina	
Father Abanoub Ava Mina	
Father Polykarpos Ava Mina	
Father Tedawes Ava Mina	
Mrs Joanna Jones	Consultant

Faculty of Engineering, University of Alexandria

Professor Nazeih Younan

Faculty of Architecture and Urban Design, Cairo University

Professor Sami Sabri Shaker

ANNEX B Documentation

The following are the main sources of written information studied by the members of the mission before, during, and after the mission.

UNESCO

Assessment of water related damages and adverse effects on historic monuments: Mission to the World Heritage Sites at Ancient Thebes and Abu Mena, September 2002

Report of the 28th Session of the World Heritage Committee, Suzhou (China), 28 June–27 July 2004: Decision 28 COM 15A.17

Document WHC-05/29.COM.7A presented to the World Heritage Committee at its 29th Session in Durban (South Africa), July 2005

Report of the 29th Session of the World Heritage Committee, Durban (South Africa), 10–17 July 2005: Decision 29 COM 7A.17

Ministry of Culture: Supreme Council of Antiquities

A report to be presented to the Head of the Islamic and Coptic Antiquities sector concerning the monumental area of Abu Mina [n.d.]

A technical report concerning the project of decreasing the underground water levels in the monumental area of Abu Mina [n.d.]

Ministry of Water Resources and Irrigation: National Water Research Center, Research Institute for Groundwater

Technical Report on the water logging problem in monumental city of West Abumina (Western Delta – Egypt) [n.d.]

Egyptian National Commission to UNESCO

A technical report concerning the project of decreasing the underground water levels in the monumental area of Abu Mina [summary of Ministry of Culture/SCA report of the same name, submitted to UNESCO on 25 January 2005]

Mar Mena Monastery

Technical Report [n.d.]

Deutsches Archäologisches Institut, Cairo

Grossmann, Peter *On the water problems at Abu Mina* [typescript report dated 12 November 2004]

Other documentation

Custodio, E. and Llamas, M.R. (1996) *Idrologia sotterranea*. Palermo: D. Flaccovio Ed., p.1100.

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Geirnaert W. and Leaven M.P. (1992) Composition and history of ground water in the Western Nile Delta. *Journal of Hydrology*, Vol. 138, pp. 169–89.

Hermans, Inne (2003) *Abu Mina: de opkomst en de ondergang van een koptisch bedevaartsoord*. Thesis submitted to the Catholic University of Leuven (Belgium)

Hussein Idris and S. Nour. (1990) Present groundwater status in Egypt and the environmental impact. *Environmental Geology*, Vol. 6, No. 3, pp. 171–7.

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Nardini A. and Hussan Fahmy. (2005) Integrated evaluation of Egypt's water resources plans. *Water International*, Vol. 30, No 3, pp. 314–28.

ARTICLE

Condition recording for the conservation and management of large, open-air sites: a pilot project at Chersonesos (Crimea, Ukraine)

Christopher Cleere, Jessica Trelogan and Stuart Eve

ABSTRACT

The initial assessment and recording of a site's current conditions is a fundamental first step in any conservation project. Unfortunately, this can be a daunting, if not impossible, task at large, complex archaeological sites. Systematic and detailed condition surveys are in fact seldom undertaken on large archaeological sites because of the significant human resources required to collect such a large amount of information and the difficulties involved in managing, accessing and visualizing this information in a way that allows meaningful conclusions to be formed. In order to address this challenge at Chersonesos, a large, multi-phase site in Crimea (Ukraine), a GIS-based condition recording system was developed by a joint team from the University of Texas at Austin Institute of Classical Archaeology and the National Preserve of Tauric Chersonesos. This paper gives a detailed overview of the recording system, presents the results of a pilot project to test its implementation in the ancient city centre of Chersonesos, and discusses its merits as a model for condition recording and long-term monitoring for complex, open-air sites.

INTRODUCTION

The importance of condition reporting has been given particular emphasis in recent years in the discussion of conservation and management planning for archaeological sites [1]. Understanding the condition of a site and the types and extent of the destructive forces acting on it is a fundamental first step in the development of a successful and sustainable conservation plan. This can be a daunting, if not impossible, task at large, complex archaeological sites that contain many hectares of exposed structures. Systematic and detailed condition surveys are in fact seldom undertaken on large archaeological sites, because they require both significant human resources to collect such a large amount of information and the capacity to manage, access and visualize this information in a way that allows meaningful conclusions to be formed.

In order to address this challenge at Chersonesos, a multi-phase site in Crimea (Ukraine), a pilot project was conducted to develop a condition recording system using Geographic Information System (GIS) technology. This project is part of a collaborative effort between the University of Texas at Austin Institute of Classical Archaeology (ICA) and the National Preserve of Tauric Chersonesos (NPTC) to create a conservation and management plan for the site as a first step toward its nomination to the UNESCO World Heritage List [2]. This paper describes the recording system developed for the project and the preliminary results of a pilot survey conducted using these methods. In order to present this recording system as a model for similar large, complex urban sites, special emphasis is given to the process and to the ideas behind its development, as well as to some of the problems encountered in its implementation.

Site description and significance

Chersonesos, located near modern Sevastopol on the southwestern tip of Crimea, is one of the most important

archaeological sites on the Black Sea coast. Settled in the 5th century BC by Greeks from Heraklea Pontika, the site was continuously occupied throughout Greek and Roman antiquity and remained a thriving Byzantine outpost and important centre for Christianity until its eventual decline in the 15th century AD. There are very few ancient sites with such a long and uninterrupted history, but it is the remarkable degree of preservation that makes Chersonesos so unique. Unoccupied since its destruction, the lack of subsequent building has left the fabric of the Byzantine city virtually intact. Still standing are large portions of the regular street plan, residential and public buildings, quarters of industrial production (such as wine presses, ceramic workshops and basins for fish-salting), tombs and numerous small churches and basilicas (Fig. 1). Large sections of the city's defensive walls, which form the largest standing monument of antiquity on the Black Sea, are also extant, spanning nearly the whole of the city's history from the 4th century BC. By the time of the city's destruction at the hands of Mongol-Tatars in the late 14th century, the total length of the defensive walls had reached approximately 3.5km, enclosing an area of about 30ha, with a further 15ha of habitation located outside the defensible area.

Outside the city walls, the site consists of a vast agricultural hinterland, or chora, which provided the main economic basis for the city throughout its history. This rural territory is one of the best-preserved examples of ancient farmland known to this day. Of the original area of over 10,000ha of ancient fields, more than 500ha remain preserved. Traces of the grid of roads that divided the Heraklean Peninsula into over four hundred roughly equal plots of land are still visible, as are the remains of planting walls for trees and vines, along with the remains of over one hundred and forty impressive stone farmhouses [3].

Figure 1. Aerial view of the northern region of the ancient city of Chersonesos with the newly restored Church of St Volodymyr (upper right) standing amidst the remains of the Byzantine city, 2001 (C. Williams).

Excavations began at Chersonesos in 1827 when Admiral Aleksey Greyg, commander of the Black Sea Fleet, appointed naval engineer Karl Kruse to find the remains of the church where Prince Volodymyr of Kyivan Rus' was said to have been baptised. Excavations have continued until the present day, the only disruptions being the suspension of research during World Wars I and II.

A museum was originally established at Chersonesos in 1892, when the then head of excavations, Karl Kazimirovich Kostsyushko-Valyuzhinich, organized the construction of a few simple buildings that became 'The Warehouse of Local Antiquities'. The National Preserve of Tauric Chersonesos (NPTC) that exists today was created in 1978 from the former Archaeological and Historical Museum of Chersonesos. Today the site remains an important cultural and scientific centre for modern Ukraine. In addition to the large open-air exhibits throughout the excavated areas of the site, the ancient defensive walls now enclose two major museum galleries, as well as the storage, research and administrative buildings of the Preserve. In addition to the city of Chersonesos, NPTC is responsible for the protection and study of the chora and numerous other archaeological sites within the administrative region of Sevastopol [4].

In the Soviet era the site was well managed by a permanent maintenance staff. Botanical colonization was regularly removed and fallen masonry rebuilt. Newly excavated structures tended to be partially reconstructed to the excavator's specifications and wall tops were levelled and capped. Conservation treatments were frequently based on grey cement mortar, as were the cappings, which in the main were heavily applied and tended to further level wall tops, thus giving the site a misleading uniformly truncated appearance.

Since Ukrainian independence in 1991, excavation has continued unabated, but owing to a dramatic

reduction in staffing and financial support, conservation and maintenance by the NPTC staff has been all but discontinued, in favour of reconstruction of major monuments funded by central government and carried out by commercial construction companies. Structures deemed less important have been largely ignored, are currently in a very bad state of repair and are becoming heavily colonized by shrubs and trees. There is at present no official requirement for excavators to conserve the material they expose, nor is there even an approved methodology for those who wish to do so.

Project history

ICA, under the direction of founder Joseph Coleman Carter, has been conducting a project of joint excavations and research with the National Preserve at Chersonesos since 1992, when Sevastopol was still a closed city. Although ICA's involvement at Chersonesos began on a small scale, with work focused on specific joint excavation projects with the NPTC, ICA has always been committed to a multi-disciplinary approach to archaeology, including an emphasis on the importance of all aspects of conservation. ICA helped to nominate the site successfully to the World Monuments Watch List of the 100 Most Endangered Sites three times, heightening the awareness of the cultural significance of Chersonesos within the international community. In 2002 the Ukrainian government decided to pursue nomination for Chersonesos and its chora to the UNESCO World Heritage List. To support this process, ICA and NPTC formed a team to develop and implement a long-term, locally sustainable conservation plan that encompasses all relevant aspects of site conservation, objects' conservation and collections' care at Chersonesos.

Meanwhile, given the urgent need for site conservation at Chersonesos and the current lack of appropriate conservation materials or a consistent methodology for their application, the team also began a parallel project of trial conservation treatments in an area newly excavated by the ICA/NPTC excavation team. The aim of this project was to locate suitable conservation materials in the surrounding area and from them to develop appropriate conservation mortars, grouts and reburial media, and to train local museum staff in their application.

CONDITION RECORDING: AIMS AND PHILOSOPHY

The initial examination of a site's current condition is widely accepted as a prerequisite for any conservation project and a cornerstone of any conservation and management plan. Without quantifying the type, extent and level of deterioration occurring across the site, it is not possible to determine the amount of intervention involved or the resources and time frame that such a project will require. While the need for such surveys has been widely documented [5], conservation projects dealing with large, open-air archaeological sites have published very little on the actual methods employed to successfully accomplish the task.

One exception is Matero's work at Casa Grande in Arizona [6]. His team intimately examined and meticulously documented the condition of all interior and exterior surfaces of the structure, using the data collected to quantify the past and present causes and rate of deterioration and to set priorities for future treatment. This process, while feasible for the survey of a single structure, nonetheless required substantial resources, taking nineteen people four weeks to complete. A survey of this level of detail would be impossible to replicate at a site the size of Chersonesos, the city centre of which alone contains over 17ha of exposed archaeology. A similar detailed survey was attempted at the site of Chan Chan in Peru, but it ultimately proved impractical owing to its substantial size (comparable with that of Chersonesos) [7].

One commonly adopted way to strike a balance between site size and the level of survey detail is to prioritize small areas or specific structures for more detailed recording. Martha Demas neatly sums up the current approach '[o]n a large, complex site, the outcome of a condition survey may simply be prioritisation of problem areas or identification of structures that need more detailed condition recording or monitoring. Undertaking of such recording would then be integrated into the plans for the site in the future' [8]. The process is not as straightforward as it may seem, however. Prioritizing particular areas of a site may indeed be the only way to approach the challenge of recording its condition in any useful amount of detail, but care must be taken to assess the site's general condition as systematically as possible before undertaking more detailed assessments of smaller areas. Making judgements based on assumptions

that a specific artefact, structure type or phase of occupation is of greater importance than any other on a site is an outdated philosophy. Unfortunately, those working to preserve large complicated sites are often forced to do so because of the difficulties involved in assembling, managing and accessing the information required to understand the site as an integrated whole [9]. By elevating the significance of a particular structure based on the inclusion of one specific type of material prior to undertaking an overall condition survey, all structures are not assessed using equal criteria. Structures within the prioritized areas will be treated long before those deemed less important. While the concentration of resources in areas of perceived importance will produce rapid improvements, there is always the risk that quickly deteriorating but less visible or high-profile elements in areas deemed of lesser importance could be lost long before the time comes for their conservation.

In short, on a site the size of Chersonesos, prioritization is likely to be the only way to assess its overall condition. To do so, while avoiding the trap of making questionable value-judgements, a general, site-wide survey is necessary to assess what is in most urgent need of treatment, regardless of currently perceived cultural significance or value.

METHODS

A two-tiered approach was adopted at Chersonesos to address this dilemma. The first phase consisted of a general survey, in which the entire site was assessed systematically as a single entity and according to a set of general criteria. Every structure on the site was assigned the same heritage value, and thus assessed according to the same criteria, irrespective of historical period, status, size or material content. Taking into account a number of different factors (e.g. material composition, previous conservation undertaken and botanical colonization), the results of this survey were used to prioritize specific areas of the site for the second phase of more detailed recording and conservation. As a precursor to interventive conservation treatment, more detailed recording began in areas identified as high priority based on the results of the general survey. As a long-term solution, both phases of the process can be repeated regularly to facilitate monitoring of the overall condition of the site and the level of success of the conservation treatments.

Geographic Information System (GIS)

It was clear from the start that this recording process would generate a huge amount of information, and that its success hinged upon the results being easy to access, maintain and update. GIS technology is especially well suited for this type of data-handling problem. It provides an excellent means of storing, integrating and administering the type of spatial and non-spatial information generated by the condition survey [10].

One of the major advantages of using a GIS as opposed to working with flat paper, or even scanned (raster) images, is that individual points, lines and areas represented on the map can contain essentially unlimited amounts of attribute information (structure types, excavation date, conservation status, etc.) as well as links to other types of digital data such as photographs or written reports. Various layers representing different attributes can be turned on or off, or can be queried to answer more complex questions (to highlight, for example, all ancient structures excavated since 1999 that have not yet been conserved). For management and conservation purposes this is a useful tool not only for integrating large amounts of varied information, but also for visualizing the spatial distribution of specific types of deterioration (salt and wind erosion, visitor damage, etc.), and thereby gaining an understanding of the significant underlying processes of deterioration acting on a given site. The results are easily accessible via a graphic interface and can be easily updated in the future.

Having this information in a dynamic and easily accessible format is an invaluable resource for long-term site monitoring and maintenance. In the future, as new areas are excavated and conserved, the digital base map can be easily updated. Likewise, as the general survey is repeated and the detailed recording updated, the results can be compared over time, providing the opportunity to observe trends and make relevant management decisions.

While a GIS made the condition recording process more efficient, its design and development involves a great deal of up-front time and effort. An up-to-date map of the entire 45ha extent of the ancient city (including current excavations, conservation work and standing modern architecture) was of the highest priority. It was determined that the updated site plan would ultimately be much more useful if captured digitally as the mapping base of a GIS as opposed to a

static paper map. This would eventually allow for much easier integration with, and access to, other non-spatial data (such as reports, photographs and drawings). Creation of a digital base map is always a large undertaking, but has been especially challenging at Chersonesos because of the site's proximity to Russian and Ukrainian naval bases [11] and lack of available up-to-date paper maps [12].

General survey

Because of the vast scale of the site it became obvious early on that it would be an enormous, if not impossible, task for an individual or team of conservators to form an objective opinion of the existing condition of the site without a systematic survey. Deterioration is so pronounced and pervasive that one is quickly overwhelmed and left with the feeling that everything requires immediate interventive conservation. While this is not necessarily far from the truth, it is of no help in determining the resources needed, the time frame required or the order in which to proceed.

It was therefore decided that the systematic collection and interpretation of relatively unbiased data pertaining to physical extent, condition and rate of deterioration of the structures should be a crucial first step for the correct selection of conservation treatments, conservation material type, order of treatment progression and extent and scale of intervention required. The initial data would thus form a 'baseline' by which, through repetition of the process, improvements to the overall condition and the success and suitability of treatments could be assessed.

As a precursor to the survey, a significant time was spent walking through the site to familiarize the surveyors with the types of problems occurring. The findings were discussed with the NPTC staff, who, through a far longer association with the site, has more intimate experience with the progression of deterioration. Combining the observations of the specialists with informed local knowledge produced a good overview of the likely root causes of problems, but it was agreed that a more systematic and objective approach was needed. The results of this initial appraisal were then used to develop a strategy for the survey and a preliminary set of evaluation criteria to be tested in a pilot project. These strategy discussions proved invaluable in developing the following methodology for the recording system.

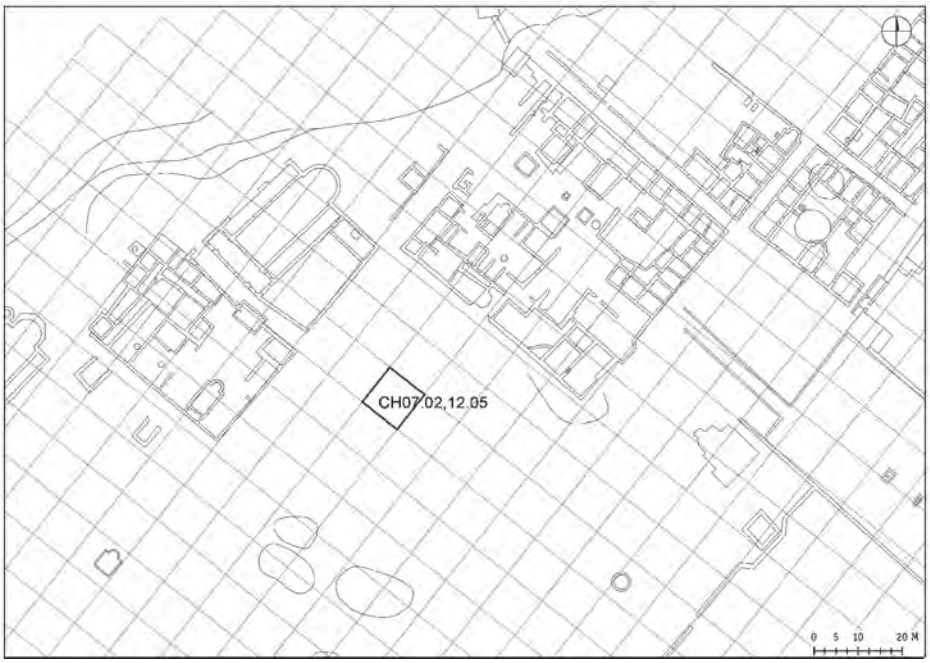
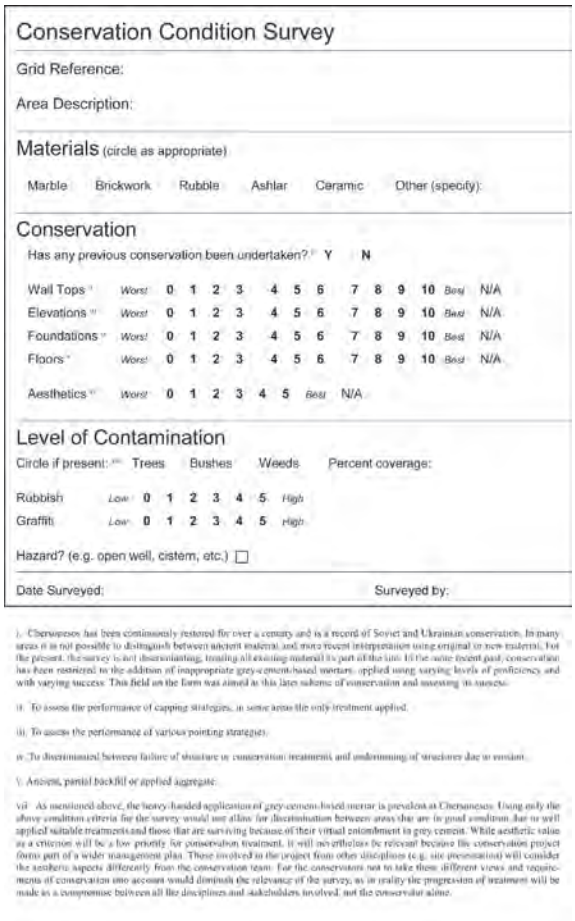


Figure 2. Section of the 10 m × 10 m grid overlay7ing a map of the city's northern region.

An arbitrary, regularly spaced 10m × 10m reference grid was established over the site, to which the general survey information would be linked (Fig. 2). The reference grid, in addition to acting as a means of positioning the surveyor in the field, allows the site to be broken up into manageable areas of equal size that can be assessed regardless of location, historical period or type of structure. While individual structures could have been examined as the basic unit of the survey, the use of an arbitrary grid was deemed useful for ensuring that the focus was not on individual structures themselves, but the general state of conservation across the site.

A score sheet based on the evaluation criteria was created, which contains basic information relating to the overall condition and construction of structures within each 10m square. Because of the international nature of the team, the use of written comments was kept to a minimum and scores were based on a numerical scale. In order to ensure that surveyors were consistent in the use of these scores, a set of standards was established during early field trials. The score sheets themselves were limited to one side of an A4 sheet of paper, in order to maximize productivity in the field (Fig. 3).



Conservation Condition Survey

Grid Reference:

Area Description:

Materials (circle as appropriate)

Marble Brickwork Rubble Ashlar Ceramic Other (specify):

Conservation

Has any previous conservation been undertaken? Y N

Wall Tops Worst 0 1 2 3 4 5 6 7 8 9 10 Best N/A

Elevations Worst 0 1 2 3 4 5 6 7 8 9 10 Best N/A

Foundations Worst 0 1 2 3 4 5 6 7 8 9 10 Best N/A

Floors Worst 0 1 2 3 4 5 6 7 8 9 10 Best N/A

Aesthetics Worst 0 1 2 3 4 5 Best N/A

Level of Contamination

Circle if present: Trees Bushes Weeds Percent coverage:

Rubbish Low 0 1 2 3 4 5 High

Graffiti Low 0 1 2 3 4 5 High

Hazard? (e.g. open well, cistern, etc.) ☐

Date Surveyed: Surveyed by:

i. Chersonesos has been continuously restored for over a century and is a record of Soviet and Ukrainian conservation. In many areas it is not possible to distinguish between ancient material and more recent interpretation using original or new material. For the present, the survey is not discriminating, treating all existing material as part of the site. If the more recent past, conservation has been restricted to the addition of inappropriate grey-cement-based mortars, applied using varying levels of proficiency and with varying success. This field on the form was aimed at this later subcome of conservation and assessing its success.

ii. To assess the performance of capping strategies, in some areas the only treatment applied.

iii. To assess the performance of various pointing strategies.

iv. To discriminate between failure of structure as conservation treatments and undermining of structures due to erosion.

v. Ancient, partial backfill or applied aggregate.

vi. As mentioned above, the heavy-handed application of grey-cement-based mortar is prevalent at Chersonesos. Using only the above condition criteria for the survey would not allow for discrimination between areas that are in good condition due to well applied suitable treatments and those that are surviving because of their virtual entombment in grey cement. While aesthetic value as a criterion will be a low priority for conservation treatment, it will not otherwise be relevant because the conservation project forms part of a wider management plan. Those involved in the project from other disciplines (e.g. site presentation) will consider the aesthetic aspects differently from the conservation team. For the conservators not to take these different views and requirements of conservation into account would diminish the relevance of the survey, as in reality the progression of treatment will be made as a compromise between all the disciplines and stakeholders involved, not the conservator alone.

Figure 3. Annotated score sheet for the general condition survey.

As the aim of the general survey is to guide the conservators to the areas in the greatest need of attention, the scores given were based on the worst example of each criterion within the square. Clearly, if the scores were based on the average condition across the whole square, wall collapses in dire need of conservation in an area that is otherwise of good condition may be missed.

Field trials confirmed that a 10m × 10m square could be examined and recorded in approximately five minutes and it was therefore hoped that collecting the required data for the entire site could be achieved in a period short enough for annual repetition to be a viable option. Various team compositions were then tested and it was finally agreed that a team of three people, with two closely examining the structures and the third filling in the form after discussion, produced the most consistent results in the shortest time, eliminating errors resulting from an individual surveyor missing a crucial area of deterioration.

Detailed recording

Based on the results of the general survey, detailed recording can then be conducted on the areas identified for interventive conservation. The primary record consists of high-resolution digital photographs taken of all parts of structures (wall tops, elevations, floors, road surfaces, etc.) prior to any conservation, and again from the same vantage points subsequent to the conservation treatment.

In order to make the photographs as easy to access as possible, a photographic database was developed that can be linked through to the GIS, allowing a quick visual reference to the conservation treatments applied throughout a structure's history. A mapping convention was established in the development of the digital base map in which each structural element [13] is represented as a set of distinct lines that represent segments of interior and exterior elevations as well as wall cappings (Fig. 4). Each of these structural elements

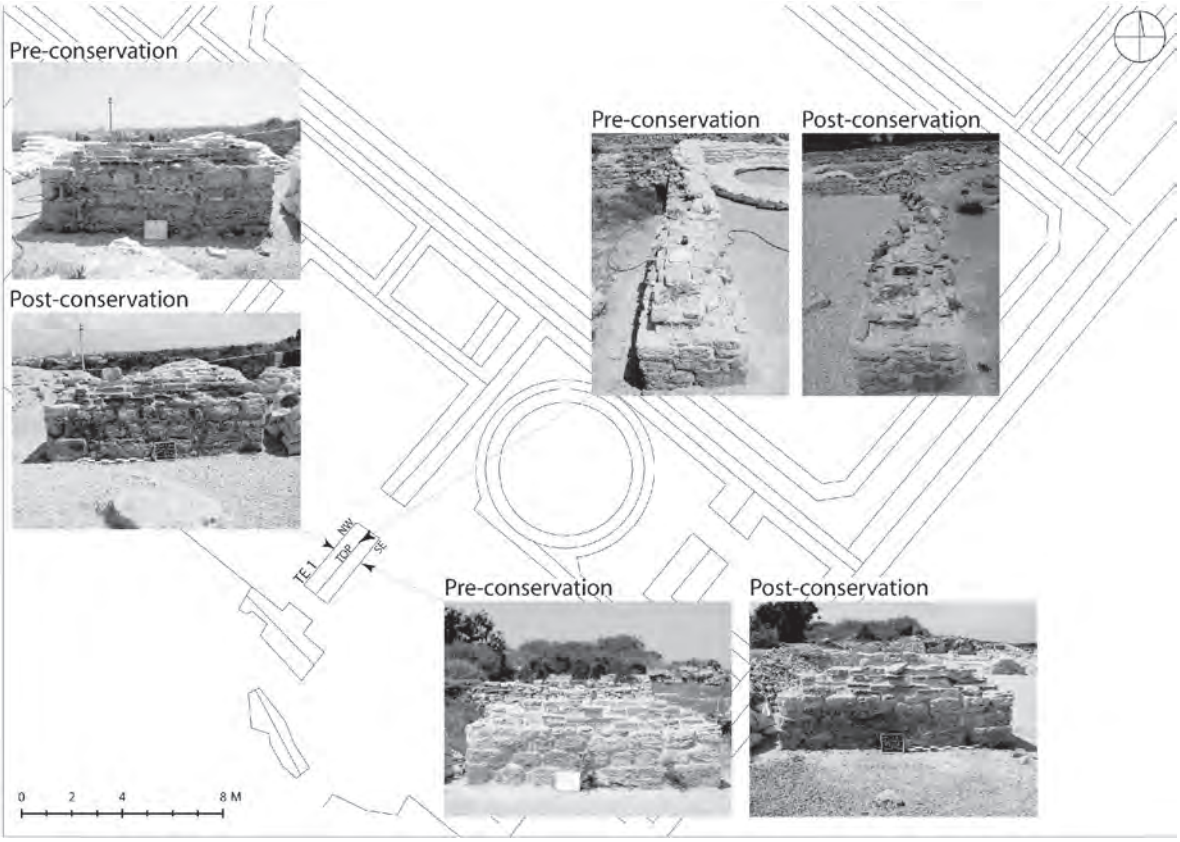


Figure 4. Example of pre- and post-conservation photographs of the top, NW, and SE faces of structural element TE 1 taken as part of the detailed recording process and accessed via the GIS.

is given a unique identifying number (ID) that consists of a structure code, a structural element number (analogous to wall number) and a face (N, S, W, E, top or surface). This unique ID is then used as the basis for naming digital photographic files and for linking to the database. Thus, by clicking on a segment of wall within the GIS plan, for example, the user can view photographs of a particular face of a particular wall before and after conservation treatment. Since the photographs can be rapidly collected in the field, the conservators can easily re-examine pre-conservation photographs during the conservation process to ensure, for example, that any material that fell prior to conservation or was removed as part of the conservation process is replaced exactly in its original position.

A database is also being developed for conservation treatment types that can be linked (as was done with the photographs) via individual structural elements to the GIS, allowing spatially based queries of specific treatment types and their long-term success. This may help shed light on some of the underlying causes of deterioration and the appropriate treatments for specific areas of the site. This database, along with the photographic documentation, will be an invaluable resource for long-term monitoring and maintenance of the site.

RESULTS

The general survey was conducted by one team of three people. Later in the survey, a second team was established, continuity of the scores being achieved by first combining the teams and later by the examination of representative squares by both teams (Fig. 5).

Within a two-week period, six people were able to survey and enter data into the database for a total of 916 10m squares (only those containing exposed

Figure 5. Example of wall elevation demonstrating several of the survey criteria. The wall has not been capped, but is reasonably stable and would therefore receive an average score for 'condition of wall top'. Accelerated loss from brick courses was highlighted by the staff of the NPTC as a particular problem on the site. The untreated area on the right would therefore result in a very low 'condition of wall elevation' score for the grid square in which this section of wall falls. The section of brick course to the left has been treated and is thus not an immediate problem and would not therefore result in a low score for 'condition of wall elevation' as, although inappropriate, the treatment is protecting the original material it is covering. It would, however, be noted as 'presence of previous treatment' and receive a very low score for aesthetic as it is crudely undertaken using an inappropriate grey cement mortar. The grid square containing this structure would be prioritized for conservation because of the rapid deterioration of the brick courses, but only the brick course section immediately treated. Capping of the wall will occur only when all lesser scored areas have been treated. Replacement of the previous conservation treatment would not occur until the upgrading of previous conservation treatments becomes a priority. Initially the preservation of original material is of higher priority than upgrading previous treatments.

archaeology, Fig. 6). Given the resources available, an annual repeat of the condition survey would be realistically achievable. The pilot project's evaluation criteria have now been established and refined and are currently being written up into a manual for use in the field, with illustrated examples of each of the criteria (see, for example, Fig. 5). This will ensure consistent results during the subsequent repetition of the survey.

A comprehensive picture of the state of conservation across the site can now be easily built and used as a tool for formulating the conservation programme. Within the GIS, individual map layers can be produced to show the condition of particular areas according to any of the survey criteria. For instance, one can select for display all of the areas where the capping is in bad condition or where mortar is failing in the elevations (Fig. 7). These data can be used to formulate longer-term strategies and assess the success or failure of the conservation methodology. It is important to remember that, whilst the survey considers the site according to 10m × 10m squares, it is not the aim to treat every structure in the square, but to indicate which areas of

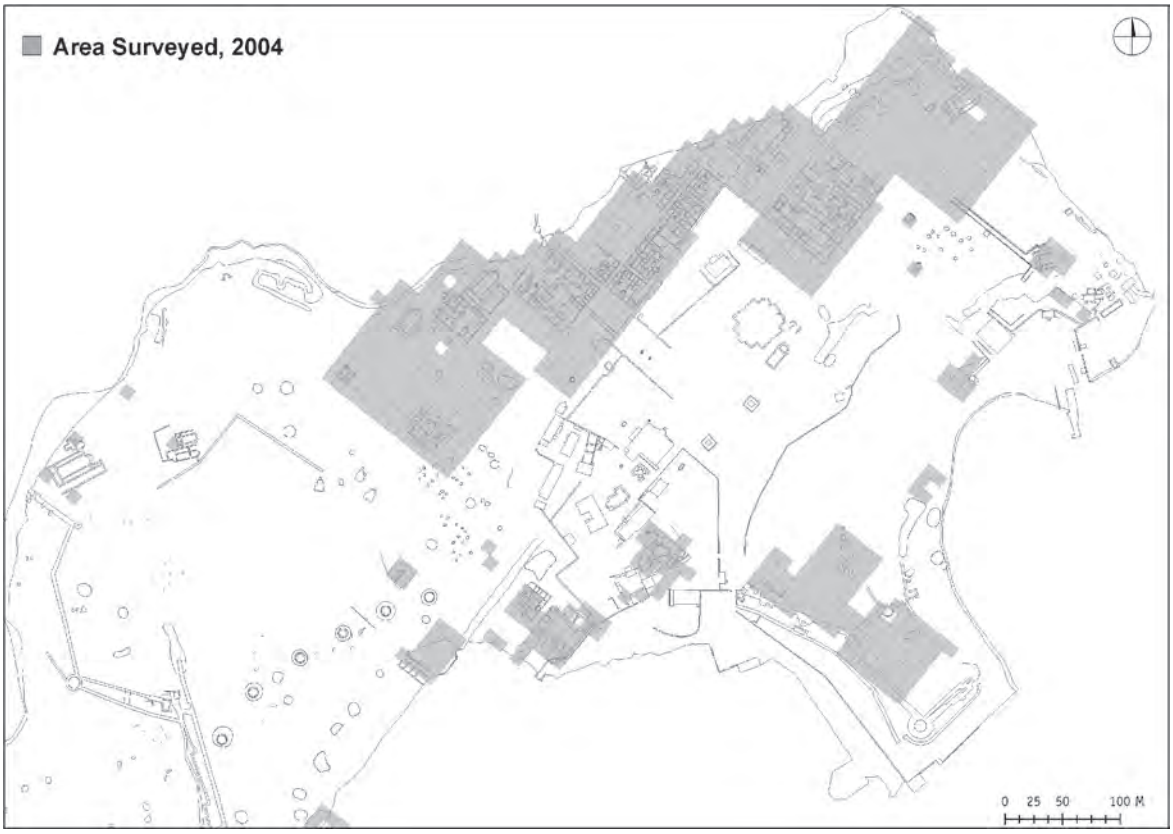


Figure 6. Area of the site surveyed in 2004.

the site are in need of conservation. Once the critical areas within the square are stabilized the square is reassessed and is given a new ranking. An overall improvement to the condition of the site will be achieved by small, low-cost, targeted interventions, not by the conservation of large areas.

Figure 7. 2004 survey results for wall tops (left) and elevations (right).

While detailed recording would normally be done after the general survey identified high priority areas of the site for conservation treatment, for the sake of developing methodology for this study, the detailed recording was begun contemporaneously with the general survey in an area where trial conservation is being conducted. This area, currently being excavated by the joint ICA/NPTC excavation team, contains over 650 individual structural elements that needed to be photographed prior to and after conservation treatment. The photographs, downloaded daily to computers and accessed through GIS software in the field, are already proving to be an incredibly useful tool for documenting conservation. On at least one occasion during the conservation season, conservators were able to call up pre-conservation photographs to help reconstruct portions of wall that had collapsed (Fig. 8).

CONCLUSIONS

In recent years a certain set of standards for site management have become established. These standards require general surveys to determine the extent of material present, and specific condition assessments to establish the condition of the individual monuments within a site. This approach works well for sites containing a distinct set of structures or features, but is inadequate when applied to a large, open-air city site containing vast areas of interconnected exposed archaeology such as Chersonesos, which in reality exist as one integrated monument. The two-tier system created for the conservation recording at Chersonesos addresses this. It allows an initial rapid general survey of the entire site, efficient and detailed recording of the structures pre- and post-conservation, and the creation of a dataset that can be continually updated and provide a comprehensive history of conservation interventions on the site.

Our goal was not just to develop this method as an application of GIS for conservation or site management, but to create an integrated system for recording and monitoring of complex sites. This is a system that could reasonably be applied without the use of GIS, but the long-term savings in labour make it well worth the initial investment in the technology. We hope that the work undertaken at Chersonesos can serve as a model, or at

Figure 8. Conservator Jonathan Kemp uses a print-out of a detailed wall face photograph to help reconstruct a section of collapsed wall, 2004.

least that discussion of the methods and tools employed will lead to overdue advances in the field.

FUTURE WORK

The methodology for condition survey described here has been tested and implemented at Chersonesos and has proved invaluable as a tool for prioritizing conservation interventions. The process will be refined in coming years to increase the productivity of the surveyors undertaking the work and to include further variables of deterioration, as and when they become apparent.

A repeat of the survey is planned for 2006 to begin the process of assessing the overall baseline rate of deterioration of the structures on the site. The GIS will also be used to look for possible environmental factors that may be exacerbating particular problems (prevailing winds, salt spray, height above sea level, etc.). If little variation in areas untreated since 2004 is found after a two-year period, the survey frequency will be reduced. If drastic change is revealed, the frequency will be increased.

As a further refinement of the overall site conservation project, attention will be focused on the detailed condition recording of structures prioritized by the general condition survey. The development of an expandable glossary of condition terminology relevant to the material types and processes of deterioration present will be formalized. The general survey, recording system, condition glossary, mapping conventions and list of accepted treatments will form the basis of a conservation field manual that, it is hoped, will be adopted by the NPTC as the official conservation field manual for all sites within its jurisdiction.

As the creation of a locally sustainable conservation plan is of the highest priority, the NPTC staff has been, and continues to be, involved in all aspects of the development, implementation and interpretation of this conservation survey system. NPTC staff members receive in-depth 'on the job' training and it is hoped in the future that this initial instruction will be complemented by a structured training programme according to an internationally accepted standard, thus ensuring the continued success of the project as ICA's role diminishes.

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2 This work has been generously funded by the Packard Humanities Institute, without whose support none of the continuing collaborative projects between ICA and NPTC would have been possible. The project has been the work of many hands, but special thanks goes to Larissa Sedikova, Head of Conservation at NPTC, for her hard work in the development and implementation of the survey and recording system, as well as for her far-sighted vision and dedication to the protection and management of Chersonesos.

3 Mack, G. and Carter, J.C. (eds) *Crimean Chersonesos, City, Chora, Museum and Environs.* Austin (2003). [AUQUERY2]

4 Mack and Carter (2003) [3].

5 ICOMOS. *International Charters for Conservation and Restoration*. Paris, International Council on Monuments and Sites (2001). The 1964 Venice Charter does not mention condition survey by name but does allude to it as a requirement in Article 16: 'In all works of preservation, restoration or excavation, there should always be precise documentation in the form of analytical and critical reports'. While this only enshrines the requirement of exact recording of the conservation work carried out, any comprehensive analytical report of works of preservation would require an assessment of the condition and material makeup of the monument to be worked on, i.e. a survey of its material makeup and condition. The Lausanne Charter of 1990 does mention survey by name (Article 4, Survey) but, again, not directly in the context of the condition of the material makeup of the heritage: 'The protection of the archaeological heritage must be based upon the fullest possible knowledge of its extent and nature. General survey of archaeological resource is therefore an essential working tool in developing strategies for the protection of the archaeological heritage. Consequently archaeological survey should be a basic obligation in the protection and management of the archaeological heritage'.

6 Matero (1999) [1].

7 Castellanos, C. Chan Chan, Peru. In: *Proceedings of Management Planning for Archaeological Sites*, Corinth (2000).[AUQUERY1]

8 Demas (2000) [1].

9 Castellanos, for example, carried out a more detailed survey 'in areas with exposed decorated surfaces while only a general inspection was done where they were not present'. Castellanos (2000) [7].

10 For a very accessible discussion of the basics of GIS and its relevance to cultural heritage, see Box, P. *GIS and Cultural Resource Management: a Manual for Heritage Managers*. UNESCO, Bangkok (1999).

11 Sevastopol is home to the Russian and Ukrainian navy's Black Sea Fleet. The military sensitivity of the area has made it difficult to obtain accurate maps and precludes the use of GPS by civilians.

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13 For purposes of recording, each structure (wall, floor, threshold, etc.), was broken up into smaller segments that correspond, not necessarily to construction phase, but to photographic extent.

[AUQUERIES]

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