RISK MANAGEMENT AT HERITAGE SITES A CASE STUDY OF THE PETRA WORLD HERITAGE SITE

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United Nations
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UNESCO Chair on preventive Conservation,
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Published in 2012 by the United Nations Educational,
Scientific and Cultural Organization
7, place de Fontenoy, 75352 Paris 07 SP, France
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ISBN 978-92-3-001073-7

Cover photo: Petra, Tomb no. 609 © UNESCO
Copy editor: Curran Publishing Services Ltd
Arabic translation: Lingo Shack Translation Services, Amman
Cover design and printed by: Rafidi Print, Amman
Printed in Jordan

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Preface and acknowledgements

This publication and development of a risk management methodology is the result of the Risk Mapping Project in Petra, a project of the UNESCO Amman Office in partnership with the Raymond Lemaire International Centre for Conservation (RLICC) at the Katholieke Universiteit (KU) Leuven in Belgium and in cooperation with the Petra Development and Tourism Regional Authority (PDTRA) and the Department of Antiquities of Jordan (DoA). This collaborative project started in February 2011 for a period of fifteen months in response to the increasing risks for loss of heritage values at the site and a need for their assessment and proposing responses to reduce their impact.

Petra Archaeological Park (PAP), the most significant World Heritage site in Jordan, with its unique landscape, monuments and natural gorges, is a fragile property. Further to its inherent fragile characteristics, Petra is endangered by natural and human-made threats and impacts. Lack of an implemented management plan coupled with no clear property boundaries and an absence of buffer zones as recommended by the World Heritage Committee, and weak visitor management strategies, result in major gaps in the management of the property and increasing risks to the site. Accordingly, risk assessment and research to better address the challenges of the management of Petra World Heritage site have been identified as the most appropriate tools for mitigation of risks and protection of the values of the property. This publication examines a systematic approach in order to identify threats, their causes, and understand and assess their effects, and proposes ways to choose responses and mitigation strategies in order to reduce the impact of threats.

The realization of this project and the publication of this book would not have been possible without the generous support of the Annenberg Foundation. UNESCO wishes to express deep appreciation for this support.

UNESCO Amman Office would also like to acknowledge and thank the continuous support of the PDTRA, Dr Emad Hijazeen, Commissioner of the PAP, Eng. Tahani Al Salhi, Director of the Cultural Resource Management unit at the PAP. We would also like to thank the rest of the PAP staff for their continuous coordination and for making this possible, as well as the DoA for applying the risk management methodology in the pilot area of Petra during the second phase of fieldwork. The outcomes of this pilot testing were crucial in the improvement of the study.

This publication presents a risk management methodology to be used as a systematic tool for the better management of heritage sites. The methodology developed incorporates similar approaches used by the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM), and the Canadian Conservation Institute (CCI)-Institute for Cultural Heritage of the Netherlands (ICN), which are embodied in the

Australian/New Zealand Standard for Risk Management. The authors wish to thank and acknowledge the cooperation with ICCROM, CCI-ICN and their courses in preventive conservation and risk reduction. Also, we would like to thank Dr Robert Waller of the Canadian Museum of Nature whose risk analysis model for cultural properties and museums has been an essential reference for the development of the methodology.

For the Petra case study the authors have utilized a variety of research and scientific documents, including published and unpublished sources, master plans, scientific articles, legal documents and planning regulations for the areas surrounding the PAP, supported by meetings and workshops. Furthermore, stakeholders, local authorities, national and international experts have been extensively involved in various meetings, workshops and field activities.

To assess categories of threats and disturbances affecting the monuments under analysis, the Middle Eastern Geodatabase for Antiquities – Jordan (MEGA–J) defined the categories that have been used. The authors would like to thank the DoA, the Getty Conservation Institute, and the World Monument Fund, for developing such a system and supporting its use.

Embarking on this work has also been a unique opportunity to contribute to the capacity-building of Jordanian experts in the fields of risk assessment, condition survey and preventive conservation, as well as to contribute to the protection of the uniqueness of Petra. We wish also to thank the local community in Petra for their support and hospitability.

During the fieldwork application and testing of the methodology, two workshops were organized. The hard work and important contribution of the RLICC class of 2011 students, and the coordinative efforts of RLICC staff are gratefully acknowledged.

We are also grateful to The World Heritage Centre Publication Unit, which without, this publication would have not been possible. Finally, we would like to thank all those individuals and institutions that in one way or another helped with the completion of this publication.

Figures and tables

Figures

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Abbreviations

CAD	computer aided-design
CCI	Canadian Conservation Institute
DoA	Department of Antiquities of Jordan
GCI	Getty Conservation Institute
GIS	geographic information systems
GNPSS	global network positioning satellite systems
ICCROM	International Centre for the Study of the Preservation and Restoration of Cultural Property
ICN	Institute for Cultural Heritage of the Netherlands
IUCN	International Union for the Conservation of Nature
JADIS	Jordan Antiquities Database and Information System
MAB	UNESCO Man and the Biosphere programme
MEGA-J	Middle Eastern Geodatabase for Antiquities – Jordan
MoTA	Ministry of Tourism and Antiquities of Jordan
OUV	outstanding universal value
PAP	Petra Archaeological Park
PDTRA	Petra Development and Tourism Regional Authority
PRA	Petra Regional Authority
PRC	Petra Regional Council
PRPC	Petra Regional Planning Council
RLICC	Raymond Lemaire International Centre for Conservation
USNPS	United States National Parks Service
WHC	UNESCO World Heritage Centre/Committee
WMF	World Monuments Fund

1. Introduction

1.1 Risk management methodology for heritage sites

A large number of significant heritage sites around the world are fragile properties, and they are faced with different challenges. Cultural heritage is always under pressure from a variety of risks. Natural disasters, development, tourism, pollution, inappropriate site management, looting and conflict are just some examples of the risks faced by these sites.

Risks to heritage sites are dependent on the nature, specific characteristics, inherent vulnerability and geographical environment of the site. From another perspective they are dependent on the nature of the external threats affecting the heritage itself.

The threats can be either natural or anthropogenic: that is, human-made. Natural risks can be divided into two categories: catastrophic and sudden occurrences, such as a flood or an earthquake, which have an immediate impact on heritage sites, and continuous threats with cumulative and slow effects, such as erosion and material decay. Anthropogenic risks result from a number of different human activities, including development in general and tourism in particular, and inappropriate management, lack of maintenance and neglect. The site's vulnerability depends on the environmental, economic, social and political context. The vulnerability of heritage sites increases when there are no maintenance approaches, there is inappropriate excavation and/or restoration, the site is affected by uncontrolled development and urbanization, there is a loss of local and traditional knowledge, and there is a lack of management systems for the site.

In order to reduce the risks, it is recommended to develop an institutional approach and define a strategy collaboratively with local authorities and staff. It is also recommended to plan appropriate training for different target groups for the methodology to be successful. It is suggested that guidelines, guiding principles and standards are produced for risk assessment and ultimately risk management. Risk management needs to be an integral part of conservation practices and conservation and management plans. When (or if) the threats and causes of deterioration are identified, assessed and prioritized through a management planning process, their effects can be minimized or mitigated. When such an approach is defined, institutionalized and implemented, the values and integrity of sites can better be protected.

The aim of Risk Management at Heritage Sites: A Case Study of the Petra World Heritage Site is to outline how to design a risk management methodology that will enable the systematic identification of disturbances and threats to a site, assessing their impact and the vulnerability of the monuments and other features of the site. The heritage at risk could be prioritized based on an assessment of its importance or significance, and the magnitude of risk. This would then enable site managers and concerned authorities to plan more in-depth assessment for the most significant monuments or areas at risk. This process provides a framework for deciding on appropriate mitigation strategies, based on cost-benefit analysis.

The publication is intended primarily to support site managers and their teams, as well as authorities and agencies responsible for the management of both Petra and other heritage sites, to assess, monitor and reduce risks to their sites. Second, it can assist researchers, stakeholders and other professionals in contributing to the preservation of sites.

Some of the threats could be reduced and mitigated through planning legislation, delineation of property boundaries, outlining guidelines and regulations for land use, and defining a buffer zone, and these aspects are explored through the Petra case study.

The publication also suggests how the risk management process could be integrated into the overall management planning process. It is designed to help put in place a more systematic approach to conservation and management planning.

The different steps presented and the emphasis on the need for planning, prevention and monitoring are at the root of all heritage conservation and management planning approaches. The risk management model presented here also involves a specific method that will allow for a more systematic path to the maintenance and preservation of sites. If the causes of risks are identified, their possible impact assessed, and responses are planned to minimize their impact, risks can be managed - if not eliminated - and ultimately better results can be achieved.

Our extensive review of the existing literature has revealed that there is a vast number of publications about the identification of risk categories and the nature of risks at heritage sites. Furthermore, many studies have been carried out on the management and prevention of disasters. Some disasters are unavoidable and can lead to considerable destruction, but other potential disasters, can be avoided with careful planning thus their impact can be mitigated. The increasingly frequent and extreme natural events such as floods, mudslides and earthquakes, plus fire and other threats, are a major source of harm to the integrity of our heritage. The Heritage Resource Manual on Managing Disaster Risks for World Heritage (UNESCO WHC, 2010b) and Risk Preparedness: A Management Manual for World Heritage (Stovel, 1998) are only two examples of disaster risk management studies with the aim of raising awareness among site managers and local communities of the challenges faced by heritage sites.

Although it is acknowledged that disaster risk management is a very important topic in managing risk at heritage sites, this publication intends to provide a systematic approach for heritage managers to assess and eventually manage all different kinds of risk, not only disastrous ones. The methodology proposed takes into consideration natural and anthropogenic risks that operate on all timescales from the sudden and catastrophic to the slow and cumulative.

The publication has been prepared by a group of cultural heritage experts and professionals, and the approach to risk is a cultural heritage safety approach. While many aspects of this proposal are focused on the safety of heritage, the aim has been where possible to take a holistic approach and take into consideration risks to visitors and the landscape as part of the process.

The book is structured in two main sections. The first section is the theoretical part where the risk methodology is described and its steps are outlined. The second section is a case study presenting the application of the methodology at Petra World Heritage Park in Jordan.

Because of time and resource constraints the risk assessment part of the methodology could be applied to only a selected pilot area of the Petra World Heritage site. However developing this methodology, and partially testing it at the PAP, is intended as the first tranche of a bigger set of objectives: testing and applying the methodology at the level of PAP as a whole as well as at other heritage sites, relying on the capabilities of different experts, and trying to refine the methodology during the process.

It is recognized that the proposed approach applies a numerically based model, and that training is required before it can be used successfully. The fieldwork of applying the methodology to Petra – as will be explained at the case study section – was preceded by lectures and training sessions for the fieldwork team. These included both training in the proposed fieldwork methodology and background lectures from relevant experts on Petra. However, it should be acknowledged that two days of training is not really enough to enable a novice to master this kind of methodology. Ideally a well-structured and more extended period of training should be provided for the fieldwork teams, managers and their staff, to enable participants to grasp the theoretical approach and application, and in addition to have a better overview of the complex risks and related assessments proposed in the methodology.

1.2 A risk management methodology for Petra

A World Heritage site since 1985 and the most visited archaeological site in Jordan, Petra is currently threatened by risks of many different kinds and at a number of levels. Because both natural and anthropogenic impacts are progressively threatening its integrity, and it is very fragile, Petra appeared on four consecutive World Monuments Fund lists of the most endangered sites in the world (in 1996, 1998, 2000 and 2002).

As well as the increased level of external threats - both natural and anthropogenic - affecting the property, there are two factors that increase Petra's inherent vulnerability. First, the monuments are sculpted from sandstone, a relatively fragile rock that is subject to natural erosion through water and wind action. And second, the development of tourism and an interest in Jordan's heritage has led to an increased number of visitors, touristic development and related human activities on site, and this too leads to wear and deterioration. In recent

years, the number of visitors per month has considerably exceeded the advisory carrying capacity of the site as defined in the 1994 UNESCO Management Plan. As well as the number of visitors, there is insufficient regulation of their movements. Visitors' uncontrolled access compounds the risks to the monuments. There has not as yet been an adequate assessment of the value of the individual monuments and archeological areas, and no appropriate mitigation strategies have been developed.

The lack of technically mapped and visualized boundaries, and the absence of a clear strategy for a defined buffer zone or zoning regulation of the property, represent further threats to the site integrity. This is in large part because the site was entered in the World Heritage List at an early stage of its development, when no clear requirements were set for the outline of property boundaries and the definition of a buffer zone. The Retrospective Inventory process is aimed at identifying gaps and omissions in nomination files of sites that were inscribed early on in the World heritage List (UNESCO WHC, 2004), but as yet only scattered efforts have been made to provide the property with boundaries, to date no delineation has been carried out for the buffer zone, and no clear frameworks have been enforced for the right of use of lands by local tribes and communities.

To address these issues, several agreements and strategies have been developed and proposed for the management of the property. However, because of insufficient funding and/or the lack of long-term planning and initiatives, none of the management and tourism strategies drafted for the PAP have been adopted officially and implemented in their totality. Only limited measures have been put into effect. To deal properly with these phenomena, a number of activities could be developed, such as the design of a baseline map for the property, and setting up adequate management regulations that aim to improve site conservation, manage tourism sustainably, and strengthen the involvement of the local community.

These issues of an unimplemented management plan, insufficient visitor management strategies and a lack of a clear on-the-ground definition of property boundaries, can be identified as major gaps in the management of the property, and they also result in increasing risk to the site. A systematic and comprehensive method for the management and conservation of the property is needed. The first steps to take towards the better preservation and systematic conservation of the property as a whole, and protection of its values and integrities, are to start from research in the field of risk management and carry out the identification, mapping and monitoring of risks.

1.3 The risk mapping project in Petra

Given the diversity of problems faced by the PAP, it is appropriate and recommended to develop and implement a common strategy in order to provide solutions at different levels. Risk assessment and research in the field of risk management in Petra have been identified

as the most appropriate tools for mitigation of risks and protection of the values of the property. At the same time, the risk assessment when integrated into the existing plan for the management and conservation of the property, will take care of cross-referencing various stand-alone plans for the property. The development of a risk management methodology is considered a preliminary step to feed into an overall management plan for a property (UNESCO WHC, 2011b). This approach was welcomed by the local authorities, recognizing the gap in the management of the site and the urgent need to address it.

From this perspective, the UNESCO Office in Amman carried out a project for the identification and assessment of risks at the PAP and partnered with the Raymond Lemaire International Centre for Conservation (RLICC) at the Katholieke Universiteit Leuven (KU Leuven), Petra Development and Tourism Regional Authority (PDTRA) and the Department of Antiquities of Jordan (DoA) to carry out this project.

The project consists of different phases with three main objectives:

- technical field mapping of the boundaries of the World Heritage site
- outline of guidelines and usage regulations for a proposed buffer zone
- definition of risk criteria and risk categories and delineation of a proposal for a risk management strategy.

A risk management methodology was proposed, to be used as a tool to contribute to the conservation, management and preservation of heritage sites, and it was employed to outline a risk management strategy for Petra. The publication of this book is an important result. It is an indication of how this project has sought to achieve its goal of providing a framework in which the risk, impact, vulnerability and rate of deterioration of the heritage site are consistently identified and monitored.

As a first stage, bibliographic research was carried out to identify the systematic approaches that have been developed for the assessment and management of risks, and select a basis for developing a risk management methodology. The draft methodology was reviewed by the authorities responsible for the management of Petra and national and international experts in the field of heritage conservation during several meetings and round-table discussions. Comments and remarks were added to the methodology, and ultimately the revised document was endorsed by the PAP authority at a validation workshop. The validated methodology was then applied to the pilot area in Petra during two weeks of fieldwork in autumn 2011 in order to evaluate its effectiveness and relevance.

The risk assessment approach presented in this document is mainly based on two concepts developed for assessing and reducing risks to collections and artefacts, the Cultural Property Risk Analysis Model: Development and Application to Preventive Conservation at the Canadian Museum of Nature by Waller (2003), and a similar approach proposed in the Risk

Management Australian/New Zealand Standard (2004) and adopted by the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) and and the Canadian Conservation Institute (CCI)–Institute for Cultural Heritage of the Netherlands (ICN), for their courses in preventive conservation and risk reduction to collections. These approaches have been adapted and enhanced to be applied to Petra and possibly to other similar heritage environments.

In terms of documentation methodology, the Middle Eastern Geodatabase for Antiquities - Jordan (MEGA-Jordan), a hybrid geographic information system (GIS) and database, and Jordanís national inventory and management system, was used as a tool in the fieldwork in order to provide geographic data (maps) and to map monuments under assessment with their exact coordinates.[1]

[1] More information on MEGA–J can be found at www.megajordan.org

2. Risk management at heritage sites

2.1 What is risk?

Risk is defined as the probability that a certain kind of damage will be realized (Ball and Watt, 2001). Risks are the result of natural or human-made threats. Natural risks include both the catastrophic and sudden, such as a flood or an earthquake, and continuous, cumulative and slow processes such as erosion. Anthropogenic risks are the result of different human activities, which include development in general and tourism in particular, inappropriate management, and the lack of maintenance and neglect. Risks to heritage sites are also dependent on the specific characteristics of each site and its inherent vulnerability.

2.2 What is risk management?

Risk management is the process of identifying, assessing and analysing expected and possible damage - in this context, to heritage sites - and of developing mitigation strategies in order to reduce the risk of damage. Decision-makers in many fields use this approach in order to reduce losses. An alternative way of saying this is that risk management is the decision-making process following a risk assessment (Ball and Watt, 2001). It is the process that involves managing losses and impacts (on the significance of a historic site) in order to minimize them and to reach a balance between opportunities gained and lost. The adoption and application of the risk management approach by the organizations and institutions involved in the management of heritage sites will provide them with a well-organized tool to assist them in their conservation and management planning decisions.

Planning is the key element for decision-making in this process. As shown in Figure 1, the protection and conservation of heritage sites for future generations involves making 'good' decisions as the result of careful planning (Demas, 2002). This process makes it possible to prevent changes, or if this is not practicable slow the impact, if they might affect the significance and integrity of the monuments and therefore the experience of visitors at heritage sites.

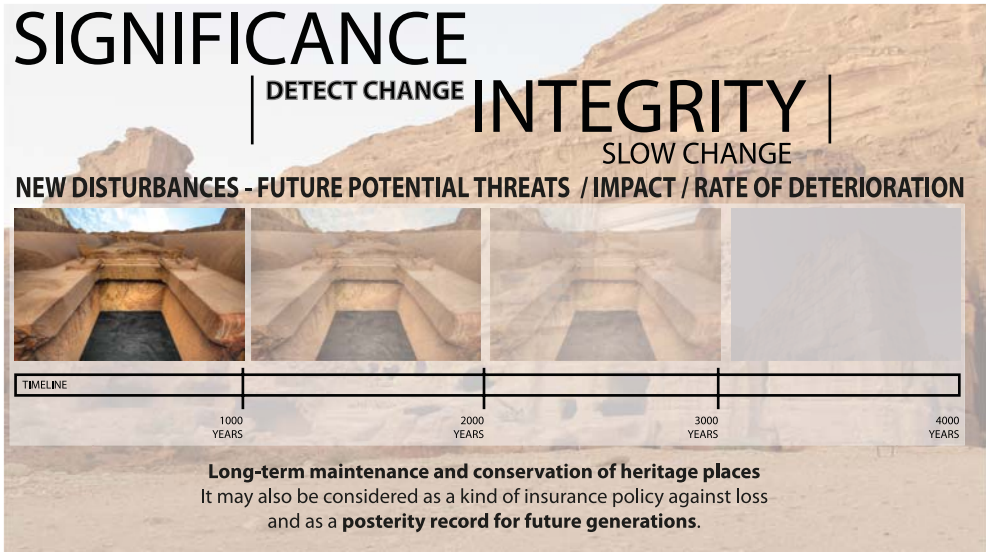

Figure 1 Managing change at heritage sites

A planning process makes it possible to sort through the multiple layers on which heritage is evaluated and the variety of issues facing heritage sites, to set priorities, to explain and to justify decisions, and finally to ensure that the results of decisions are sustainable. As was stated by Demas (2002), in brief this process is an opportunity to bring together different actors and stakeholders related to the heritage site to assess its significance and condition, and establish management priorities to protect the site for future generations. It has increasingly become clear that heritage gains meaning and will only survive if there is carrying capacity and the means for stakeholders to take on this responsibility.

In order for managers and authorities to plan more in-depth assessment for highly significant monuments or areas at risk, a risk assessment carried out in the context of the site could be a tool for prioritizing monuments at risk. Based on these priorities, decisions could be made by identifying appropriate mitigation strategies and evaluating their costs and benefits. Hence, a risk management strategy could provide a decision-making tool for the reduction of possible damage and the better conservation of the property. Such a strategy, when it becomes part of the overall management and conservation plan for a heritage site, can also assist site managers in the effective use of their resources.

2.3 Approach and methodology

As mentioned before, this risk management proposal is based on two approaches for assessing and reducing risks to collections and artefacts, Waller's Cultural Property Risk Analysis Model (2003) and the Risk Management Australian / New Zealand Standard (Standards Australia/Standards New Zealand,2004), as applied by CCI–ICN and ICCROM. These approaches have been enhanced here so they can be applied to heritage sites in order to develop and provide a systematic tool to identify, assess and manage risks. The risk management methodology is an integral part of the management plan, with the aims of improving site conservation and tourism management, and strengthening the involvement of the local community.

In this proposal the systematic application of the risk management process (Figure 2) includes six steps:

1) Defining the context and scope, including a documentation review as well as a values, condition and management context assessment.
2) Identifying the risks.
3) Assessing the impact of each risk.
4) Identifying possible mitigation strategies.
5) Evaluating risks and mitigation strategies based on cost–benefit analysis.
6) Implementation of the strategies (preventively or actively) to treat risks.

There are also two permanent components of the risk management process: monitoring, and communication and consultation with the different stakeholders.

Looking at different management plans based on the Burra Charter, and in particular the Demas Management Planning Chart (2002), we identified two further elements of the planning process which are also necessary in the risk management process: the assessment of values, and a condition assessment of the site. These are sometimes underestimated, but they are also necessary steps to be taken before starting the core part of risk assessment process. These are basic elements that help to identify the condition of integrity of the heritage site. Success in assessing and evaluating the risks will be based on the capacity to understand and recognize both the values and the actual condition of the site, its site elements[2] and features.

It should be noted that condition assessment is not necessarily a step to be taken before the risk assessment, as it could be done at the same time as the risk assessment. This will be made clearer in the Petra case study section.

[2]For the definition of sites and site elements in this publication please refer to the glossary on pages 120 and 121.

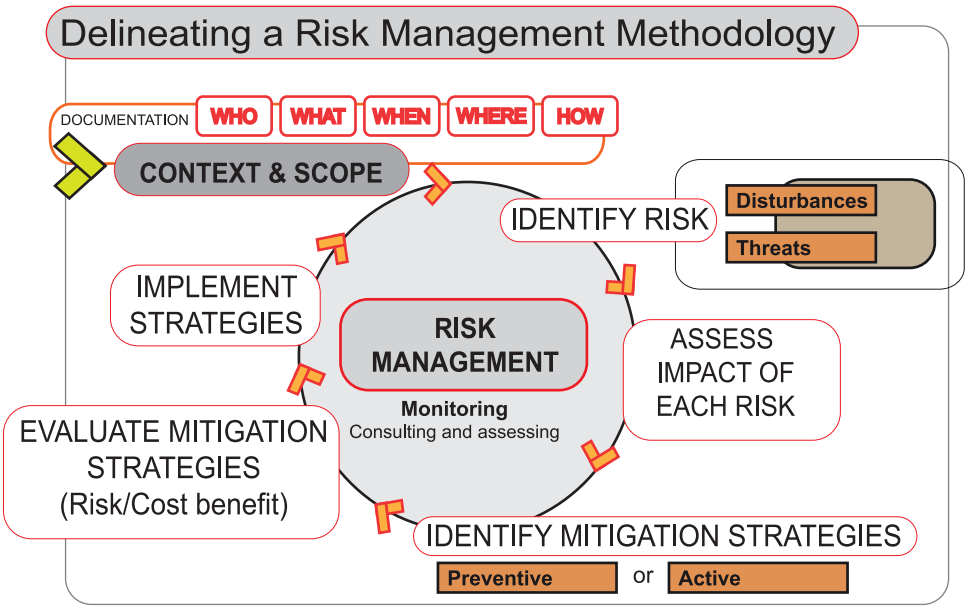

Figure 2 A risk management approach
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2.4 Understanding and assessing values

Heritage, whether it is cultural, natural or a cultural landscape, is so regarded because of the value that people - stakeholders or interest groups[3] - give to an object, place or landscape. In order to find the best way to protect heritage, it is important to know what that value represents, and who the stakeholders are who invest the heritage with this added value.

The assessment of heritage values has become an essential part of heritage preservation in practice. A number of documents exemplify this: for example, the Nara Document on Authenticity (1994) highlighting the importance of cultural and social values and tangible and intangible heritage; the Declaration of Saint Antonio (1996) stressing the role of the social value of the site, not just the material fabric, and the connection between cultural identity and authenticity; and the ICOMOS Burra Charter (1999) defining cultural significance and its importance in managing and conserving heritage. Moreover, the values and participation of stakeholders are placed at the centre of the planning and decision-making process, as proposed by Demas (2002), Mason and Avrami (2000) and Sullivan (1997). Based on these planning and decision-making processes, after the collection of information, a necessary step in the assessment stage is to understand and establish the values associated with the site. These values are the ones that will need to be known and preserved by all

[3] The terms 'stakeholders' and 'interest groups' have the same meaning here: an individual or a group of people who have interests in the protection of a site (regardless of whether or not they own the site) and its development, preservation and interpretation.

stakeholders including the site managers. A manager must know why a place is worth being conserved. This is a necessary part of the decision-making process, since knowing what needs to be conserved and preserved is necessary in order to decide how to allocate and prioritize resources for further conservation works.

Different sources of information may be used for the value assessment of heritage sites. Each aspect of our heritage has a different meaning and potential value depending on who is looking at it. Knowing these different perspectives helps us to understand and interpret the site better. Decisions about managing and presenting a site should not be taken based on the interests of small groups. Instead, better results can be achieved when all interest groups – for example, local and national authorities, experts in archaeology and conservation, researchers, the local community, the tourism industry – cooperate with each other and agree on compromises that reflect their diverse interests and priorities. As De la Torre (2005) argues, involving more stakeholders and trying to balance their different interests makes it possible to prevent or minimize conflicts of interest and to better protect and interpret the site. The value assessment also needs to take a comparative approach, to assess the significance of a selected monument in the context of other monuments and the whole site, and also other sites in the region.

Values attributed to monuments, places and landscapes are at the core of conservation plans, and accordingly of this risk management methodology. Risks involve threats to outcomes that we value. Defining risk means specifying those valued outcomes clearly enough to make choices about them (Fischhoff and Kadvany, 2011). Consequently, a values-based study is the preliminary step for the assessment of the risk impact, identification of priorities, and application of mitigation strategies. The outcome of such a study, using internationally recognized value assessment systems, could provide an indication of the required level of integrity to preserve an important heritage property.

2.5 Condition assessment

A values-centred study of heritage sites goes hand in hand with the condition assessment, which is focused on assessing the physical state of conservation of the site, its elements and features. As underlined by Demas, the outcome of a condition survey is an 'archive of valuable graphic and written documentation representing baseline data about the site, which can be used to make recommendations for its future use and treatment and to monitor change over time' (2002, p. 39). As she also suggests, the condition assessment consists of three basic stages:

1) Collection of information and historical documentation.
2) Visual assessment and condition recording of the current physical condition.
3) Analysis and diagnosis of the condition.

Documentation and collection of existing information is the initial phase of the condition assessment. Given old images of the site, the previous monitoring and condition record, excavation reports and all other relevant archived documents, one can better understand and identify any change over time. The second stage, recording the current condition, involves elaborating an assessment of what exists, primarily based on a visible assessment of the actual condition. At this stage the cause is not relevant but the effect is. Disturbances, as visible and detectable negative effects, are what need to be recorded at this stage. Finally, the analysis and diagnosis is related to the examination and analysis of the current condition to determine the probable causes of the deterioration of the site – what we call here the agents of deterioration. This phase requires an interdisciplinary approach through analysis of the whole monument or site, using the knowledge and experience of specialized experts in related fields such as geology, hydrology, conservation and architecture.

As part of the risk assessment, the condition assessment helps to identify the existing disturbances –as present effects – and provide information about the actual condition of elements or sites. Moreover, it helps to identify the past agents which resulted in (caused) the disturbances, while the risk assessment forecasts future threats and future possible negative effects from potential agents (Taylor, 2005). Thus, future threats could not be identified easily without assessing the actual disturbance and condition of site and its elements. In other words, the visible effect of risk can be viewed and assessed in terms of current condition. This makes the condition assessment an integrated and important part of the risk assessment.

One further important point that needs to be kept in mind in the planning process of the assessment is to determine the level of detail needed in the recording of the condition of a site or an area under study. For large sites it might be feasible only to study selected areas or monuments that need more detailed assessment, and to extrapolate the results to other parts of the site. This is relevant to the risk management of sites, as this approach seeks prioritization of actions based on identification of indicators. This approach was used to define the pilot area for the Petra case study, which is discussed in Chapter 3.

2.5.1 Risk management context assessment

Before carrying out any risk management assessment activity, the available documentation on the heritage site, including the context and parameters, should be collected and assessed in order to help identify external risks to the risk assessment project and set up the scope for the rest of the risk management process. First, the organizational monitoring and maintenance systems and approaches (if any) and their effectiveness should be identified. All relevant documentation should be identified, including maps, plans, and published or unpublished documents that can give the historical and legal background. At this stage any possible gaps in knowledge about the site can be identified as areas in need of further research.

In addition to the assessment of the condition and values of the site, there needs to be a comprehensive study of the site management context to identify all relevant factors other than physical condition of the heritage that might affect the future conservation and management of the site or jeopardize the sustainability of the approach. This involves the identification and understanding of governance, social, economic and environmental issues (both internal and external to the organization) such as:

- organizational policies and goals
- structure of the organization
- legal context of the site regarding boundaries, protected areas and land uses, zoning systems and regulations, and policies regarding the buffer area
- financial capabilities of the organization
- staff of the organization and their level of technical expertise
- identification of stakeholders and local communities
- infrastructure and development plans.

These organizational points will help in understanding the needs of the risk project, and in ensuring that the organizational system has the capacity to apply the proposed measures to mitigate identified risks. This will ensure the sustainability of the risk project from its beginning. Risk management happens in the context of the goals and policies of the organization. The decision on whether a mitigation strategy and treatment are needed or not depends not just on the physical integrity of sites and elements, but on goals, financial, technical, social, political, environmental and other criteria.

The risk management context and identification of the scope and extent of project activities, extent of the area under study, level of detail of the risk assessment, time line of the project, and the profile of the team carrying out the assessment and the roles and responsibilities of different actors taking part in the risk management process are other points that need to be established.

Defining the scope

The scope and extent of the project's activities should be defined before the start of the risk assessment. The risk management scope needs to be defined in terms of the extent of the area and monuments and structures that will be included in the assessment, the level of detail, the time period and the profile of people involved.

Extent of the area

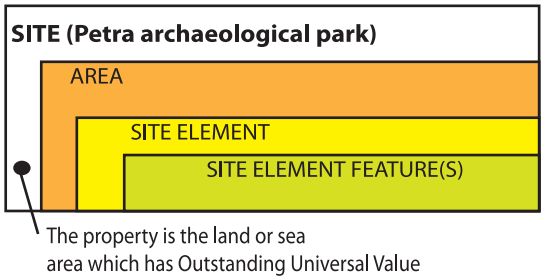
The extent of the area to be assessed depends on the time available and the objectives of the risk management project. If the objective is to do a very detailed risk management of selected structures, then the extent of the area will be those selected structures. If the

objective is to carry out risk management for the whole site, and to use more a holistic approach, then the extent will be the whole site. However, depending on the size and complexity of the site, the assessment might need to be less detailed. If the site covers a vast area, sections of the site could be chosen to provide representative samples, which will make it possible to identify imminent risks and provide sufficient information to develop a risk management strategy for other areas of the site.

Level of detail

Different levels of detail have been provided in this proposal to stream the type of threats and disturbances affecting heritage sites. These levels are depicted in Figure 3. Based on the definition provided by MEGA–J and the project partners, the following levels have been defined:

- Site: a spatially defined area and location of a significant event, that contains physical remains of past occupation and human activity including human-built and human-used features (houses, shelters, tombs, earthworks, mounds, quarries, canals, roads, workshops and so on), artifacts and any other physical remains whether standing, ruined or vanished that contribute to the historical and cultural identity of a group of people.
    - World Heritage property: as described in Articles 1, 2 of the World Heritage Convention, a World Heritage property is inscribed on the World Heritage List on the basis of its outstanding universal value (OUV), which is fulfilled when criteria (i) to (x) are met. A World Heritage property can be cultural, and in this case include sites, groups of buildings and monuments; natural; or mixed (UNESCO WHC, 2010 c, p. 58).
- Area: this level relates to assessment areas, which will be defined by the project staff to carry out the risk assessment. This level could cover the whole site, selected site element(s), landscape area(s) or both.
- Site elements: this level relates to 'a distinct component of an archaeological site which has any evidence of human activity' (MEGA–Jordan guideline) such as monuments, standing structures, caves or natural features.
- Site element feature: this level relates to features in each site element, such as walls, carvings, entrance, floor or roof.



Site: a spatially defined area and location of significant event, that contains physical remains of past occupation and human activity including human-built and human-used features (houses, shelters, tombs, earthworks, mounds, quarries, canals, roads, workshops, etc.), artifacts and any other physical remain whether standing, ruined or vanished that contributes to the historical and cultural identity of a group of people.
Area: this level relates to assessment areas, which will be defined by the project staff to carry out the risk assessment. This level could cover whole site, selected site element(s), landscape area(s) or both.
Site elements: this level relates to "a distinct component of an archaeological site which has any evidence of human activity" (MEGA-J guideline) such as monuments, standing structures, caves, natural features, etc.
Site element feature: this level relates to features in each site element, such as walls, carvings, entrance, floor, roof, etc.

Figure 3 Levels of detail for risk assessment
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Timeline

In order to determine accurate risks at the site, it is advised to carry out assessment periodically at different times of the year (climatic and/or visitor seasons), taking into consideration the weather conditions in different seasons and their impact on the site and site elements. The number of visitors and their impacts also need to be assessed in high and low seasons.

Below figure shows this relationship, and the importance of continuous monitoring in risk assessment of the property and its elements.

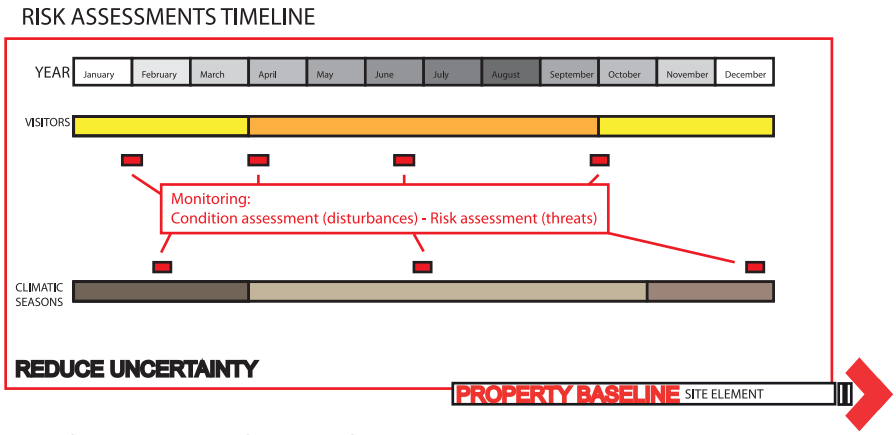

Figure 4 Risk assessment timeline example
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Risk assessment team: desired competences

In general the team carrying out the fieldwork should take an interdisciplinary approach. Therefore it is important that professionals, both men and women, from different background and fields be part of the team, such as archaeologists, historians, geologists, architects, landscape archaeologists and/or architects, conservators, engineers and hydrologists. A site manager or representative of the local authorities should also be part of the team. These members need to be selected carefully, and they need to perform as a team at all stages in the risk assessment process. Also if relevant, having a member of the local community in the team will improve the assessment, as the locals have the best live memory of the past and history of the site and the condition of its elements over the time.

At least jointly the members of the team should be able to cover the following knowledge and fit the mentioned criteria:

- general knowledge of heritage sites
- thorough understanding of the OUV of the World Heritage property, local heritage site values and the statement of significance
- understanding of typologies and site elements (such as standing structures, carved facades, landscape features)
- comprehensive knowledge of the risk methodology including the following:
  - disturbances, threats and agents of deterioration
  - condition assessment and its relation to the loss of integrity
  - risk assessment and risk magnitude assessment
  - preliminary mitigation strategies: methods of controls
- technical knowledge:
  - inventory skills
  - moderate knowledge of features of geographic information systems (GIS) applications
  - basic knowledge of surveying techniques, for example use of total station and moderate understating of global network positioning satellite systems (GNPSS) and their use
  - digital photography, especially use of panoramic photography (360-degree geo- referenced photography)
  - literate in standard (such as Microsoft Office) software packages.

2.5.2 Risk identification

Disturbances, threats and agents of deterioration

To identify risks two elements need to be identified: what might happen in terms of potential damage (the threat), and the probable cause (the agent(s) of deterioration). Risk categories, such as natural impact, and the main types of threat, such as erosion and wind, when defined, make it easier to identify threats on site and record them. For this publication, since the risk methodology has been mainly developed, tested and implemented in Petra, from the beginning it was decided to use the predefined categories of threats and disturbances developed and standardized by MEGA-J for archaeological sites in Jordan. These categories were used for identifying and recording the condition of and risk to the sites and site elements, and to link geographic data to the condition of monuments.

As defined by MEGA–J, disturbances are current 'detectable, negative effects on the site or site element by natural forces or human activities' and threats are 'detectable phenomena, whether natural forces or human activities, that appear to predict a future disturbance to a site or element'. Threats and disturbances as classified and defined in MEGA–J fall into six main categories: agricultural, development, human, natural, site management and other impacts, as depicted in Figure 5. For more details on threats falling in each category please refer to Appendix 1.

These categories could be used as indicators relevant to each heritage site, or developed for other heritage sites in other countries. They could be also complemented by the similar ones listed in the Operational Guidelines for the Implementation of the World Heritage Convention (UNESCO WHC, 2011a), as factors threatening the OUV of a property: development pressures (such as encroachment, adaptation, agriculture, mining); environmental pressures (such as pollution, climate change, desertification); natural disasters and risk preparedness (earthquakes, floods, fires and so on); responsible visitation at World Heritage sites; and number of inhabitants within the property and the buffer zone.

As shown in Figures 5 and 6, the disturbances and threats from MEGA–J, as detectable impacts, are linked to ten agents of deteriorations used by Monuments Watch Flanders[4] (based on Waller, 1995) , in order to identify what caused those disturbances or threats. Agents of deterioration are therefore mechanisms and processes that separately or jointly cause damage or threaten heritage. For example, once a threat, as a consequence of an agent, is identified and its probability and severity have been assessed, its magnitude of risk could be defined. Recorded agents on the other hand, as the causes of threats, will help to identify methods of mitigation and treatment, as will be explained in the following sections.

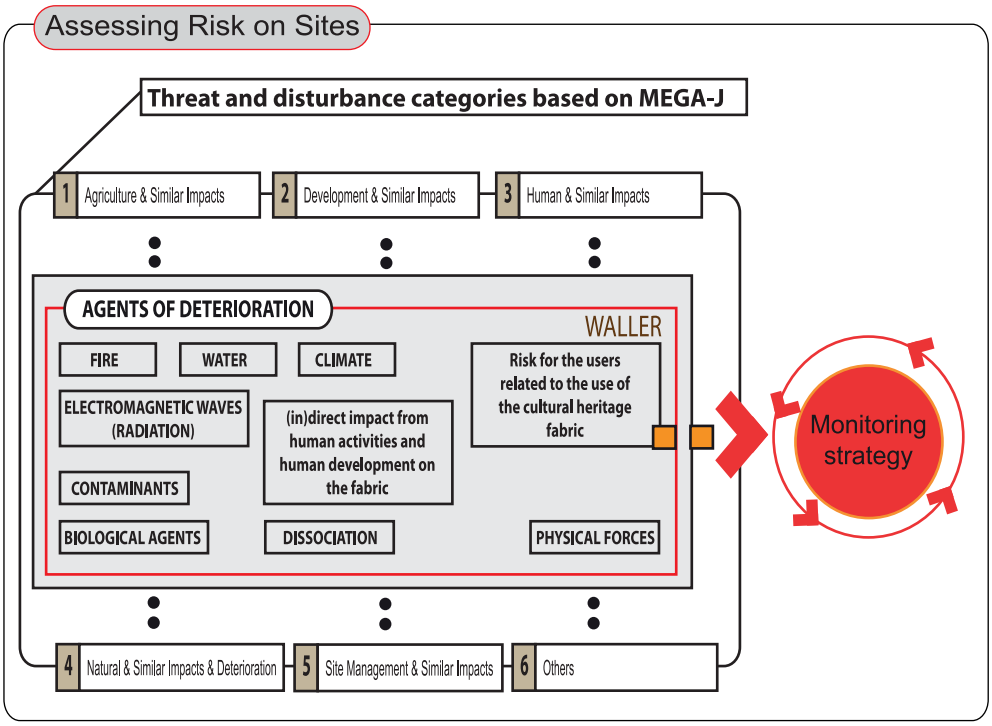

Figure 5 Risks and agents of deterioration potentially affecting the integrity of heritage sites
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[4] More information can be found at: http://www.monumentenwacht.be/.

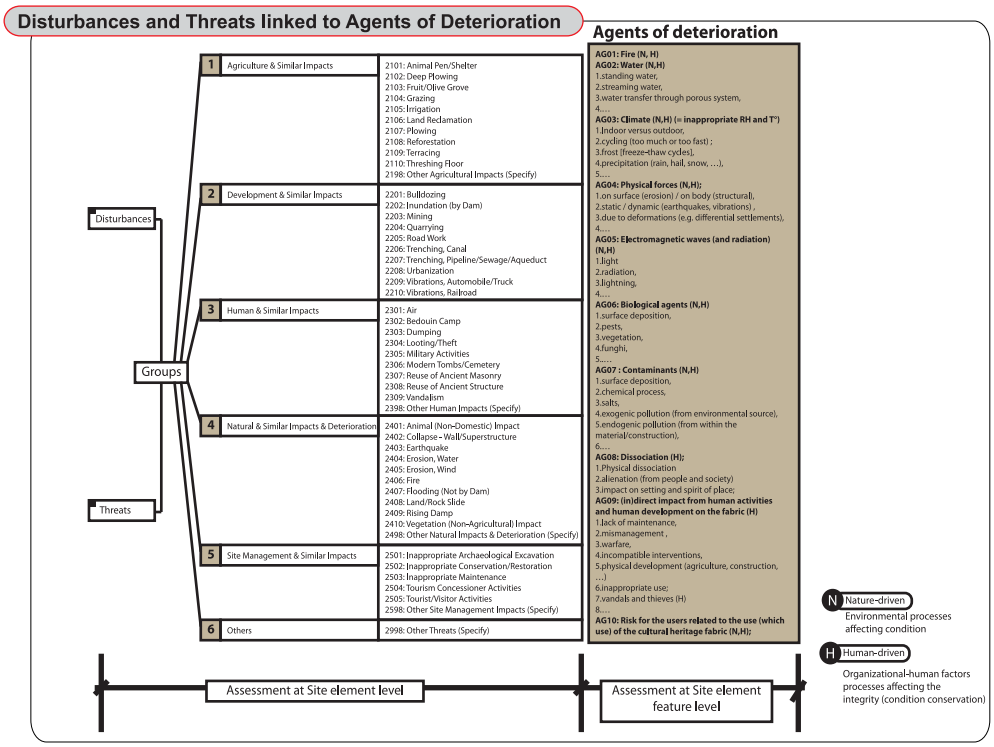

Figure 6 Threats and disturbances from MEGA-J linked to agents of deterioration. For the MEGA-J threat and disturbances code cards as well as the combined threats with the deterioration agents, please refer to Appendix 2.
Source: based on MEGA-J field cards

2.5.3 Assessing the impact of the risk

Risk assessment forecasts future threats from potential agents (Taylor, 2005). Once threats and their agents are identified, the risk impact and its level can be assessed based on the probability of the identified threat happening and the severity of its impact (Waller, 2003). The risk impact increases when the frequency or strength of threat increases. Therefore, in order to be able to assess the impact, the frequency of occurrence or probability of threats and the severity and impact of their effects should be assessed.

The level of risk can be assessed based on both qualitative and quantitative approaches and criteria. In this risk management methodology both qualitative and quantitative approaches are presented. The qualitative approach uses words to describe the magnitude of severity (effect of damage) and the probability (likelihood) of a damage occurring. The quantitative

approach uses numerical values for the risk criteria, and the magnitude is based on a scoring system. The quality of the quantitative analysis depends on the accuracy of the numerical values. Both methods are valid and could be used depending on the risk assessment projects and their targeted objectives, and the amount of data, time and resources available, as not everything can be grasped by numbers.

In the qualitative approach level of risks are identified based on the severity of effect (mild, severe, catastrophic) and frequency and probability of the damage happening (rare, sporadic, continuous). Three main types of risks can be defined according to their severity of effect and frequency:

- Type 1: catastrophic and rare
- Type 2: medium and sporadic
- Type 3: mild and constant.

Figure 7 shows the matrix of severity and frequency and these three types of risks. Using this matrix, each agent and threat can be manifest in one or more of the three types of risks.

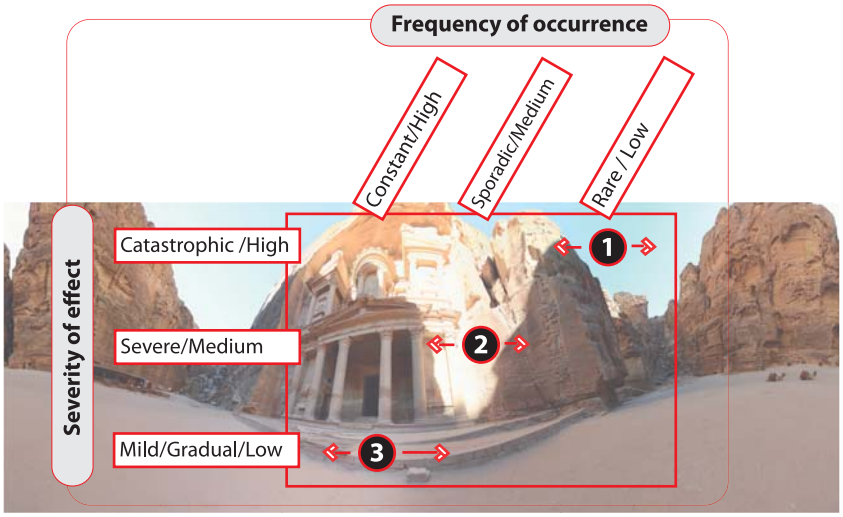

Figure 7 The ranges of frequency and severity of the types of risk 1, 2 and 3
Source: based on Waller (1995).

Usually Type 3, continuous risks, have a mild effect in the short term, but over long spans of time they can have really serious consequences. An example of Type 3 risk is damage caused by weathering affecting rocks and thus also rock-built monuments. The continuation of this

effect over a long period of time will affect the structural strength of the monument. This reduction in structural strength could become more serious and have immediate consequences if there is a rare but dangerous event such as an earthquake or flash flood (a Type 1 risk).

The types of risk serve as indicators of the degree of impact and its frequency, which is needed in order to prioritize actions required in a specific site, element and/or area to mitigate and reduce risks.

In the quantitative approach, the level and magnitude of risk can be calculated based on three criteria:

A probability or extent of damage happening
B degree of loss of value and integrity as a result of the impact
C fraction of the assessed area susceptible to the threat, and the extent of its vulnerability.

One factor that plays a role in risk assessment with the ABC criteria is the inclusion of loss in value in the equation. Risk assessment relates directly to values and loss in integrity. As mentioned earlier, values of the site and OUVs of the properties should be taken into consideration in order to assess the impact of risks to the values and integrity of the site as a whole. At the area and site element level, it is recommended to carry out a value-centred assessment covering individual elements under assessment. The significance of the whole site needs to be taken into account. This way of assessing the relative value of the studied area will show the priority areas for mitigation decision-making and action later in the risk assessment process.

Based on the ICCROM–CCI–ICN risk assessment course held in Sibiu, Romania (ICCROM-CCI–-ICN, 2007), Figure 8 provides guidance on how to calculate and quantify the magnitude of specific risk and make the risk comparison easier.

A (probability) + B (loss in value) + C (fraction susceptible) = magnitude of risk

Each of these criteria (A, B and C) is evaluated based on a scoring system from 0.5 to 5, as shown in Figures 8 to 11. Adding the scores for A, B and C gives a number representing the magnitude of risk for the specific threat. The advantage of this approach is that the scoring system provides a base of comparison for different threats, and this makes the comparison of impact and prioritization of threats easier. It provides a tool for comparing different risks. However, this approach depends considerably on the accuracy of the scores given for A, B and C based on the knowledge of the experts conducting the assessment and analysing the risks. Because of its detailed and numerical approach, using a quantitative method to define the magnitude of risk calls for understanding and a clear definition of the different factors, and training in performing the calculations.

The calculated risk magnitude can be categorized into one of five classes of priority: extremely high, very high, high, medium/high and low.

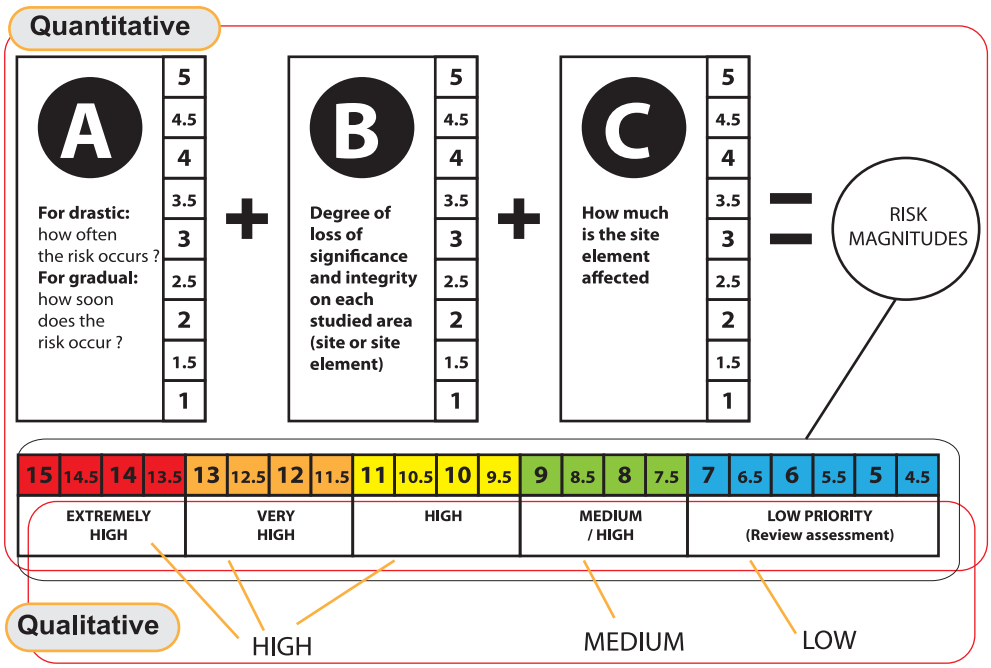

Figure 8 Magnitude of risks
Source: based on ICCROM–CCI–ICN (2007).

In order to establish the risk magnitude, this ABC framework provides the following indications. Note that the framework has been adapted to assess areas and site elements at heritage sites by quantifying the impact on loss of significance of site elements.

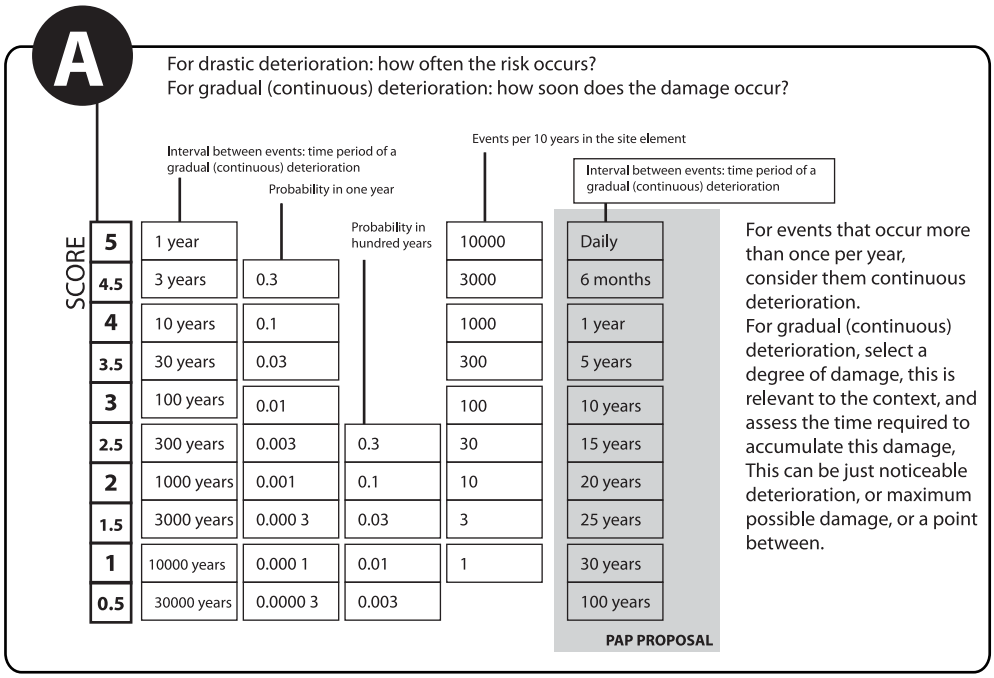

Figure 9 Table A – probability
Source: based on ICCROM–CCI–ICN (2007).

A. This criterion is the estimation of the probability that a specific risk will happen. This definition is for drastic changes and threats. As an example, the answer to the question 'How often is there a flood at the site?' is an A value. For continuous changes on the other hand the A value is the probability of the damage should the identified threat occur. In this case the question to be asked is 'How soon would damage occur?' For example there could be vibration from cars on the site on a daily basis, but a noticeable physical effect on the site elements will not be found daily. The A value in this example is the estimation of the damage that could occur, and the risk that this will take place, as the result of this daily physical force.

For the risk assessment fieldwork it was decided and agreed – at one of the experts' meetings – to adjust and compress the intervals for A to match them to the time range of management plans, from six months to 100 years, for the purpose of application at Petra. It should be noted that this adjustment to the intervals needs more time and study, and also needs to be further analysed based on its application on the site and the results. It is therefore advisable that the effective table be revised in consultation with different experts including mathematicians, and the intervals be recalculated to reflect the typology of both drastic and continuous risks, as in the Petra case.

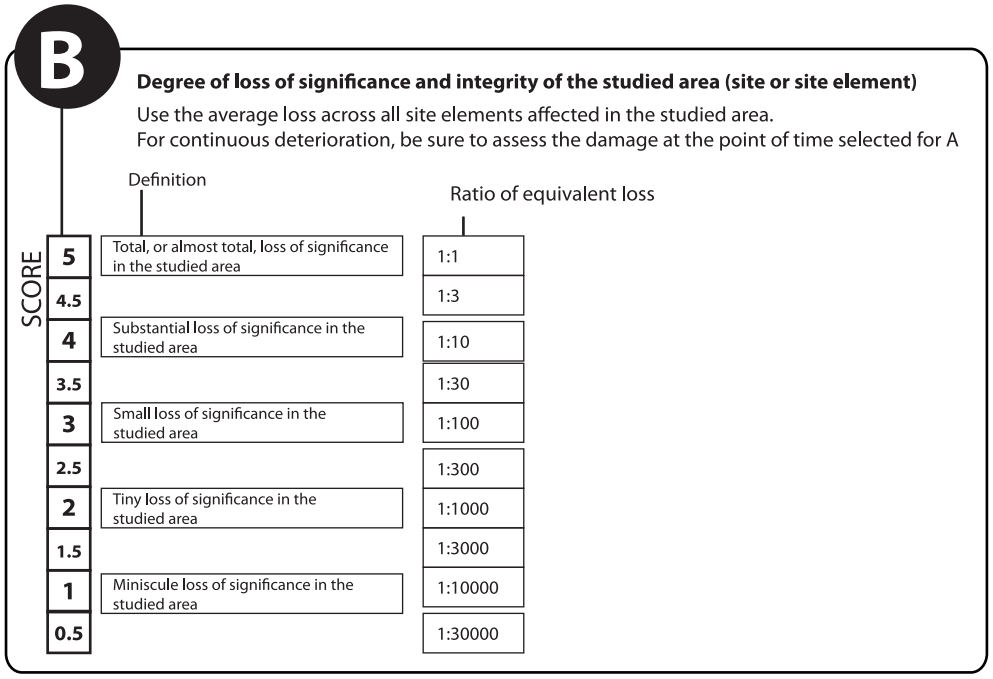

Figure 10 Table B – degree of loss of significance and integrity
Source: based on ICCROM–CCI–ICN (2007).

B. In the process of risk assessment, an estimation of possible total loss of value as a result of risk needs to be calculated. The B value represents the degree of loss of significance and integrity of the studied area, whether it is the whole site or a site element. The degree of loss of value is the direct effect of a risk on the overall significance of the site element or the site. This loss might be evaluated based on the structural damage and loss of the aesthetic, historic and scientific value of the element, or based on the loss in economic, social or environmental terms.

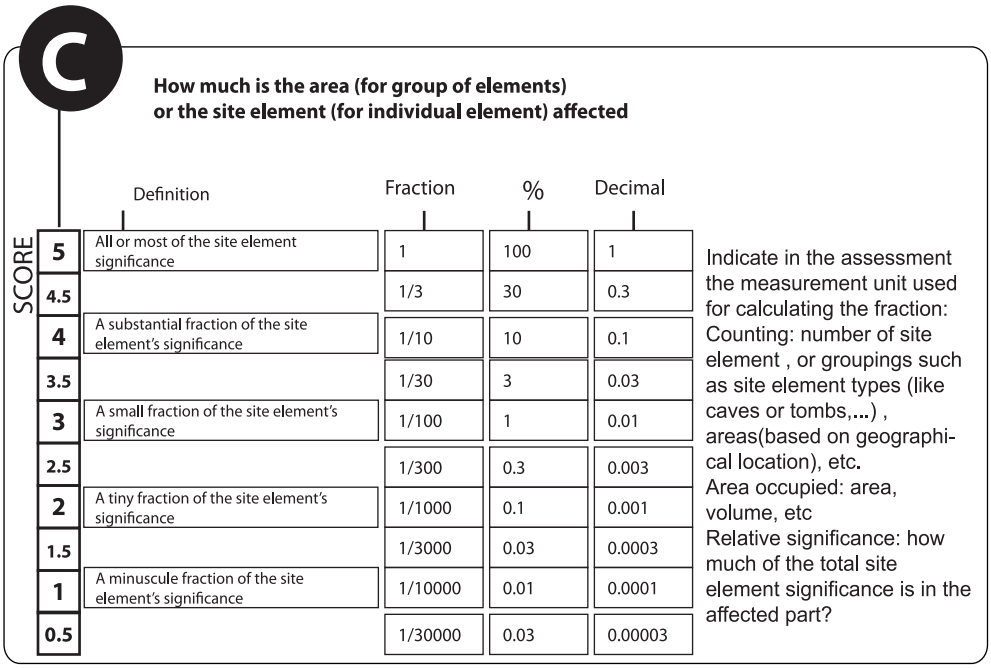

Figure 11 Table C – area affected
Source: based on ICCROM–CCI–ICN (2007).

C. The C value represents the fraction of the studied area affected by the severity of the damage. For example, the number of site elements that might be damaged because of the specific risk is the C value. It should be noted that the same measurement unit should be applied for different threats in the same risk assessment project. The measurement unit and the way of calculating the affected area could be identified and indicated by the assessment team from the beginning of the process.

In terms of the magnitude, each of the priority levels can be defined as follows.

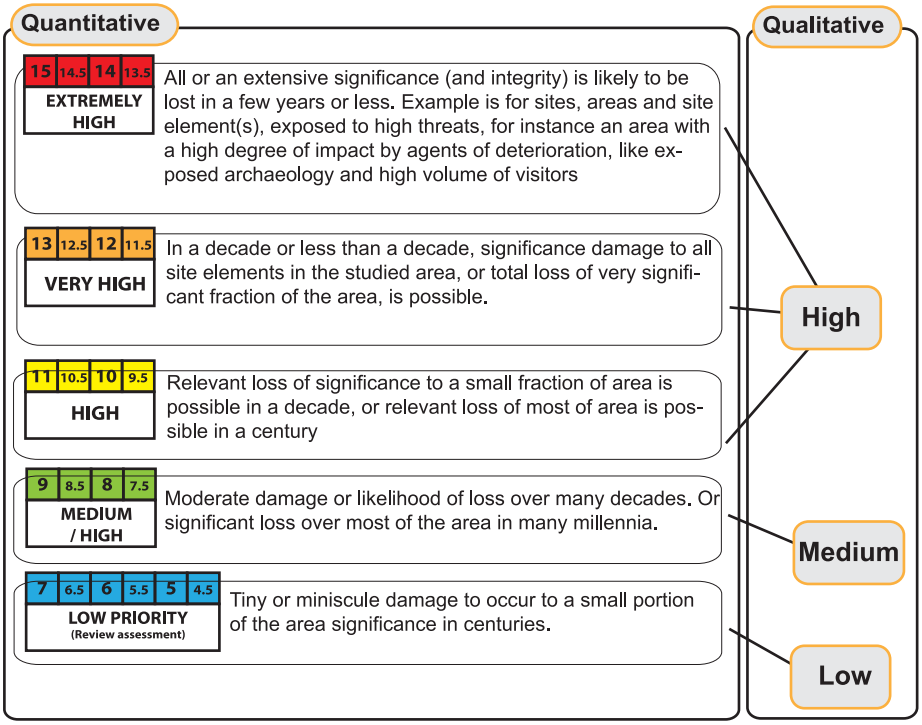

Figure 12 Table of magnitude
Source: based on ICCROM–CCI–ICN (2007).

- 13 ½–15. Extremely high priority: all or an extensive degree of significance (and integrity) is likely to be lost in a few years or less. An example is sites, areas and site element(s) exposed to high threats, for instance an area with exposed archaeology and a high volume of visitors.
- 11 ½–13 : Very high priority: in a decade or less than a decade, significance damage to all site elements in the studied area, or total loss of a very significant fraction of the area, is possible.
- 9 ½–11 : High priority: relevant loss of significance in a small fraction of the area is possible in a decade, or relevant loss of most of the area's significance is possible in a century.
- 7 ½–9 : Medium/high priority: moderate damage or likelihood of loss over many decades. Or significant loss over most of the area in many millennia.
- 7 and below: Low priority: tiny or minuscule damage is likely to occur to a small portion of the area's significance in centuries.

This assessment of magnitude should take into consideration the impact of these risks not only to the site and site element's physical attributes, but also to visitors, researchers and stakeholders as well as the landscape of sites. However, the model and most of the forms used have been designed to assess the magnitude of risks on physical aspects of the property, and assessing the risk to people and nature might need to be tackled differently and separately. For the Petra case study one of the pilot areas was chosen because nature and landscape were under risk there.

2.5.4 Possible mitigation strategies

Risk mitigation strategies or responses can be reviewed once all risks have been identified and their magnitude has been assessed. When risks are high, and their significance is high as well, finding a strategy for risk mitigation should be prioritized. As Figure13 shows, a risk mitigation strategy involves identifying a method of control and the level of control at which it is to be applied (Waller, 2003, p. 104). It provides a control matrix, which was originally designed for collections and museums, and which has been adapted to the risk management methodology, where site/property, area (covering monuments and landscape), site element (cultural or natural), site element feature, policy and procedure are defined as the levels of control.

This model provides a tool for site managers to consider risk mitigation tactics and decide on the method of control, whether preventive or active, at each relevant level of control.

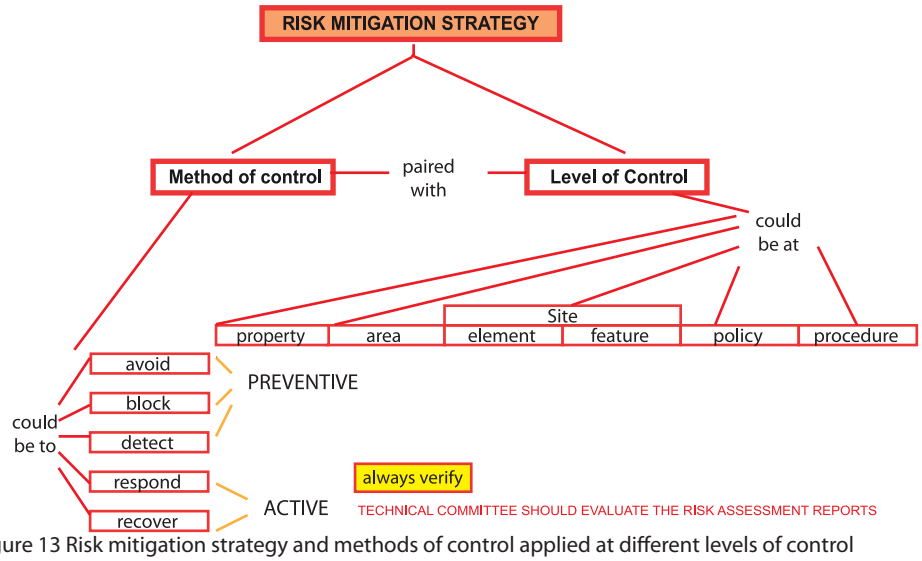

Figure 13 Risk mitigation strategy and methods of control applied at different levels of control

Methods of control

Five methods of control have been defined: avoid, block, detect, respond and recover.

Avoid (eliminate)

The aim here is to avoid sources and attractants of the agent of deterioration.
Signs such as 'Do not climb on the archaeological remains' are one procedure designed to eliminate a threat without any intervention.
In most cases, eliminating the threat is the preferred method of control.

Block (establish a barrier)

The purpose here is to block all access and paths of the agent of deterioration (since sometimes the method of avoiding the occurrence does not entirely prevent it).
Closing access to a defined area is a way of establishing a barrier. The risk to exposed archaeological remains can serve as an example of how each strategy could be applied to the same problem. If the problem is caused by erosion of structures, this can be prevented by backfilling the exposed ruins. Alternatively, if the problem involves rain damage, the exposed ruins could be protected by adding a waterproofed layer on top of each structure, or providing a shelter with a roof. However, in this example, creating the new protective layer might affect the significance of the site element.

Detect

Here the aim is to detect threats before the event happens, so that immediate protective action can be taken. One example is installing monitoring and early warning systems for floods and earthquakes.

Respond (act on agent)

This method involves responding to the agent of deterioration after presuming or detecting its presence. This is usually done when the other methods of control have failed to reduce the risk sufficiently.

Recover (conservation)

The final method is to recover from the agent's effect on the site or site element by doing actual conservation work on the site or site elements in order to maintain them.

An associated element is to reconsider what went wrong and plan improvements.

The avoid, block and detect control methods are methods of preventive conservation. The last two stages, respond and recover, are methods of active conservation. In some cases, effective control of the risk might require the combined use of different methods. Remedial conservation and restoration would be necessary only when the preventive stages have failed. In the scope of risk assessment and identification of mitigation strategies at heritage sites, the first three methods of control are relevant for the preparation of preventive maintenance strategies. However the last two methods should be considered for an area and site elements whose integrity has been substantially affected by disturbances and potential threats.

One thing that should be borne in mind before choosing a method of control and a mitigation strategy is the importance of the long-term consequences of the choice of methods of control. To return to the example of exposed archaeology, backfilling the ruins is a method of acting on the agent. It is worth noting that while this direct approach is often considered first, depending on the source and extent of the problem, it could prove to be the worst choice when all long-term costs and risks are considered. Backfilling could increase the risks of fire and of local flooding, particularly if maintenance and servicing requirements could not be met.

The selection of methods of control is directly related to the identified agents of deterioration – that is, to the causes of the risk. The terms 'disturbances' and 'threats' relate to the damage and risk of damage. However the cause (agents of deterioration) is what will lead to the identification of the correct mitigation strategy.

Levels for control

Each of the five methods of control defined above can and should be considered at each of the levels of control: site, area, site element, site element feature, policy and procedure.

Site/property/area

Many risks to site elements can be significantly affected by the location and orientation of the site.

Site element

Site elements can be substantially affected by agents of deterioration. The values-centred assessment is also carried out at this level. This is probably the most important level for controlling risks from most agents of deterioration.

Site element feature

Agents of deterioration can affect each feature. This level is important for controlling that the significance of a site element is not substantially affected.

Policy

The policy level of risk mitigation is especially important for reducing risks from custodial neglect. For example, needless damage to site elements from inappropriate impact from visitors can be controlled by establishing and enforcing a policy that defines the required carrying capacity.

Procedure

Finally, proper and well-established procedures are essential to an effective overall risk management strategy. In many cases such procedures will, by themselves, provide the most cost-effective manner of reducing a risk.

Identifying a method for the mitigation strategy involves considering the range of options for treating and mitigating risk, bearing in mind the timeframe of the strategy – short, medium or long term – and assessment of the risk-mitigation options.

Selecting the most appropriate mitigation option involves balancing the implementation cost of each strategy against the benefits derived from it. All possible methods of control should be considered for mitigating each significant risk. One of the methods will be the most appropriate and provide the best cost–benefit ratio for mitigation of the risk.

After selecting a mitigation strategy, an action plan should be drafted on how the selected option will be implemented. Such a plan – for each risk – should include:

- summary of the methods of control option(s) and expected result(s)
- proposed preservation and/or conservation work
- required resources (in terms of staff, budget, research and documentation)
- timeframe of the work.

It should be noted that monitoring and reporting needs to be an integral part of the process.

Uncertainty

A general reflection should be made about uncertainty, its meaning and its effect on the risk management and decision-making process. When determining and assessing risks to heritage sites, a very important factor in this assessment is to recognize and be upfront with the existence of uncertainty during the process.

Uncertainty is related to the reliability of the information on risk and accuracy of the quantitative values assigned to criteria. This means the reliability of information on the probability of the event (damage) happening, its impact on values, and the extent of damage and magnitude of risk. Thus, in order to make better mitigation decisions, it is necessary to include information on the level of uncertainty in the assessment process and decision-making. The

recognition of uncertainty helps the decision-makers assess the limitations and accuracy of the information available, make the wisest decision and prioritize allocation of resources for the application of risk mitigation measures, or further documentation and research.

The more impact uncertainty has on the result of risk evaluation, the more important additional research is to reduce the uncertainty. It might, for example, be very unwise to decide on drastic measures based on highly unreliable information, resulting in a large impact on heritage values. Many examples show that this happens, unfortunately. But similarly if for a specific threat, the estimated high risk is underestimated, the risk will be judged to be moderate and this will affect the risk management decision on not to take mitigation measures. And as a result the high risk will continue. Therefore decision-makers need to know the level of knowledge and degree of belief in the accuracy of the risk assessment results, as well as the degree of certainty of each of the results, prior to studying the risks and deciding on any mitigation strategies. Recognition, explanation and recording of the level of (un)certainty and its effect on the process of risk assessment is fundamental in the risk management approach.

Levels of uncertainty also apply to estimating the impact of possible solutions and methods of control.

There are different ways of trying to reduce uncertainty. Further information and a higher level of knowledge may reduce the uncertainty. However, as will be seen in the risk evaluation section, the amount of effort, time and resources needed to reduce uncertainty should be balanced with the added value of the information to the risk assessment and decision-making process.

2.5.5 Risk evaluation

The goal of risk evaluation is to evaluate and stream the outcome of risk assessment – risk identification and estimation – in order to manage risks and decide which risks need to be treated (mitigated) and in what priority. The decision is intended to prevent (or slow) the negative impact of deterioration. At this stage, criteria identified for making decisions about the risk management process at the risk management context assessment step need to be revisited in order to make sure the decisions taken at this stage are aligned with the defined internal and external institutional context.

Some important elements in the evaluation process are level of risk magnitude, cost–benefit analysis of the mitigation strategies, and criteria against which risk needs to be evaluated, such as objectives of the organization, gain or loss of the local community, economic benefits (or loss), and financial, technical, social and other criteria.

Priority-setting and risk management decisions

As explained previously, the level of uncertainty plays a very important role in the accuracy of the risk assessment. In order to prioritize risk management decisions, the site manager and/or the decision-maker need to know the level of risk and degree of uncertainty. The degree of certainty of each of the risk assessment results needs to be known by the decider. It is for this reason that risk management decisions depend on the level of risk magnitude combined with the level of the uncertainty. Using a table like the priority-setting table (Table 1) to assess the magnitude of risk and the uncertainty is an effective way to record the level of uncertainty and with that in mind, prioritize the decision. This table shows the dependency of the risk decision on risk magnitude and uncertainty, combined with the feasibility and costs of reducing the risk through mitigation or reducing the uncertainty. When uncertainty is low, as shown in Table 1, the strategy is risk mitigation, and when uncertainty is high, further risk research and analysis to reduce the uncertainty has been proposed as a strategy. Decision-makers at heritage sites are responsible for taking the final decision on what strategy to take. Table 1 will help them to analyse and rationalize part of this decision-making process. However, in cases when both risk magnitude and uncertainty are high, and the table suggests the highest priority for both mitigation strategy and research, and when the costs for both are comparable, it is up to the site manager and decision-maker to decide which approach to follow.

UNCERTAINTY						
	High	Requires research to ascertain that assessment is correct, but low priority.	Apply low cost mitigation; cost–benefit analysis of research to reduce uncertainty when highest risks have been dealt with.	High priority for research, cost–benefit analysis of the mitigation strategy is recommended.	High priority for research; short-term mitigation strategy is recommended; cost–benefit analysis of the mitigation strategy is recommended.	Highest priority for research; short-term mitigation strategy will buy time until uncertainty is lower; cost–benefit analysis of the mitigation strategy is recommended
	Moderate	Low magnitude of risk with moderate uncertainty is acceptable. Action is not necessary.	No direct action required but try to reduce the uncertainty. Cost–benefit analysis of mitigation versus research.	Risk mitigation prioritized by cost–benefit analysis of research and further risk analysis.	Risk mitigation prioritized by cost–benefit analysis of mitigation strategies, research and further risk analysis.	Second priority risk mitigation. Cost–benefit analysis of mitigation strategies and research is recommended.
	Low	Low magnitude of risk with low uncertainty is acceptable. No action.	Mitigate risk when highest risks have been dealt with, based on cost–benefit analysis of mitigation strategies.	Prioritize by cost–benefit analysis of mitigation strategies.	High priority for risk mitigation.	Highest priority for risk mitigation.
		Low	Medium high	High	Very high	Extremely high
		MAGNITUDE OF RISK				

Table 1 Matrix of priority based on level of risk magnitude and level of uncertainty
Source: based on ICCROM–CCI–ICN (2007).

Evaluation of the cost and benefits associated with each strategy

The final phase in the risk assessment, after identifying all risks, assessing their magnitude and identifying the mitigation strategies, is evaluating options for risk mitigation and assessing the costs and benefits associated with each strategy in order to be able to select the most appropriate options. The effect of each strategy on each and every agent of deterioration and threat should be taken into consideration. Cost–benefit analysis should also be associated with the implementation and maintenance stages. The effect of the strategy on factors at risk other than the heritage places and their significance, as well as risks to visitors, researchers, stakeholders and the landscape, should also be taken into consideration.

2.5.6 Implementation of the strategy

Implementation of the mitigation strategy to treat the risks is based on the results of the risk assessment, and should be validated by a technical committee (as defined in the next point). These actions could be preventive or active. Preventive methods of control are the most cost-effective way to reduce risks in the long term. For example, at the policy and procedure level a large number of risks could be blocked or avoided.

Decisions concerning the mitigation strategies (risk control and risk management decisions) might be based on financial, operational, legal, political, environmental, social or other criteria.

The reasons that these actions were taken should also be documented in a form of risk treatment (mitigation) report. Different options for mitigating and treating risk should be clearly identified in this report. Each of the options needs to be assessed clearly, and moreover the implementation of each mitigation strategy needs to be explained clearly.

Monitoring and control

It is crucial to monitor the different steps of the risk assessment, and review the risk magnitude and the suitability of the mitigation strategies adopted to ensure that they are still valid. The factors affecting the property as well as the actions taken are prone to change over time. Therefore, the risk assessment cycle should be carried out on a regular basis.

Different controls or verifications are introduced to ensure the accuracy of the risk assessment reports and information taken in the field. First, a follow-up team (or office team) should be established to review and verify the work and report of the fieldwork team through consensus meetings before drafting the report and proposing any mitigation strategies. All actions taken during different stages of the risk assessment by the fieldwork team should be supported and cleared by this follow-up team at different stages of the assessment. A second verification process is through the establishment of round tables and

meetings – advisory meetings – with experienced and interdisciplinary experts to provide feedback and advice on the reports and results of the work. The final method is the creation of a technical committee, as part of a managerial committee, composed of experts from different fields and representatives of local authorities and site managers, to review the final reports, and to make decisions and carry out prioritized mitigation strategies and treatments. This process could also help to acknowledge best practices implemented at the heritage site, which might later be repeated, or could enable learning from the less successful measures. Keeping a record of all the actions taken could help later in improving management performance.

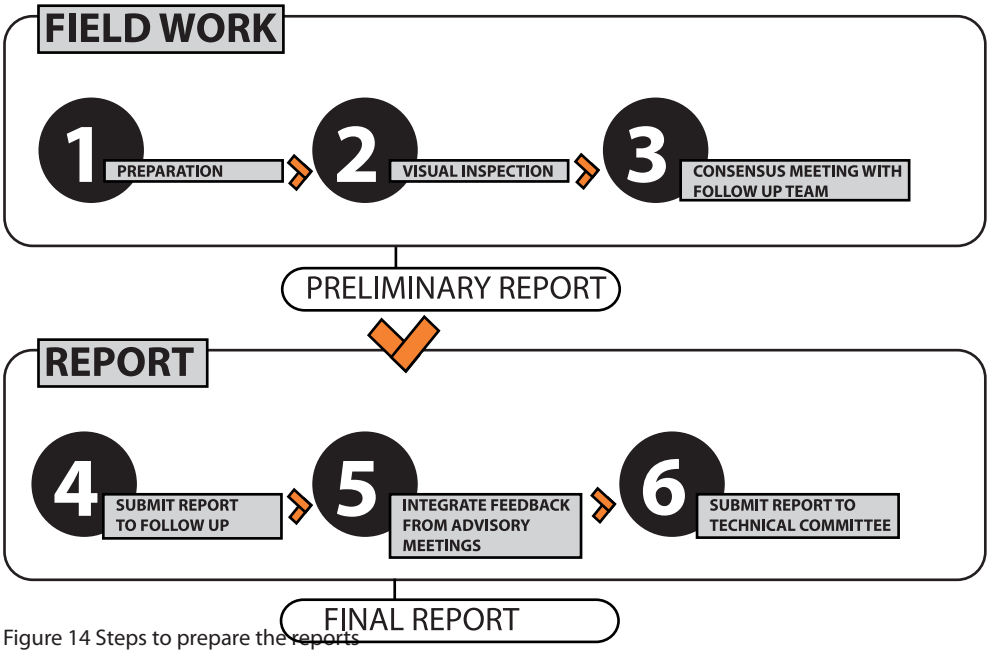

Figure 14 Steps to prepare the reports

3. Risk management at the Petra World Heritage site – a case study

3.1 Historic and geographic context

Petra was a caravan city, known as the capital of the Nabatean kingdom. Located in south-west Jordan, at an important crossroads between Arabia, Egypt and Syria, and lying between the Red Sea and the Dead Sea, the city acquired a dominant position early in its history.

Figure 15 Map of Jordan
© UNESCO

The site has been inhabited since the Paleolithic period, and remains of Neolithic settlements have been discovered from about the seventh millennium BC. The Edomites occupied the area in the first millennium BC, and from the third century BC Edom became a centre of the Nabataean kingdom.

Because of its location on the axis of a network of ancient trade routes –from the north to the Silk Road and from the south to the Incense and Spice Road – Petra soon acquired a very prominent position as a major caravan centre.

In the second century BC, the Nabataean kingdom increased in strength due to its major role in trade. By the first century BC the kingdom extended from Damascus in the north to the Red Sea in the south. During the Hellenistic period, the Nabataeans were able to maintain their independence and political autonomy, as their art, architecture and hydraulic technology can testify. In 106 AD the Roman emperor Trajan annexed the Nabataean kingdom as part of a major military campaign on Rome's eastern frontiers.

Christianity reached Petra in the fourth century, when a Byzantine church and a Chapel were built, and various tombs and temples at Petra were used as churches. At this time, Petra still kept its importance as administrative centre of the Byzantine province of Palaestina Tertia. However, changing trade routes to prioritize sea routes and redirect trade through the northern lands led to a gradual decline in Petra's importance, and after an earthquake in 551 AD the city declined even further. From archaeological research, it seems that there is no sign of habitation of the city in the years following the arrival of Islam in the region, at least not until the twelfth century when fortresses were built by the crusaders in the mountains of Petra in order to defend their eastern border. Again after the crusades, Petra became a 'lost city', known only to locals, and it was not until 1812 that Petra was rediscovered for the western world by a Swiss traveller, Johann Ludwig Burckhardt.

Nowadays Petra is one of the most famous archaeological sites in the world, thanks to its unique architecture, including structures half-built and half-carved into the rock, and its setting among mountains riddled with passages and gorges.[5] Its outstanding archaeological heritage and the combination of monumental, natural, hydrological and landscape treasures led to its inscription in the UNESCO World Heritage List in 1985, according to the first, third and fourth criteria of OUV.

3.2 Institutional and management framework

Since 2009 the Petra Development and Tourism Regional Authority (PDTRA) has been responsible for the management of the Petra region, which extends over an area of 755 sq km. The PDTRA includes a specific entity, the Petra Archaeological Park (PAP), primarily devoted to the management of the World Heritage property. The management of the site is shared with the DoA, defined by the Jordanian Law of Antiquities[6] as a national (and governmental) sector, whose jurisdiction encompasses archaeology, research, conservation, preservation and management of all archaeological sites and antiquities in Jordan. The archaeological heritage of Jordan, including Petra, has been protected under the first Antiquities Law since 1924, soon after the establishment of the DoA in 1923. Protection of the heritage continued under the Emirate of Transjordan (1921–46) and later on with the Hashemite Kingdom of Jordan. Since the Jordanian Law of Antiquities of 1988, the DoA has been the only body responsible for the protection and conservation of the site (law no. 21, art. 5).

A protected area for the site of Petra was defined in 1993, with the issue of a justification by-law for the establishment of the park.[7] In 2007, with a further by-law, the PAP was officially established over an area of 26,400 ha,[8] and the limits of the PAP as such were officially acknowledged as limits of the Petra World Heritage property.

[5] UNESCO, WHC Brief description of Petra. http://whc.unesco.org/en/list/326 (Accessed 10 January 2012.)
[6] The Jordanian Law of Antiquities is the Jordan's primary law governing archaeological sites.
[7] Council of Ministers decree no. 513/86, 1993.
[8] Petra Archaeological Park, by-law no. 78, 2007.

The establishment of a governmental body devoted to the management and conservation of the World Heritage site stemmed initially from the recommendations included in the UNESCO Management Plan of 1994, which instead led to the establishment of the Petra Regional Council (PRC) in 1995. This entity later became the Petra Regional Planning Council (PRPC). Nevertheless, the mandate of the Council included not only the management of the World Heritage area but also the development of tourism and economic activities within and beyond the World Heritage property. With a similar function, the Petra Regional Authority (PRA) was then established in 2005.[9] Later on, the Petra Devolpment and Tourism Regional Authority (PDTRA) was established in 2009,[10] playing the same role, but has also financial and administrative independence as it reports directly to the prime minister and has its own legislative set-up. The mandate of the PDTRA encompasses support to the protection of the PAP, tourism management and development, zoning and land use, investment, improvement of the socio-economic conditions of local communities, and sustainable development. The PDTRA's role is the development of the Petra region economically, by capitalizing on its potential for tourism, among other areas such as local community development, heritage management and protection, and environmental protection.

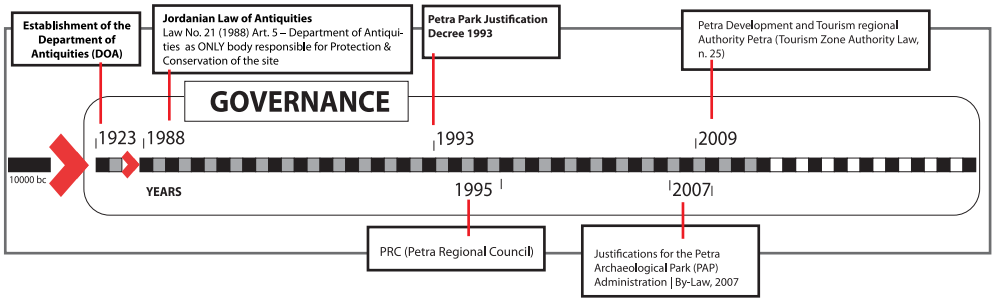

Figure 16 Governance time line in Petra
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The PDTRA is headed by a chief commissioner who is assisted by four deputy commissioners, including the commissioner for the PAP and cultural heritage affairs, who reports to the chief commissioner, the head of the PDTRA, who in his turn reports directly to the prime minister. The DoA directly reports to the Ministry of Tourism and Antiquities (MOTA). Therefore, there can be overlapping responsibilities for the governmental organizations involved in the decision-making process, and in the control of management and conservation work in Petra, which could cause risk to the site.

[9] Petra Regional Authority, Law no. 15, 2005.
[10] Petra Development and Tourism Regional Authority, Law no. 15, 2009.

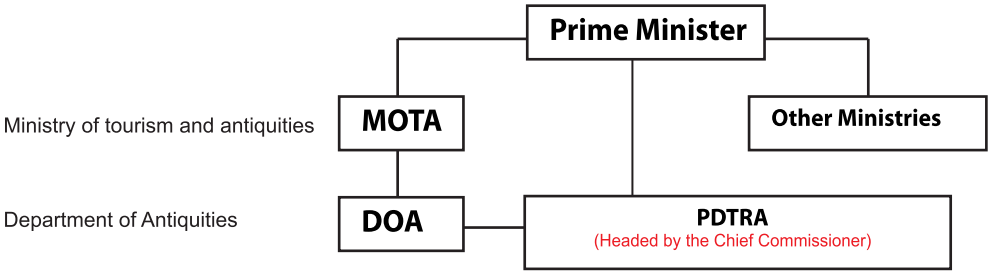

Figure 17 Flow chart of governmental sectors responsible for the management of PAP
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In terms of management of the property over the past four decades, Petra has been governed by several agreements and strategies. Because of the lack of funding, long-term planning and initiatives, none of the four tourism and management plans and strategies elaborated (the United States National Parks Service (USNPS) plan 1968 (USNPS, 1968), UNESCO Management Plan 1994 (UNESCO, 1994), ICOMOS Management Recommendations 1996 (US/ICOMOS, 1996), and the Operating Plan 2000 (USNPS, 2000), have been officially adopted and implemented in their totality by the government by decree.

More recently, the PDTRA commissioned the preparation of a Strategic Master Plan for the Petra Region to the Austrian Tourism Consultants (ACT) 2011. This had per objective the determination of appropriate development zones and land uses, develop sustainable tourism, stimulate domestic and foreign investment, and improve the socio-economic conditions of the local communities. The protection of the PAP was not the main scope of this plan but it fell within the overall management of the region.

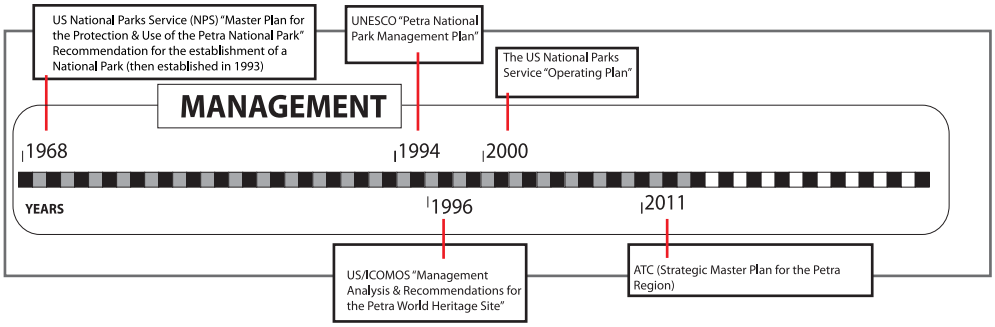

Figure 18 Plans and strategies for Petra
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3.3 Introducing the risk management approach for Petra

As mentioned in the introduction, Petra is threatened by a number of different risks. Natural causes such as weathering, flash floods and biological damage particularly affect the monuments in Petra because of the specific and vulnerable characteristics of the rock from which they are carved and built. Anthropogenic impacts such as vandalism and theft, and tourism development, are other major factors threatening the integrity of the property. One of the main causes of risk to the monuments is the lack of regulation concerning visitors' accessibility to paths and monuments, resulting in an increased movement of tourists on the site. With a growth rate of 59% in tourist numbers from 2004 to the first half of 2010, according to statistics from the Ministry of Tourism and Antiquities of Jordan (MoTA),[11] the needs for a visitor management strategy to be implemented, and for visitor flow to be regulated, have become crucial. The current number of visitors per month considerably exceeds the advisable carrying capacity of the site, which was defined as 3,000–3,500 visitors per day in the UNESCO Petra National Park Management Plan (1994, p. 191).

In addition to the above threats, the lack of technically mapped and visualized boundaries and a holistic defined strategy for a buffer zone or zoning regulations also represents a threat to the physical integrity of the site. At the time of Petra's inscription in the World Heritage List, property boundaries were defined inaccurately and no buffer zone was created, since no clear regulations then existed. Despite the call by the Retrospective Inventory (WHC, 2004), no technical delineation of boundaries and buffer zones has been provided for the PAP to date.

Accordingly, most of the relevant international organizations have shown concern about the state of conservation of the property and the considerable risks to which it is exposed. The World Monuments Fund (WMF) placed the PAP on its watch list[12] on four consecutive occasions (in 1996, 1998, 2000 and 2002), in a sustained effort to draw attention to the need to improve tourist management at the location. Petra was also included in the ICOMOS World Report 2004/2005 (Wedekind, 2005), where water erosion, salt weathering and shortcomings due to incorrect restoration interventions on the rock-cut facades were acknowledged as major threats to Petra conservation.

The World Heritage Centre requested the State Party to 'invite a joint World Heritage Centre/ICOMOS reactive monitoring mission to Petra to assess the state of conservation of the property, the advancement of the works in the Petra Siq and to discuss the planned actions, as well as the progress, in the finalization of the Management Plan' (UNESCO WHC, 2010a). The latest decisions by the World Heritage Committee urged the State Party to finalize the process leading to the establishment of functioning management arrangements for the site, expressed deep concern about the state of conservation of the property, and requested the development of an integrated conservation plan (UNESCO WHC, 2011b).

[11] According to MoTA (www.mota.gov.jo/Home/index.htm), visitor numbers increased from 310,271 in 2004 to 493,379 in the first half of 2010.
[12] WMF webpage: www.wmf.org/project/petra-archaeological-site (Accessed 23 November 2011.)

As a result of the risks mentioned above, coupled with the vulnerability of the site, a risk management approach incorporated in a management plan for Petra has been identified as the most appropriate tool for a mitigation of risks and protection of values of the property. The main objective of such a plan will be maintaining the values of the site and safeguarding its historic monuments and its landscape from external threats. From this perspective, in the following sections we examine the risk mapping project's main activities at Petra, aimed at reducing the risks to the property. The first part gives a summary of the boundary-mapping fieldwork and looks at the issues of outlining guidelines and regulations for the buffer zone of the park. In the second section the application of the proposed risk assessment approach in Petra is examined.

3.4 Mapping boundaries and outlining a buffer zone

3.4.1 Introduction

A substantial risk factor to heritage properties is the absence of defined boundaries and a buffer zone, or their unclear definition. Boundaries and a buffer zone, far from being a purely formal requirement for heritage sites, are essential tools for assuring better management and protection to a property. The lack of well-defined boundaries represents a major threat to a siteís integrity. A buffer zone serves to provide a stronger level of protection to a heritage property, and should include its immediate setting, important views, and other areas or attributes that are functionally important as a support to the property and its protection.

In the planning process methodology defined in Chapter 2, the delineation of property boundaries is part of the identification and description of the site, and defining a buffer zone and zoning regulations forms part of the assessment of the legal and legislative context (step one of the methodology: documentation and defining context).

Looking at the broader context of disaster risk management, a buffer zone comes to play an even more relevant role, as the risks to cultural and natural heritage might originate either inside the property or in the surrounding environment. This should lead to direct action, mainly in buffer areas, to ensure that they represent an added layer of protection. Various measures, mainly to protect against natural hazards (concerning for example water catchment areas, fire hazards and landslide probabilities based on geological surveys) could help in developing appropriate risk management guidelines.

In the case of the PAP, the early nomination of the site in the World Heritage List in 1985, with minimal documents, accounts for the lack of physical definition and full mapping of the boundaries of the property, as well as the lack in the definition of its buffer zone and related strategies. This gap has not been filled in the past few years, and although scattered measures have been taken in terms of boundary definition, no holistic action has been implemented to ensure the full protection of the Petra site by means of a buffer zone.

The scope of the present work as part of the risk management process was to identify strategies for the better protection of the park at the level of both boundaries and a buffer zone. In terms of boundaries, a technical mapping of the PAP government boundaries established in 1993 was carried out to fix clearly and officially the limits of the property. The work included:

1) A review of existing planning regulations in terms of boundaries at the PAP, and data collection from concerned authorities (GIS vector layers, and the coordinates of current boundary points).
2) Field survey and identification of the existing boundary points on the ground, physical marking of new boundary points on the ground, registration of precise GPS coordinates, and photographic documentation of each boundary point.
3) Handover of all data gathered to Jordanian authorities, for verification and validation, after which they will be submitted to the World Heritage Centre.

In terms of a buffer zone, criteria have been set for a buffer zone/zoning of the park. Because of the time limitations of the project, based on a value assessment study and analysis, the study focused on the examination of the north-eastern PAP boundary section including Um Sayhun and Beidha as a priority action. The work included:

1) Literature review, data collection related to the boundaries mapping initiative, review of zoning and recommendations for a buffer zone in relation to the management plans for the PAP.
2) Review of existing land use, building regulations and present building permits and practices for the areas surrounding the PAP, with an emphasis on the north-eastern section of the PAP, and including a review of the findings of the latest Strategic Master Plan for the Petra Region (ATC, 2011).
3) Developing guidelines for a buffer zone between Um Sayhun and Beidha, and recommendations for the land-use regulation in the areas surrounding the PAP.

What are boundaries?

By definition, boundaries serve to define a space and its use. Accordingly, the boundaries of heritage sites should include all elements which bear significance and that contribute to the integrity of a heritage site, whatever its nature (such as cultural, natural or urban).[13]
Criteria for outlining heritage boundaries aim at identifying a clearly defined area with common heritage values and determining how the delimitation of such an area should be carried out for enhancement of the protection of a heritage site. There are a number of guidelines for adequately defining the boundaries of heritage properties, depending on the type of heritage to be preserved. Different types of boundaries can be identified, such as natural, ecological, scenic and non-continuous, depending on the type of landscape in which the site is located.

[13] A number of organizations have developed guidelines for this, among the most significant being the United States National Park Service, ICOMOS, ICCROM, the International Union for the Conservation of Nature (IUCN), WHC and the UNESCO Man and the Biosphere (MAB) programme. National legislation concerning heritage sites is also relevant here.

What is a buffer zone?

Buffer zone is a military term used to define a neutral area set between hostile or belligerent forces that serves to prevent conflict. In urban planning, buffer zone is a tract of land between two differently zoned areas.

The term, once transferred to the heritage context, defines a clearly delineated area outside a heritage property or adjacent to its boundaries, in which land uses and development are regulated, and which contributes to the protection, management, integrity, authenticity and sustainability of the values of the heritage property. The concept of buffer zone was brought to cultural heritage from the natural sciences, natural heritage and biosciences. Nowadays, both at the international level (organizations such as USNPS, ICOMOS, ICCROM, the International Union for the Conservation of Nature (IUCN), WHC, and the UNESCO Man and the Biosphere (MAB) programme) and at the national level (through national legislation), guidelines have been developed to set buffer zones for heritage sites.

Boundaries and buffer zones at World Heritage properties

According to the Operational Guidelines (UNESCO WHC, 2011a, §§ 99–102), the delineation of boundaries is an essential requirement in the establishment of effective protection for nominated properties. They should be drawn to ensure the full expression of the OUV and the integrity and/or authenticity of the property. They may coincide with one or more existing or proposed protected areas, such as national parks or nature reserves, biosphere reserves or protected historic districts.

In addition, it is advisable not to give primary consideration to administrative convenience in establishing boundaries, but have as main criterion the fact to separate the property from the wider area, in relation to which the property will appear to be distinctly of potential OUV. Boundaries need also to be logical and defensible in relation to the legal protection and management of the property. Thus, it is recommended for boundary definition to be carried out at the same time as the definition of management priorities and requirements for the property, with the involvement of all stakeholders. Furthermore, it is of primary importance for boundaries to be readily identifiable, thus they can be based on physical, natural or human features (such as roads). It is advisable to use topographic maps annotated to show the property boundaries, complemented if possible by a GIS application to show the protected area.

According to the Operational Guidelines (UNESCO WHC, 2011a, §§ 103–7), a World Heritage buffer zone is a summary term used by the World Heritage Committee for a diverse range of buffer zone typologies that are used to provide additional protection to an inscribed World Heritage property, or to support its sustainable use. It should include:

- the immediate setting of the nominated property
- important views
- areas or attributes that are functionally important as a support to the property and its protection.

In certain cases, the presence of existing well-defined legislation and/or zoning could make defining a buffer zone unnecessary, but its absence should be strongly justified. The buffer zone is therefore a legal tool contributing to the preservation of the integrity and authenticity of a property beyond heritage boundaries, and operating with other management and legal instruments already in place. It does not imply land expropriation.

It is worth noting that initially, the definition of boundaries at the time of inscription of a site in the World Heritage List was not mandatory. Thus, many properties nominated in the 1980s were not provided with clear boundaries or a buffer zone. More recently[14], providing a site with a buffer zone has been seen as an integral component of the State Party's commitment to the protection, conservation and management of a World Heritage property. Also, nominations to the World Heritage List are considered incomplete if the boundaries of the property are not delineated, making clear and unambiguous the distinction between the nominated property and the buffer zone.

3.4.2 Petra Archaeological Park: boundaries and buffer zone, the general context

Petra Archaeological Park boundaries

At the time of inscription of Petra in 1985, providing clear topographic maps of the area to be inscribed was not mandatory, and the Petra map submitted with the nomination dossier lacked clarity. During the following years, limited efforts were made by park authorities to better delineate the area, but until the beginning of the risk mapping project a full physical-technical delineation of the property boundaries seems not to have taken place.

The first maps outlined for the park are the ones included in the 1968 Master Plan for Petra and the map submitted with the Nomination Dossier in 1985 (Figures 19 and 20). The criteria applied in the delineation of park boundaries in 1968 included consideration of historical and archaeological features, scenic views, areas that show historic conservation practices, and the presence of unobtrusive sites for development necessary for public use and management facilities. Despite being inaccurate, the map submitted with the nomination dossier of 1985 is useful to roughly understand which areas were considered as being within the park at the time of the nomination.

[14] The section in the Operational Guidelines 2008 (http://whc.unesco.org/archive/opguide08-en.pdf) on boundaries is the result of the latest revisions and was included only in 2005.

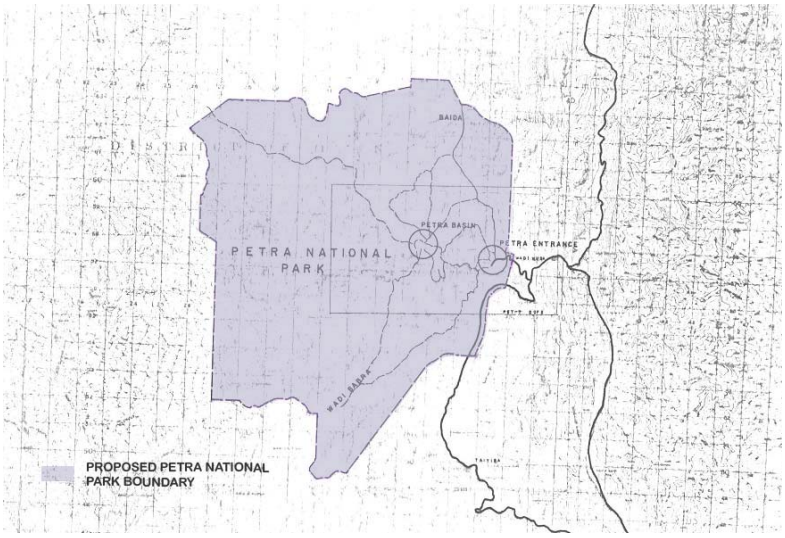

Figure 19 Map of Petra park, as produced for the Master Plan of 1968
Source: based on USNPS (1968).

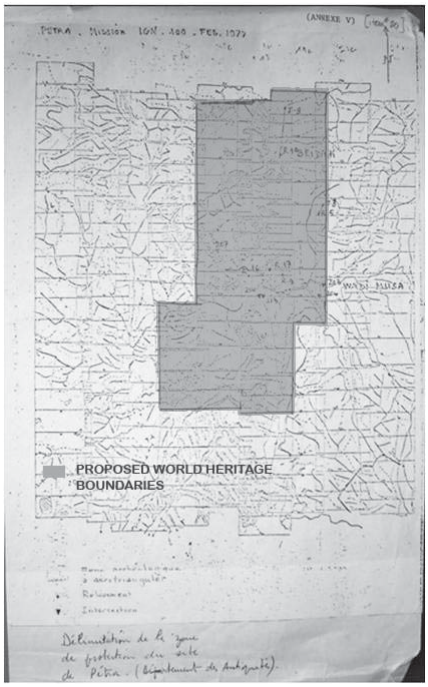

Figure 20 Boundary map submitted with nomination dossier in 1985
Source: based on UNESCO WHC (1985).

In 1993, the boundaries of the archaeological site of Petra[15] were officially delineated by the Jordanian government, with an overall park area of 264 sq km. However, no clear topographic maps exist that could confirm a full physical mapping. Probably, only few points were mapped and in the only map available boundaries were drawn only on paper (Figure 21).

The same map was later included in the UNESCO Management Plan 1994 with the title 'Petra National Park boundaries and buffer zone as demarcated by the Ministry of Agriculture', but with no date indicated (Figure 22). Also, a proposal for modification of park boundaries as established in 1993 (Figure 21) was included, as it was acknowledged for 'the limits set up by the DoA (in 1993) to have several major drawbacks' (UNESCO, 1994, p. 135).

[15] The park as established in 1993 is known under two different names: Petra National Park and Petra Archaeological Park. The latter is closer to the Jordanian reality and systems than the first, Comer argues (2012, pp. 19–21). Hence, this is how it is referred to in this publication.

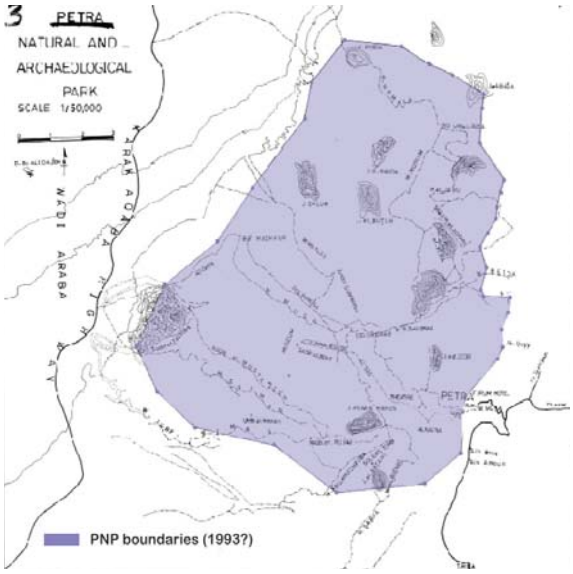

Figure 21 Petra Archaeological Park (PAP) boundaries delineated in 1993
Source: based on UNESCO WHC (2004).

In 2007, the boundaries delineated by the Jordanian government in 1993 were adopted as official World Heritage property boundaries, and the PAP emerged as an autonomous legal entity.

In the framework of the Retrospective Inventory project, aimed at identifying gaps and omissions in the nomination files of sites inscribed in the World Heritage List between 1978 and 2004[16] and collecting additional missing baseline data, a selection of maps was gathered at the World Heritage Centre. Among these were the ones on Petra submitted by the Government of Jordan from 1985 onwards (Appendix 3). However, no official clarification on Petra property boundaries as detailed in the Retrospective Inventory (WHC06-30COM-11A2, WHC07-31COM-11A2 and following committees) was ever submitted to the World Heritage Centre, nor was an accurate topographic map of the Petra property inclusive of GIS coordinates. Until the beginning of the risk mapping project, it was not clear which were the boundaries applicable at the time of inscription, and the boundaries of the park, whereas not close to any major urban areas, seemed to follow arbitrary criteria in several sections.

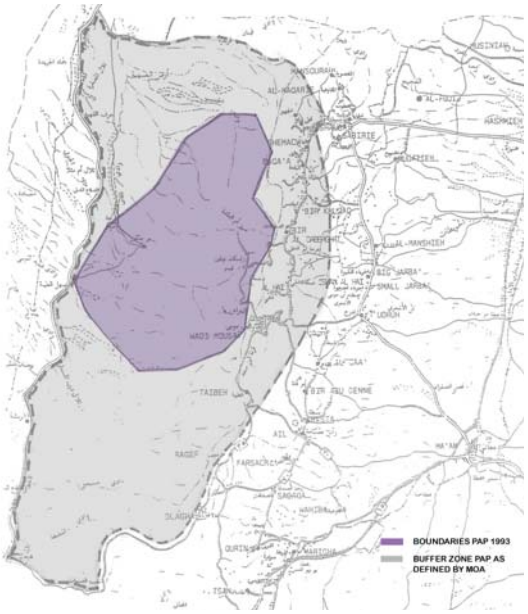

Figure 22 Petra National Park (PNP) boundaries and buffer zone as demarcated by the Ministry of Agriculture. No date. Source: based on UNESCO WHC (1994).

[16] The programme was elaborated in 2004 (approved by the 7th Extraordinary Session Decision 7EXT.COM 7.1) and implemented in Europe, North America and the Arab States from 2006; in Africa since 2009. The other regions of the world have not gone through this process yet.

More recently, the Strategic Master Plan for the Petra Region (ATC, 2011) has proposed an extension to the current 1993 boundaries following natural land characteristics, leading to the inclusion of the naturally sensitive Masoudha and Dana conservation areas (south and north of the PAP respectively),[17] and beyond the western boundary of the park toward the Wadi Araba road, but no extension has been proposed to the eastern section of the PAP.

Petra Archaeological Park buffer zone

The establishment of a buffer zone in Jordan follows the regulations established by the Jordanian Law of Antiquities (Law no. 21, 1988, amended under Law no. 23, 2004), which foresees the establishment of an area outside any archaeological site boundaries at about 5–25 m distance from the antiquities, where no construction can happen and where the land should be expropriated. This is quite distinct from the World Heritage regulations, which see a buffer zone as a protected (but not expropriated) area. Normally, this 25 m band is considered to act 'as a buffer zone', or additional layer of protection that surrounds the boundaries of the site, where no activity whatsoever can take place. Apart from this, land-use and master plans with restricted or special building regulations are the basis for regulating uses of areas that need protection or building control.[18]

Since the inscription of Petra on the World Heritage List, no clear buffer zone for the site as defined by the World Heritage Convention has been put in place. Proposals were made in the past years to provide the property with a buffer zone/zoning system, but they never reached the implementation phase. As will be explained in the following sections, at present there are some special land use/zoning and building regulations in place in areas adjacent to the PAP.

UNESCO Management Plan 1994

A comprehensive zoning system was delineated in 1994, as part of the UNESCO Management Plan. It was based on the distribution and importance of the archaeological remains, natural values, land tenure and land use. Eight zones were identified, as illustrated in Figure 23: Archaeological Sanctuary (I), Natural Reserve (II), Hisha Forest Reserve (III), Intensive Grazing Management Area (IV), Extensive Grazing Management Area (V), Sustainable Cropping Area (VI), Catchment Area Protection (VII) and Village Control Area (VIII). This zoning is included in the proposal for extension of park boundaries mentioned above (page 53) but it is concurrently stated that "all zones except zone I (Petra Sanctuary) are in fact buffering areas"(UNESCO, 1994, p.136). This definition remains arbitrary and unclear.

[17] This may indeed require political decisions, because it would change political boundaries in the region.
[18] Article 13 (b) of Cities, Villages and Buildings Planning Law no. 79 for 1966 and its amendments.

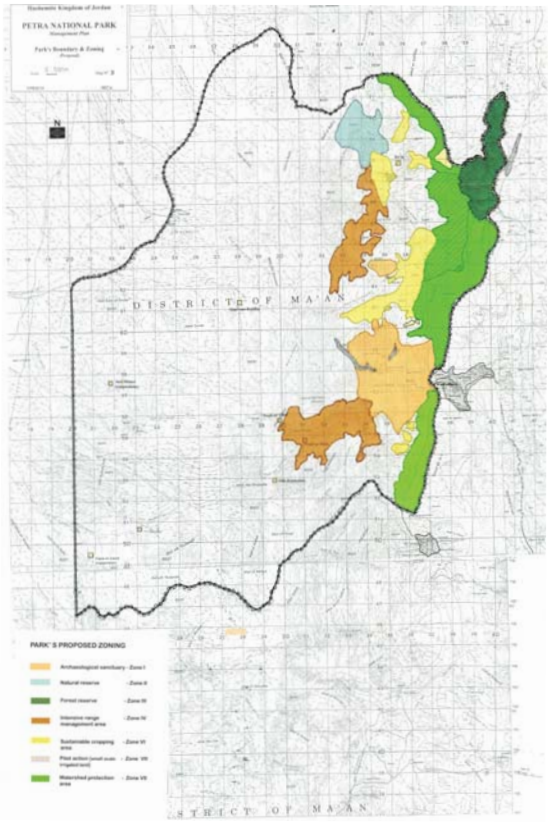

Figure 23 The zoning and buffer zone proposal in the UNESCO Management Plan 1994
Source: based on UNESCO Management Plan (1994).

Strategic Master Plan for the Petra Region

More recently, the new Strategic Master Plan for the Petra Region (ATC, 2011), released in 2011, although it primarily addresses the entire Petra region, with a focus on the main urban areas, key natural landscape, environmental and archaeological areas, it also addresses urban efficiency, economic and social development for the six communities surrounding the PAP. In order to identify areas most suitable for development, a model generated in a GIS environment was developed combining layers indicating sensitivities around the PAP (land sensitivity) and infrastructure, utilities and public facilities in the region (growth efficiency).
The proposed land sensitivity model was obtained from the superimposition of:

1) slope analysis
2) hydrology: wadis, drainage system
3) geology: fault lines
4) vegetation types and vegetation zones
5) forested areas
6) archaeological sites
7) agricultural soils
8) significant views
9) reserves and protected areas.

The proposed growth efficiency model was obtained from the superimposition of:

10) transportation infrastructure
11) water and sewer infrastructure
12) zoning/existing development
13) public services
14) proximity to schools.

In order to develop an applicable approach for establishing a guideline for land use, activity and special building regulation concurrent with the OUV of the PAP, the almost equal weight of each component resulted in a planning framework geared towards priority for development areas, when superimposed with the availability of services and amenities. The final zoning and priorities map derived from the overlay of the different GIS layers serves as a road map for the protection/conservation area and future development scenarios in the Petra region.

Sensitivities within the PAP left the issues of its boundaries and the definition of a buffer zone surrounding the protected World Heritage property still to be fully finalized. Some of the development priority areas identified in the ATC master plan are located adjacent to the park, in sensitive areas, which shall be designed for the buffer zone. Most importantly, areas close to Beidha have become potential areas for development. In addition, for the Strategic Master Plan there was no research into the mitigation of foreseeable threats, which should necessarily impact the main functions of the immediate areas surrounding the PAP, and which could be addressed in the buffer zone. Considerations of visual connectivity for instance were limited to the relation with the main monuments of the basin/core area. The higher priority for development was considered in relation to growth efficiency, and the plan did not necessarily focus on the function or setting of the immediate areas surrounding the PAP, or respond to the need for clear criteria for the buffer zone in relation to the OUV of the park. Thus, when the growth efficiency model was created through this process, the results lacked sensitivity to the park. This can especially be seen in the section between Um Sayhun and Beidha, the subject areas of this study.

Although the GIS layers developed for this plan and its final recommendations could still contribute to the zoning of the buffer, further in-depth analysis is needed, and itis recommended this to be in accordance with best practices for the protection of the OUV of the park.

3.4.3 Management and local governance in relation to boundaries and the buffer zone

Boundaries and buffer zones in Petra have always been associated with managing local communities. The Jordanian government has taken several initiatives since the inscription of Petra in 1985 to this end. The Bdul and Al Ammarin tribes were relocated outside the

archaeological site, following the recommendation by USNPS in 1968 and a UNESCO consultant in 1978 to preserve the monuments. The recommendation also stressed on the need to accommodate the different socio-economic needs of the relocated communities (Akrawi, 2012, p. 32).

As early as 1970 (Farajat, 2012, p. 151), a defence order was issued to evacuate all archaeological sites in Jordan, and local committees were formed in Ma'an district to enforce the decision in Petra. Because of budgetary constraints and lack of political will, no action was taken. In1985 and 1986, the Jordanian government relocated the Bdul and Al Ammarin in the nearby lands of Um Sayhun and Beidha by establishing two housing projects to accommodate them outside the archaeological site.

In 1993, the proposals for boundaries have been negotiated to accommodate the needs of the adjacent local communities to the east. When delinating the PAP, the Jordanian government gave rights to the different tribes of Wadi Musa, Bdul and Al Ammarin, amongst others, to use the agricultural lands located within the existing park area which they had previously exploited. The management decisions, and the processes by which they were taken, still had repercussions for the local communities.

The establishment of the PRPC in 1995 was the Jordanian reaction to protect and develop the PAP and take into consideration the surrounding local communities. Hence, at the theoretical level governance and management decisions were always taken hand in hand. However, rivalry over land and resources between tribes was extended to rivalry over their access to the benefits from tourism.

The PRA later on (it was established in 2005) emphasized the role of engaging the local communities with the benefits of tourism. Under the PRA mandate, in 2007 the governmental boundaries were recognized as coinciding with the limits of the Petra World Heritage site. In 2009 PDTRA, a decentralized autonomous body, and the latest governance structure for the region, was established and the PAP was included in a broader area, the Petra region (755 sq km), which could potentially work as a wider protection area to the park.

In 2000 the government transferred all government-owned lands for the proposed zoning of the 1994 UNESCO Management Plan to the local communities of Wadi Musa and Beidha. 'The decision to placate the traditional owners of these Mirri lands was taken at the expense of protecting the park', wrote Dr Farajat, a former PAP director (Farajat, 2011, p. 153). In reality, the lack of a unified vision and the limited understanding of the necessary regulatory framework for a buffer zone with a restricted land-use policy resulted in this piecemeal approach to solving problems, which only delayed the issue of regulating uses around PAP. Even the finalizing of the latest Strategic Master Plan (ATC, 2011) was affected. Currently, the main owners of the lands east of the park are investors from outside the region, reports Farajat

Existing land uses, building regulations and regulatory frameworks

As a first step to define a buffer zone, the regulatory frameworks already in place were analysed to see whether they ensure a sufficient level of protection to the property. The main land use plans and zoning regulation for the areas surrounding the PAP have been reviewed in detail.

There follow the major relevant findings of research into land-use and zoning regulations undertaken for the scenic road between Wadi Musa and Taibeh and the Darah area. With regard to the regulations related to the urban areas, the scope of this work could not cover the collection of data for all settlements or communities surrounding the PAP, but focused mainly on the current building regulations and land use for both Um Sayhun and the Ammarin village of Beidha, and the road between them (Figure 24).

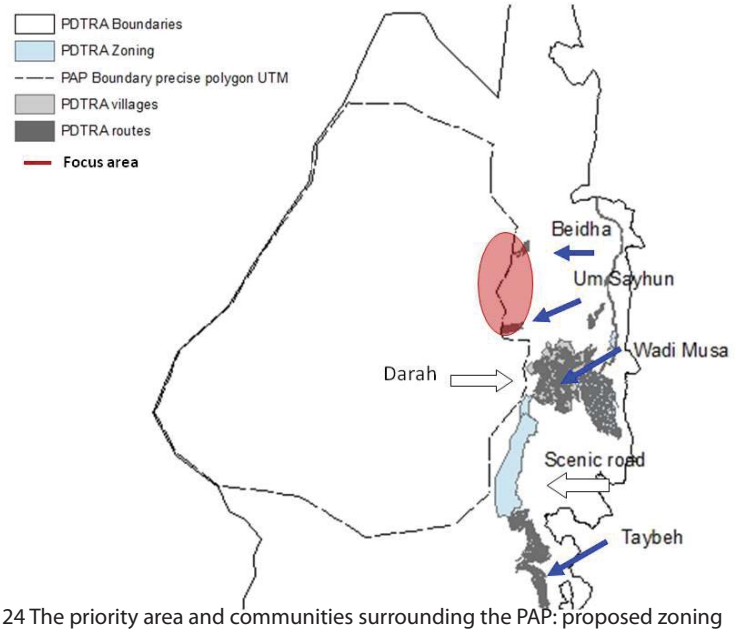

Figure 24 The priority area and communities surrounding the PAP: proposed zoning
Source: baseline data from PDTRA and Department of Land and Survey registers.

Revision of existing building regulations and land use

The main urban development regulatory instrument in Jordan is the master plan, which addresses the organization of master/land use plans, taking into consideration the protection of sites, caves, buildings, and relics of historic, archaeological or architectural value, as reported in Law no. 79, 1966 and its amendments.[19] This law also addresses the organiza

[19] Article 19(2) Cities, Villages and Buildings Planning Law no.79 for the year 1966 (published in Official Gazette no. 1952 (25/9/1966).
[20] Law no. 15, 2009, Article 8, i for the year 2009: Petra Tourism Development Zone Authority Law.

tion of master/land use plans by the Ministry of Municipal Affairs, whose role was later transferred to PDTRA based on Law no. 15, 2009,[20] which determines the specializations of the Higher Regulatory Council along with the district and local committees according to the Cities, Villages and Buildings Regulation Law in effect and the regulations issued therewith.

Land use and main building and zone regulations are approved and implemented by PDTRA for sensitive areas regulated outside the PAP to enhance the protection of visual shed areas. These regulations were based on the Petra Priority Action Plan Study undertaken by the Dar Al Handasah group and funded by the World Bank (Dar Al Handasah, 1996).[21] This study was carried out following the concerns expressed in the UNESCO Management Plan (UNESCO, 1994) about the rapid urbanization and uncontrolled development happening in the urban areas encroaching on the park to the east, and the need to establish buffer zoning in that area.

The objective of the Petra Priority Action Plan Study was to develop an outline for a development and growth scenario for the Petra region, including the preparation of urban development plans for the towns surrounding the PAP, the scenic road between Taybeh, Wadi Musa and Um Sayhun, and the identification of priority actions and preliminary designs. The area between Um Sayhun and Beidha was not developed under this study.

The area along the scenic road was zoned into three zones with different levels of protection: zone A (scenic road, northern section) as a no-building zone; zone B (scenic road, central section), with stricter measures and detailed regulations in subzones B1 and B2; and zone C, subject to less development controls. Within zone A, in an area called Darah, despite its no-construction status, the Ministry of Planning obtained approval from the World Bank, previously involved in the Dar Al Handasah study, in 1997 to allow 25% development, with the condition that the area be used for light tourism activities and recreation. In 2003 the Petra Authority through a loan issued by Jordan Social Security purchased 88% (63 dunums) of the land; the remaining area (7 dunums) still belongs to private owners who refused to sell. Most recently, a Royal initiative has been issued to increase the land usage from 25% to 75%, thus exposing the area to high developments encroaching on the PAP site.

In relation to the area under study between the villages of Um Sayhun and Beidha, and the area between them, a quick review of existing building land-use regulations and current restrictions or (khala muqaiid) (freezing building activities) has been undertaken. The main results indicated that:

- First, land-use and specific building regulations are defined for lands within towns and villages around the PAP, in addition to the Ammarin housing of the Beidha area and Um Sayhun, which also have special building regulations and zoning for land uses;
- Second, specific building regulations and limited uses are defined for lands outside municipal regulation (see Table 2). This issue is 'settled', and a registry of these

[21] The study was undertaken by Dar Al Handasah Group, financed by the World Bank and later developed and detailed by Sigma Consulting Engineers and Bittar Consulting Engineers.

lands has been finalized. Land ownership, especially for the defined study areas surrounding the PAP, has also been settled;

- Third, specific building regulations for camp sites and activities outside the PAP boundaries have been developed. Three camps have been initiated: Seven Wonders Camp, Helali Camp and Rock Camp.

Area	Front set backs (m)	Back set backs (m)	Side set backs (m)	Percent-age %	Max. number of floors	Minimum land parcellation area	Minimum front facade
Outside municipal areas, developments over 4,000 sq m	15	10	5	5, max 1000 sq m	2	4000 sq m	35m
Outside municipal areas, developments of 1,000–3,999 sq m	10	5	5	25, max. 500 sq m	2	4000 sq m	35m
Outside municipal areas, developments below 1,000 sq m	7	4	4	30, max 200 sq m	2	4000 sq m	35m

Table 2 Building regulations for lands outside the municipal and village regulation
Source: based on PDTRA documentation.

Boundaries and the buffer zone in relation to management /protection plans for the area under study

The various management and protection plans and strategies developed for Petra over the past forty years have made diverse attempts to address the issue of adequately protecting the PAP by means of boundaries and a buffer zone. An overview is given for the area under study within the risk mapping project, comprised between the villages of Um Sayhun and Beidha in relation to the existing plans:

The 1968 Master Plan for the Protection and Use of the Petra National Park (USAID, 1968, pp. 21–2): The area within the park boundaries takes into consideration historical and archaeological features, scenic views, areas that show historic conservation practices, and the presence of unobtrusive development sites for necessary public use and management facilities. The proposed north boundary extends to include the Neolithic site of Beidha and Siq al Barid.

The 1994 UNESCO Petra National Park Management Plan: This recognizes the weaknesses of the Petra National Park boundaries and proposes a revision of the park boundaries in all directions, an extension of the 1993 boundaries based mostly on topography and landscape criteria, and site spatial zoning and a buffer zone to provide a considerable level of protection to the site (UNESCO, 1994, pp. 135–44).

The 1996 ICOMOS Management Analysis and Recommendations for the Petra World Heritage Site: The scope and schedule of the study did not allow the authors to carry out a survey of the protected area. It expressed agreement with the proposals in the UNESCO Management Plan (1994) and the Master Plan of 1968 (ICOMOS, 1996, p. 12).

The 2000 USNPS Petra Archaeological Park Operating Plan: Upon authorization by law, three categories of adjustments are identified for PAP boundaries: revisions to include adjacent real properties (1) acquired by donation, (2) purchased with donated funds, and (3) transferred from any other government agency, or exchange. This plan also favours adjustments, and presents the need for boundaries to correspond to logical delineations such as topographic or other natural features or roads.

3.4.4 The Petra Archaeological Park boundaries: results of the study

The precise definition of park boundaries implies:

- Better protection and management of the park. The area would be managed in its complete extension rather than being accounted for the sole core area.
- A reduction in the risk from external agents.
- Inclusion within the park of all areas of OUV, for which better protection can be provided.
- Availability of a comprehensive base map for Petra, as a reference for all management, touristic and conservation activities undertaken on site.

For these reasons, in this study the PAP boundaries were technically mapped and analysed.

Mapping the boundaries

The technical mapping of the boundaries of the PAP that was carried as part of the risk management process for Petra was intended to establish a clear and officially acknowledged delimitation of the property, something that had not been in place since the establishment of the park.

A preparatory phase gathered relevant GIS data from the appropriate relevant (or concerned) authorities, including GIS vector layers and coordinates of the 1993 government boundaries. The boundary polygon was received from the PDTRA in the JTM (Jordan Transverse Mercator) coordinate system, and was transformed into the UTM (Universal Transverse Mercator) system using Arc Map 10 JTM to make it compatible with the field instrumentation used. The resulting digital layer file, representing the outline of the park as defined in 1993, was transferred to a hand-held GeoXH 2008 GPS device, using DGPS with SBAS (EGNOS) corrections (on WGS84 coordinates), which made it possible to control precision directly in the field with measurements accurate to less than 1 m.

A field survey was then carried out from April to September 2011, and included the following phases:

- Division of the PAP boundaries into different sections to make the fieldwork more effective and more organized.
- Identification of boundary coordinates on the ground, where possible.
- Where no boundary points could be retrieved in the field (which was true in the majority of cases), new boundary points were physically marked on the ground with an iron stake stabilized with concrete and the point number written on top of the mark.
- A new boundary polygon was drawn in AutoCAD and input into the GIS database. This polygon differed from the coordinates of the polygon provided by PDTRA in three points in the Wadi Araba area (points 21, 22 and 25 in Figure 25). Another two points (30 and 31 in Figure 25) were located in unreachable terrain, so they could not be mapped on the ground and the original coordinates provided by PDTRA were used as the reference.
- A set of three photographs was taken for each of the points, one each looking from within and from outside the boundary, and one looking at the materialized point.

All data gathered were handed over to Jordanian authorities and upon their verification and validation official PAP boundaries could eventually be identified and recognized by the World Heritage Centre as official boundaries of the World Heritage property.

The GPS measurements and photographs taken were integrated into the GIS system, and the resulting files were transmitted to the local authorities. The mapped points are currently being materialized using more solid construction materials, in compliance with the standards of the Royal Jordanian Geographic Centre and in agreement with the Jordan Department of Land and Survey

Figure 25 Map produced by F. Ishakat in the framework of the Petra risk mapping project and included in Mapping the Petra Archaeological Park (PAP) boundaries (2011), unpublished UNESCO report.

Analysing the boundaries

In order to understand whether the current boundaries satisfy the requirements for which they were established and adequately protect the PAP, a value analysis by area was carried out. Based on the boundary mapping, boundaries (and areas located in their proximity) were divided by areas and described at macro, meso and microlevel , as detailed below.

Macro: the boundaries a are one entity in relation to their surrounding landscape (esh-Shera mountains) and the six communities of Wadi Musa, Um Sayhun, Beidha, Taybeh, Rajif and Dlagha.

Meso: the boundaries are divided into nine subareas, according to terrain, environment, proximity to urban areas, use by local communities, vegetation and similar factors (Figure 26).

Micro: the surrounding of each boundary point is considered as an individual entity (Figure 25).

Because of the size and complexity of the PAP, the study started at the micro level (boundary points), but a value analysis was conducted at the meso level (boundary areas) to pinpoint areas of outstanding value. The meso level works as a connection between the micro (boundary points) and macro (PAP whole boundary extent) levels of analysis, and eases the decision-making process.

Based on this approach, the nine areas identified are 1) Wadi Musa, 2) Wadi Musa to Umm Sayhun, 3) Umm Sayhun to Beidha, 4) Beidha to Namalah, 5) Namalah to Wadi Araba, 6) Wadi Araba north, 7) Wadi Araba south, 8) Massouda road and Wadi Sabra, and 9) Scenic road (Figure 26).

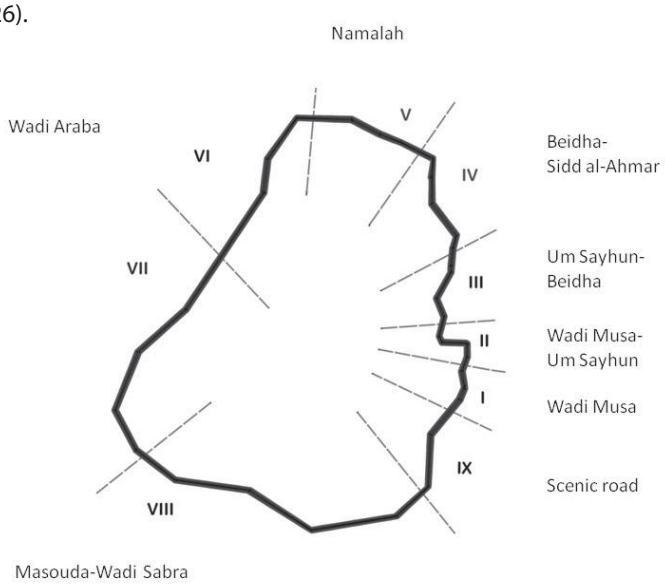

Figure 26 Representation of defined areas for boundary study (Cesaro, 2011)

Each area was located with reference to the boundary points and boundary line passing through it, and the specific characteristics that contribute to the OUV of the property were identified. The value analysis (extensively described in Cesaro, 2011) took into account cultural value (archaeology), natural value (geology/hydrology/vegetation), social value (social aspect and use), views, and threats to these values.

The evaluation was mostly based on visual inspection, further readings and acquisition of information from the persons concerned. Values and threats were respectively rated from 1 (not present) to 5 (considerably present) and weighted following two distinct categories: values and values/threats as reported in Table 3.

AREAS	ARCHAEOLOGICAL VALUE	NATURAL VALUE	SOCIAL ASPECT & USE	VIEWS	THREATS	RESULTS VALUES	VALUES/THREATS RATE
AREA I	5	4	5	4	5	18	23
AREA II	5	4	5	5	5	19	24
AREA III	5	5	5	5	5	20	25
AREA IV	5	4	5	4	4	18	22
AREA V	3	4	4	3	3	14	17
AREA VI/VII	4	5	4	5	3	18	21
AREA VIII	5	5	3	5	2	18	20
AREA IX	5	5	4	5	5	19	24

Table 3 Value assessment results for PAP boundary sectors (Cesaro, 2011)

Based on the results gathered through both the area evaluation and the boundary mapping carried out as part of the fieldwork, it was possible to examine the effective protection provided by the current PAP boundaries and to propose a best solution for PAP boundary adjustments, outlining the priority areas where necessary.

The area between Um Sayhun and Beidha on the eastern boundary

Based on the value analysis mentioned above, the area along the north-east PAP boundary, between the villages of Um Sayhun and Beidha (Figure 26, area III), was identified as the richest in terms of values, but equally an area exposed to threats from future development. Hence it was chosen as a priority area, to bring forward further recommendations and guidelines for a buffer zoning approach.

The specific criteria applied for the selection of the area were:

- sensitivity of the area in relation to future touristic development and to the new visitors' exit from the PAP
- identification as a highly suitable area for development in the Strategic Master Plan, although this appeared contrary to indicators of the richness of the archaeological remains confirmed by recent archaeological surveys (the Brown University Petra Archaeological Park mission 2010 and 2011)
- proximity to the PAP boundary, with the presence of urban and tourism development pressure, and a lack of regulatory framework for the future zoning of these adjacent lands
- rapid urbanization and community growth in Um Sayhun and Beidha
- a strong visual connection with the PAP
- the surrounding cultural landscapes and the abundance of archaeological sites spread in the area of study and adjacent to the current boundaries.

Figure 27 The area between Um Sayhun and Beidha and the urban development of Um Sayhun in relation to the PAP and Wadi Musa town

3.4.5 Buffer zoning scenarios focusing on the Um Sayhun/Beidha area

The identification of a buffer zoning approach was closely related to the steps detailed in the previous sections: the mapping of PAP boundaries, the assessment of the Strategic Master Plan for the Petra Region (ATC, 2011) and the recommendations for already existing land use.
In order to ensure the protection of the OUV of the site, different scenarios for the identification of a buffer or extension of the PAP boundaries for the priority area were identified in accordance with:

- Jordanian legislation and/or possibility of implementation at the level of land-use and building regulations
- observations for viable extension of the boundaries, in line with several recommenda tions in the UNESCO Management Plan 1994 and the Operational Management Plan 2000
- criteria for proposals and guidelines for a buffer zone as set by the UNESCO WHC Operational Guidelines (2011a), where site spatial zoning and a buffer zone are intended to guarantee a considerable level of protection to the site and its OUV
- responding to local community aspirations and needs
- research on best practices and solutions that have been found in similar case studies of World Heritage sites, in relation to zoning and buffering.

These criteria led to three different scenarios:

a) boundary extension to include Um Sayhun, Beidha and the Hisheh forest
b) buffer zone and boundary adjustments.
c) buffer-zoning system and limited boundary adjustments

These three scenarios are discussed below, and it is explained why in our opinion, option C is the best scenario. The analysis has been based on a detailed assessment in relation to the priority area, taking into account a general understanding of the boundary sensitivities.

Proposal a): boundary extension to include Um Sayhun, Beidha and the Hisheh forest

The scope of this section of the study (area of Um Sayhun/Beidha) prevented a full consideration of the topic of extension of the PAP boundaries and the tools that could be used to realize it. However it did consider several questions on this general theme.

The aim was to encourage investigation of whether better protection of areas with the same OUV as the overall property could best be achieved by including them in the PAP, particularly when these areas are adjacent to the PAP and contain relevant archaeological sites. We also felt desirable to consider whether it is necessary to include further areas in order to ensure protection of the visual shed area and provide connectivity to the site.

The different management plans that have been drawn up address the issues of adjustments to boundaries and inclusion of lands, in addition to zoning practices by extending restricted zones around the PAP. The UNESCO Petra National Park Management Plan (1994) recommended an extension on the eastern boundary (1) including the eastern paved roads (to Umm Sayhun, Beida, Hisheh in the north and Taybeh in the south), allowing PAP control over any further development which could occur along these roads; (2) including the Hisheh oak forest; and (3) incorporating state-owned lands (see page 56). The USNPS Petra Archaeological Park Operating Plan (2000) recommended three categories of adjustments to the PAP boundaries: technical revisions; minor revisions based on statutorily defined criteria; and revisions to include adjacent real property acquired by donation, purchased with donated funds, transferred from any other government agency, or acquired through exchange.[22]

Opportunities:

- Inclusion of lands adjacent to the PAP boundaries would ensure better protection of the OUV of the property as well as a more logical delineation of the boundaries.
- The WHC would consider positive the extension to include also natural features as recommended in the UNESCO Management Plan 1994, as these measures would benefit the conservation and protection of the PAP.

Challenges:

- The private and public ownership of the surrounding lands, in addition to current Jordanian legislation make the inclusion of lands within the PAP a difficult process.
- Owners and local communities with lands along the road from Um Sayhun to Beidha and beyond are anticipating benefits and investment opportunities from the new land use proposals in the Strategic Master Plan for the Petra Region (ATC, 2011). They could be expected to resist the appropriation and incorporation of their land holdings. The Bdul and Al Ammarin tribes, among other stakeholders, would generally prefer to maintain their ownership.
- The WHC only permits a 10% extension of property boundaries without the need for initiating a new procedure of nomination (UNESCO WHC, 2011a, §§ 163–5).
- Re-submit the nomination dossier as mixed site (the Hisheh is the most southern oak forest in the Middle East).
- The recommendation to not define an institutionalized buffer zone would need to be justified in depth to the WHC.

Proposal b):buffer zone andboundary adjustments

This scenario envisages the identification of an institutionalized buffer zone to enhance the protection of the park by regulating urban development and touristic use of the area surround

[22] The following two criteria should also be satisfied: 1. the added lands should be feasible to be administered considering their size, configuration, ownership, and cost, the presence of hazardous substances, the view of and impacts on local communities and surrounding jurisdictions, and other factors; 2. other alternatives for management and resource protection are not adequate. These criteria can apply also to any proposal for deletion of lands from Park boundaries (USNPS, Appendix A3–4).

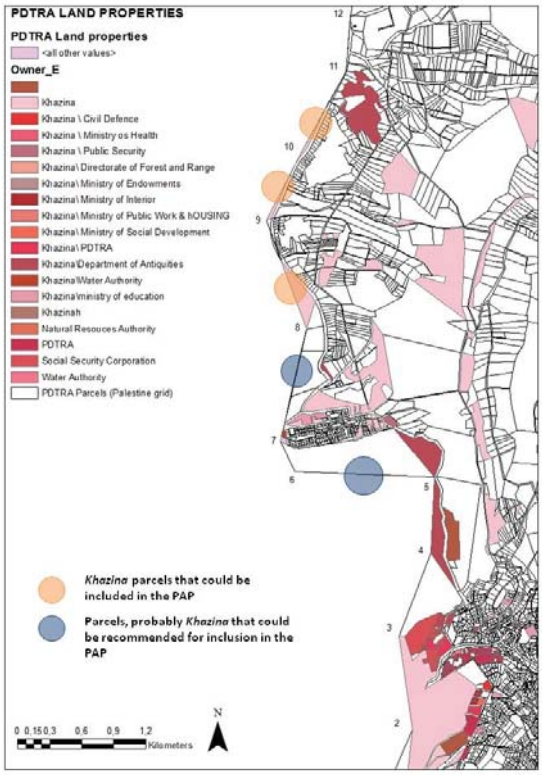

Figure 28 Plot parcellation and type of ownership in the Um Sayhun / Beidha area. Source: baseline data from from PDTRA and Department of Land and Survey registers.

ing the PAP. The boundary adjustments could be performed after checking the status of boundaries on the ground and carrying out technical mapping. It would involve minimal extensions to the PAP area where necessary but would maintain the existing land ownership.

In fact, most parcels of land located along the eastern PAP boundary are state treasury/public lands, known locally as Khazina (Figure 28). There is a considerable spread of these in the selected area. The inclusion of Khazina parcels in the PAP could contribute to a better alignment of the boundary in several sections, along the road to Beidha, and especially between points 8 and 11 as shown in Figure 28.

The section between points 5 and 8 is probably also Khazina (Figure 28). Its inclusion within the PAP could contribute to the protection of the visual context, since this area is closely related to the sanctuary area and Qasr al-Bint/Basin area.

Opportunities:

- Private and public ownership for surrounding lands would remain untouched from the present situation, and this would respect the sensitivities of the local communities.
- Inclusion of few parcels adjacent to the PAP boundaries would ensure a better protection of the OUV of the property as well as a more logical delineation of park boundaries.
- Approval would be granted by WHC as these measures would benefit the conservation and protection of the PAP and would be in compliance with the Operational Guidelines (UNESCO WHC, 2011a).
- The boundary adjustments would fall within the 10% extension that is allowed by the WHC without the need for initiating a new nomination procedure (UNESCO WHC, 2011a, §§ 163–5).

Challenges:

- The criteria for selection and extension of boundaries would need to be clarified, It would be necessary to assess previous studies and recommendations for boundary extension, zoning, protection of visual shed areas, related site management plans, and adopt related criteria for minimum extension of the boundaries. In addition, it is important to evaluate the new archaeological findings from sites that contribute to the OUV of PAP, and recommend inclusions, if necessary.
- Compliance with the Jordan Antiquities Law (expropriation up to 25m from the site boundaries) could not be applied to the surrounding lands.

Proposal c): buffer-zoning system and limited boundary adjustments

This scenario has been chosen because it is compatible with Jordanian legislation and practice on developing planning, building and land-use regulations. The PAP boundaries would be redefined, but keeping closely to the existing boundaries and only after proper assessment of the latest proposals for boundary extension (in ATC, 2011). In place of an institutionalized buffer zone as described in the Operational Guidelines (UNESCO WHC, 2011a), a buffer-zoning system would be developed using planning, land-use and building regulations. Different zones could be defined in which different development regulations applied.

Opportunities:

- Developing a land-use/buffer zoning to include Um Sayhun, Beidha and the road between them. This would provide the site with better protection and lead to approval by the WHC.
- Special zoning regulations could be developed for agricultural land use, green land use, low-density building regulation, light tourism activities and areas requiring special regulation.
- An opportunity to reassess the Strategic Master Plan recommendations for land use to take better account of sensitivities, criteria and values (see page 56 and 57).
- Inclusion of lands adjacent to the PAP boundaries would ensure better protection of the OUV of the property as well as a more logical delineation of park boundaries.
- Approval would be granted by the WHC as the measures would benefit the conservation and protection of the PAP.

Challenges:

- A situation similar to that in the Darah area could arise.[23]
- The process is likely to obtain acceptance from the local community and other stakeholders.

[23] In that case, the pressure of the local community in Wadi Musa led to a 90% appropriation of the land under a compensation act, although low-density and limited land use was initially proposed by the studies and scenic road zoning and regulation were enforced.

- The recommendation to not define an institutionalized buffer zone would need to be justified in depth to the WHC.
- The fact that the Strategic Master Plan has been approved, although it has not been implemented as a strategy or guiding policy for implementation of future decisions, is a strong limitation to this scenario.
- In spite of the challenges identified, we feel that scenario C is the most realistic. Guidelines for its implementation are suggested in the next section.

3.4.6 Proposals for buffer zoning based on scenario c

Defining minor boundary adjustments to the PAP without exceeding the 10% extension (UNESCO WHC, 2011a, paras 163–5) is considered a feasible issue; the main challenge of scenario c would be to establish and enforce an overall regulatory framework for land use, restriction of uses and building regulation in the 'buffer zone'. This is further discussed below.

Criteria and guidelines for buffer zoning

Buffer zoning is a planning tool which contributes to the preservation of the integrity and authenticity of a property by ensuring actions are taken beyond the heritage boundaries, which rely on management and legal instruments that are already in place.

The main source on the issues for defining buffer zoning regulations in areas adjacent to PAP boundaries are the UNESCO Operational Guidelines, which for the section on WH buffer zone are mostly based on the outcomes of the experts meeting on World Heritage and buffer zones held in Switzerland in 2008 (UNESCO, 2008) . Here we summarize how these could be applied in the Petra case.

Areas of influence, related attributes and the wider setting

Areas of influence, attributes and wider setting around the property need to be identified as they can be functionally important for the long-term protection of the park.

Areas of influence include wadis and water sheds, geological strata and view shed areas, which should be adequately protected and managed, after thorough studies have been conducted.

Wider setting: the cultural landscapes surrounding the park need to be revisited, to reassess their contribution to the OUV of the PAP. The agricultural land around Petra is of importance to the OUV of the PAP, and present agricultural practices, both within and outside the park need to be assessed and negotiated.[24] Overall, further research is needed to define and link the cultural landscape and the intangible heritage values with the OUV of the PAP, in light of ownership patterns and future tourism attractions that could benefit or contribute to this

[24] With the establishment of the PAP in 1993, the use of lands within the park was allocated to the traditional local tribes, while in the year 2000 the government transferred all surrounding Miri lands to the ownership of the Bedouin tribes. However, further assessment and management frameworks need to be reinforced to successfully manage the use of land for the tribes inside and adjacent to PAP.

understanding. The cultural landscapes located in the visual shed zone, around Um Sayhun and Beidha, need to undergo land use zoning to protect the OUV of the PAP. Such regulation could be based on maintaining existing land uses, such as agriculture uses and/or ecotourism opportunities linked with the intangible heritage of the Bdul and Al Ammarin tribes among others. This is regarded as the only foreseeable option concerning these sensitive visual sections and possible functions, in relation to PAP. In this respect, it is also suggested that a forum of experts revise the land sensitivity model proposed by ATC, in order to address the OUV of the park, and not focus only on areas for development.

Views

Important views to and from the property are used to determine buffer zones for cultural properties and can lead to the definition of visual corridors (UNESCO WHC, 2008). Hence, the visual connectivity and setting of surrounding landscapes need to be analysed in relation to the OUV of the PAP. To this end, a visual survey was undertaken all along PAP boundaries to document views towards the site and views from site boundaries. This type of documentation can contribute to building a better sensitivity when analysing the topography through research, computer modelling or GIS, as well as allocating priorities to visually sensitive zones of high visual connectivity towards and outside the PAP. This analysis cannot therefore be restricted to the visual shed areas in relation to the main archaeological monuments as proposed in the latest Strategic Master Plan for Petra (ATC, 2011, Map Atlas, pp. 19–20).

Opportunities

Lands that do not fall within the viewshed area, and do not contribute to the OUV of the PAP, could be regulated, where the landscape of the terrain allows, with creative solutions for light interventions to celebrate the intangible heritage of the surrounding local communities.

A link with the local communities could also be built on inside the site, where some caves are still inhabited by local people. Introducing visitors to these living realities would link visitors with the place as both a living memory and a link to a distant past.

Foreseeable threats or impacts

The main function of a buffer zone is to protect a World Heritage property from external threats that could undermine its status. This is therefore one of the most relevant criteria for defining buffer zones.

In the Petra case and more specifically in the section from Um Sayhun to Beidha, the main foreseeable threats are related to tourism development pressure, and further spread of urbanization. These threats may increase when and if the new visitorsí exit route proposed for the PAP, which runs through Wadi Turkamania and Um Sayhun, is implemented. The proposed use of ecologically friendly vehicles to take tourists from the basin area via Wadi

Turkamania and Um Sayhun to Wadi Musa with no stop in Um Sayhun would not bring sufficient management tools and alternative economic gains to the surrounding local communities (al Bdul for instance). It is also anticipated that there will be added competition between the different stakeholders for new tourist gains. The proposed exit might also contribute significantly to the attraction of new tourism projects and expansion of existing settlements. Hence there is a necessity to engage as soon as possible with a land-use and spatial plan with regulatory frameworks protecting the visual shed area and other valuable archaeological sites and cultural landscapes, contributing to the OUV of the PAP in the area and responsive to the challenge at hand.

Stakeholders and benefit to local communities

The regulation of allowable use or activity needs necessarily to provide benefits to the local communities, while still maintaining their sense of ownership. This way, effective protection, management and sustainable use within the buffer zone can create new partnerships to strengthen community-based tourism initiatives and to establish more effective protection within the PAP. This process should be in line with the current tourist camp regulations (see page 49), but with additional detailed guidelines for the location, design and implementation of sensitive camps or eco-lodges.

Final considerations on scenario c

Scenario c forms the essence of planning regulation provided by the Jordanian by-laws. It also defines uses in areas adjacent to archaeological and traditional sites of rural villages and related landscapes. This will and can differ from area to area so as to safeguard and regulate the different activities taking place in each of them and protect their varied landscapes.

In addition, the existing buffer zone, defined by Jordanian legislation as a 25m expropriated area with zero development surrounding the park along all its perimeter, is not sufficient.

In the specific case of Petra, we recommend that buffer zoning be considered as:

- a regulatory and planning tool that can prevent threats to areas along the boundary or can help manage existing threats
- a means to further protect the OUV of the property whereas property boundaries alone cannot satisfy this requirement
- a means to protect view sheds and view corridors towards and from the PAP, in which case evaluation of the areas identified should be improved to reach a higher level of detail
- a means to benefit the local communities and maintain their sense of ownership.

When defining a zoning and related regulatory frameworks, much broader research needs to be carried out, in order to regulate land uses and finalize building restrictions and regula

tions. It is expected that since the area has not been regulated before, finalizing a land-use plan will not be a difficult task.

Local tribes and communities have been waiting for a long time to be given opportunities to engage further in acceptable and diversified tourism activities. It is also anticipated that other stakeholders, from inside or outside the area, could be interested in promoting high-impact tourism attractions or projects. Any future planning needs to concentrate firmly on the long-term protection of the PAP, for the local communities and Jordanians for generations to come.

3.5 Application of the risk assessment in Petra

3.5.1 Risk assessment application phases

In April 2011 a first set of meetings took place between experts in heritage conservation from UNESCO, RLICC, and Jordanian experts. The goal was to outline risk criteria and categories and set up a plan for the future phases of the project. MEGA–J, as the Jordan national database owned and used by the DoA to protect, conserve and manage archaeological sites in Jordan, has standardized categories for threats and disturbances. During these first meetings it was agreed to adopt and use these predefined categories. In addition, the database was considered a useful tool to map site elements within Petra, their subsequent attributes, and threats and disturbances in order to assess their overall condition and threat ratings.

Another decision following from these meetings relates to the assessment of risks. In order to conduct an in-depth study of risks it is necessary to define agents of deterioration as causes of threats. As mentioned in the section on risk identification, a set of ten agents of deterioration adopted and used by Monuments Watch Flanders was linked to the MEGA–J threat categories. Related agents were introduced next to the noted threats on the MEGA–J monitoring cards. Consequently a site investigator can identify both threats and their causative agents (see Appendix 2).
It was also decided that the risk assessment should be tested at different levels defined for the scope of the methodology: the site (property), area, site element and site element feature levels. However, because of the time constraints of the project and fieldwork time, the assessment was only applied at the area and the site element level.

In May 2011, on the established basis of risk criteria, a risk-mapping workshop was undertaken by a group of multidisciplinary conservation graduate students (architects, archaeologists, civil engineers and art historians) from the University of Leuven in cooperation with PAP staff, over a period of two weeks (hereinafter referred to as “May workshop”). The May workshop took place in the four selected areas shown in Figure 30, which had been chosen as representative of the core area of the PAP with regard to the OUV of the property. During this period around 100 site elements were mapped with GPS coordinates, georeferenced.

photographs and sketches. The reports compiled at the end of the field work identified and illustrated agents, disturbances and threats. Finally, all information was uploaded into the MEGA–J system following the guidelines provided for this system.

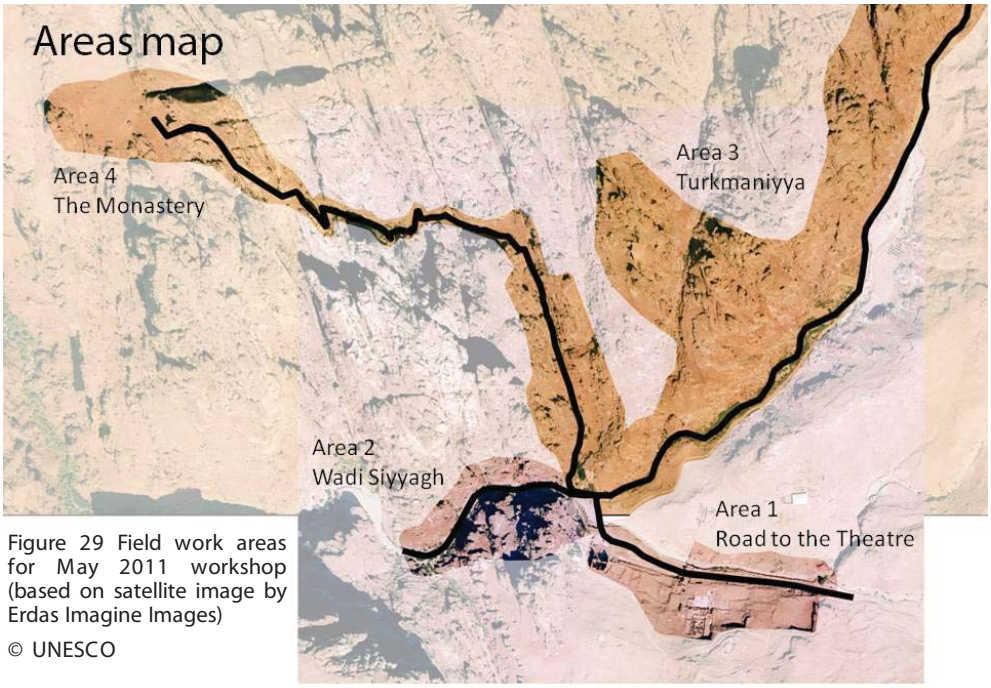

Figure 29 Field work areas for May 2011 workshop (based on satellite image by Erdas Imagine Images)

The May workshop results, in combination with desk research, allowed the authors to put together a methodology for risk assessment (as detailed in chapter 2). This was reviewed at expert meetings and round-table discussions with different stakeholders and experts. The aim was to define a systematic approach to identifying and assessing risks in Petra. The assessment of risks would also help PAP decision-makers to prioritize and implement mitigation strategies in order to manage risks at the property and preserve the integrity of the site. In October 2011, the defined risk methodology was presented ,validated and endorsed by the local authorities and experts at a validation presentation to be applied and tested at the pilot area on the property during a risk assessment fieldwork (hereinafter referred to as "fieldwork").This validation presentation was followed by two days of background lectures and training for the fieldwork team members (three master students in conservation, one architect and staff of DoA and PAP) from University of Leuven and UNESCO Amman Office experts as well as relevant experts on Petra, which covered information on monuments and architectural structures at the property, geological and hydrological issues as well as the

proposed risk methodology and its modality. Throughout the project and fieldwork, capacity-building for the staff responsible for the management of the property was considered an important part of the implementation of the risk methodology.

The fieldwork team compiled comprehensive preliminary reports on the risk assessment of the pilot area, including propositions and suggestions for mitigation and threat-reducing strategies. These reports were illustrated with georeferenced photographs, completed MEGA–J forms and maps, as well as tables of risk assessment and risk prioritization strategies. These reports need to be analysed and studied closely, and then be submitted to the local authorities to be further reviewed by different stakeholders and experts in a technical committee.

3.5.2 Fieldwork workflow

It is important to note that because of time constraints, only the risk assessment part of the methodology was applied in the pilot areas, along with identification of mitigation strategies. The analysis of the data gathered from the field and evaluation of the proposed mitigation strategies is a vital step in the process, and needs more time to be completed. For prioritization of strategies and decision-making it is necessary to work closely with site managers and local decision-makers. It is therefore recommended that a second fieldwork phase be carried out, to consolidate the methodology and to complete the process of applying it.

In brief, the fieldwork approach for the risk assessment in the pilot area of Petraís core involved the following phases:

- Preparation:
    - Research on existing documentation.
    - Research on the period, topography and typology of the assessment area.
    - Research on the significance and values of the studied area, and preparation of a significance assessment using an internationally accepted value assessment approach such as the NARA grid (University of Leuven) or MEGA–J approach (based on the Getty Conservation Institute, GCI).
    - Localization of the assessment area on MEGA–J.
    - Print the MEGA–J site element and monitoring forms.
    - Print satellite and/or aerial images covering the assessment area.
- Visual inspection:
    - Localization of the studied area.
    - Identification of the topography and period, and comparing this with existing research sources .
    - Sketch of the site elements with GPS coordinates, to produce a plan and elevations.

- Photography of the site elements, noting the context and camera position.
- Identification of threats and disturbances using MEGA–J groups and agents of deterioration (employing the MEGA–J field cards and related agents of deterioration). Detailed photography of threats and disturbances, and indication of the location of disturbances on the plans and sketches, using for instance hatching or colouring.
- Assessment of threats and risk using qualitative or quantitative approaches, and filling out a risk assessment table.
- A draft report, which includes a preliminary assessment of the severity of the threat/disturbances.
- Evaluation of risk priority and proposing mitigation strategies.
- Consensus meetings with the follow-up team.
- Inputting information into MEGA–J: mapping, forms and photographs.
- Archiving.

- Draft preliminary reports to be submitted to the follow-up team[25].
- Distribute questionnaires to the field assessment team members and experts on the follow-up team to obtain feedback and to assess the use of the risk methodology. Two types of questionnaires were distributed, for experts and fieldwork members.
- Advisory and consensus meetings with interdisciplinary experts and local authorities.
- Finalize the risk assessment report with feedback received from the follow-up team and advisory meetings.
- Submit the final report to the technical committee (for Petra this is the PAP Technical Committee) of interdisciplinary national and international experts and stakeholders, for their review and validation.

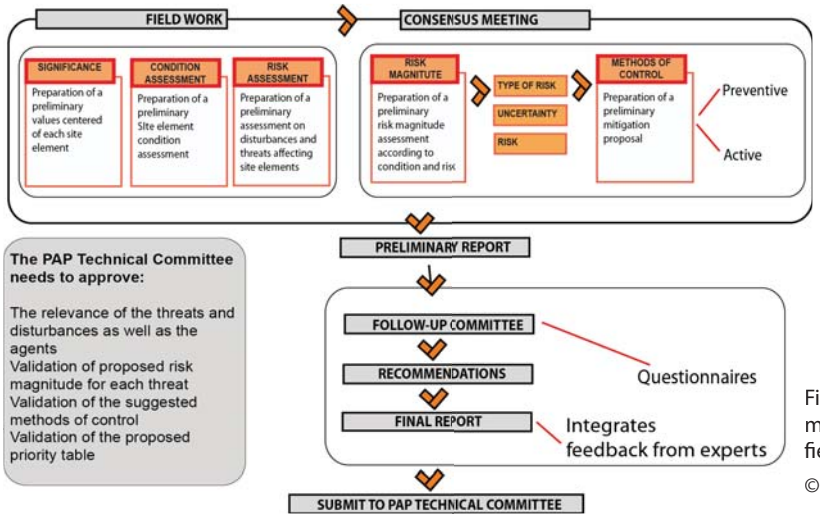

Figure 30 Risk management – fieldwork wrap-up
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[25] Please refer to page 43 for the proposed teams and committees

3.5.3 Selection of the pilot area for the fieldwork

Following the validation presentation and trainings organized with several Petra experts, the fieldwork mission was launched. The goal was to evaluate and test the effectiveness and relevance of the proposed risk methodology. It should be noted that despite the importance of continuous monitoring in such risk assessment studies, because of the project time and resources constraints the fieldwork was carried out once, in October 2011. The fieldwork was carried out in a well-considered and carefully selected pilot area within the property boundaries.

Given that the PAP covers a vast area of land, the risk assessment fieldwork was designed for two site elements and two areas, chosen from among the four areas selected for the May workshop (see Figure 29 for the May workshop areas). The selection was based on the following criteria:

- Representative of the Petra World Heritage property: areas where disturbances and threats affecting relevant OUV aspects are clearly present, for example carved and standing structures.
- Representative of the imminent risks faced by the site, so it can provide sufficient information to develop a risk management strategy for other areas within the park.
- Evidence of impact: areas where threats from anthropogenic actors are evident.
- Evidence of change: areas where possible development is foreseen within the boundaries of the property.
- Landscape continuity: the area was chosen to include the main elements of the Petra landscape such as the wadis. It is a meeting point of several wadis. In addition, the selected area represents in microcosm the site-specific topography, since there is both low and high land within it.
- An area that would allow a extensive and detailed visual inspection within the anticipated timeframe for the fieldwork.

The pilot area selected based on the above criteria contained these site elements and areas:

Site elements:

- The Temple of Winged Lions, a representative standing structure in the historical city centre of Petra. At present, the temple complex is affected by many disturbances relating to the impact of visitors, researchers and contractors.
  The overall temple complex was defined as one site element. However, to maintain clarity, it was subdivided into smaller elements within the temple complex such as the north platform, the workshop/storage rooms and the gate/stairway.

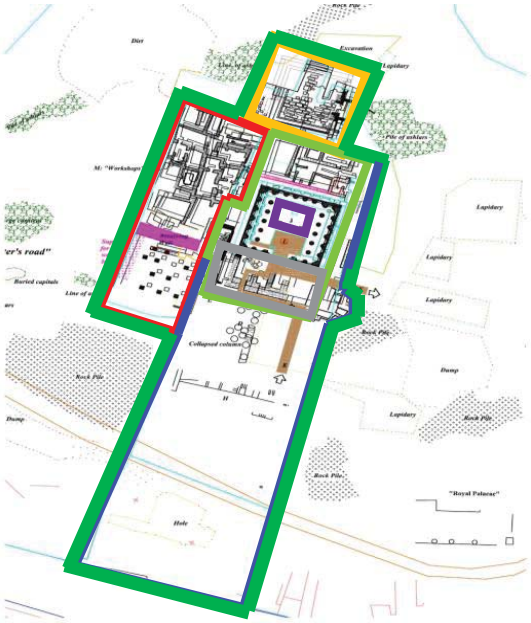


Figure 31 The boundaries of the Temple of Winged Lions
Source: map produced by Ishaqat, F. and Kanellopoulos Chr. (2009). Joint project Hashemite University and American Centre for Oriental Research.

- The Turkmaniyya tomb is representative of Petraís carved structures, and is located on the west bank of the Turjamaniyya wadi. It faces a specific threat related to the contemporary development plans: the widened road proposed to be constructed in the Abu-Ollega wadi in order to provide a supplementary exit from the PAP.
  The Turkmaniyya tomb was treated as a single site element.

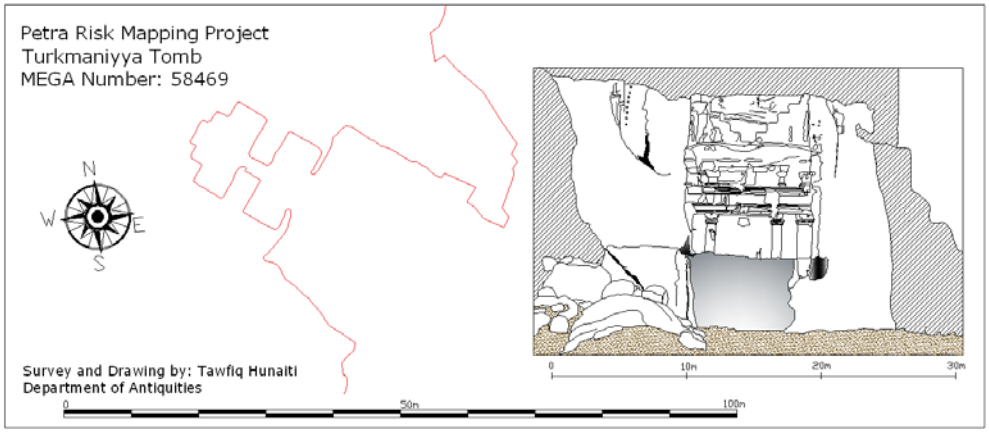
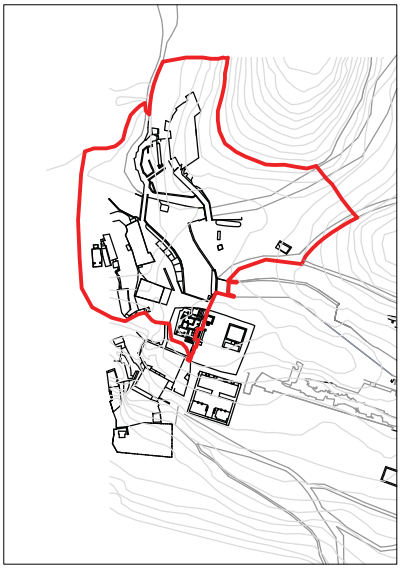


Figure 32 Plan of the Turkmaniyya tomb
Source: Tawfiq Huneiti, Department of Antiquities.

Areas:



- The Basin encloses an area which provides facilities for visitors such as restaurants and toilets, car parks for authorized vehicles and an animal shelter. This element has natural topography including wadis and cliffs, so it can contribute to the understanding of the landscape and its relationship with adjacent monuments. It also provides a good example of tourism concession activities and other human behavioral impacts on the landscape and surrounding elements. Figure 33 shows its boundaries, defined by topography and visual connectivity.

Figure 33 The boundaries of the Basin
Source: Petra Preservation Project (2005) Hashemite University and American Centre for Oriental Research.

- The path to the Monastery: alongside the trail from the Basin to the Monastery, on both sides, a variety of caves and tombs are carved in the bedrock. The path and the tombs in this area face threats from uncontrolled tourism activities and use of animals to carry tourists to the Monastry.
  A selection of site elements was made along the trail from the Museum to the Monastery. Tombs with sculpted facades, the Monastery, the Lion's Triclinium, a quarry, a dam, and a cistern were selected and studied. Further, few significant caves in the beginning of the trail were mapped. Signification of these caves was given by their present use such as storages for generators and goods.
  It should be apparent that the components of the pilot area are quite diverse, in both their intrinsic properties and their historical and contemporary significance.

It should be noted that for all four components, the risk assessment considered an area larger than the defined limits for the studied areas and elements, in which there could be an impact on the component (as there also could be, of course, from threats within the boundary). For the Basin the generators, which are located just beyond the area boundary, were regarded as a threat. The Temple of Winged Lions has several dumps of archaeological spoil in close proximity to it. These have resulted in forced patterns of movement and new paths throughout the area. For the Turkmaniyya tomb the area of possible road construction was considered.

3.5.4 Risk identification approaches in the pilot area

In order to start to identify threats and assess the site condition, after identifying the boundary of the Basin area the fieldwork team decided to divide it into component groups and subcomponents. According to the preliminary value assessment and the defined boundaries, the Basin is essentially a natural landscape within which many components have shaped its current state and uses. The components can be seen as agents acting on the Basin. The team grouped them into four main categories: mobile components, natural components, built components and historical components, and defined subcomponents for each (see Table 4).

Mobile components	Natural components	Built components	Historical components
Cars/trucks	Vegetation	Bridges	Caves
Animals	Earthquakes	Retaining walls and canals	Archaeological excavations
Pedestrians	Floods	Toilets	
		Tourist Police booth	
		Bedouin restaurant	
		Crowne Plaza restaurant	

Table 4 Overview of the component groups and their sub-components

The preliminary report shows that the same threats tend to occur for different subcomponents in the same component group. In other words, the threat is identical but the agent is different. For example, inside the Basin area, vibration has been identified as a threat, with its agents being generators, cars and animals, each producing vibration at a different force and frequency. The effect of the interactions between the sources is unknown for this preliminary risk assessment. Consequently, the team chose to assess the threats and causes separately for each component and subcomponent, since the nature of the agent affecting each subcomponent will have an impact on the mitigation priority and decisions. In the Basin area, it would be all but impossible to take a single action to mitigate the risk of vibrations from all the different sources because they are managed by different stakeholders. Arguably the best solution here is control at the policy level, overarching the mitigation of this problem throughout the property, as well as a mandate to all stakeholders.

For the Temple of Winged Lions and the Turkmaniyya tomb site elements, as well as the path to the Monastery area it was apparent that interaction between the threats would be a major issue. For example the threat of 'collapse of wall and dirt piles' at the temple complex is higher because of the existence of natural threats such as erosion, solar radiation and

running water. Another issue noted is that over time the mortar between the stones of the temple structure has crumbled away, and been replaced by dirt. This dirt, and the dirt piles in the area, provide ideal habitats for lizards and certain insects. The activity – possibly increasing over time – of these creatures could make the structures less stable. At the same time, visitors tend to walk on and climb the structures because there is no clear visitor route around the temple. This results in physical forces on the surface of the temple, which also adds to the instability. In this example the agents of deterioration can be seen as primary threats, and the collapse of a wall as a secondary threat. The team's decision in this case was to approach the related agents together, treating them as one threat in the overall risk assessment, rather than assessing them separately.
A table of results was drawn up to show the magnitude of the threats to each component in the Basin, and at a later stage it was assessed with the help of the GIS platform for the whole area in order to provide a basis for prioritizing actions. At the Temple of Winged Lions and the Turkmaniyya tomb, in contrast, the threats and risks were assessed based on the locality of threats on the structure of the monuments.

3.5.5 Documentation

Developing the heritage information strategy for systematic identification and documentation of heritage places in Jordan is an ongoing process. Presently the most comprehensive system for the inventory of archaeological sites in Jordan is MEGA–J. Initially, information on all the sites was transferred to MEGA–J from the Jordan Antiquities Database and Information System (JADIS), a program created by ACOR with a grant from USAID in the 1990s. Trained staffs from the DOA have started process of reviewing and editing data transferred from JADIS to MEGA–J, and entering new sites and site elements into the system. This work is ongoing, and since there are not assigned staff from each governorate to work on updating the database, the progress has been slow.

The need for an adequate heritage information policy, a general documentation system and adequate cartography/reference map were among the major gaps identified for Petra. This lacuna also poses indirect threats to the park, as lack of information equals lack of protection because no knowledge is shared on what has to be protected.

In order to guarantee concise and structured information during the fieldwork, it was decided to use the MEGA–J system to retrieve satellite images, UTM coordinates and site element information about the pilot area. MEGA–J is able to produce maps with hybrid geographic and database capability that are linked to the full record of site elements and their overall threat rating. In addition, a simple GIS platform was developed after the fieldwork to capture and manage the risk assessment information collected. This platform presents the results of the risk assessment using a visual multilayered representation. The GIS project can easily query for patterns, identify concentrations and visualize congestion areas, where different risk indicators overlap in a pilot area. Once the risks, their subsequent

information and their impact area are inserted in the GIS database, fast queries can be conducted according to the defined attributes.

The assessment teams were equipped with a handheld Trimble GeoXH 2008 GPS device, using DGPS with SBAS (EGNOS) corrections (on WGS84 coordinates). This permitted a recording accuracy to within 1m, as well as enhancing portability, at a lower cost than using a differential GPS device.

Identification of the pilot area and its boundaries was the first step in the work, followed by a thorough sketch of the site elements and an overall visual inspection, using the Trimble. In addition with the help of the DoA staff a survey was conducted with a Total Station (Leica TC407) to prepare cartography of the studied areas. Leica Mining Editor 1.1 and Global Mapper Software enabled the projections of the acquired data to be aligned, resulting in georeferenced AutoCAD shapefiles.

Photographic records were produced as a core action in the mapping process. The team used both digital photography to capture disturbances and threats, and spherical panoramic photography which was georeferenced using the hand-held GPS.

3.5.6 Preliminary value assessment

Although Petra has been extensively researched and is inscribed on the UNESCO World Heritage List according to criteria I, III, and IV, which clearly outline its OUV, the site has not received an exhaustive values-centred study that provides specific information about what needs to be preserved (covering the standing and carved structures, landscape and so on). Such a study, using an internationally recognized value assessment systems, could provide an indication of the required level of integrity to preserve this important heritage property.

Petra's listing is as a cultural property and not a cultural landscape, so its diverse landscape and natural features, as well as the intangible aspects of the culture of the Bedouin people who have inhabited this area for centuries (which is still part of the current cultural dynamics of this heritage place) are not included in the stated OUVs of the property. Therefore these values are not adequately protected. It is important to note that the OUV of cultural landscapes arises from the assessment of cultural and natural qualities and values together and not independently. Without such a study, the impact on the values cannot be determined precisely in isolation from the landscape context, as well as the social context of the living heritage.

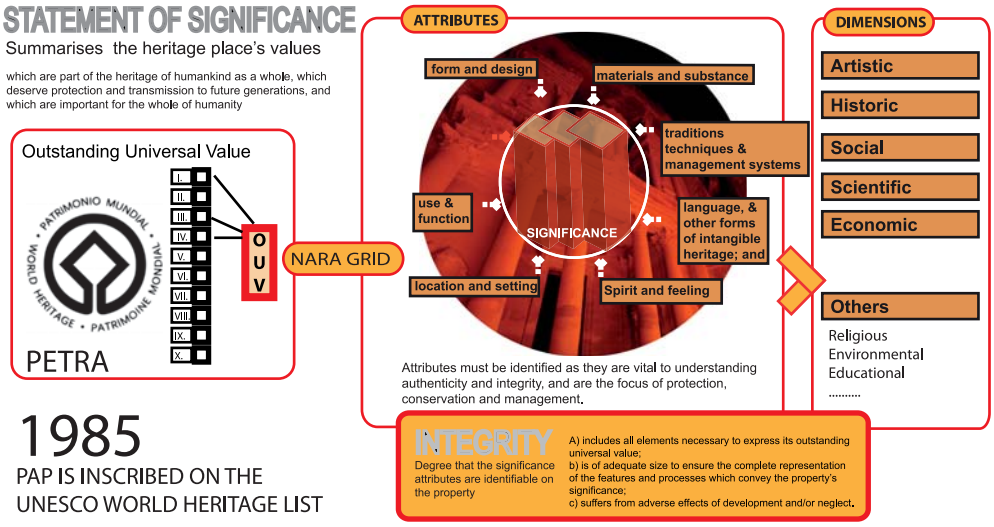


Figure 34 Petra's OUV and aspects related to the statement of significance and integrity
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It is for this reason that a thorough values assessment in Petra should consider the context of both the landscape and living heritage, in addition to its monuments. Such a values assessment should be based on collaborative work between experts with different backgrounds and in-depth knowledge of Petra and issues concerning the site, during consensus meetings. Groups of different stakeholders and members of the local communities with different interests need to be part of these meetings. Managers of heritage sites need to know the values of their site, and their main responsibility is to protect these values.

A detailed assessment study of the pilot area should determine different categories of the values and significance of the area and monuments under study. Determining the level of significance is necessary not only to be able to assess the magnitude of risk, but also for prioritizing areas – and elements – which have a high level of significance and are under threat. Since one main objective of this methodology is to provide a complete framework to further develop monitoring tools that would allow the DoA and PDTRA to determine qualitative and quantitative indicators of risks, and since a complete risk assessment study cannot be carried out without knowing the value of the studied area, it was decided that a preliminary value assessment for the pilot area should be carried out. This was done by a group of experts working together, as part of a preparatory meeting.

For the preliminary value assessment of the Basin area, the Monastery path and the Turkmaniyya tomb, it was decided to use the GCI (and MEGA–J) method that had been used

for the Jerash value identification and assessment case study. This defines the six categories of natural, scientific, historic, aesthetic, spiritual and economic values, for both short and long periods (Myers, Smith and Shaer, 2010).

During the values assessment for the Temple of Winged Lions it became clear that for each GCI category more substrata and additional information could be defined. The team moved to the Nara grid since it has more subcategories for the value assessment of built heritage. In the Nara grid each category of value (artistic, historic, social and scientific), has subcategories of form and design, use and function, material and substance, tradition and techniques, location and setting, and spirits and feeling. The method is being developed by RLICC, and is based on the Nara document on authenticity (1994).

Disturbances and threats identification

The team also used the MEGA–J threats and disturbances categories (agricultural, development, human, natural, site management, and other impacts: see Appendix 1) for identifying risks and recording conditions. Each fieldwork team had printed copies of MEGA–J field cards. After localizing site elements and recording their coordinates with a GPS device, they drew sketch of the elements on a MEGA site element card and took pictures, indicating the position of the camera on the sketch. Threats were identified based on visual inspection, and recorded on the monitoring cards. Photos of each threat and disturbance were taken and recorded with their exact location, and the location of the disturbance was also indicated on the sketch. Causes and agents of deterioration – or possible future deterioration – were identified and recorded for each threat. Off the field, all this information was entered into the MEGA–J system and archived. Appendix 4 shows an example of a completed MEGA–J monitoring card for the Monastery.

Figure 35 is a pie-chart representation of identified threats to the selected monuments of the path to the Monastery area (see Figure 29).

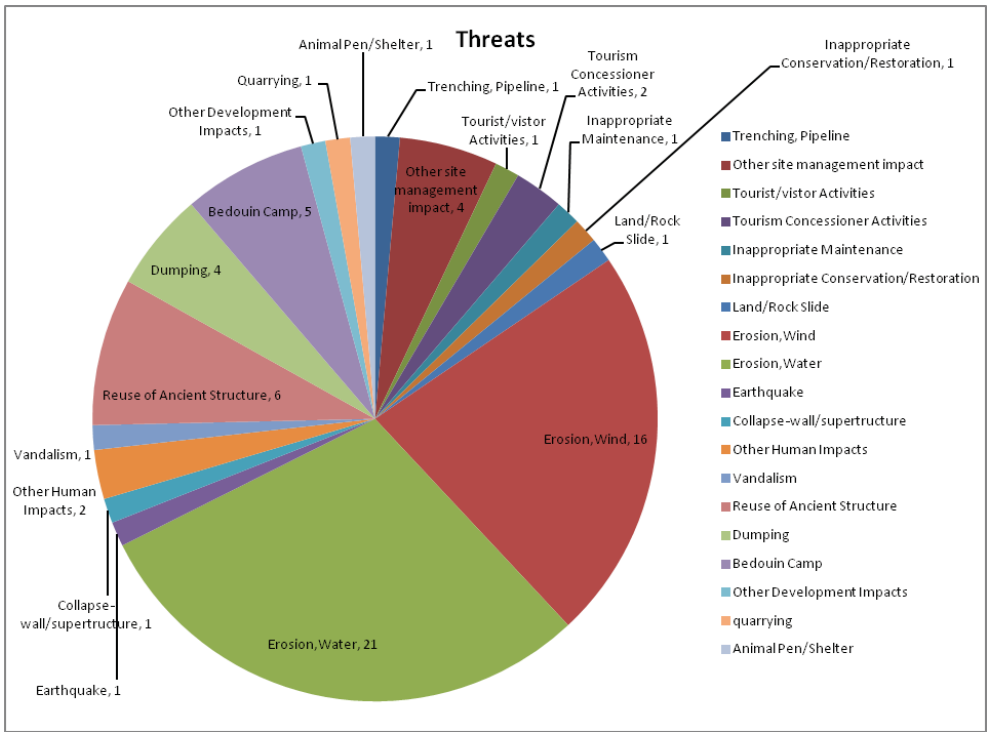

Figure 35 Pie chart of identified threats for the Monastery trail
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In this example (Figure 35) the natural impacts of water and wind erosion are the main threats, and disturbances can be found in most of the site elements. The deterioration of the decoration on the sculpted facades is caused by environmental processes. Concerning the human aspect, disturbances and threats are caused by the reuse of the caves and tombs as camps or animal shelters, the absence of indicator signs and panels, and the lack of visitor flow and visitor management strategies. Tourists are left free to vandalize monuments, dump trash and climb everywhere. They can both cause damage to the monuments and put themselves at risk.
It is important to note that for the results of the risk analysis to be considered seriously effective, there would need to be more researched and scientific data, and more time than was available to this project, because of its very nature.

Assessing risk magnitude

As noted in section 2.5.3 , two methods were used for assessing magnitude and level of risk, the Waller matrix and the ABC system. The Waller matrix is based on qualitative data and analysis, and uses words to describe severity and probability (likelihood). The ABC system is a quantitative analysis based on a scoring system (rating for A, probability of damage, B, degree of loss of significance, and C, the area affected). The quality of any quantitative analysis depends on the accuracy of the numerical values. The process of quantitatively defining the magnitude of risk is quite complex and requires a thorough understanding, clear definition of its different components and training in the calculations. However, when the process is understood, its application is less difficult The use both qualitative and quantitative approaches to assess risks in the pilot area was chosen to ensure the identification of patterns and compatibilities during the process.

Figure 36 shows the effect and probability matrix for threats to the site elements selected from the Monastery path (that is, the same example as used in Figure 35). (See pages 27and 28 for a description of the levels and types of risk.) An example of Type 3 risk is erosion caused by the combined action of wind and water: something that affects the Monastery in a mild way but over a long period of time could lead to a decrease in aesthetic value and structural strength. As noted on page 28, this kind of risk could also become more serious and have immediate consequences should there be a rare but dangerous event such as an earthquake or flash flood (Type 1 risks). The other two threats assessed in Figure 36 for the Monastery are from visitor activities and visitor concession activities, which were both assessed as Type 3 risks.

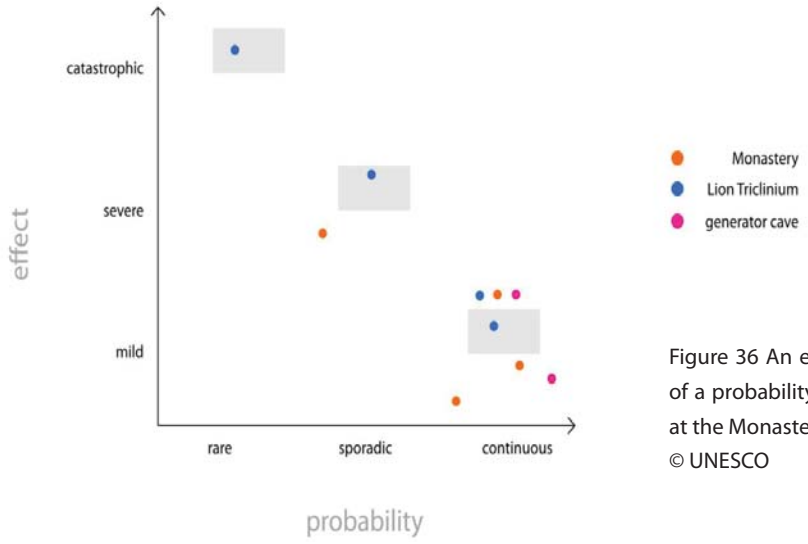

Figure 36 An example of the use of a probability and effect matrix at the Monastery path
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Table 5 is an extract from the risk magnitude table for the Temple of Winged Lions, using the ABC method. The ABC criteria defined as:

A probability or extent of damage happening
B degree of loss of value and integrity as a result of the impact
C fraction of the assessed area susceptible to the threat, and the extent of its vulnerability

An existing dirt road running through the temple precinct could cause extensive damage to buried archaeological material. As the road is used by animals and vehicles (which create physical forces on the surface of the structure), the existence of this road was recorded as one of the threats to the site element. In this example the probability of the damage from the use of road to the archaeological remains was assessed as relatively high (A). The degree of loss of significance is also high (B), but the area that could be affected is small in comparison with the whole site element (C). The A+B+C calculation assesses the magnitude of the risk as 10 = high. Another example of a threat is earthquake. Given the poor condition of the temple, including many threats to its stability, a powerful earthquake would have major destructive consequences and could be fatal for visitors. The probability is low, but the degree of loss of value and the affected area are high, leading to another overall ABC assessment of 10.5 = high. This method of scoring using the same scale for the different criteria gives site managers and decision-makers a way to compare the seriousness of different threats.

Threat	Agents of deterioration	A	B	C	∑Risk magnitude	Magnitude of risk
2205: Road/path running through precinct	Physical forces: AG04.1: On surface. Impact human activities: AG09.5: Physical developments.	4.5	4	1.5	10	High
2404: Earthquake	Physical forces: AG04.1: on body. AG04.2: dynamic. Dissociation: AG08.1: Physical dissociation. AG10: Risk for users.	1	4.5	5	10.5	High

Table 5 Risk magnitude calculation and comparison table

A note should be added on the probability factor. For continuous risks (when it is known that the risk itself is present) the probability assessed is that of damage occurring. For example, the presence of vibrations is a daily event and a threat in each pilot area, but the point at which significant damage will occur as a result is less evident. The actual impact of the physical forces in this example was not clear at the time of inspection (as was also true for some other risks), and the nature of the rapid risk assessment, and the lack of information and research available to the team, meant that it was not possible to make an accurate assessment of probability. This stresses the importance of experienced and interdisciplinary

experts forming a follow-up team and technical committee (see page 43), and verifying and reviewing the assessment and reports as part of the risk assessment process.

Based on the outcome of the qualitative and quantitative evaluations proposed in this methodology, we judged that the effectiveness of their application is closely related to both the supporting information available and the knowledge and experience of the field team. Undoubtedly, more extensive research into the cause and impact of disturbances and threats would lead to a better risk magnitude assessment than a purely visual inspection. The application of the proposed risk methodology in Petra can therefore be considered as a platform for rapid decision-making.

The success of the visual inspection can be measured over time by the periodic monitoring of those indicators that have been identified in the risk magnitudes. This in turn will help to identify the extent of their impact on the site element(s) being assessed.

It should be mention that during the fieldwork, the MEGA–J monitoring form was used to record the current condition of the site. The six categories, of good, fair, poor, very bad, and inundated and destroyed, indicate to what degree a site element or a site is physically stable or experiencing active deterioration.

3.5.7 Identification of possible mitigation strategies

The importance of adopting a risk management approach as part of the overall management of a property is that if risks are identified and monitored regularly, possible damage could be avoided or reduced by means of less costly preventive measures. During the fieldwork, it became clearer that the methods of control relating to site management should be applied in preventive and active strategies at the level of procedures and policies. It should be noted that the site management strategies of a single pilot area are – and should be – directly related to the management of the site as a whole.

We recommend that the priority for methods of control should given to selecting and implementing preventive actions, mostly at the policy and procedure level, as a significant number of risks could be overcome by preventive conservation measures involving block and avoid actions. These are the most cost-effective ways to reduce risk. Take the example of the existing dirt road running through the precinct of the Temple of Winged Lions. The best method of control would be to prevent traffic from passing through the precinct (by diverting or simply banning it). This is a simple no-cost measure. If it is not done, the impact of the vibration could lead to damage that is irreparable, or costly to put right.

Based on identified mitigation measures, an ad hoc strategy could be drafted on how the proposed mitigation measures will be implemented. The strategy should include a timeline, human resources needed and their responsibilities, and an estimated budget for each measure.

Finally, in order to enhance the method of controls, there needs to be verification. This involves a technical committee reviewing and verifying the mitigation measures and strategy plan. Currently, the PAP has an appointed Technical Committee that could fill in this role.

Risk evaluation

Risk evaluation is based on the probability of damage, the reliability of the risk assessment and the quantitative values assigned to both risk criteria and risk magnitude. The combination of the level of risk (based on the ABC impact assessment process) and degree of uncertainty will result in a priority table. This can then contribute to the decision-making process in prioritizing, selecting and implementing mitigation strategies in order to manage identified risks.

Looking at the site elements assessed during the fieldwork, the level of uncertainty mostly remained moderate and high. This can be attributed not just to unavoidable uncertainties, but to the rapid visual inspection nature of the risk assessment and the limitations of the supporting information. For example wind erosion is recognized to be an omnipresent and constant threat in Petra, but this does not imply that it is constantly affecting the pilot areas.

During the fieldwork, once the two noted aspects of magnitude and uncertainty had been determined and considered carefully, they were interrelated by means of a clear and understandable table in order to give priorities for decision-making. This table was revisited, edited and its results were studied based on the experience of the fieldwork and advisory meetings with the experts. It was decided to use the information given in Table 5, with three levels of uncertainty (high, moderate and low), and five levels of magnitude (extremely high priority, very high priority, high priority, medium high priority and low priority). However this table needs further study if it is to be used in practice at Petra.

Uncertainty	Low magnitude of risk	Medium high	High	Very high	Extremely high
High	Requires research to ascertain that assessment is correct, but low priority.	Apply low-cost mitigation; cost–benefit analysis of research to reduce uncertainty when highest risks have been dealt with.	High priority for research, cost–benefit analysis of the mitigation strategy is recommended.	High priority for research; short-term mitigation strategy is recommended; cost–benefit analysis of the mitigation strategy is recommended.	Highest priority for research; short-term mitigation strategy will buy time until uncertainty is lower; cost–benefit analysis of the mitigation strategy is recommended
Moderate	Low magnitude of risk with moderate uncertainty is acceptable. Action is not necessary.	No direct action required but try to reduce the uncertainty. Cost–benefit analysis of mitigation versus research.	Risk mitigation prioritized by cost–benefit analysis of research and further risk analysis.	Risk mitigation prioritized by cost–benefit analysis of mitigation strategies, research and further risk analysis.	Second priority risk mitigation. Cost–benefit analysis of mitigation strategies and research is recommended.
Low	Low magnitude of risk with low uncertainty is acceptable. No action.	Mitigate risk when highest risks have been dealt with, based on cost–benefit analysis of mitigation strategies.	Prioritize by cost–benefit analysis of mitigation strategies.	High priority for risk mitigation.	Highest priority for risk mitigation.
	Magnitude of risk				

Table 6 Matrix of priority based on level of risk magnitude and level of uncertainty
Source: based on ICCROM–CCI–ICN (2007)

This table is presented as a guideline to prioritize decision-making strategies, when conducting the risk methodology. This interrelation of the components of risk magnitude and uncertainty could also give similar priorities for different risks for the decision-makers.

Level of uncertainty

The information available during the fieldwork was limited. This prevented the reliable forecasting of risks and their impact on the condition of the areas and site elements. For this reason a number of assumptions were made. To minimize the effect of the gaps in information and limits to knowledge, the approach applied in the fieldwork acknowledged that the level of uncertainty is high. This leads to the suggestion that further research is required in order to increase the scientific credibility of the information obtained.

3.5.8 A heritage information platform and a geographic information system for risk assessment

The assessment team prepared a simple heritage information platform for the risk assessment pilot area, using an open source GIS application, which could assist in evaluating the feasibility of designing a GIS system for risk assessment for the entire PAP.

The platform was appropriate to the results of the required multilayered assessment approach for the Basin as well as the Temple of Winged Lions. A GIS provided the possibility of carrying out simple queries for patterns, identifying concentrations and visualizing congestion areas, and identifying where different risk indicators overlap in a part of the pilot area.

The preliminary Risk Assessment GIS project was created using Quantum GIS (QGIS) version 1.7.2. This software offers a wide range of applications for basic querying, similar to the ones provided by the commercial and licensed ArcMap ESRI product. The shapefiles created in QGis can easily be used in licensed software.

For the cartography of the pilot area, a georeferenced computer aided-design (CAD) layer with an outline of the archaeological features and topography was used as the base for the GIS project. On top of the cartographic layer, each of the site element's risks was digitized using a blend tool, which linked the attribute tables with disturbance and threat assessment to the areas affected.

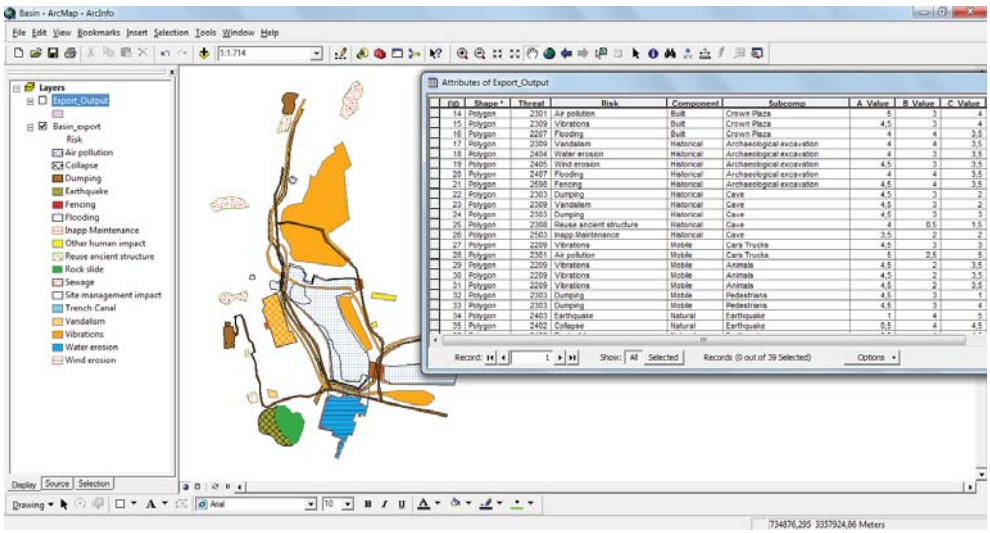

Figure 37 Attributes table and disturbances/threats layers for the Basin area
© UNESCO

Additional symbology was used to categorize and thereafter to classify the column of threats and risks.

This helped to obtain a suitable and clear presentation of the pilot area's risks. This preliminary GIS was designed to both record different layers of information gathered during the fieldwork, and study, analyse and visualize these data and conduct different queries. Now that the data is stored, further time is needed to analyse all the data gathered during the project and obtain relevant information from the system that can be used for making decisions on the mitigation strategies to be implemented in the park, as well as the management process.

3.5.9 Lessons learned from the pilot area assessment

Given that the implementation of the methodology is at its initial stage, it is early to assess the results. For better results, the entire methodology needs to be applied at the pilot area. However, the authors offer the following conclusions from involvement in the application of the risk management methodology at the pilot area in Petra.

The assessment of the selected pilot area greatly contributed to the improvement of the risk methodology presented in this publication. A number of issues required fine-tuning and adaptation from the original approach developed. As has been noted, only the risk assessment part of the methodology was applied, together with suggestions for mitigation strategies. The complete risk management cycle could not be applied within the time frame. Decision-making and setting priorities need to be done in very close collaboration with stakeholders and the site manager, and the social, political, institutional and financial context needs to be understood and assessed in order to conduct a cost–benefit analysis and define risk mitigation strategies.

As has been noted, different approaches were used to assess the Basin and the two structure-based elements of the pilot area. The identification of disturbances and threats was conducted at the Basin using a layers and components approach, while the other assessments were based on the geographical location of threats and disturbances on the structure.

The processing of such a differentiated approach was facilitated by a GIS. However, for further application more substantial effort should be applied to the design of a larger-scale system that is capable of assisting in querying for patterns and concentration or congestion areas for the risks in the park. Once the risks, their attributes and their impact area are inserted in the GIS database, fast searches can be done according to the defined attributes. The project time constraints prevented this from being done to a level that would yield relevant information. For further development, the integration of periodic information into the designed GIS would make it possible to integrate and deduce more detailed information for monitoring the impact and rate of disturbances. This process would also make it possible to improve the assessment of risks and probability of events.

The delineation and further application of a risk management methodology combined with a documentation strategy enabled us to collect a considerable amount of well-organized information. This same process could be developed as a ready-to-use tool for site managers and applied to other areas of the property and other properties in general.

The accuracy of the results needs to be monitored and evaluated regularly. In order to make an accurate assessment, the fieldwork team needs to be experienced, interdisciplinary, and trained in the risk management methodology. It is also important to have an office-based follow-up team to review and verify the work and reports of fieldwork team.

The choice between qualitative and quantitative assessment needs to be taken in light of the level of expertise involved in the application of the assessment, as well as the amount of documentation and research available.

Monitoring and evaluation is essential for the implementation of the risk management methodology. Consensus meetings shall take place during the fieldwork, with the follow-up team consisting of more experienced and interdisciplinary experts to provide ongoing advice in the development of the assessment. Especially if there is a shortage of technical and experienced experts involved in the fieldwork, consensus meetings with a follow-up team and advisory meetings with interdisciplinary experts become crucial.

A technical committee (in the case of Petra, the PAP Technical Committee) is recommended to review and validate the field assessment reports to increase the reliability of results. This committee should evaluate:

- the relevance of the threats and disturbances as well as the agents
- validation of the proposed risk magnitude for each threat
- validation of the suggested methods of control
- validation of the proposed priority table.

The role of such a committee is another essential requirement for success in implementation of the risk management methodology.

The questionnaires distributed to the fieldwork team and experts on the follow-up committee proved a useful way to get feedback on the methodology. The responses provided useful recommendations such as a short duration of fieldwork to monitor changes through time and develop long-lasting monitoring strategies; the need to cover larger areas to allow a better understanding of the disturbances and threats at the PAP; the need for more research and collection of existing data prior to fieldwork; and a need for more extensive training sessions.

However to increase the level of feedback and avoid any misinterpretations, it would have been preferable to obtain feedback during a workshop session. Further development of the methodology should take into account a concise visual glossary for the disturbances and

threats combined with the agents of deterioration, specifically designed for the existing disturbances at Petra. (This could be based on the existing glossary for the threats and disturbances for MEGA–J and researches such as the Petra Stone Preservation Project.) This glossary could be applied not only in risk management, but also in other conservation projects in Petra.

The importance of cooperation with local stakeholders in implementing the phases of the project and in taking relevant decisions has to be identified as an essential condition for the project's success. The risk mapping project and the application of the risk management methodology at the PAP showed how close collaboration between stakeholders, experts and the local community can lead to positive results and a more accurate strategy to document and manage a World Heritage property. All actors involved in the management of a World Heritage property are required to identify the changes and understand the site in its various layers of history, including the past, present and future. Eventually, this approach will lead to an appropriate selection of management and preservation strategies showing the evolution of the site throughout the time, and allow for further growth.

The capacity-building inherent in the risk management methodology and its use is also a significant condition for the success of the project. The proposed methodology is not easy to apply, and needs to be accompanied by structured and long-term training for the stakeholders involved. Training of the staff and site managers at Petra in the application of the methodology was an integrated part of this project.

4. Conclusion

The proposed methodology presented in this publication is aimed at providing guidelines for mitigating and monitoring of risks at archaeological sites, which can contribute to the design and implementation of appropriate management systems.

Each heritage site has its own challenges and added factors which could prove to be risks to the integrity of the site. Some of these challenges might not be part of the normal process of risk assessment, but they should be identified and looked into as an integral part of the activity, in order to reduce risk at sites. Identification and mapping of boundaries and buffer zones, a protection area and land use zone are examples that arose in our case study. When identified, these issues could become important tools for risk management.

Risk management methods have been studied and used in other disciplines for many years, mainly as reactive measure to disasters. Based on these studies, risk management approaches for museums have been developed, based on assessing and reducing the risk to collections and artifacts as preventive measure. The present proposal for a risk management methodology in Petra is based on this approach for museums, but has been enhanced and adapted for Petra and other heritage sites. The risk assessment part of the methodology was applied and tested in the pilot area based on visual inspection. Mitigation strategies were suggested for each identified risk. As this is a developing field, this methodology has provided a preliminary understanding of its impact in identifying disturbances and threats. We feel it offers an appropriate platform for evaluating risks on archaeological sites. However it requires further development. This should include testing and monitoring change at different times of the year, testing it in a larger and more comprehensive area, as well as testing it as a whole, in order to identify its practical strengths and limitations. This effort would benefit not only the site managers at the PAP but also other national and international stakeholders concerned with the management of cultural and cultural landscape sites.

The following remarks are based on outcomes from the fieldwork carried out to validate the developed methodology applied to Petra. The recommendations provided here will assist in designing a follow-up project:

4.1 Desired competences

- The competences of the risk assessment team need to be reviewed, and more cross-disciplines should be encouraged, for example to cover the fields of cultural landscape and conservation of nature.
- Training of site managers and the team implementing this methodology needs to be an integral part of the approach. Before implementing the risk management process, training should be planned and organized for different target groups

4.2 Recommended assessment timeline

- It is recommended that the methodology be evaluated through its application at different stages of the year and over a larger pilot area in order to get a better understanding of the impact of agents of deterioration. The prioritization approach based on quantitative or qualitative evaluation should also be reviewed.
- It is also recommended that the timeframe to evaluate the effectiveness of the methodology be conducted over a longer period and cover larger and more representative typologies, which for the PAP should include archaeological, landscape and other important features.

4.3 Monitoring and evaluation

- It is strongly advised to establish a board of PAP experts to evaluate the project results, specifically on the risk assessment methodology.
- This methodology was intended to give the DoA and PDTRA a base and guideline to carry out condition and risk assessments and to conduct continuous monitoring of the property and its elements. If a methodology were in place and institutionalized, a significant number of threats and disturbances could be dealt with and their effects could be reduced, by implementing preventive conservation strategies instead of active conservation work.

4.4 Information system platform

- It is encouraged to use hybrid and/or geographic information systems. Redesigning an information strategy for the PAP including a correct and comprehensive site atlas with adequate cartography is also a priority. This site atlas will be the base of the information system and will serve not only the risk methodology, but also to monitor research permits and other management issues of the site. An information system makes it possible to prepare complex queries on the different actions happening on the site and evaluate their impacts.

4.5 Assessing risk by detecting the rate of deterioration and its relation with the stakeholders and nature of Petra

- Risk evaluation is based on the uncertainty of a threat occurring and the accuracy of the risk assessment. This would help to prioritize the decision-making strategies.
- It is also necessary to take into account the magnitude of risks. The interrelation of the two components of risk magnitude and uncertainty will give priorities and assist in decision-making.

- This methodology puts the main emphasis on assessing the physical condition of the heritage, however, people and landscape are two important components in risk management in Petra which should be further incorporated into the risk management application by identifying appropriate expertise. In order to assess the overall condition and threat ratings, MEGA–J was used in this project as a first tool to record site elements and map threats and disturbances related to each site element. However, since MEGA–J has been designed for the DoA, whose is to protect, conserve and manage archaeological sites in Jordan, the system does not include threats to nature and visitors. For a site like Petra, the identified risks should also acknowledge threats to users and to landscape. It is recommended that for Petra a new GIS platform be developed which once in place, could record all the existing data and documentation. This would make it possible to look at the time span of the events and to identify threats in order to stop them before they become actual disturbances.

Appendix 1 MEGA-J site and code cards

MEGA Middle Eastern Geodatabase for Antiquities—Jordan Version 5.0 10/09 قاعدة البيانات الجغرافية للآثار في الشرق الأوسط – الاردن

#1 NEW SITE FIELD CARD **# ١ بطاقة ميدان موقع جديد**

Site Identification			**تحديد هوية الموقع**
Investigator(s) الباحث		Investigator(s)' Institution	المؤسسة التابع لها الباحث
Investigation Date التاريخ للبحث	**Site** Primary Name		الأسم الأساسي **للموقع**
Other **Site** Name(s)			الأسماء الأخرى **للموقع**
Site Governorate, District/Province, Municipality محافظة, لواء/قضاء , بلدية		DoA Office Responsible for Site مكتب دائرة الآثار المسؤول عن الموقع	
Describe Significance of Site			**وصف أهمية الموقع**
Scientific Value			القيمة العلمية
Historical Value			القيمة التاريخية
Aesthetic Value			القيمة الجمالية
Social Value			القيمة الاجتماعية
Spiritual Value			القيمة الروحانية
Comments (e.g. directions to Site or notes on accuracy of Site boundary):			

#1 NEW SITE, page 2 Version 5.0 10/09 **# ١ موقع جديد ,**صفحة ٢

Site Identification **تحديد هوية الموقع**

Investigator(s) **and** Institutional Affiliation الباحث /المؤسسة التابع لها الباحث	Investigation Date التاريخ للبحث

Site Primary Name الأسم الأساسي **للموقع**	Other **Site** Name(s) الأسماء الأخرى **للموقع**

Sketch of Site مخطط الموقع

Approximate Sketch Scale: مقياس تقريبي للمخطط:

Site Coordinates (minimum of 3 coordinates) **احداثيات الموقع** الحد الأدنى ثلاثة احداثيات

Lat/Long (GPS settings: WGS 84, Decimal Degrees) **خط العرض / خط الطول** (إعدادات: WGS 84, درجة عشرية)

Coordinate# #الإحداثيات	Longitude خط الطول Example: 36.xxxxx E مثال:	Latitude خط العرض Example: 31.xxxxx N مثال :

Additional coordinates on attached sheet ☐ أية احداثيات أخرى تدرج على صفحة لاحقة

MEGA Middle Eastern Geodatabase for Antiquities—Jordan Version 5.0 10/09 قاعدة البيانات الجغرافية للآثار في الشرق الأوسط - الاردن

#2a NEW SITE ELEMENT FIELD CARD (with **Boundary**) #٢ أ بطاقة ميدان **عنصر جديد للموقع (مع الحدود)**

Site Identification		**تحديد هوية الموقع**
Investigator(s) الباحث	Investigator(s)' Institution المؤسسة التابع لها الباحث	
Investigation Date التاريخ للبحث	**SITE** Primary Name الأسم الأساسي **للموقع**	MEGA Site Number (if not new site) رقم الموقع ميجا (ان لم يكن موقعاً جديداً)

SITE ELEMENT				**عنصر الموقع**
Element Code الرمز	**ELEMENT** Primary Name الأسم الأساسي **للعنصر**	Other **Element** Name(s) الأسماء الأخرى **للعنصر**	Period Code(s) رمز(رموز) الفترة	Topography Code الرمز الطبوغرافي

Sketch of SITE ELEMENT **المخطط عنصر الموقع**

Approximate Sketch Scale: مقياس تقريبي للمخطط:	Elevation (m) الارتفاع عن سطح البحر
Site Element Coordinates minimum of 3 coordinates) **احداثيات الموقع** الحد الأدنى ثلاث احداثيات	

Coordinate# #الإحداثيات	Longitude Example: 36.xxxxx E خط الطول مثال:	Latitude Example: 31.xxxxx N خط العرض مثال :

Comments: تعليقات :

Additional coordinates on attached sheet ☐ اية احداثيات أخرى تدرج على صفحة لاحقة

MEGA Middle Eastern Geodatabase for Antiquities—Jordan Version 5.0 10/09 قاعدة البيانات الجغرافية للآثار في الشرق الأوسط – الاردن

#2b NEW SITE ELEMENTS FIELD CARD (POINTS only) #٢ ب بطاقة ميدان عناصر جديدة للموقع (تمثيل نقطي فقط)

Site Identification		تحديد هوية الموقع
Investigator(s) الباحث	Investigator(s)' Institution المؤسسة التابع لها الباحث	
Investigation Date التاريخ للبحث	**SITE** Primary Name الاسم الأساسي **للموقع**	MEGA Site Number (if not new site) رقم الموقع ميجا (إن لم يكن موقعاً جديداً)

Site ELEMENT (1)				عنصر الموقع ١
Element Code الرمز	**ELEMENT** Primary Name الاسم الأساسي **للعنصر**	Other **Element** Name(s) الأسماء الأخرى **للعنصر**	Period Code(s) رمز(رموز) الفترة	Topography Code الرمز الطبوغرافي
Site Element Coordinates: **Lat/Long** (GPS settings: WGS 84, Decimal Degrees)				**احداثيات عنصر الموقع خط العرض/ خط الطول** (إعدادات: WGS 84 , درجة عشرية)
Longitude خط الطول		Latitude خط العرض		Elevation (m) الارتفاع عن سطح البحر

Site ELEMENT (2)				عنصر الموقع ٢
Element Code الرمز	**ELEMENT** Primary Name الاسم الأساسي **للعنصر**	Other **Element** Name(s) الأسماء الأخرى **للعنصر**	Period Code(s) رمز(رموز) الفترة	Topography Code الرمز الطبوغرافي
Site Element Coordinates: **Lat/Long** (GPS settings: WGS 84, Decimal Degrees)				**احداثيات عنصر الموقع خط العرض/ خط الطول** (إعدادات: WGS 84 , درجة عشرية)
Longitude خط الطول		Latitude خط العرض		Elevation (m) الارتفاع عن سطح البحر

Site ELEMENT (3)				عنصر الموقع ٣
Element Code الرمز	**ELEMENT** Primary Name الاسم الأساسي **للعنصر**	Other **Element** Name(s) الأسماء الأخرى **للعنصر**	Period Code(s) رمز(رموز) الفترة	Topography Code الرمز الطبوغرافي
Site Element Coordinates: **Lat/Long** (GPS settings: WGS 84, Decimal Degrees)				**احداثيات عنصر الموقع خط العرض/ خط الطول** (إعدادات: WGS 84 , درجة عشرية)
Longitude خط الطول		Latitude خط العرض		Elevation (m) الارتفاع عن سطح البحر

Site ELEMENT (4)				عنصر الموقع ٤
Element Code الرمز	**ELEMENT** Primary Name الاسم الأساسي **للعنصر**	Other **Element** Name(s) الأسماء الأخرى **للعنصر**	Period Code(s) رمز(رموز) الفترة	Topography Code الرمز الطبوغرافي
Site Element Coordinates: **Lat/Long** (GPS settings: WGS 84, Decimal Degrees)				**احداثيات عنصر الموقع خط العرض/ خط الطول** (إعدادات: WGS 84 , درجة عشرية)
Longitude خط الطول		Latitude خط العرض		Elevation (m) الارتفاع عن سطح البحر

Comments (identify which element[s]): تعليقات :(تحديد أي العنصر [العناصر])

Additional Site Elements on attached sheet ☐ أية احداثيات أخرى تدرج على صفحة لاحقة

MEGA Middle Eastern Geodatabase for Antiquities—Jordan Version 5.0 10/09 قاعدة البيانات الجغرافية للآثار في الشرق الأوسط- الأردن

#3 MONITORING FIELD CARD

#٣ بطاقة ميدان المراقبة

Site/Site Element Identification			**تحديد هوية الموقع أو عنصر الموقع**
ENTIRE SITE or **ONE SITE ELEMENT?** ☐ **SITE** الموقع ☐ **SITE ELEMENT** عنصر الموقع			**مراقبة كل الموقع أو عنصر الموقع**
Investigator(s) الباحث	Investigator(s)' Institution المؤسسة التابع لها الباحث	MEGA Number رقم ميجا	
Date of Monitoring Visit تاريخ زيارة المراقبة	**Site** Primary Name		الاسم الأساسي **للموقع**
If Element: إذا كان عنصر: **Element** Code رمز العنصر	**If** Element: إذا كان عنصر: **Element** Primary Name		الاسم الأساسي **للعنصر**
Site Governorate, District/Province, Municipality			محافظة, لواء/قضاء , بلدية

Ownership choose as many as apply — اختر كل ما ينطبق على **الملكية**

☐ DoA دائرة الآثار العام ☐ DoA Acquisition in Progress دائرة الآثار - تحت الإستملاك ☐ Government (other) حكومة (أخرى) ☐ Private ملك خاص ☐ Unknown غير معروف

Ownership Description: صفة الملكية :

Important DISTURBANCES (new and ongoing) — **أهم الاختلالات (الجديدة والجارية)**

Code رمز	Disturbance Description وصف الاختلال
Code رمز	Disturbance Description وصف الاختلال
Code رمز	Disturbance Description وصف الاختلال

Overall Condition Rating choose one — **تقييم الحالة العامة** اختيار واحد

☐ Good جيد ☐ Fair وسط ☐ Poor ضعيف ☐ Very Bad سيئة جدا ☐ Inundated مغمور بالماء ☐ Destroyed مدمر

Overall Condition Description: وصف الحالة العامة:

Important THREATS — **أهم التهديدات**

Code رمز	Threat Description وصف التهديد
Code رمز	Threat Description وصف التهديد
Code رمز	Threat Description وصف التهديد

Overall Threat Rating choose one — **التقييم العام للتهديد** اختيار واحد

Low ☐ منخفضة Medium ☐ متوسطة High ☐ عالية Urgent ☐ عاجل Unknown ☐ غير معروف

Overall Threat Description: الوصف العام للتهديد :

Possible VIOLATIONS of ANTIQUITIES LAW — **الانتهاكات المحتملة لقانون الآثار**

Code رمز	Violation Description وصف الانتهاك
Code رمز	Violation Description وصف الانتهاك

#3 MONITORING, page 3	Version 5.0 10/09	**#٣ المراقبة,** صفحة ٣
Site/Site Element Identification		**تحديد هوية الموقع أو عنصر الموقع**
MONITORING ENTIRE SITE or ONE SITE ELEMENT? ☐ **SITE** الموقع ☐ **SITE ELEMENT** عنصر الموقع		**مراقبة كل الموقع أو عنصر الموقع**
Investigator(s) الباحث	Investigator(s)' Institution المؤسسة التابع لها الباحث	MEGA Number رقم ميجا
Date of Monitoring Visit تاريخ زيارة المراقبة	**Site** Primary Name	اسم الموقع الأساسي
If Element: إذا كان عنصر: **Element** Code رمز العنصر	**If** Element: **Element** Primary Name	إذا كان عنصر: اسم العنصر الأساسي
Site Photographs		**صور الموقع**
File Name:		اسم الملف:
Caption:		وصف الصورة :
File Name:		اسم الملف:
Caption:		وصف الصورة :
File Name:		اسم الملف:
Caption:		وصف الصورة :
File Name:		اسم الملف:
Caption:		وصف الصورة :
File Name:		اسم الملف:
Caption:		وصف الصورة :
File Name:		اسم الملف:
Caption:		وصف الصورة :

#3 MONITORING, page 4	Version 5.0 10/09	**#٣ المراقبة,** صفحة ٤
Site/Site Element Identification		**تحديد هوية الموقع أو عنصر الموقع**
MONITORING ENTIRE SITE or ONE SITE ELEMENT? ☐ **SITE** **الموقع** ☐ **SITE ELEMENT** **عنصر الموقع**		**مراقبة كل الموقع أو عنصر الموقع**
Investigator(s) الباحث	Investigator(s)' Institution المؤسسة التابع لها الباحث	MEGA Number رقم ميجا
Date of Monitoring Visit تاريخ زيارة المراقبة	**Site** Primary Name	اسم الموقع الأساسي
If Element: إذا كان عنصر: **Element** Code رمز العنصر	**If** Element: **Element** Primary Name	إذا كان عنصر: اسم العنصر الأساسي

Site Photographs (Continue)	**صور الموقع**
File Name:	اسم الملف:
Caption:	العنوان :
File Name:	اسم الملف:
Caption:	العنوان :
File Name:	اسم الملف:
Caption:	العنوان :
File Name:	اسم الملف:
Caption:	العنوان :
File Name:	اسم الملف:
Caption:	العنوان :
File Name:	اسم الملف:
Caption:	العنوان :

MEGA Middle Eastern Geodatabase for Antiquities—Jordan Version 5.0 10/09 قاعدة البيانات الجغرافية للآثار في الشرق الأوسط- الأردن

CODE CARD #1 SITE ELEMENTS & PERIODS # ١ بطاقة الرموز -عناصر الموقع

Elements Group 1: **Tall / Tell**		عناصر المجموعة الأولى: **تل**	
101	Tall/Tell		تل
Elements Group 2: **Agricultural** & Similar Site Elements		عناصر المجموعة الثانية: عناصرالموقع **الزراعية** وما يماثلها	
201	Agricultural Terrace مصطبة زراعية	202	Animal Pen حظيرة حيوانات
203	Hamlet/Farmstead/Farmhouse مزرعة مع بيوتها (توابعها)	204	Mill طاحونة
205	Press, Oil معصرة زيت	206	Press, Wine معصرة عنب
207	Stables إصطبل	208	Threshing Floor ارضية لدرس القمح
209	Villa فيلا/ بيت مستقل	299	Unspecified/Unknown Agricultural Structure منشآات زراعية غير معروفة /غير محددة
Elements Group 3: **Cultic/Religious** & Similar Site Elements		عناصر المجموعة الثالثة : عناصرالموقع **الدينية** وما يماثلها	
301	Church/Chapel كنيسة / مصلى	302	Menhir/Standing Stone/ Cromlish نصب حجري (منهر) /نصبية/كروملش
303	Monastery دير	304	Mosque مسجد
305	Mosque, Desert مسجد في الصحراء	306	Sanctuary حرم / مكان مقدس
307	Stone Circle دائرة حجرية	308	Temple معبد
399	Unspecified/Unknown Religious Structures		منشآات دينية غير معروفة /غير محددة
Elements Group 4: **Funerary** & Similar Site Elements		عناصر المجموعة الرابعة: عناصرالموقع **الجنائزية** وما يماثلها	
401	Burial, Cairn/Tumulus قبر على شكل كوم حجارة	402	Burial, Cave (Loculus/Arcosolium) دفن داخل كهف
403	Burial, in Church مدفن داخل كنيسة	404	Burial, Jar مدفن داخل جرة
405	Burial, in Natural Cave مقبرة داخل كهف طبيعي	406	Burial, Pit مدفن داخل حفرة
407	Burial, Sub-Floor مدفن تحت ارضية منزل	408	Cemetery مقبرة / مدافن
409	Colombarium كولومباريوم / مدافن رماد بهيئة بيوت الحمام الزاجل	410	Dolmen دولمن
411	Grave قبر / مدفن	412	Hypogaeum هايبوجايوم / غرفة سفلية تحت الأرض (سكن / مدفن)
413	Mausoleum ضريح	414	Sarcophagus/Stone Anthropode Coffin تابوت حجري /تابوت حجري ذو وجه انثروبودية ذو هيئة آدمية
415	Tomb, Cist لحد	416	Tomb, Rock-cut Monumental with Sculpted Facade دفن في قبر حجري ذي مدخل منحوت / قبر حجري منحوت الواجهة وبشكل إحتفالي
417	Tomb, Rock-cut with Simple Entrance or Dromos دفن في قبر حجري ذي مدخل بسيط / قبر منحوت بالصخر ذو مدخل بسيط	418	Tomb, Rock-cut with Shaft قبر رأسي منحوت بالصخر
419	Tomb, Tower قبر برجي	420	Tombstone شاهد قبر
499	Unspecified/Unknown Funerary		عنصر جنائزي غير معروف /غير محدد
Elements Group 5: **Habitation/Military** & Similar Site Elements		عناصر المجموعة الخامسة:عناصرالموقع **العسكرية والسكنية** وما يماثلها	
501	Camp/Nomadic Camp مخيّم بدوي	502	Caravanserai خان
503	Castle قلعة	504	Castrum مخيم عسكري روماني
505	Cave/Shelter كهف / ملجأ	506	Fortress حصن
507	Hearth موقد	508	Hermitage صومعة
509	Hut Circle كوخ دائري	510	Latrine دورة مياه / مرحاض
511	Palace قصر	512	Rujm رجم
513	Settlement, Fortified مستقر محصن	514	Settlement, No Fortifications(Village) مستقربدون تحصينات(قرية)
515	Tower برج	599	Unspecified/ Unknown Habitation/Military عسكرية وسكنية غير معروف/ غير محدد
Elements Group 6: **Industrial/Mining** & Similar Site Elements		عناصر المجموعة السادسة :عناصرالموقع **الصناعية** وما يماثلها	
601	Flint Knapping Site موقع شحذ صوان	602	Furnace فرن الصهر
603	Kiln فرن لشي(فخار,زجاج ,طين ,جير)	604	Mine منجم
605	Quarry محجر	606	Smelting Site/Slag Heap موقع صهر معادن , موقع خبث
699	Unspecified/Unknown Industrial		منشآت صناعية غير محددة / غير معروفة
Elements Group 7: **Inscription** & Similar Site Elements		عناصر المجموعة السابعة :عناصرالموقع **النقوش** وما يماثلها	
701	Inscription, Arabic نقش بالخط العربي	702	Inscription, Aramaic نقش باللغة الآرامية
703	Inscription, Greek نقش باللغة اليونانية	704	Inscription, Kufic نقش بالخط الكوفي
705	Inscription, Latin نقش باللغة اللاتينية	706	Inscription, Nabataean نقش بالخط النبطي
707	Inscription, Turkish نقش باللغة التركية	708	Inscription, Safaitic نقش بالخط الصفوي
709	Inscription, Thamudic نقش بالخط الثمودي	799	Unspecified/Unknown Inscription نقوش كتابية غير محددة / غير معروفة
Elements Group 8: **General** Site Elements		عناصر المجموعة الثامنة :عناصر الموقع العامة	
801	Baths حمامات	802	Bridge جسر
803	Cairn كوم حجارة	804	Courtyard فناء
805	Cupmarks/Cupholes حفر في الصخر	806	Domestic Installation (Rock-Cut or in Natural Cave) منشآت منزلية (في كهف صناعي أو طبيعي)
807	Frescoes فريسكو - لوحة جدارية	808	Hijaz Railway Station محطة سكة حديد الحجاز

809	Hippodrome	مضمار سباق الخيل	810	Isolated Structure/House	بناء/ بيت
811	Jellyfish Structure (Manyatta) اكواخ دائرية مجمعة بشكل دائري ضمن سو		812	Kite	مصيدة حيوانات
813	Macellum	ماكيلوم- سوق روماني	814	Milestone	شاهد مسافات
815	Monumental Gateway/Arch	بوابة تذكارية / قوس	816	Mosaic	فسيفساء
817	Nymphaeum	سبيل الحوريات / نيفيوم	818	Platform	منصة
819	Plaza/Forum	ساحة عامة	820	Public Building	مبنى عام
821	Road	طريق	822	Rock Art	رسومات /فن صخري
823	Rock-cut Basin	حوض صخري	824	Rock-cut Triclinium (قاعة الطعام في المنزل الروماني)/ غرفة محفورة بالصخر للطقوس الجنائزية	تركلينوم
825	Statue/Sculpture/Bas-Relief	تمثال / منحوتة	826	Souk/Market	السوق
827	Stele/Obelisk	مسلة / نصب تذكاري	828	Stone Fences/Enclosures	سياج حجري
829	Storage Facility/Silo	صومعة خزين	830	Tabun	طابون
831	Theater(Odeon)	مسرح (أوديون)	832	Wali/Dharih	ضريح / مقام / ولي
833	Wall, unspecified	جدار غير محدد	834	Water Structure, Aqueduct	قناة ماءمحمولة
835	Water Structure, Cistern	خزان ماء	836	Water Structure, Dam or Barrage	سد أو جسر
837	Water Structure, Qanat	قناة	838	Water Structure, Reservoir (Birket)	بركة/خزان مياه
839	Water Structure, Well	بئر	840	Water Structure, Unspecified	بناء للمياه غير معروف
899	Unspecified/Unknown General Site Element (Specify)				عنصر عام للموقع غير معروف / غير محدد (حدد)
Elements Group 9: **Site Elements with No Structure(s) Found**					عناصر المجموعة التاسعة: **عناصر دون معالم مشيدة**
901	Sherd/Flint Surface Scatter (Unexcavated) انتشار للصوان /للفخار على السطح (غير منقب)		902	Sherd/Flint or Other Material Culture (Excavated) انتشار للصوان /للفخار أو غيرها من المخلفات المادية (منقب)	

Period of Site Element					**فترة عنصر الموقع**
9001	Paleolithic, Lower	الحجري القديم / الادنى	9002	Paleolithic, Middle	الحجري القديم المتوسط
9003	Paleolithic, Upper	الحجري القديم الأعلى	9004	Paleolithic, Unspecified	الحجري القديم
9005	Epi-Paleolithic	الحجري القديم الإنتقالي	9006	Kebaran	الكباري
9007	Natufian	الناطوفي	9008	Neolithic, Pre-pottery	الحجري الحديث ما قبل الفخاري
9009	Neolithic, Pre-pottery A	الحجري الحديث ما قبل الفخاري A	9010	Neolithic, Pre-pottery B	الحجري الحديث ما قبل الفخاري B
9011	Neolithic, Pre-pottery C	الحجري الحديث ما قبل الفخاري C	9012	Neolithic, Pottery	الحجري الحديث الفخاري
9013	Neolithic, Pottery A (Yarmoukian) الحجري الحديث الفخاري / اليرموكي A		9014	Neolithic, Pottery B	الحجري الحديث الفخاري B
9015	Neolithic, Unspecified	الحجري الحديث غير محدد	9016	Chalcolithic, Early	الحجري النحاسي المبكر
9017	Chalcolithic, Late	الحجري النحاسي المتأخر	9018	Chalcolithic, Unspecified	الحجري النحاسيغير محدد
9019	Early Bronze I	البرونزي المبكر - الفترة الأولى	9020	Early Bronze II	البرونزي المبكر - الفترة الثانية
9021	Early Bronze II-III	البرونزي المبكر الثاني والثالث	9022	Early Bronze III	البرونزي المبكر - الفترة الثالثة
9023	Early Bronze IV (EB-MB)	البرونزي المبكر - الفترة الرابعة	9024	Early Bronze, Unspecified	البرونزي المبكر غير محدد
9025	Middle Bronze IIa	البرونزي المتوسط - الفترة الثانية a	9026	Middle Bronze IIb-c	البرونزي المتوسط - الفترة الثانية b/c
9027	Middle Bronze, Unspecified	البرونزي المتوسط غير محدد	9028	Late Bronze I	البرونزي المتأخر- الفترة الأول
9029	Late Bronze IIa-b	البرونزي المتأخر- الفترة الثانية a/b	9030	Late Bronze, Unspecified	البرونزي المتأخر غير محدد
9031	Iron Age I	العصر الحديدي الأول	9032	Iron Age IIa-b	العصر الحديدي الدور الثاني a/b
9033	Iron Age IIc	العصر الحديدي / الفترة الثانية c	9034	Iron Age III (Persian)	الحديدي الدور الثالث (الفارسي)
9035	Iron Age, Unspecified	العصر الحديدي غير محدد	9036	Hellenistic, Early	الهلنستي المبكر
9037	Hellenistic, Middle	الهلنستي المتوسط	9038	Hellenistic, Late	الهلنستي المتأخر
9039	Hellenistic, Unspecified	الهلنستي غير محدد	9040	Nabataean, Early	النبطي المبكر
9041	Nabataean, Middle	النبطي المتوسط	9042	Nabataean, Late	النبطي المتأخر
9043	Nabataean, Unspecified	النبطي غير محدد	9044	Roman, Early	الروماني المبكر
9045	Roman, Late	الروماني المتأخر	9046	Roman, Unspecified	الروماني غير محدد
9047	Byzantine, Early	البيزنطي المبكر	9048	Byzantine, Late	البيزنطي المتأخر
9049	Byzantine, Unspecified	البيزنطي غير محدد	9050	Islamic, Umayyad	الأموي
9051	Islamic, Abbasid	العباسي	9052	Islamic, Fatimid	الفاطمي
9053	Islamic, Ayyubid	الأيوبي	9054	Islamic, Mamluk	المملوكي
9055	Islamic, Unspecified	الإسلامي غير محدد	9056	Crusader	الصليبي
9057	Ottoman, Early	العثماني المبكر	9058	Ottoman, Late	العثماني المتأخر
9059	Ottoman, Unspecified	العثماني غير محدد	9060	Modern (1915-1950)	الحديث
9061	Hashemite	الفترة الهاشمية	9999	Unspecified/Unknown Period	الفترة غير معروفة / غير محددة

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CODE CARD #2 TOPOGRAPHY & MONITORING #٢ بطاقة الرموز- طبوغرافية و مراقبة

Site Element Topography طبوغرافية عنصر الموقع

1001	Alluvial Fan	مصب / دلتا	1002	Cliff	جرف
1003	Cutbank	جرف النهر	1004	Dune Field	كثبان رملية
1005	Hilltop	قمة التلة	1006	Plain, Alluvial	سهل غريني
1007	Plain, Non- Alluvial	سهل غير غريني	1008	Plateau	هضبة / سهل واسع
1009	Playa	أرض جافة	1010	Ridge	شفا / حافة
1011	Slope	سفح/منحدر	1012	Terrace	مصطبة
1013	Valley Bottom	قعر الوادي	1998	Other Topography (Specify)	الطبوغرافية الأخرى (حدد)
1999	Unspecified/Unknown Topography			طبوغرافية غير معروفة / غير محددة	

Site Monitoring Codes ترميز مراقبة حالة الموقع

THREATS(s): future threats/risks to site				**تهديد:** التهديدات المحتملة في المستقبل/ تعرض الموقع للخطر	
Threat Group 1: **Agriculture** & Similar Impacts				تهديد - المجموعة الأولى:التأثيرات **الزراعية** وما يماثلها	
2101	Animal Pen/Shelter	حظيرة حيوانات / ملجأ	2102	Deep Plowing	حراثة عميقة
2103	Fruit/Olive Grove	بستان فواكه / زيتون	2104	Grazing	رعي
2105	Irrigation	ري	2106	Land Reclamation	استصلاح الاراضي
2107	Plowing	حراثة	2108	Reforestation	تحريج / زراعة حرجية
2109	Terracing	سلاسل / مصاطب	2110	Threshing Floor	ارضية لدرس القمح
2198	Other Agricultural Impacts (Specify)			التأثيرات الزراعية الأخرى (حدد)	
Threat Group 2: **Development** & Similar Impacts				تهديد - المجموعة الثانية :التأثيرات **الحضارية** وما يماثلها	
2201	Bulldozing	تجريف بالاليات	2202	Inundation (by Dam)	مغمور بالماء نتيجة بناء سد
2203	Mining	منجم	2204	Quarrying	محجر/مقلع
2205	Road Work	انشاء طرق	2206	Trenching, Canal	خندق ,قناة
2207	Trenching, Pipeline/Sewage/Aqueduct	خندق (مواسير / مجاري) أو شبكة مياه أو نظام قائمي	2208	Urbanization	التمدن
2209	Vibrations, Automobile/Truck	الاهتزازات , سيارة / شاحنة	2210	Vibrations, Railroad	الاهتزازات, خط السكة الحديدية
2298	Other Development Impacts (Specify)			التأثيرات الحضارية الأخرى (حدد)	
Threat Group 3: **Human** & Similar Impacts				تهديد - المجموعة الثالثة:التأثيرات **البشرية** وما يماثلها	
2301	Air	تلوث هواء	2302	Bedouin Camp	مخيم بدوي
2303	Dumping	مكب / طمم	2304	Looting/Theft	نهب / سرقة
2305	Military Activities	نشاطات عسكرية	2306	Modern Tombs/Cemetery	مدافن حديثة / مقبرة
2307	Reuse of Ancient Masonry	إعادة أستعمال مباني قديمة	2308	Reuse of Ancient Structure	إعادة أستعمال منشآت قديمة
2309	Vandalism	تخريب	2398	Other Human Impacts (Specify)	التأثيرات البشرية الأخرى(حدد)
Threat Group 4: **Natural** & Similar Impacts & **Deterioration**				تهديد - المجموعة الرابعة: التأثيرات و **تدهورات الطبيعية** وما يماثلها	
2401	Animal (Non-Domestic) Impact	أثر الحيوانات غير الداجنة (البرية)	2402	Collapse - Wall/Superstructure	انهيارات / انزلاقات
2403	Earthquake	هزات أرضية / زلزال	2404	Erosion, Water	تعرية / مياه
2405	Erosion, Wind	تعرية / رياح	2406	Fire	حريق
2407	Flooding (Not by Dam)	الفيضانات (وليس بواسطة السد)	2408	Land/Rock Slide	إنزلاقات أرضية / صخرية
2409	Rising Damp	ارتفاع الرطوبه	2410	Vegetation (Non-Agricultural) Impact	تأثير الغطاء النباتي (غير الزراعية)
2498	Other Natural Impacts & Deterioration (Specify)			التأثيرات الطبيعية الأخرى والتدهور (حدد)	
Threat Group 5: **Site Management** & Similar Impacts				تهديد - المجموعة الخامسة:التأثيرات الناتجة عن **إدارة الموقع** وما يماثلها	
2501	Inappropriate Archaeological Excavation	غير مناسب حفر اثري	2502	Inappropriate Conservation/Restoration	حفاظ/ ترميم غير مناسب
2503	Inappropriate Maintenance	صيانة غير مناسبة	2504	Tourism Concessioner Activities	أثر التراجع السياحي
2505	Tourist/Visitor Activities	النشاطات السياحية /الزائر /أثر السياحة	2598	Other Site Management Impacts (Specify)	أثر القرارات الإدارية الأخرى (حدد)
Threat Group 6: **Other**				تهديد - المجموعة السادسة: عوامل أخرى	
2998	Other Threats (Specify)	تهديدات أخرى (حدد)	2999	No Threats Observed	لا توجد تهديدات

DISTURBANCE(s) existing disturbances at site			**الاختلال :** الاختلال القائمة في الموقع
Disturbance Group 1: **Agriculture** & Similar Impacts			الاختلال - المجموعة الأولى:التأثيرات **الزراعية** وما يماثلها
3101	Animal Pen/Shelter حظيرة حيوانات / ملجأ	3102	Deep Plowing حراثة عميقة
3103	Fruit/Olive Grove بستان فواكه / زيتون	3104	Grazing رعي
3105	Irrigation ري	3106	Land Reclamation استصلاح الاراضي
3107	Plowing حراثة	3108	Reforestation تحريج / زراعة حرجية
3109	Terracing سلاسل / مصاطب	3110	Threshing Floor ارضية لدرس القمح
3198	Other Agricultural Impacts (Specify) التأثيرات الزراعية الأخرى (حدد)		
Disturbance Group 2: **Development** & Similar Impacts			الاختلال - المجموعة الثانية :التأثيرات **الحضارية** وما يماثلها
3201	Bulldozing تجريف بالاليات	3202	Inundation (by Dam) مغمور بالماءنتيجة بناء سد
3203	Mining منجم	3204	Quarrying محجر/مقلع
3205	Road Work اعمال طرق	3206	Trenching, Canal خندق ,قناة
3207	Trenching, Pipeline/Sewage/Aqueduct خندق (مواسير / مجاري) أو شبكة مياه أو نظام قائمي	3208	Urbanization التمدن
3209	Vibrations, Automobile/Truck الاهتزازات , سيارة / شاحنة	3210	Vibrations, Railroad الاهتزازات, خط السكة الحديدية
3298	Other Development Impacts (Specify) التأثيرات الحضارية الأخرى (حدد)		
Disturbance Group 3: **Human** & Similar Impacts			الاختلال - المجموعة الثالثة : التأثيرات **البشرية** وما يماثلها
3301	Air Pollution تلوث هواء	3302	Bedouin Camp مخيم بدوي
3303	Dumping مكب / طمم	3304	Looting/Theft نهب / سرقة
3305	Military Activities نشاطات عسكرية	3306	Modern Tombs/Cemetery مدافن حديثة / مقبرة
3307	Reuse of Ancient Masonry إعادة أستعمال مباني قديمة	3308	Reuse of Ancient Structure إعادة أستعمال منشآت قديمة
3309	Vandalism تخريب	3398	Other Human Impacts (specify) (حدد) التأثيرات البشرية الأخرى
Disturbance Group 4: **Natural** & Similar Impacts & **Deterioration**			الاختلال - المجموعة الرابعة: التأثيرات و **تدهورات الطبيعية** وما يماثلها
3401	Animal (Non-Domestic) أثر الحيوانات غير الداجنة (البرية)	3402	Collapse - Wall/Superstructure انهيارات / انزلاقات
3403	Earthquake هزات أرضية / زلزال	3404	Erosion, Water تعرية / مياه
3405	Erosion, Wind تعرية / رياح	3406	Fire حريق
3407	Flooding (Not by Dam) الفيضانات (وليس بواسطة السد)	3408	Land/Rock Slide إنزلاقات أرضية / صخرية
3409	Rising Damp ارتفاع الرطوبه	3410	Vegetation (Non-Agricultural) تأثير الغطاء النباتي (غير الزراعية)
3498	Other Natural Impacts & Deterioration (Specify) التأثيرات الطبيعية الأخرى وتدهور (حدد)		
Disturbance Group 5: **Site Management** & Similar Impacts			الاختلال - المجموعة الخامسة: التأثيرات السلبية الناتجة عن **إدارة الموقع** وما يماثلها
3501	Inappropriate Archaeological Excavation حفر اثري غير مناسب	3502	Inappropriate Conservation/Restoration حفاظ/ ترميم غير مناسب
3503	Inappropriate Maintenance صيانة غير مناسبة	3504	Tourism Concessioner Activities أثر التراجع السياحي
3505	Tourist/Visitor Activities النشاطات السياحية /الزائر /أثر السياحة	3598	Other Site Management Impacts (Specify) أثر القرارات الإدارية الأخرى (حدد)
Disturbance Group 6: **Other**			ا الاختلال - المجموعة السادسة:عوامل **أخرى**
3998	Other Disturbances (Specify) اختلالات أخرى (حدد)	3999	No Disturbances Observed لا توجد اختلالات
POTENTIAL LEGAL VIOLATIONS observed			الانتهاكات القانونية الممكنة
4001	Attach Notice to Antiquities وضع ملصقات على الآثار	4002	Bulldoze Site تجريف الموقع
4003	Damage Antiquities الإضرار بالآثار	4004	Encroachment by Devices تأثيرات التقنيات الحديثة تعدي بالأجهزة او بالمعدات
4005	Erect Construction بناء المنشآت	4006	Expose to Fire Risk التعرض لخطر الحريق
4007	Illegal Excavation الإعتداء بالحفر	4008	Move or Dispose Antiquities نقل الآثار و تجريفها
4009	Plant Vegetation or Plowing زراعة / حراثة	4010	Trade in Antiquities الإتجار غير المشروع بالآثار
4998	Other Legal Violation (Specify) مخالفات قانونية أخرى (حدد)	4999	No Legal Violations Observed لا توجد مخالفات قانونية
MANAGEMENT RECOMMENDATIONS after monitoring event			**التوصيات الإدارية** بعد المراقبة
5001	DoA Acquire Property دائرة الآثار العامة ألإستملاك	5002	Documentation توثيق
5003	Excavation إجراء تنقيب أثري	5004	Fencing تسييج
5005	In-depth Condition Assessment التعمق في تقييم الحالة	5006	Intervene with Other Government Authorities التنسيق مع جهات حكومية أخرى
5007	Intervene with Owner/Occupant/Local Inhabitant(s) المقيم / الشاغل /التدخل لدى مالك / المحتل / الساكن المحلي	5008	Mitigate Fire Threat معالجة تهديد الحريق
5009	Reburial إعادة دفن	5010	Registration تسجيل الموقع
5011	Relocate Development Proposal نقل/ إزاحة مشاريع التنمية	5012	Conservation/Restoration تثبيت الحالة, حفاظ, ترميم
5998	Other Action Recommended(Specify) إجراءات أخرى (حدد)	5999	No Action Recommended عدم وجود إجراءات الموصى بها

Appendix 2 MEGA-J monitoring code cards with the agents of deterioriation

MEGA Middle Eastern Geodatabase for Antiquities—Jordan Version 5.0 10/09 قاعدة البيانات الجغرافية للآثار في الشرق الأوسط- الأردن

CODE CARD #2 TOPOGRAPHY & MONITORING #٢ بطاقة الرموز-طبوغرافية و مراقبة

Site Element Topography الموقععنصرطبوغرافية

1001	Alluvial Fan	مصب / دلتا	1002	Cliff	جرف
1003	Cutbank	جرف النهر	1004	Dune Field	كثبان رملية
1005	Hilltop	قمة التلة	1006	Plain, Alluvial	سهل غريني
1007	Plain, Non- Alluvial	سهل غير غريني	1008	Plateau	هضبة / سهل واسع
1009	Playa	أرض جافة	1010	Ridge	شفا / حافة
1011	Slope	سفح/منحدر	1012	Terrace	مصطبة
1013	Valley Bottom	قعر الوادي	1998	Other Topography (Specify) الأخرى(حدد)	الطبوغرافية
1999	Unspecified/Unknown Topography				طبوغرافيةغير معروفة/ غير محددة

Site Monitoring Codes(Version for RLICC KU Leuven) ترميز مراقبة
حالة الموقع

THREATS(s): future threats/risks to site		**تهديد:** التهديدات المحتملة في المستقبل/تعرض الموقع للخطر	
Threat Group 1: **Agriculture**& Similar Impacts		تهديد - المجموعة الأولى:**التأثيرات الزراعية**وما يماثلها	
2101	Animal Pen/Shelter حظيرة حيوانات / ملجأ	2102	Deep Plowing حراثة عميقة
	AG04: Physical forces (N,H);		AG04: Physical forces (N,H); AG09.5: (in)direct impact from human activities and human development on the fabric (H): physical development (agriculture, construction, …)
2103	Fruit/Olive Grove بستان فواكه / زيتون	2104	Grazing رعي
	AG06: Biological agents (N,h)		AG06: Biological agents (N,h) AG04: Physical forces (N,H);
2105	Irrigation ري	2106	Land Reclamation استصلاح الاراضى
	AG02: Water (N,H)		AG09.5: (in)direct impact from human activities and human development on the fabric (H): physical development (agriculture, construction, …)
2107	Plowing حراثة	2108	Reforestation تحريج / زراعة حرجية
	AG04: Physical forces (N,H); AG09.5: (in)direct impact from human activities and human development on the fabric (H): physical development (agriculture, construction, …)		AG09.5: (in)direct impact from human activities and human development on the fabric (H): physical development (agriculture, construction, …)
2109	Terracing سلاسل / مصاطب	2110	Threshing Floor ارضية لدرس القمح
	AG09: (in)direct impact from human activities and human development on the fabric (H)		AG09.5: (in)direct impact from human activities and human development on the fabric (H): physical development (agriculture, construction, …)
2198	Other Agricultural Impacts (Specify) التأثيرات الزراعية الأخرى (حدد)		
Threat Group 2: **Development**& Similar Impacts		الثانيةتهديد - المجموعة:**الحضارية** وما يماثلهاالتأثيرات	
2201	Bulldozing تجريف بالاليات	2202	Inundation (by Dam) مغمور بالماء نتيجة بناء سد
	AG04: Physical forces (N,H); AG09: (in)direct impact from human activities and human development on the fabric (H)		AG02: Water (N,H) AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)
2203	Mining منجم	2204	Quarrying محجر/مقلع
	AG04: Physical forces (N,H); AG05: Electromagnetic waves (and radiation) (N,H) AG09: (in)direct impact from human activities and human development on the fabric (H)		AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)
2205	Road Work انشاءطرق	2206	Trenching, Canal خندق ,قناة
	AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)		AG02: Water (N,H) AG09: (in)direct impact from human activities and human development on the fabric (H)
2207	Trenching, Pipeline/Sewage/Aqueduct AG02: Water (N,H) AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)	2208	Urbanization AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H) التمدن
2209	Vibrations, Automobile/Truck الاهتزازات,سيارة / شاحنة	2210	Vibrations, Railroad الاهتزازات,خط السكة الحديدية

	AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)		AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)
2298	Other Development Impacts (Specify) التأثيراتالحضاريةالأخرى (حدد)		
Threat Group 3: **Human**& Similar Impacts **الثالثةتهديد - المجموعة:وما يماثلهاالتأثيرات البشرية**			
2301	Air تلوث هواء	2302	Bedouin Camp مخيم بدوي
	AG07 : Contaminants (N,H)		AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)
2303	Dumping مكب / طمم	2304	Looting/Theft نهب /سرقة
	AG07 : Contaminants (N,H) AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)		AG09: (in)direct impact from human activities and human development on the fabric (H)
2305	Military Activities نشاطات عسكرية	2306	Modern Tombs/Cemetery مدافن حديثة / مقبرة
	AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H) AG10: Risk for the users related to the use (which use) of the cultural heritage fabric (N,H);		AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)
2307	Reuse of Ancient Masonry إعادة أستعمال مباني قديمة	2308	Reuse of Ancient Structure إعادة أستعمال منشآت قديمة
	AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)		AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)
2309	Vandalism تخريب	2398	Other Human Impacts (Specify) التأثيرات البشرية الأخرى(حدد)
	AG09: (in)direct impact from human activities and human development on the fabric (H)		AG09: (in)direct impact from human activities and human development on the fabric (H)
Threat Group 4: **Natural**& Similar Impacts &**Deterioration**التأثيرات: المجموعةالرابعة- **الطبيعية**وتدهوراتها وما يماثلها تهديد			
2401	Animal (Non-Domestic) Impact أثر الحيوانات غير الداجنة (البرية)	2402	Collapse - Wall/Superstructure انهيارات / انزلاقات
	AG04: Physical forces (N,H); AG08: Dissociation (H);		AG02: Water (N,H) AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)
2403	Earthquake هزات أرضية / زلزال	2404	Erosion,Water تعرية / مياه
	AG04: Physical forces (N,H); AG10: Risk for the users related to the use (which use) of the cultural heritage fabric (N,H);		AG02: Water (N,H) AG04: Physical forces (N,H);
2405	Erosion, Wind تعرية / رياح	2406	Fire حريق
	AG03: Climate (N,H) (= inappropriate RH and T°) AG04: Physical forces (N,H);		AG01: Fire (N, H) AG10: Risk for the users related to the use (which use) of the cultural heritage fabric (N,H);
2407	Flooding (Not by Dam) الفيضانات (وليس بواسطة السد)	2408	Land/Rock Slide إنزلاقاتأرضية / صخرية
	AG02: Water (N,H) AG04: Physical forces (N,H); AG09: (in)direct impact from human activities and human development on the fabric (H) AG10: Risk for the users related to the use (which use) of the cultural heritage fabric (N,H);		AG02: Water (N,H) AG04: Physical forces (N,H);
2409	Rising Damp ارتفاع الرطوبه	2410	Vegetation (Non-Agricultural) Impact تأثير الغطاء النباتي (غير الزراعية)
	AG02: Water (N,H) AG07 : Contaminants (N,H)		AG06
2498	Other Natural Impacts & Deterioration (Specify)التأثيرات الطبيعية الأخرى والتدهور(حدد)		
	AG05: Electromagnetic waves (and radiation) (N,H)		
Threat Group 5: **Site Management**& Similar Impacts **الخامسةتهديد - المجموعة:وما يماثلهاالتأثيرات الناتجة عن إدارة الموقع**			
2501	Inappropriate Archaeological Excavation غير مناسب حفر اثري	2502	Inappropriate Conservation/Restoration حفاظ/ ترميم غير مناسب
	AG09: (in)direct impact from human activities and human development on the fabric (H) AG10: Risk for the users related to the use (which use) of the cultural heritage fabric (N,H);		AG09: (in)direct impact from human activities and human development on the fabric (H) AG10: Risk for the users related to the use (which use) of the cultural heritage fabric (N,H);
2503	Inappropriate Maintenance غير مناسبةصيانة	2504	Tourism Concessioner Activities أثر التراجع السياحي
	AG09: (in)direct impact from human activities and human development on the fabric (H) AG10: Risk for the users related to the use (which use) of the cultural heritage fabric (N,H);		AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)

CODE CARD #2, page 2**TOPOGRAPHY & MONITORING** **# ٢ بطاقة الرموز- طبوغرافية و مراقبة , صفحة**

2505	Tourist/Visitor Activities النشاطات السياحية /الزائر /أثر السياحة	2598	Other Site ManagementImpacts (Specify) أثر القرارات الإدارية الأخرى(حدد)
	AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H) AG10: Risk for the users related to the use (which use) of the cultural heritage fabric (N,H);		
Threat Group 6: **Other**			السادسةتهديد - المجموعة:عوامل أخرى
2998	Other Threats (Specify) تهديدات أخرى(حدد)	2999	No Threats Observed لا توجد تهديدات

CODE CARD #2, page 2**TOPOGRAPHY & MONITORING** **#٢ بطاقة الرموز- طبوغرافية و مراقبة , صفحة ٢**

DISTURBANCE(s) existing disturbances at site			**الاختلال:**الاختلال القائمة في الموقع
Disturbance Group 1:**Agriculture**& Similar Impacts			الأولىالاختلال - المجموعة:التأثيرات **الزراعية**وما يماثلها
3101	Animal Pen/Shelter حظيرة حيوانات / ملجأ	3102	Deep Plowing حراثة عميقة
	AG04: Physical forces (N,H);		AG04: Physical forces (N,H); AG09.5: (in)direct impact from human activities and human development on the fabric (H): physical development (agriculture, construction, …)
3103	Fruit/Olive Grove بستان فواكه / زيتون	3104	Grazing رعي
	AG06: Biological agents (N,h)		AG06: Biological agents (N,h) AG04: Physical forces (N,H);
3105	Irrigation ري	3106	Land Reclamation استصلاح الاراضي
	AG02: Water (N,H)		AG09.5: (in)direct impact from human activities and human development on the fabric (H): physical development (agriculture, construction, …)
3107	Plowing حراثة	3108	Reforestation تحريج / زراعة حرجية
	AG04: Physical forces (N,H); AG09.5: (in)direct impact from human activities and human development on the fabric (H): physical development (agriculture, construction, …)		AG09.5: (in)direct impact from human activities and human development on the fabric (H): physical development (agriculture, construction, …)
3109	Terracing سلاسل / مصاطب	3110	Threshing Floor ارضية لدرس القمح
	AG09: (in)direct impact from human activities and human development on the fabric (H)		AG09.5: (in)direct impact from human activities and human development on the fabric (H): physical development (agriculture, construction, …)
3198	Other Agricultural Impacts (Specify)		التأثيرات الزراعية الأخرى(حدد)
Disturbance Group 2: **Development**& Similar Impacts			الثانيةالاختلال - المجموعة:**الحضارية** وما يماثلهاالتأثيرات
3201	Bulldozing تجريف بالاليات	3202	Inundation (by Dam) مغمور بالماء نتيجة بناء سد
	AG04: Physical forces (N,H); AG09: (in)direct impact from human activities and human development on the fabric (H)		AG02: Water (N,H) AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)
3203	Mining منجم	3204	Quarrying محجر/مقلع
	AG04: Physical forces (N,H); AG05: Electromagnetic waves (and radiation) (N,H) AG09: (in)direct impact from human activities and human development on the fabric (H)		AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)
3205	Road Work اعمال طرق	3206	Trenching, Canal خندق ,قناة
	AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)		AG02: Water (N,H) AG09: (in)direct impact from human activities and human development on the fabric (H)
3207	Trenching, Pipeline/Sewage/Aqueduct خندق (مواسير / مجاري) أو شبكة مياه أو نظام قائمي	3208	Urbanization التمدن
	AG02: Water (N,H) AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)		AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)
3209	Vibrations, Automobile/Truck الاهتزازات,سيارة / شاحنة	3210	Vibrations, Railroad الاهتزازات,خط السكة الحديدية
	AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)		AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)
3298	Other Development Impacts (Specify)		التأثيراتالحضاريةالأخرى (حدد)
Disturbance Group 3: **Human**& Similar Impacts			الثالثةالاختلال - المجموعة:وما يماثلهاالتأثيرات **البشرية**
3301	Air Pollution تلوث هواء	3302	Bedouin Camp مخيم بدوي
	AG07 : Contaminants (N,H)		AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)
3303	Dumping مكب / طمم	3304	Looting/Theft نهب /سرقة
	AG07 : Contaminants (N,H) AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)		AG09: (in)direct impact from human activities and human development on the fabric (H)
3305	Military Activities نشاطات عسكرية	3306	Modern Tombs/Cemetery مدافن حديثة / مقبرة
	AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)		AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)

MEGA (Middle Eastern Geodatabase for Antiquities—Jordan) Version 5.0 10/09 قاعدة البيانات الجغرافية للآثار في الشرق الأوسط- الأردن

CODE CARD #2, page 2**TOPOGRAPHY & MONITORING** **#٢ بطاقة الرموز- طبوغرافية و مراقبة , صفحة**

	AG10: Risk for the users related to the use (which use) of the cultural heritage fabric (N,H);		
3307	Reuse of Ancient Masonry إعادة أستعمال مباني قديمة	3308	Reuse of Ancient Structure إعادة أستعمال منشآت قديمة
	AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)		AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)
3309	Vandalism تخريب	3398	Other Human Impacts (specify) (حدد) التأثيرات البشرية الأخرى
	AG09: (in)direct impact from human activities and human development on the fabric (H)		AG09: (in)direct impact from human activities and human development on the fabric (H)
Disturbance Group 4: **Natural**& Similar Impacts &**Deterioration** وما يماثلها**وتدهوراتالطبيعية**الاختلال -المجموعةالرابعة: التأثيرات			
3401	Animal (Non-Domestic) أثر الحيوانات غير الداجنة (البرية)	3402	Collapse - Wall/Superstructure انهيارات / انزلاقات
	AG04: Physical forces (N,H); AG08: Dissociation (H);		AG02: Water (N,H) AG04: Physical forces (N,H); AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)
3403	Earthquake هزات أرضية / زلزال	3404	Erosion,Water تعرية / مياه
	AG04: Physical forces (N,H); AG10: Risk for the users related to the use (which use) of the cultural heritage fabric (N,H);		AG02: Water (N,H) AG04: Physical forces (N,H);
3405	Erosion, Wind تعرية / رياح	3406	Fire حريق
	AG03: Climate (N,H) (= inappropriate RH and T°) AG04: Physical forces (N,H);		AG01: Fire (N, H) AG10: Risk for the users related to the use (which use) of the cultural heritage fabric (N,H);
3407	Flooding (Not by Dam) الفيضانات (وليس بواسطة السد)	3408	Land/Rock Slide إنزلاقاتأرضية / صخرية
	AG02: Water (N,H) AG04: Physical forces (N,H); AG09: (in)direct impact from human activities and human development on the fabric (H) AG10: Risk for the users related to the use (which use) of the cultural heritage fabric (N,H);		AG02: Water (N,H) AG04: Physical forces (N,H);
3409	Rising Damp ارتفاع الرطوبه	3410	Vegetation (Non-Agricultural) تأثير الغطاء النباتي (غير الزراعية)
	AG02: Water (N,H) AG07 : Contaminants (N,H)		AG06: Biological agents (N,h)
3498	Other Natural Impacts & Deterioration (Specify) التأثيرات الطبيعية الأخرى وتدهور(حدد)		
Disturbance Group 5: **Site Management**& Similar Impacts **إدارة الموقع** الخامسة:وما يماثلهاالتأثيرات السلبية الناتجة عن الاختلال - المجموعة			
3501	Inappropriate Archaeological Excavation حفر اثري غير مناسب	3502	Inappropriate Conservation/Restoration حفاظ/ ترميم غير مناسب
	AG09: (in)direct impact from human activities and human development on the fabric (H) AG10: Risk for the users related to the use (which use) of the cultural heritage fabric (N,H);		AG09: (in)direct impact from human activities and human development on the fabric (H) AG10: Risk for the users related to the use (which use) of the cultural heritage fabric (N,H);
3503	Inappropriate Maintenance غير مناسبة صيانة	3504	Tourism Concessioner Activities أثر التراجع السياحي
	AG09: (in)direct impact from human activities and human development on the fabric (H) AG10: Risk for the users related to the use (which use) of the cultural heritage fabric (N,H);		AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H)
3505	Tourist/Visitor Activities النشاطات السياحية /الزائر /أثر السياحة	3598	Other Site Management Impacts (Specify) أثر القرارات الإدارية الأخرى(حدد)
	AG08: Dissociation (H); AG09: (in)direct impact from human activities and human development on the fabric (H) AG10: Risk for the users related to the use (which use) of the cultural heritage fabric (N,H);		
Disturbance Group 6: **Other** السادسة:عوامل **أخرى** ا الاختلال -المجموعة			
3998	Other Disturbances (Specify) اختلالاتأخرى (حدد)	3999	No Disturbances Observed لا توجد اختلالات
POTENTIAL LEGAL VIOLATIONS observed الانتهاكات القانونية الممكنة			
4001	Attach Notice to Antiquities وضع ملصقات على الآثار	4002	Bulldoze Site تجريف الموقع
4003	Damage Antiquities الإضرار بالآثار	4004	Encroachment by Devices تأثيرات التقنيات الحديثةتعدي بالأجهزة او بالمعدات
4005	Erect Construction بناء المنشآت	4006	Expose to Fire Risk التعرضلخطر الحريق
4007	Illegal Excavation الإعتداء بالحفر	4008	Move or Dispose Antiquities نقل الآثار و تجريفها
4009	Plant Vegetation or Plowing زراعة / حراثة	4010	Trade in Antiquities الإتجار غير المشروع بالآثار
4998	Other Legal Violation (Specify) مخالفات قانونية أخرى(حدد)	4999	No Legal Violations Observed لا توجد مخالفات قانونية
MANAGEMENT RECOMMENDATIONS after monitoring event **التوصيات الإدارية** بعد المراقبة			
5001	DoA Acquire Property الإستملاكدائرة الأثار العامة	5002	Documentation توثيق

CODE CARD #2, page 2 **TOPOGRAPHY & MONITORING** **#٢ بطاقة الرموز- طبوغرافية و مراقبة , صفحة ٢**

5003	Excavation إجراء تنقيب أثري	5004	Fencing تسييج
5005	In-depth Condition Assessment التعمق في تقييم الحالة	5006	Intervene with Other Government Authorities التنسيق مع جهات حكومية أخرى
5007	Intervene with Owner/Occupant/Local Inhabitant(s) المقيم / الشاغل /التدخل لدى مالك / المحتل / الساكن المحلي	5008	Mitigate Fire Threat معالجة تهديد الحريق
5009	Reburial إعادة دفن	5010	Registration تسجيل الموقع
5011	Relocate Development Proposal نقل/ إزاحةمشاريع التنمية	5012	Conservation/Restoration تثبيت الحالة, حفاظ, ترميم
5998	Other Action Recommended(Specify) إجراءات أخرى (حدد)	5999	No Action Recommended عدم وجود الموصى بها إجراءات

Appendix 3 Petra Retrospective Inventory Report (2006)

WHC Retrospective Inventory - Technical Evaluations

JO-326 Petra

Date(s) inscribed: 1985 **Received: 10/05/1984**

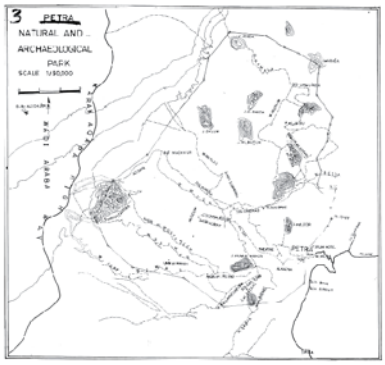
At its 9th session in 1985, at the time of inscription of Petra on the World Heritage List, the World Heritage Committee "noted that the boundaries of the site corresponded to those of the Petra National Park." Several maps, with different boundaries for the Park have been submitted in the intervening years and it has not been clear to many observers which boundaries were the applicable boundaries at the time of inscription in 1985. A proposal for an extension of the site was received in 1995 from the Department of Antiquities but withdrawn the same year after an ICOMOS evaluation mission. The mission reported at the time that "the precise area inscribed on the List was somewhat uncertain."

The plans on file at the World Heritage Centre and in the UNESCO-ICOMOS Documentation Centre are the following:

- **Plan A** (below left) was submitted prior to inscription but was considered too imprecise to adequately define the boundaries of the Park.
- **Plan B** (below right) was contained in the 1994 Management plan as a statement of the current boundaries at the time. The limit of the Petra National Park shown coincides with Plan C. This plan also shows a substantial buffer zone.
- **Plan C** is undated but may be the earliest representation of the official boundaries of Petra National Park.
- **Plan D** is a blueline print showing both the limits shown in B and C above, as well as the new, revised limits proposed by the 1994 Management Plan.
- **Plan E** (right), from the 1994 Management Plan by UNESCO and the Société d'Eco-Aménagement (SECA), presents a proposal for the park boundaries and a management zoning scheme for the park.

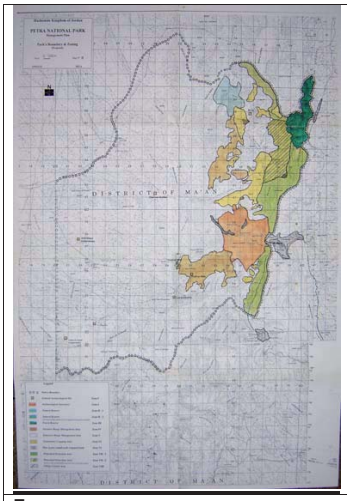
A. Plan "Petra. Mission IGN 100. February **1974** (Annexe V)", handwritten annotation "Délimitation de la zone de protection du site de Petra (Département des Antiquités)", A4, no scale (item #20)

B. "Fig. II-1. Official boundaries for the PNP and its Buffer zone as demarcated by the MOA. (under the responsibility of the PNP Authority)". A4 B&W map inserted in mgmt plan as p. 137. No scale. shows "PNP Boundary" and "Buffer zone". (item #32a)



C. Plan "Petra Natural and Archaeological Park", A4, scale 1:50,000. (*inventory item #74)*

D. Plan "Petra Natural and Archaeological Park", scale 1:50,000, blueline print, 85 x 100 cm (item #17)



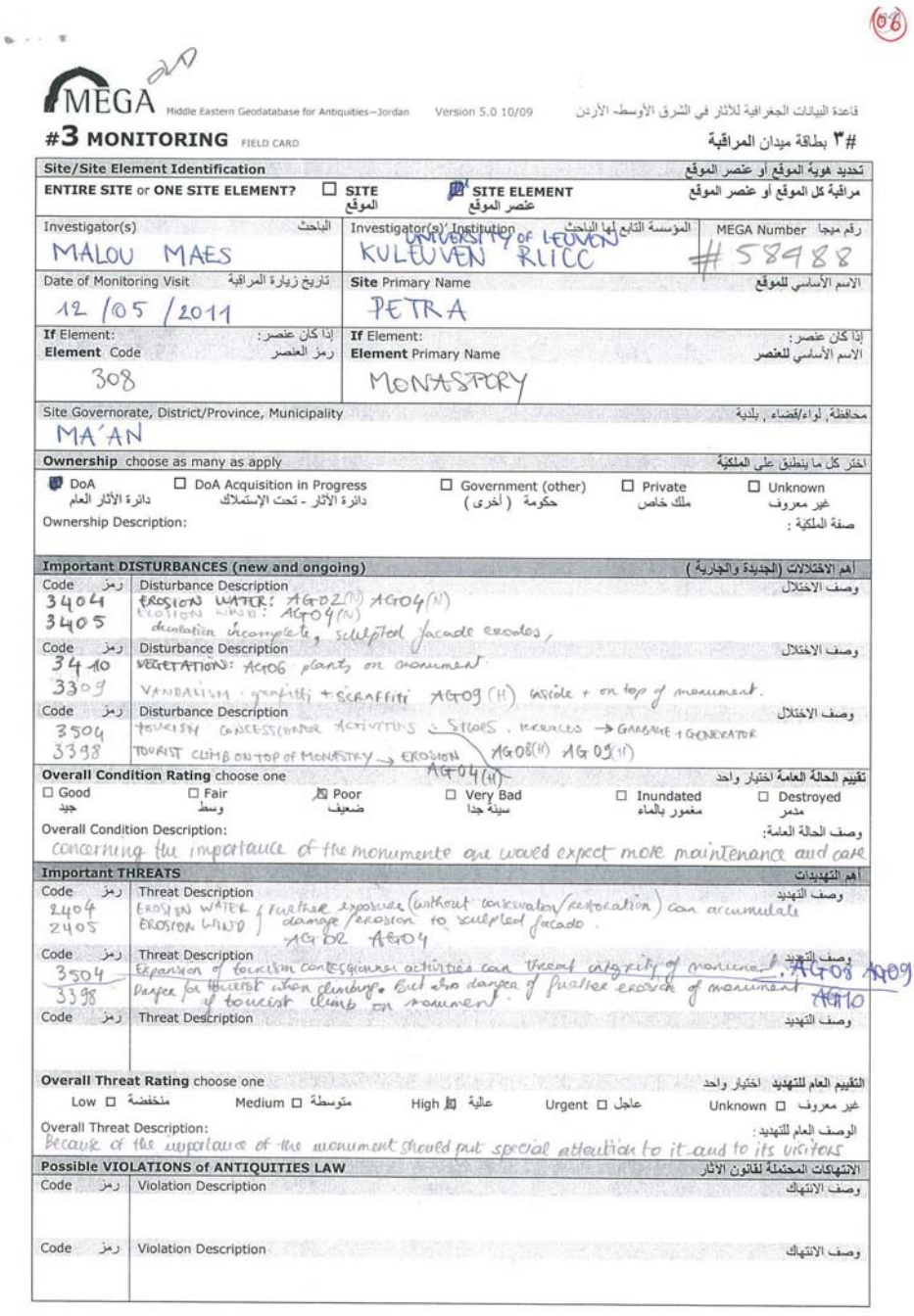
E. Map n° 3: "Park's Boundary and Zoning" (proposal), 54x81 cm, scale 1:50,000). From the 1994 Management Plan. *(inventory item #35*

From these maps it would appear that the older map, possibly showing the 1985 boundaries, is Plan C.

Cartographic Information requested:

- We ask that the authorities identify the boundaries by which the site was inscribed in 1985, confirming, if appropriate, that "Map C" (above) correctly presents these limits.
- Secondly, please submit the largest scale topographic or cadastral map available which clearly shows the boundary of the inscribed property. We are aware of the excellent set of maps of the central Petra produced by the Petra Preservation project at the Hashemite University (HU) in cooperation with the American Center of Oriental Research (ACOR) in 1999. A similar map or maps of the entire Petra National Park would be appreciated, if it exists.
- Please indicate the size in hectares of the property. If a buffer zone exists, please inform the Centre and provide its size.

Appendix 4 Example of a completed MEGA-J monitoring card for the Monastery



MEGA Middle Eastern Geodatabase for Antiquities–Jordan Version 5.0 10/09 قاعدة البيانات الجغرافية للآثار في الشرق الأوسط- الأردن

#3 MONITORING FIELD CARD #٣ بطاقة ميدان المراقبة

Site/Site Element Identification تحديد هوية الموقع أو عنصر الموقع

ENTIRE SITE or **ONE SITE ELEMENT?** ☐ SITE الموقع ☑ SITE ELEMENT عنصر الموقع — مراقبة كل الموقع أو عنصر الموقع

Investigator(s) الباحث	Investigator(s)' Institution المؤسسة التابع لها الباحث	MEGA Number رقم ميجا
MALOU MAES	UNIVERSITY of LEUVEN KULEUVEN RLICC	#58988

Date of Monitoring Visit تاريخ زيارة المراقبة	**Site** Primary Name الاسم الأساسي للموقع
12/05/2011	PETRA

If Element: **Element** Code إذا كان عنصر: رمز العنصر	**If** Element: **Element** Primary Name إذا كان عنصر: الاسم الأساسي للعنصر
308	MONASTERY

Site Governorate, District/Province, Municipality محافظة ,لواء/قضاء , بلدية

MA'AN

Ownership choose as many as apply اختر كل ما ينطبق على الملكية

☑ DoA دائرة الآثار العام ☐ DoA Acquisition in Progress دائرة الآثار - تحت الإستملاك ☐ Government (other) حكومة (أخرى) ☐ Private ملك خاص ☐ Unknown غير معروف

Ownership Description: صفة الملكية :

Important DISTURBANCES (new and ongoing) أهم الاختلالات (الجديدة والجارية)

Code رمز	Disturbance Description وصف الاختلال
3404	EROSION WATER: AG02(N) AG04(N)
3405	EROSION WIND: AG04(N) deterioration incomplete, sculptural facade exfoliates,
3410	VEGETATION: AG06 plants on monument
3309	VANDALISM: graffiti + SCRAFFITI AG09 (H) outside + on top of monument.
3504	TOURISM CONCESSIONAIRE ACTIVITIES: SHOPS, TOILETS → GARBAGE + GENERATOR
3398	TOURIST CLIMB ON TOP OF MONASTERY → EROSION AG08(H) AG09(H) AG04(H)

Overall Condition Rating choose one تقييم الحالة العامة اختيار واحد

☐ Good جيد ☐ Fair وسط ☑ Poor ضعيف ☐ Very Bad سيئة جدا ☐ Inundated مغمور بالماء ☐ Destroyed مدمر

Overall Condition Description: وصف الحالة العامة:

concerning the importance of the monumente one waved expect more maintenance and care

Important THREATS أهم التهديدات

Code رمز	Threat Description وصف التهديد
2404	EROSION WATER / Further exposure (without conservation/restoration) can accumulate
2405	EROSION WIND damage/erosion to sculpted facade. AG08 AG04
3504	Expansion of tourism concessionaire activities can threat integrity of monument, AG08 AG09
3398	Danger for tourist when climbing. But also danger of further erosion of monument if tourist climb on monument. AG10

Overall Threat Rating choose one التقييم العام للتهديد اختيار واحد

Low ☐ منخفضة Medium ☐ متوسطة High ☑ عالية Urgent ☐ عاجل Unknown ☐ غير معروف

Overall Threat Description: الوصف العام للتهديد :

Because of the importance of the monument should put special attention to it and to its visitors

Possible VIOLATIONS of ANTIQUITIES LAW الانتهاكات المحتملة لقانون الآثار

Code رمز	Violation Description وصف الانتهاك

#3 MONITORING, page 2 — Version 5.0 10/09 — #٣ المراقبة, صفحة ٢

Site/Site Element Identification — تحديد هوية الموقع أو عنصر الموقع

MONITORING ENTIRE SITE or ONE SITE ELEMENT? ☐ Site الموقع ☑ Site Element عنصر الموقع — مراقبة كل الموقع أو عنصر الموقع

Investigator(s) الباحث	Investigator(s)' Institution المؤسسة التابع لها الباحث	MEGA Number رقم ميجا
MALOU MAES	KULEUVEN RLICC UNIVERSITY OF LEUVEN	
Date of Monitoring Visit تاريخ زيارة المراقبة	**Site** Primary Name الاسم الأساسي للموقع	
12/05/2011	PETRA	
If Element: **Element** Code إذا كان عنصر: رمز العنصر	**If Element:** **Element** Primary Name إذا كان عنصر: الاسم الأساسي للعنصر	
308	MONASTERY	

Sketch of Site or Site Element — مخطط الموقع أو عنصر الموقع
With location of disturbances, threats, and possible legal violations — مع تحديد مكان الاختلالات , التهديدات والانتهاكات القانونية

Approximate Sketch Scale: — مقياس تقريبي للمخطط:

MANAGEMENT RECOMMENDATIONS — التوصيات الإدارية

Code رمز	PRIORITY: الأولوية						
5002	Comments:	Low ☐ منخفضة	Medium ☐ متوسطة	High ☑ عالية	التوصيات :
5005	Comments:	Low ☐ منخفضة	Medium ☐ متوسطة	High ☑ عالية	التوصيات :
5012	Comments:	Low ☐ منخفضة	Medium ☐ متوسطة	High ☑ عالية	التوصيات :
	Comments:	Low ☐ منخفضة	Medium ☐ متوسطة	High ☐ عالية	التوصيات :

RECOMMENDED Future Monitoring Schedule choose one — توصيات جدول لمراقبة اختيار واحد

☑ Every 6 months كل ٦ أشهر ☐ Every year كل سنة ☐ Every other year كل سنتين ☐ 3-5 years ٣-٥ سنوات ☐ Discontinue monitoring وقف مراقبة ☐ Other أخرى

#3 MONITORING, page 3 — Version 5.0 10/09 — #٣ المراقبة, صفحة ٣

Site/Site Element Identification — تحديد هوية الموقع أو عنصر الموقع

MONITORING ENTIRE SITE or ONE SITE ELEMENT? ☐ SITE الموقع ☑ SITE ELEMENT عنصر الموقع — مراقبة كل الموقع أو عنصر الموقع

Investigator(s) الباحث	Investigator(s)' Institution المؤسسة التابع لها الباحث	MEGA Number رقم ميجا
MALOU MAES	KULEUVEN RLICC	

Date of Monitoring Visit تاريخ زيارة المراقبة	Site Primary Name اسم الموقع الأساسي
12/05/2011	PETRA

If Element: إذا كان عنصر: Element Code رمز العنصر	If Element: إذا كان عنصر: Element Primary Name اسم العنصر الأساسي
308	MONASTERY

Site Photographs — صور الموقع

File Name: اسم الملف:	M_58488_2011_0001.jpg
Caption: وصف الصورة:	PANORAMIC OVERVIEW 1
File Name: اسم الملف:	M_58488_2011_0002.jpg
Caption: وصف الصورة:	PANORAMIC OVERVIEW 2
File Name: اسم الملف:	M_58488_2011_0003.jpg
Caption: وصف الصورة:	EROSION ON TOP OF MONASTRY.
File Name: اسم الملف:	M_58488_2011_0004.jpg
Caption: وصف الصورة:	EROSION ON SCULPTED FACADE
File Name: اسم الملف:	M_58488_2011_0005.jpg
Caption: وصف الصورة:	DETAIL OF COLLAPSED PART OF SCULPTED FACADE ABOVE ENTRANCE
File Name: اسم الملف:	M_58488_2011_0006.jpg
Caption: وصف الصورة:	INSIDE VIEW GRAFFITI

Glossary of key terminology

This is based on the thesaurus developed by David Ball and John Watt (Ball and Watt, 2001), as well as the glossary of relevant disaster management terms adopted by UNESCO in its Managing Disaster Risks for World Heritage, World Heritage Resources Manual, 2010 and the Risk Preparedness Strategy (RPS) project at the Baalbek UNESCO World Heritage property.

Area: this level relates to assessment areas, which will be defined by the project staff to carry out the risk assessment. This level could cover the whole site, or selected site element(s), landscape area(s) or both.

Condition assessment: the activity aimed at identifying to what degree an entire property or site element is physically stable, is able to withstand natural or human forces, including the ability to shed weather phenomena, and is or is not experiencing active deterioration (MEGA–J guidelines). It provides important information to identify disturbances/threats and therefore design management recommendations.

Disaster: a serious disruption to the functioning of a community or a society, causing widespread human, material, economic or environmental losses, which exceed the ability of the affected community or society to cope using its own resources. (www.unisdr.org)

Disturbance: a detectable, negative effect (new or ongoing) on the property (site) or site element by natural forces or human activities (Mega–J guidelines).

Hazard: a natural or human-caused phenomenon that may occur in or near the property and may threaten human life and well-being, or cause physical damage and economic loss. A hazard is a situation that could cause damage or destruction (Ball and Watt, 2001), for instance an earthquake or an excess number of visitors. In this research a hazard is considered as a form of threat.

Mitigation: taking action in the time frame before a disaster to lessen post-event damage to lives and property. In risk management, many hazards, such as earthquakes, cannot be diminished, but the risk from that hazard can be reduced or mitigated (UNESCO, 2010).

Preparedness: planning efforts to reduce the risk and consequences of a disaster; also includes planning efforts to prepare for response and recovery.

Preventive conservation: an approach whose primary objective is to ensure the long-term physical survival of a property, with minimal intervention on the fabric itself (Woolfitt, 2007).

Risk: the probability of a certain agent of deterioration occurring within a certain time span, and harming the aspects of the property that are valued by human beings (Kates and Kasperson, 1983). The actual damaging effect of the harmful event or process is related to its intensity

and to the vulnerability of the heritage place or component. Risk assessment: the activity of identifying hazards and assessing the probability of harm (Ball and Watt, 2001) as part of risk management process.

Risk management: a set of elements of an organization's management system concerned with managing risk and the decision-making process following a risk assessment. (Ball and Watt, 2001). In terms of a process, relates to the systematic application of management policies, procedures and practices to the tasks of communicating, establishing context, identifying, analysing, evaluating, treating, monitoring and reviewing risk (Standards Australia/New Zealand , 2004).

Site: a spatially defined area and location of significant event, that contains physical remains of past occupation and human activity including human-built and human-used features (houses, shelters, tombs, earthworks, mounds, quarries, canals, roads, workshops and so on), artifacts and any other physical remains whether standing, ruined or vanished that contribute to the historical and cultural identity of a group of people.

Site element: this level relates to 'a distinct component of an archaeological site which has any evidence of human activity' (MEGA–J guidelines) such as monuments, standing structures, caves and natural features.

Site element feature: this level relates to features in each site element, such as walls, carvings, entrance, floor and roof.

Threat: detectable phenomena, whether natural forces or human activities, that appear to predict a future disturbance to a site or element. Threats can also be phenomena that are causing ongoing disturbances to a site or element and that are predicted to continue to negatively affect the site or element into the future (Mega–J guidelines).

Uncertainty: caused by the lack of knowledge about unpredictable actions by agents of deterioration in the property and/or site element because of the type of in-depth assessment being carried out.

Vulnerability: the susceptibility or exposure of cultural property to a disturbance/threat; it is the inherent weakness of the heritage property (UNESCO, 2010).

World Heritage property: a property as defined in Article 1 and 2 of the World Heritage Convention and inscribed on the World Heritage List on the basis of its outstanding universal value, which is fulfilled when criteria (i) to (x) are met. A World Heritage property can be cultural, and in this case include sites, groups of buildings and monuments; natural; or mixed (UNESCO WHC, 2010, p. 58).

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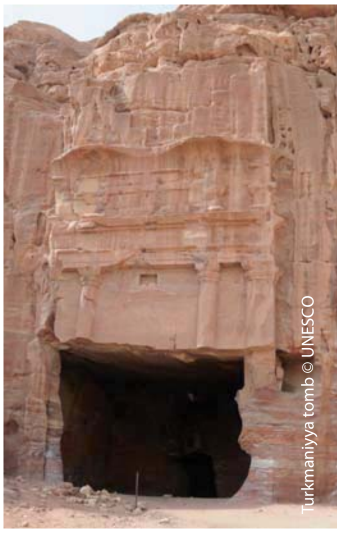
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إدارة المخاطر في المواقع التراثية
دراسة حالة موقع البتراء للتراث العالمي

المؤلفون من مكتب يونسكو - عمان

آنا باوليني

آزاده ڤافاداري

جيورجيا شيزارو

المؤلفون من جامعة لوفين الكاثوليكية

ماريو سانتانا كوينتيرو

كون فان بالن

أونا ڤيليكيس

المستشاره لمكتب اليونسكو - عمان

لين فاخوري

United Nations
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المحتويات

قائمة الأشكال

مقدمة مع شكر وتقدير

جاء هذا المنشور الذي يضع منهجية لإدارة المخاطر كنتيجة لمشروع ترسيم المخاطر في موقع البتراء، وهو مشروع تابع لمكتب اليونسكو في عمان بالشراكة مع مركز ريمون لومير الدولي للترميم (RLICC) التابع لجامعة لوفين في بلجيكا، وبالتنسيق مع سلطة إقليم البتراء للتنمية والسياحة، ودائرة الآثار العامة في الأردن. بدأ هذا المشروع التعاوني في فبراير ٢٠١١، وكانت مدته خمسة عشر شهراً استجابة للمخاطر المتزايدة المحدقة بالقيمة التراثية للموقع، وللحاجة إلى تقييم تلك المخاطر واقتراح سبل الحد من تأثيرها. البتراء، أهم موقع للتراث العالمي في الأردن، بمناظرها الطبيعية المميزة وما تحتويه من آثار ووديان؛ لها خصائص هشة. وهي مع ذلك مهددة بشكل مستمر بعوامل وتأثيرات طبيعية خارجية، وأخرى من صنع البشر. إن الافتقار إلى خطة إدارية مفعلة، وحدود واضحة للممتلكة، وعدم وجود مناطق عازلة وفقاً للجنة التراث العالمي، وضعف استراتيجيات إدارة السياح؛ كلها تؤدي إلى وجود فجوات كبيرة في إدارة الممتلكة تزيد من المخاطر المحدقة بالموقع. وبناء عليه، فإن عملية تقييم المخاطر وإجراء البحوث في مجال إدارة المخاطر في البتراء هما أفضل وسائل للتخفيف من حدة المخاطر وحماية قيمة هذه الممتلكة. يطرح هذا المنشور أسلوباً منهجياً لتحديد التهديدات وأسبابها، وفهم وتقييم آثارها، ويقترح وسائل لاختيار الاستجابة الصحيحة، واستراتيجيات التخفيف من أثر التهديدات.

وما كان تحقيق هذا المشروع، ونشر هذا الكتاب ممكناً لولا الدعم السخي الذي قدمته مؤسسة أننبرغ (Annenburg Foundation)، ولذا ترغب اليونسكو في أن تعرب عن عميق تقديرها لهذا الدعم.

كما يود مكتب اليونسكو في عمان أن يقدم الشكر والتقدير للدعم المتواصل من سلطة إقليم البتراء للسياحة والتنمية (PDTRA)، بما في ذلك وحدة محمية البتراء الأثرية، ودائرة الآثار العامة في الأردن(DoA).

هذا المنشور يقدم منهجية لإدارة المخاطر، والتي من الممكن أن تستخدم كأداة نظامية لتقديم إدارة أفضل للمواقع التراثية. وتوظف هذه المنهجية نهجاً مماثلاً لذلك المستخدم من قبل المركز الدولي لدراسة حماية وترميم الممتلكات الثقافية (ICCROM) و (CCI-ICN) "المعايير الأسترالية/النيوزيلاندية لإدارة المخاطر". ويقدر معدّوا هذه الدراسة التعاون الذي تم مع الـ ICCROM و CCI-ICN، ودوراتهم في الصيانة الوقائية والحد من المخاطر. كما يود المعدون أن يقدموا الشكر للدكتور روبرت والر من المتحف الكندي للطبيعة والذي شكل نموذجه لتحليل مخاطر الممتلكات التراثية والمتاحف مرجعاً أساسياً لوضع هذه المنهجية.

لقد قام معدّو هذه الدراسة لحالة موقع البتراء باستخدام مجموعة من الوثائق والبحوث المدعومة بالاجتماعات وورش العمل، بما في ذلك نشر المصادر المنشورة وغير منشورة، والخطط الرئيسية، والمقالات العلمية، والوثائق القانونية، ولوائح التخطيط للمناطق المحيطة بمحمية البتراء. وعلاوة على ذلك، فقد تم إشراك الجهات المعنية والسلطات المحلية والخبراء الوطنيين والدوليين في العديد من الاجتماعات وورش العمل والأنشطة الميدانية. ونحن ممتنون بشكل خاص، إلى السادة فواز اسحاقات، وجيدو كيبس، والدكتور طلال عكاشة، وكريستوفر تاتل.

ولطرح فئات التهديدات والاختلالات المؤثرة على الآثار قيد الدراسة، تم استخدام الفئات المدرجة ضمن قاعدة بيانات الشرق الأوسط الجغرافية للآثار – الأردن (MEGA-Jordan)، ويشكر معدّو الدراسة دائرة الآثار ومعهد جيتي لصيانة الآثار وصندوق المعالم الدولية لتطوير، وذلك لتطويرهم لهذا النظام، وتشجيع استخدامه.

كما أسهم هذا المشروع في بناء قدرات الخبراء الأردنيين في مجالات تقييم المخاطر ودراسة الحالة والمحافظة الوقائية، بالإضافة إلى المساهمة في حماية الطابع الفريد لمدينة البتراء. نود أن نشكر الدكتور عماد حجازين، والمهندسة تهاني الصالحي وبقية الموظفين في محمية البتراء لتنسيقهم المستمر حيث جعلوا هذا المشروع أمراً ممكناً. كما نود أن نشكر السيد سامي حسنات، عضو البرلمان عن منطقة وادي موسى، لمشاركته الداعمة للمشروع، ولجهوده في المحافظة على موقع البتراء.

أثناء التطبيق الميداني للمنهجية واختبارها، تم إعداد ورشتي عمل. ونود أن نقدر العمل الشاق والمساهمة الهامة لطلاب مركز ريمون لومير لعام ٢٠١١، والجهود التنسيقية للوك فيربويست، وكاريسا كورنيلس، وكريستسن لونبيك. بالإضافة إلى مالو مايس، وأزيليس فانديساندة، ورزان الشدفان، ومحمد البطاينة، وموظفي محمية البتراء الأثرية ودائرة الآثار العامة؛ لتطبيق منهجية إدارة المخاطر في المنطقة التجريبية في البتراء أثناء العمل الميداني الثاني. فقد كانت نتائج هذا الاختبار التجريبي مهمة جداً للدراسة.

كما أننا ممتنون بشكل خاص لفينسا فوجيتشك-لوجاسي من مقر اليونسكو، فإن هذه النشرة ما كانت لتصدر لولا تنسيقها ومساعدتها المستمرين.

وأخيراً، نود أن نشكر جميع الأفراد والمؤسسات الذين ساهموا بشكل أو بآخر في إتمام هذا المنشور.

مقـــدمـــة

منهجية إدارة المخاطر في مواقع التراث

كثير من المواقع التراثية الهامة حول العالم تتمتع بخصائص هشة، وتواجه تحديات عديدة. والتراث الثقافي يعاني من ضغوط متواصلة بسبب السياحة والكوارث الطبيعية والتطور العمراني والتلوث البيئي وسوء الإدارة والنهب والنزاعات، وغيرها من المخاطر.

وتختلف حدة هذه المخاطر باختلاف طبيعة الموقع التراثي وسماته الخاصة وجوانب الضعف المتأصلة فيه وبيئته الجغرافية، بالإضافة إلى طبيعة المخاطر الخارجية المحدقة بالتراث نفسه.

تلك المخاطر قد تكون ناتجة عن تهديدات طبيعية، أو تكون من صنع البشر. أما المخاطر الطبيعية فتنقسم إلى فئتين: فأحياناً تكون مفاجئة وكارثية، وأحياناً أخرى تكون ذات آثار بطيئة ومستمرة وتراكمية، كالتعرية واضمحلال المواد. وفي المقابل فإن المخاطر التي من صنع الإنسان تنتج عن العديد من الأنشطة البشرية، ابتداء بالتطور العمراني، وانتهاء بالسياحة، ومروراً بسوء الإدارة والإهمال وقلة الصيانة. وتعتمد الظروف المؤدية إلى ذلك الضعف على الأطر البيئية والاقتصادية والاجتماعية والسياسية المحيطة بالموقع، وتزداد حدة عوامل الضعف بانعدام منهجيات الصيانة، وبسوء عمليات الحفر والترميم، بالإضافة إلى التمدن والتطور العمراني غير المنضبطين، وانعدام الثقافة المحلية والتراثية، وانعدام الأنظمة الإدارية للمواقع.

ومن أجل الحد من تلك المخاطر، فإنه ينبغي تطوير نهج وإطار مؤسسيين؛ بمشاركة السلطات والكوادر المحلية من أجل تحديد وتطبيق تلك الخطط الاستراتيجية، كما يجب وضع خطط لتدريب الفئات المستهدفة بالشكل المناسب، ووضع المعايير والمبادئ التوجيهية لإدارة المخاطر؛ والتي يجب أن تكون جزءاً لا يتجزأ من ممارسات وخطط إدارة الصون. وعندما يتم تقييم أسباب التدهور والتهديدات ووضع أولويات لها من خلال عملية تخطيط إداري فإنه يصبح بالإمكان الحد أو التخفيف من آثارها. وبعد أن يتم تحديد ذلك النهج وإضفاء الطابع المؤسسي عليه وتنفيذه، فإن المحافظة على قيمة وتكاملية المواقع التراثية ستتم بشكل أفضل.

ويهدف منشور "إدارة المخاطر في مواقع التراث – دراسة موقع البتراء للتراث العالمي"؛ بالدرجة الأولى إلى دعم مدراء الموقع وفرقهم والسلطات والهيئات المسؤولة عن مواقع التراث من أجل مراقبة الأخطار المحدقة بالموقع والتقليل منها. وثانياً، لمساعدة الباحثين وأصحاب المصالح وغيرهم من المهنيين، للمساهمة في الحفاظ على المواقع التراثية.

كما تهدف هذه النشرة إلى تقديم مثال لتصميم منهجية إدارة مخاطر من أجل التحديد المنتظم للاختلالات والتهديدات التي تواجهها مواقع التراث، بالإضافة إلى الحد من تأثير عوامل الاضمحلال (الطبيعية والتي من صنع البشر). زيادة على ذلك، فإن الاستجابة لبعض التهديدات يمكن أن تجسد من خلال سن التشريعات، وترسيم حدود الممتلكة، ووضع التوجيهات والأنظمة المتعلقة باستخدام الأرض وتحديد منطقة عازلة (كما هو موضح في قسم دراسة البتراء).

سوف تخدم منهجية تقييم المخاطر كأداة وأطار لتحديد المخاطر، ولقييم مدى تأثيرها، ودرجة الضعف الذي تعاني منه الصروح الموجودة في مواقع التراث، بالإضافة إلى اقتراح استراتيجيات للتخفيف من حدة المخاطر. وبالإمكان ترتيب الأماكن التراثية المعرضة للخطر بحسب أهميتها وبحسب حجم الخطر، وذلك ليتسنى لمدراء المواقع وللسلطات المعنية التخطيط لتقييم الصروح والمناطق المعرضة للخطر بشكل أكثر عمقاً. وبناء على هذا الترتيب للأولويات وعلى دراسات الجدوى الاقتصادية يتم صنع القرارات بشأن استراتيجيات التخفيف من حدة المخاطر.

وستمنح هذه الدراسة التوجيه والمنهجية اللازمين لوضع وتطبيق استراتيجية إدارة المخاطر للمواقع التراثية، بالإضافة إلى استخدامها كأداة عملية بيد مدراء المواقع التراثية والمهنيين العاملين فيها وغيرهم من المهتمين بالشؤون الإدارية المتعلقة بها. كذلك فإن العمل الميداني والدراسة المتعلقة بالبتراء يهدفان إلى إعطاء السلطات المعنية بمحمية البتراء الأثرية والمسؤولة عن إدارتها وصونها فهماً أساسياً للمخاطر المحدقة بالموقع، ومقترحاتٍ لكيفية استخدام هذه الأداة، وكيفية دمجها في خطط إدارة الموقع.

ويعتزم هذا المنشور وضع نهج أكثر انتظاماً للحفظ والتخطيط الإداري. إن الخطوات المختلفة المقدمة والتركيز على الحاجة إلى الوقاية والتخطيط والرصد هي الأصل في المحافظة على التراث والتخطيط الإداري ووضع المناهج. ومع ذلك، فإن نهج إدارة المخاطر المطروح هنا يدرس طريقة محددة من شأنها أن تسمح لاتباع نهج أكثر انتظاماً لصيانة المواقع وحفظها. عن طريق تحديد وتقييم أسباب وآثار المخاطر، والاستجابة للحد من آثارها، ومن الممكن للمخاطر أن تعالج أو أن يقضى عليها، مما يحقق نتائج أفضل في نهاية المطاف.

وتكشف نظرة متعمقة في المراجع عن وجود عدد كبير من الأبحاث المنشورة حول تحديد وطبيعة المخاطر الموجودة في مواقع التراث. وكذلك فقد عقدت العديد من الدراسات حول كيفية الوقاية من تلك المخاطر وإدارة الكوارث. وحيث أن الكوارث لا يمكن تجنبها، وتتضمن أحداثاً مدمرة، فإن هذه الدراسات العديدة أجريت لتطوير الأطر والتخطيط للتخفيف من آثار الكوارث. والأحداث الطبيعية المتكررة والقاسية كالفيضانات والانهيارات الأرضية والزلازل والحرائق وغيرها من التهديدات تشكل مصدراً رئيسياً للإضرار بسلامة التراث. إن دراسة "دليل التراث المرجعي لإدارة مخاطر الكوارث للتراث العالمي

(WHC. 2010)، ودراسة "الاستعداد للمخاطر: دليل لإدارة التراث العالمي (Stovel. 1998)" ليستا سوى مثالين لدراسات حول إدارة مخاطر الكوارث والتي تهدف لرفع مستوى الوعي بين مدراء المواقع والمجتمعات المحلية حول التحديات التي تواجهها المواقع التراثية.

وبالرغم من أهمية موضوع إدارة المخاطر الكارثية بالنسبة لإدارة المخاطر في مواقع التراث، فإن هذه النشرة ستمنح مدراء المواقع التراثية المنهجية المنتظمة اللازمة لتقييم وإدارة أنواع مختلفة من المخاطر المحدقة بالمواقع التراثية، وذلك دون الاقتصار على المخاطر الكارثية، وسيتم التركيز في هذا الكتاب على إعطاء منهجية تأخذ بعين الاعتبار الأنواع المختلفة للمخاطر، بما فيها المخاطر الطبيعية والبشرية، والمخاطر الفجائية الكارثية، وتلك البطيئة التراكمية.

وقد قامت مجموعة من الخبراء في مجال التراث على إعداد هذه النشرة، وهم كمهنيين تراثيين يتعاملون مع المخاطر باعتماد منهاج السلامة التراثية الثقافية. وبالرغم من أن الكثير من جوانب المنهاج تركز على سلامة التراث، فإن هذه النشرة تبنت منهجاً تكاملياً يشمل المخاطر التي يتعرض لها الزائرون والمشاهد الطبيعية، بقدر الإمكان.

وينقسم الكتاب إلى جزئين رئيسيين: الجزء الأول هو الجزء النظري، حيث تم توصيف منهجية المخاطر مع خطواتها المختلفة، والجزء الثاني، وهو جزء الدراسة، والذي يطرح تنفيذ المنهجية في موقع البتراء.

أما فيما يتعلق بدراسة موقع البتراء للتراث العالمي، فإنها لم تشمل كل الموقع، وإنما اقتصرت على منطقة نموذجية مختارة، وذلك لأسباب ضيق الوقت والموارد. ومع ذلك فإنها تعد محاولة أولى لإنجاز هدف أكبر وهو أن يتم اختبارها وتطبيقها في مواقع مختلفة وبالاستعانة بخبراء عدة، لتطويرها بالقدر اللازم.

ومن المسلم به أن المنهجية المقترحة تستخدم نماذج (رقمية) معقدة والتي ينبغي استيعابها وتطبيقها كما هي، وبالتالي لابد وأن تكون مصحوبة بالتدريب عليها. ولقد كان تطبيق المنهجية لدراسة حالة موقع البتراء –والذي سيتم شرحه في قسم دراسة الحالة– مصحوباً بسلسلة من المحاضرات والدورات التدريبية لمدة يومين قبل بدء العمل الميداني. وكانت تلك الدورة التدريبية متعلقة بمنهجية العمل الميداني المقترحة، بالإضافة إلى محاضرات حول خلفية العمل قدمها خبراء ذوو صلة بموقع البتراء. ومع ذلك، فإنه ينبغي الاقرار بأن يومين من التدريب على هذه المنهجية لا تكفي، وأن الدورات التدريبية ينبغي أن تكون مكثفة أكثر، من أجل الإلمام بالنهج النظري والتطبيقي، بالإضافة إلى الحصول على لمحة عامة عن المخاطر المعقدة والتقييمات اللازمة والمقترحة في المنهجية. كما ينبغي التخطيط لتدريب منظم على أرض الموقع لفرق العمل الميداني، ومدرائهم، وموظفيهم، من أجل اعتماد منهجية لإدارة المخاطر في موقع البتراء.

منهجية إدارة المخاطر في موقع البتراء

بالرغم من مكانتها كموقع للتراث العالمي منذ عام ١٩٨٥، وكونها أكثر المواقع التراثية زيارة في الأردن فإن البتراء مهددة حالياً بمخاطر متعددة من حيث النوع والحدة. وبسبب كل من الأخطار الطبيعية والبشرية التي تواصل تهديدها التدريجي لسلامة الموقع وطبيعته الهشة، فإنه تم إدراج موقع البتراء في قائمة المواقع التراثية الأكثر عرضة للخطر في العالم، وذلك لأربع سنوات متتالية (١٩٩٦ و١٩٩٨ و٢٠٠٠ و٢٠٠٢)، وهي قائمة يتولى إعدادها الصندوق العالمي للمعالم والتراث.

ويؤثر على الموقع عنصران ذاتيان للضعف بالإضافة إلى ازدياد في مستوى المخاطر الخارجية -الطبيعية والبشرية-. وكذلك فإن الحجارة الرملية التي تشكل المعالم تتعرض للتآكل بسبب الرياح والماء، بالإضافة إلى أن السياحة والتطور العمراني والأنشطة البشرية غير المنضبطة في الممتلكة كلها أسهمت كثيراً من تدهور حالته. ففي السنوات الأخيرة تجاوز عدد السياح القدرة الاستيعابية التي تنصح بها خطة الإدارة التي وضعتها اليونسكو عام ١٩٩٤. وتشكل الأعداد الكبيرة للسياح إلى جانب عدم وجود تنظيم كاف لحركتهم في المسارات وعند النصب التذكارية، وحركة السياح غير المنضبطة في الممتلكة؛ أسباب الخطر الرئيسية على المعالم الأثرية. بالإضافة إلى أنه لم يتم تقييم الصروح والمناطق الأثرية التي في الموقع، ولم يتم وضع استراتيجيات تخفيف مناسبة.

ومن أكبر المخاطر التي تهدد سلامة الموقع عدم تعيين حدود للموقع والمنطقة العازلة ضمن خارطة أساسية، حيث أنه في الوقت الذي تم إدراج الموقع في قائمة التراث العالمي لم تكن هناك متطلبات لتعيين حدود الموقع والمنطقة العازلة. وحالياً فإنه وبالرغم من النداءات المطالبة بعمل جرد بأثر رجعي لتحديد الفجوات ومواطن النقص في ملفات ترشح المواقع لقائمة التراث العالمي (WHC, 2004)، فإن جهوداً متناثرة تمت لوضع حدود مناسبة لموقع البتراء. أما المنطقة العازلة فإنه لم يتم حتى الآن بذل جهود بشأنها، كما لم يتم تفعيل إطار واضح لحقوق استعمال الأراضي من قبل القبائل والمجتمعات المحلية.

ومن أجل معالجة هذه الأمور تم وضع العديد من الاتفاقيات والاستراتيجيات المتعلقة بالبتراء، لكن بسبب عدم وجود التمويل الكافي و/أو التخطيط بعيد المدى والحوافز، فإن أياً من الخطط الإدارية والسياحية التي تمت صياغتها بشأن البتراء لم يتم تطبيقها بالكامل، كما لم يتم اعتمادها رسمياً، واكتفي بتفعيل القليل من التدابير. ولكي يتم التعامل الصحيح مع هذه الظواهر، فإنه ينبغي تطوير عدد من الأنشطة، كوضع خارطة أساسية للموقع، ووضع أنظمة إدارية تهدف إلى تحسين جهود المحافظة على الموقع، وإدارة السياحة بشكل مستدام، وتعزيز مشاركة المجتمع المحلي.

إن الأمور المذكورة أعلاه من عدم تطبيق خطة إدارية، وعدم كفاية استراتيجيات إدارة الزوار، وعدم

وجود حدود واضحة للممتلكة على الأرض، يمكن تعيينها كفجوات كبيرة في إدارة الممتلكة، مسببة المزيد من المخاطر. والمطلوب هو وضع منهج منتظم وشمولي لإدارة وحفظ الممتلكة، ابتداء من البحث في مجال إدارة المخاطر وتحديد المخاطر وترسيمها ومراقبتها من أجل صون الممتلكة ككل وحفظها بشكل أفضل، وحماية قيمتها وتكامليتها.

مشروع ترسيم المخاطر في موقع البتراء

نظراً لتنوع الإشكالات التي تواجهها محمية البتراء الأثرية فإنه ينبغي وضع وتنفيذ استراتيجية مشتركة توفر الحلول على مختلف المستويات. وقد تم تعيين آليتين على أنهما الأكثر ملاءمة لتخفيف المخاطر وحماية قيمة موقع البتراء، وهما: تقييم المخاطر، والبحوث في مجال إدارة المخاطر. وفي الوقت نفسه، فإنه ينبغي أن يكون تقييم المخاطر جزء من الخطة الحالية لإدارة الممتلكة وحفظها، مستعملين في ذلك أسلوب المقارنة بين مختلف الخطط القائمة بذاتها والمتعلقة بالممتلكة (اليونسكو ٢٠١٠، ص ١٧). وتعتبر منهجية إدارة المخاطر خطوة تمهيدية تصب في الخطة العامة لإدارة الممتلكة (اليونسكو ٢٠١٠). وقد لاقى هذا النهج ترحيباً من قبل السلطات المحلية والتي تقر بوجود فجوة في إدارة الموقع، والحاجة الماسة إلى التصدي لذلك.

من هذا المنظور، قام مكتب اليونسكو في عمان بعمل مشروع تحديد وتقييم المخاطر في محمية البتراء الأثرية، وذلك بالتعاون مع مركز ريمون لومير الدولي للترميم التابع لجامعة لوفين الكاثوليكية، وبالتنسيق مع سلطة إقليم البتراء للسياحة والتنمية، ودائرة الآثار العامة في الأردن.

ويتكون المشروع من مراحل مختلفة، وله ثلاثة أهداف رئيسية:

- الترسيم الفني الميداني لحدود ممتلكة التراث العالمي.
- وضع إطار عام للمبادئ التوجيهية واللوائح المتعلقة باستخدام المنطقة العازلة المقترحة.
- تعريف معايير وفئات المخاطر، وترسيم مقترح لاستراتيجية إدارة المخاطر.

تم البدء بتقديم مقترح منهجية لإدارة المخاطر من أجل استخدامها كأداة للمحافظة على واقع التراث وإدارتها وصيانتها، بالإضافة إلى تنمية تلك المواقع، وذلك عن طريق وضع الخطوط العريضة لمنهجية إدارة المخاطر في موقع البتراء. ويعتبر هذا الكتاب نتيجة وإنجازاً مهمين من إنجازات هذا المشروع، والذي يسعى إلى توفير إطار التحديد المتواصل ورصد الأخطار، والتأثيرات، وجوانب الضعف، ومعدل تدهور الموقع التراثي.

بعد إجراء بحث مرجعي دقيق، قام معدّو هذه الدراسة بوضع منهجية لإدارة المخاطر، وذلك من أجل

وضع نهج منتظم لتقييم وإدارة المخاطر. وقد تمت مراجعة مسودة المنهجية من قبل السلطات المحلية وخبراء محليين ودوليين في مجال المحافظة على التراث، وذلك ضمن عدة اجتماعات مائدة مستديرة. ثم تم تنقيح المنهجية بإضافة عدة ملاحظات وتعليقات، وفي نهاية المطاف تمت المصادقة على الوثيقة المنقحة من قبل الجهة المختصة، ضمن ورشة عمل خصصت لذلك.

هذه المنهجية طبقت على منطقة تجريبية في البتراء خلال أسبوعين من العمل الميداني في خريف عام ٢٠١١، وذلك لتقييم مدى فعاليتها وملاءمتها.

ويستند النهج الذي تقترحه هذه الدراسة لإدارة المخاطر على مفهومين، تم وضعهما في الأصل لتقييم المخاطر التي تتعرض لها الحرف اليدوية ومجموعات التحف. والمفهومان هما: مفهوم الحفظ الوقائي في المتحف الكندي للطبيعة الذي وضعه ونفذه "والر" (٢٠٠٣)، ومفهوم آخر مشابه اقترحه المعيار الأسترالي/النيوزيلاندي لإدارة المخاطر (٢٠٠٤)، والذي اعتمد من قبل المركز العالمي للمحافظة على الممتلكات الثقافية وترميمها، كما تم اعتماده من قبل المعهد الكندي للصون والمعهد الهولندي للتراث الثقافي (CCI-ICN) في دوراتهما التدريبية حول الحفظ الوقائي لمجموعات التحف، وتقليل المخاطر التي تتعرض لها. كما تم تكييف وتحسين هذين المفهومين ليتم تطبيقهما على البتراء، وعلى بيئات تراثية أخرى شبيهة.

أما من حيث منهجية التوثيق، فقد تم استخدام قاعدة البيانات الجغرافية لآثار الشرق الوسط-الأردن (MEGA-J)، وهي عبارة عن هجين من قاعدة بيانات جغرافية ونظام لإدارة المخزون الوطني الأردني، في العمل الميداني، وذلك كأداة لتوفير البيانات الجغرافية (خرائط)، ورسم خريطة الآثار قيد الدراسة مع الإحداثيات على وجه الدقة [١].

[١] المزيد من المعلومات حول MEGA-J على موقع www.megajordan.org

١ إدارة المخاطر في المواقع التراثية

١,١ ما هو الخطر؟

تعرف المخاطر بأنها احتمالية حدوث نوع معين من الضرر (بول، وات، ٢٠٠١). وتنتج المخاطر عن تهديدات طبيعية أو بشرية. أما المخاطر الطبيعية فتكون أحياناً مفاجئة وكارثية، كالفيضانات والزلازل، وأحياناً أخرى تكون بطيئة ومستمرة وتراكمية، كعوامل التعرية الناتجة عن السياحة. أما المخاطر التي من صنع الإنسان فتنتج عن العديد من الأنشطة البشرية، كالتطور العمراني والسياحة وسوء الإدارة والإهمال وقلة الصيانة. ويعتمد أثر المخاطر التي تتعرض لها مواقع التراث على المواصفات الخاصة بتلك المواقع، ومواطن الضعف الأصيلة فيها.

١,٢ ما هي إدارة المخاطر

إدارة المخاطر هي عملية تحديد وتقييم وتحليل للأضرار المتوقعة والمحتملة على مواقع التراث، ووضع استراتيجيات التخفيف للحد من مخاطر وقوع أضرار. ويستعمل صناع القرار في العديد من المجالات الأخرى هذا النهج للحد من الخسائر. وبعبارة أخرى، فإن إدارة المخاطر هي عملية صنع القرار التي تعقب تقييم المخاطر (بول، وات، ٢٠٠١). فهي عملية تنطوي على تقليل الخسائر والتأثيرات التي تتعرض لها أهمية المواقع التاريخية والأثرية، بحيث يتم التوصل إلى توازن بين اكتساب الفرص وفقدانها. وسيوفر اعتماد وتطبيق نهج إدارة المخاطر من قبل المنظمات والمؤسسات المعنية بإدارة المواقع التراثية وسيلة منظمة تنظيماً جيداً لمساعدتهم في صنع قراراتهم المتعلقة بالحفاظ عليها والتخطيط الإداري لها.

التخطيط هو العنصر الرئيسي لصنع القرار في هذه العملية. وكما هو مبين في الشكل رقم ١ فإن حماية وصون الأماكن التراثية للأجيال القادمة ينطوي على صنع القرارات "الجيدة" كنتيجة للتخطيط الدقيق (ديماس، ٢٠٠٢)، وتؤدي هذه العملية إلى إنهاء وتباطؤ تأثير التغير الذي يؤثر في أهمية وتكاملية المعالم الأثرية، وبالتالي تؤثر في زوار المواقع التراثية.

(الشكل رقم ١: توضيح التغيرات في المواقع التراثية)

وتسهم عملية التخطيط في فرز طبقات متعددة لتقييم التراث، ثم تحديد الأولويات ضمن القضايا المتنوعة التي تواجه المواقع التراثية، وشرح وتبرير القرارات المتعلقة بها، وضمان ديمومة نتائج تلك القرارات. وكما قال ديماس (٢٠٠٢): إن هذه العملية هي فرصة للجمع بين مختلف الجهات الفاعلة وأصحاب المصلحة المعنيين بمواقع التراث من أجل تقييم الأهمية والحالة، وتحديد أولويات إدارية لحماية الموقع للأجيال المقبلة. فقد أصبح من الواضح بشكل متزايد أن التراث لا يمكن له أن يبقي على معناه، ولا أن يستمر في البقاء إلا إذا كان هناك قدرة على تحمل المسؤولية، وعمل وسائل لذلك من قبل الجهات المعنية.

وحتى يتسنى للمدراء والسلطات التخطيط لعمل تقييم أكثر عمقاً لتلك الآثار ذات الأهمية الكبيرة أو المناطق المعرضة للخطر، فإن تقييماً للمخاطر يأخذ في الاعتبار سياق موقع يمكن أن يكون أداة لوضع أولويات للمعالم المعرضة للخطر. وعلى أساس تلك الأولويات يمكن اتخاذ القرارات من خلال تحديد استراتيجيات التخفيف المناسبة وتقييم تكاليفها وفوائدها. وبالتالي، فإن وضع استراتيجية لإدارة المخاطر سيكون أداة صنع القرارات المتعلقة بالحد من الأضرار المحتملة، والحفاظ الأفضل على الممتلكة. إن وضع استراتيجية من هذا القبيل كجزء من خطة إدارة وصيانة شاملة لمواقع التراث يمكن أن يساعد مدراء الموقع في الاستخدام الفعال لمواردهم.

١,٣ النهج والمنهجية

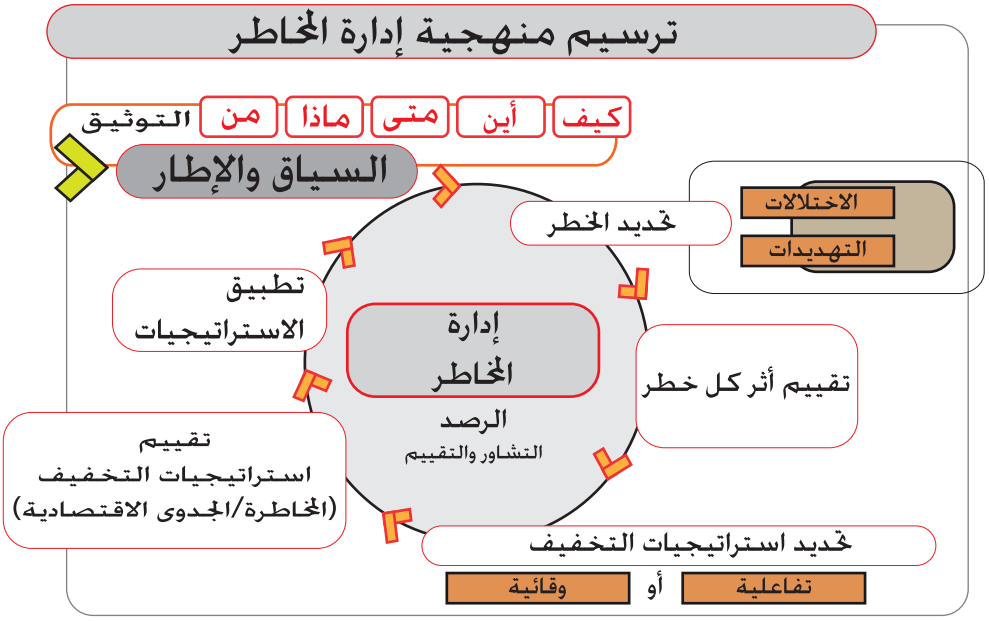
كما ذكر آنفاً، فإن هذا النهج لإدارة المخاطر يستند على مفهومين، تم وضعهما في الأصل لتقييم المخاطر التي تتعرض لها الحرف اليدوية ومجموعات التحف. والمفهومان هما: مفهوم الحفظ الوقائي في المتحف الكندي للطبيعة الذي وضعه ونفذه "والر" (٢٠٠٣)، ومفهوم آخر مشابه اقترحه المعيار الأسترالي/النيوزيلاندي لإدارة المخاطر (٢٠٠٤). وقد تم تعزيز هذين النهجين ليتم تطبيقها على مواقع التراث لتطوير وتوفير وسيلة منهجية لتحديد وتقييم المخاطر وإدارتها. إن منهجية إدارة المخاطر هي جزء لا يتجزأ من خطة الإدارة، وتهدف إلى تحسين صيانة المواقع، وإدارة السياحة، وإلى تعزيز مشاركة المجتمع المحلي.

ضمن هذا الاقتراح فإن التطبيق المنهجي لعملية إدارة المخاطر (الشكل ٢) يتضمن ست خطوات هي: (١) تحديد الإطار والنطاق، بما في ذلك استعراض الوثائق، فضلاً عن تقييم إطار القيمة والحالة والإدارة، (٢) تحديد المخاطر، (٣) تقييم تأثير كل خطر، (٤) تحديد استراتيجيات التخفيف المحتملة، (٥) تقييم المخاطر واستراتيجيات التخفيف على أساس تحليل الجودة الاقتصادية، ومن ثم (٦) تنفيذ الاستراتيجيات (الوقائية أو التفاعلية) لمعالجة المخاطر. وعلاوة على ذلك، فإن هناك نوعين من المكونات الدائمة العضوية في عملية إدارة المخاطر، وهما: الرصد، والاتصال والتشاور مع مختلف الجهات المعنية.

بالإضافة إلى الخطوات الست المذكورة أعلاه، وبالنظر في خطط الإدارة المختلفة والتي تقوم على ميثاق بورا، وعلى مخطط ديماس للتخطيط الإداري (٢٠٠٢)، تم تعيين عنصرين مهمين لعملية التخطيط، ولعملية إدارة المخاطر. هذان العنصران هما: تقدير القيم، وتقييم حالة الموقع، والتي يتم التقليل من أهميتها في بعض الأحيان، هما أيضاً من الخطوات اللازمة التي يجب اتخاذها قبل البدء في الجزء الأساسي من عملية تقييم المخاطر. هذان العناصران الأساسيان يسهمان في التعرف على حالة تكاملية المواقع التراثية. ولذلك، فإن نجاح تقدير وتقييم المخاطر سيعتمد على القدرة على فهم القيمة، والحالة الفعلية للموقع وعناصره[٢] ومميزاته، والتعرف عليها.

وتجدر الإشارة إلى أن تقييم الحالة لا يجب أن يتم بالضرورة قبل تقييم المخاطر، بل يمكن أن يتم كل منهما في نفس الوقت. وسيتم تفصيل ذلك بقدر أكبر في قسم دراسة حالة موقع البتراء.

[٢] للحصول على تعريف مصطلحي "الموقع" و"عنصر الموقع" في هذه النشرة يرجى الرجوع إلى قائمة المصطلحات الموجودة في نهاية النشرة.



(الشكل ٢: نهج إدارة المخاطر)

١,٣,١ فهم و تقييم القيمة

التراث، سواء كان ثقافياً أو طبيعياً، فإنه يصنف على أنه تراث نظراً لكونه شيئاً أو مكاناً أو منطقة طبيعية ذات قيمة عند شعب ما أو عند أصحاب المصلحة أو أية جهات معنية. من أجل العثور على أفضل طريقة لحماية التراث، فإنه من المهم معرفة القيم وأصحاب المصلحة[٣] الذين يعطون هذه القيم للتراث.

لقد أصبح تقييم التراث جزء أساسياً من المحافظة عليه، وذلك من خلال التجربة الواقعية وبحسب عدد من الوثائق. فعلى سبيل المثال، توجد وثيقة نارا المتعلقة بالأصالة (١٩٩٤) والتي تسلط الضوء على أهمية القيم الثقافية والاجتماعية للتراث الملموس وغير الملموس، وهناك أيضاً إعلان سان انطونيو (١٩٩٦) الذي شدد على أهمية القيمة الاجتماعية للموقع وليس فقط النسيج الملموس، والعلاقة بين الهوية الثقافية والأصالة، وكذلك فإن ميثاق المجلس العالمي للمعالم والمواقع – بورا (١٩٩٩) حدد المغزى الثقافي وأهميته في إدارة التراث والحفاظ عليه. وعلاوة على ذلك، فإن القيم والمشاركة التي يدلي بها أصحاب المصلحة فيما يتعلق بعملية التخطيط هي في صميم عملية صنع القرار على النحو الذي اقترحه ديماس (٢٠٠٢)، وميسون (٢٠٠٠)، وسوليفان (١٩٩٧). وبناء على هذه القرارات، وبعد جمع المعلومات، فإن من الخطوات الضرورية في مرحلة التقييم فهم وتحديد قيم للموقع. وهذه القيم يجب أن تكون معلومة

[٣] إن مصطلحي "أصحاب المصلحة" و "الجهات المعنية" لهما نفس المعنى: أي فرد أو مجموعة من الناس الذين لهم مصلحة في حماية موقع ما (بغض النظر عما إذا كانت تملك الموقع أم لا) وتنميته والمحافظة عليه.

ومحافظاً عليها من قبل جميع أصحاب المصلحة بما في ذلك مدراء الموقع، فإنه يجدر بالمدير أن يكون على علم بالسبب الذي من أجله يستحق المكان أن يحافظ عليه. وسيكون هذا بمثابة أداة لتحديد ما يجب الحفاظ عليها وصيانته، بالإضافة إلى معرفة كيفية تخصيص الموارد وتحديد أولويات أعمال الصيانة الأخرى.

ويمكن استخدام مصادر معلوماتية مختلفة لتقييم المواقع التراثية، فإن كل جزء من التراث يتضمن معنى مختلف وقيمة محتملة، باختلاف الناظر إليه. ومعرفة وجهات النظر المختلفة هذه تساعد في فهم وتفسير الموقع بشكل أفضل. لا ينبغي أن تبنى القرارات الإدارية في الموقع على مصالح الجماعات الصغيرة، بل إنه بالإمكان تحقيق نتائج أفضل عندما تتعاون كل الجهات المعنية، بما في ذلك السلطات الوطنية، وخبراء علم الآثار وطرق المحافظة عليها، والباحثين، والمجتمع المحلي، والقطاع السياحي، من أجل إيجاد قاسم مشترك بين مصالحها المختلفة. يقول دي لا توري (٢٠٠٥) إنه من خلال إشراك المزيد من الجهات المعنية، ومحاولة تحقيق التوازن بين المصالح المختلفة سيكون من الممكن منع تضارب المصالح، وتقديم حماية وتقييم أفضل للموقع. وكذلك فإن عملية التقييم تحتاج إلى استعمال نهج المقارنة لتقييم أهمية معلم معين في سياق الآثار الأخرى وبقية الموقع ككل، وفي سياق بقية المواقع في المنطقة.

إن القيم المناطة بالآثار والأماكن والمناظر الطبيعية هي في صميم خطط الحفظ، بالتالي فهي في صميم منهجية إدارة المخاطر هذه. إن المخاطر تحمل في طياتها خطراً على الأشياء التي هي ذات قيمة لنا، ومواجهة هذه المخاطر إنما يعني تحديد تلك الأشياء القيّمة بالوضوح الكافي لاتخاذ القرارات بشأنها (فيشكوف، كادفاني، ٢٠١١). وبالتالي، فإن دراسة ترتكز على القيمة هي الخطوة التمهيدية لتقييم تأثير المخاطر، وتحديد الأولويات، وتطبيق استراتيجيات التخفيف من حدتها. إن نتائج هذه الدراسة والتي تستخدم أنظمة تقييم معترف بها دولياً، يمكن أن تكون مؤشراً على مستوى التكاملية المطلوب من أجل الحفاظ على هذه الممتلكة التراثية الهامة.

١,٣,٢ تقييم الحالة

إن دراسة مرتكزة على قيم مواقع التراث تتماشى مع تقييم الحالة، والتي سوف تسمح بتقييم الحالة الملموسة للموقع، وعنصره ومزاياه، فقد أكد ديماس على أن نتيجة "دراسة الحالة" تمثل "أرشيف للوثائق المرسومة والمكتوبة التي تمثل البيانات الأساسية للموقع، والتي يمكن استخدامها لتقديم توصيات الاستخدام المستقبلي له، ومعالجته، ورصد التغير مع مرور الزمن" (٢٠٠٢: ٣٩). كما أشارت أيضاً إلى أن تقييم الحالة يتكون من ثلاث مراحل أساسية: (١) جمع المعلومات والوثائق التاريخية، (٢) التقييم البصري وتسجيل الحالة الملموسة، (٣) تحليل الحالة وتشخيصها.

أولاً، إن المرحلة الأولى من مراحل تقييم الحالة هي توثيق وجمع المعلومات الحالية. باستعمال الصور القديمة للموقع، والسجل السابق للرصد والحالة، وتقارير أعمال الحفر، وغيرها من الوثائق المحفوظة ذات الصلة، يصبح من الممكن فهم وتحديد التغييرات مع مرور الوقت. ثانياً، إن تسجيل الوضع الحالي والذي يتضمن تقييماً لما هو موجود، يستند في المقام الأول على تقييم واضح للحالة الفعلية. في هذه المرحلة فإن السبب ليس ذا أهمية، ولكن مدى التأثير هو المهم. إن الاختلالات والآثار السلبية الواضحة والتي يمكن الكشف عنها هي ما يجب تسجيله في هذه المرحلة. أخيراً، يرتبط التحليل والتشخيص بدراسة الوضع الحالي وتحليله من أجل تحديد الأسباب المحتملة لتدهور الموقع – وهو ما نسميه عوامل التدهور. وتتطلب هذه المرحلة اتباع نهج متعدد التخصصات من خلال تحليل المعلم أو الموقع ككل، وذلك باستخدام المعرفة والخبرة لدى متخصصين في المجالات ذات الصلة، مثل الجيولوجيا والهيدرولوجيا، والحفظ، والمعمار، وغير ذلك.

وكجزء من عملية تقييم المخاطر، يساعد تقييم الحالة على التعرف على الاختلالات الموجودة -كمؤثرات حالية- وتقديم معلومات عن الحالة الفعلية للعناصر أو المواقع. وعلاوة على ذلك، فإنه يساعد على تحديد الأسباب الماضية (أو العوامل) التي سببت الاختلالات، في حين يتنبأ تقييم المخاطر بالتهديدات المستقبلية، والتأثيرات السلبية المحتملة للعوامل المحتملة (تايلور ٢٠٠٥). وبالتالي فإنه لا يمكن تعيين التهديدات المستقبلية بسهولة دون تقييم الاختلالات الفعلية وحالة الموقع وعناصره. وبعبارة أخرى، يمكن للأثر المرئي للمخاطر أن يشاهد ويقيم من منظور الوضع الحالي، مما يجعل تقييم الحالة جزء مهماً لا يتجزأ من تقييم المخاطر.

وعلاوة على ذلك، فإن من المهم أن يوضع في الاعتبار أثناء عملية التخطيط أن يحدد مستوى التفاصيل المطلوبة عند تسجيل حالة الموقع أو المنطقة قيد الدراسة. وبالنسبة للمواقع الكبيرة فإنه قد يكون من المجدي دراسة مناطق مختارة أو دراسة المعالم التي تحتاج إلى تقييم أكثر تفصيلاً، والتي تمثل جزء آخر من الموقع. إن هذا الأمر مهم لإدارة المخاطر في المواقع، ذلك أن هذا النهج يسعى إلى تحديد أولويات العمل على أساس تحديد المؤشرات، وقد تم استخدام هذا النهج لتحديد المنطقة النموذجية لدراسة حالة موقع البتراء، والتي تمت دراستها في قسم الدراسة.

(١) تقييم سياق إدارة المخاطر

قبل إجراء أي نشاط لتقييم إدارة المخاطر ينبغي جمع وتقييم الوثائق المتاحة حول الموقع التراثي، بما في ذلك السياق والمعايير، وذلك من أجل تحديد المخاطر الخارجية لمشروع تقييم المخاطر، وإعداد النطاق لبقية عملية إدارة المخاطر. ينبغي أولاً تحديد نظم ومناهج الرصد والصيانة التنظيميين (إن وجدت)،

ودراسة مدى فعاليتها. وينبغي تحديد جميع الوثائق بما في ذلك الخرائط والخطط، والوثائق المنشورة وغير منشورة التي يمكن أن تزود بالخلفية التاريخية والقانونية. ويمكن في هذه المرحلة تحديد الثغرات الموجودة في المعلومات حول الموقع على أنها بحاجة إلى بحث أكثر.

إلى جانب تقييم حالة قيمة الموقع ووضعه، فإنه لا بد من عقد دراسة شاملة لسياق إدارة الموقع من أجل تعيين جميع العوامل الأخرى ذات الصلة، بالإضافة إلى الحالة الملموسة للتراث والتي يمكن أن تؤثر على مستقبل صيانة وإدارة الموقع، والتي قد تعرض استدامة هذا النهج للخطر. وهذا ينطوي على تحديد وفهم الأمور المتعلقة بالحاكمية، والقضايا الاجتماعية والاقتصادية والبيئية (الداخلية والخارجية للمنظمة)، مثل:

- وضع السياسات والأهداف التنظيمية
- الهيكل التنظيمي للمنظمة
- السياق القانوني للموقع بخصوص الحدود والمناطق المحمية، واستعمالات الأراضي، وأنظمة
- تقسيم المناطق، والأنظمة والسياسات المتعلقة بالمنطقة العازلة
- القدرات المالية للمنظمة
- موظفي المنظمة ومستوى خبراتهم الفنية
- تحديد أصحاب المصلحة والمجتمعات المحلية
- البنية التحتية وخطط التنمية

النقاط التنظيمية المذكورة أعلاه ستساعد في فهم احتياجات مشروع المخاطر، ولضمان أن النظام التنظيمي لديه القدرة على تطبيق التدابير المقترحة للتخفيف من المخاطر التي تم تعيينها، مما سيضمن استدامة المشروع منذ بدايته. إن إدارة المخاطر تحصل في سياق أهداف وسياسات المنظمة، ويعتمد قرار وضع استراتيجية التخفيف والمعالجة أو عدمه على الأهداف، والمعايير التقنية والمالية والاجتماعية والسياسية والبيئية وغيرها.

إن سياق إدارة المخاطر وتحديد نطاق أنشطة المشروع ومداها، ومدى المنطقة قيد الدراسة، ومستوى التفاصيل في تقييم المخاطر، والإطار الزمني للمشروع، وسمات الفريق القائم على إجراء التقييم، وأدوار ومسؤوليات مختلف الفاعلين في عملية إدارة المخاطر هي كلها من ضمن الأمور التي يجب أن يتم تأسيسها.

تحديد النطاق

ينبغي تحديد نطاق أنشطة المشروع ومداها قبل البدء بتقييم المخاطر. وينبغي تعريف نطاق إدارة المخاطر من حيث مدى المنطقة والمعالم والهياكل التي سيشملها التقييم، بالإضافة إلى مستوى التفصيل، والفترة الزمنية، وتوصيف الأشخاص المعنيين.

مدى المنطقة

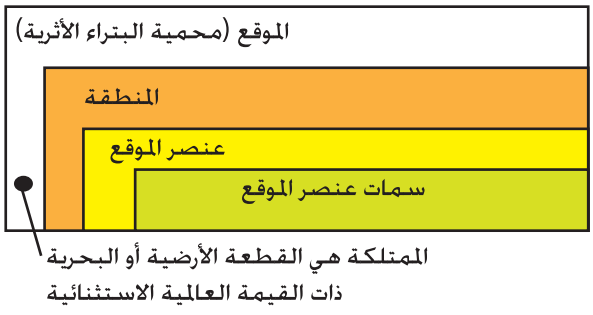
مدى المنطقة قيد التقييم يعتمد على توقيت وأهداف مشروع إدارة المخاطر. فإذا كان الهدف هو عمل إدارة مخاطر مفصلة جداً لهياكل مختارة، فإن مدى المنطقة يكون تلك الهياكل المحددة. وإذا كان الهدف هو عمل إدارة مخاطر للموقع بأكمله، وتطبيق نهج أكثر شمولاً، يكون المدى هو الموقع بأكمله. ومع ذلك، فإنه اعتماداً على درجة التعقيد الذي يتسم به الموقع، فإن التقييم يمكن أن يصبح أقل تفصيلاً. وإذا كان الموقع يغطي مساحات شاسعة من الأرض، يمكن تحديد مناطق ضمن الموقع كعينات تمثل المخاطر الوشيكة، والتي من شأنها أن توفر معلومات كافية لوضع استراتيجية إدارة المخاطر لمناطق أخرى في الموقع.

مستوى التفاصيل

هذا المقترح يقدم مستويات مختلفة من التفصيل من أجل جدولة نوعية التهديدات والاختلالات المؤثرة في المواقع التراثية. وقد تم تبيين هذه المستويات في الشكل رقم ٣. استناداً إلى التعريف المقدم من قبل J-MEGA وشركاء المشروع، فقد تم تحديد المستويات التالية:

- **الموقع**: وهو منطقة محددة فضائياً ومكانياً، وهي مكان ذو أهمية، وتحوي بقايا ملموسة لوجود ونشاط بشري بما في ذلك الملامح البشرية المشيدة والمستخدمة (منازل، ملاجئ، مقابر، أعمال حفر، محاجر، سواتر، قنوات، طرق، ورش عمل، الخ)، والتحف، وأية بقايا ملموسة أخرى سواء منتصبة أو محطمة أو مختفية تسهم في الهوية التاريخية والثقافية لمجموعة من الناس.
    - **ممتلكة التراث العالمي**: كما هو موضح في المادتين ١ و ٢ من اتفاقية التراث العالمي، فإنه يتم إضافة الممتلكة التراثية على قائمة التراث العالمي بناء على قيمتها العالمية الاستثنائية، والتي تتوفر بحسب توفر المعايير (أولاً) إلى (عاشراً). ويمكن لممتلكة التراث العالمي أن تكون ثقافية، وتشتمل على مواقع، ومجموعات من المباني والمعالم، سواء كانت طبيعية أو مختلطة (WHC، 2010، ص ٥٨).

- **المنطقة:** هذا المستوى يتعلق بتقييم المناطق التي سيتم تحديدها من قبل موظفي المشروع لتنفيذ تقييم المخاطر. يمكن لهذا المستوى أن يغطي الموقع كاملاً، أو عناصر منتقاة منه أو مناظر طبيعية أو كلاهما.
- **عناصر الموقع:** هذا المستوى يتعلق بعنصر مميز لموقع تراثي يحوي أدلة على وجود أنشطة بشرية (توجيهات MEGA-J) كالمعالم والهياكل المنتصبة والكهوف والمعالم الطبيعية، الخ.
- **خاصية عنصر الموقع:** يتعلق هذا المستوى بخصائص كل عنصر في الموقع، كالجدران والمنحوتات والمداخل والأرضية والسقف، الخ.

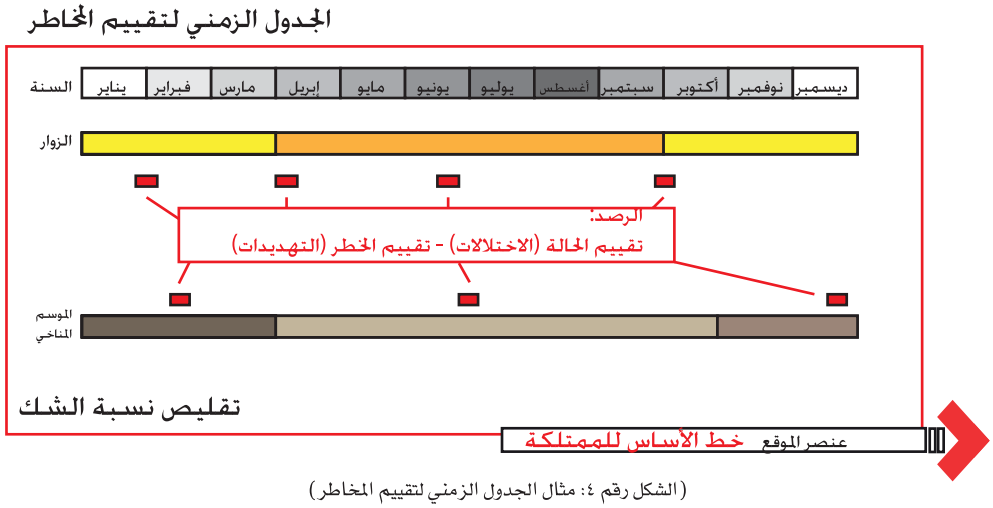


الموقع: منطقة محددة فضائياً، ومكان حدوث حدث هام، تحتوي على بقايا مادية لوجود ونشاط بشري بما في ذلك الملامح البشرية المشيدة والمستخدمة (منازل، ملاجئ، مقابر، أعمال حفر، محاجر، سواتر، قنوات، طرق، ورش عمل، الخ)، والتحف، وأية بقايا مادية أخرى سواء منتصبة أو محطمة أو مختفية والتي تسهم في الهوية التاريخية والثقافية لمجموعة من الناس.
المنطقة: هذا المستوى يتعلق بتقييم المناطق التي سيتم تحديدها من قبل موظفي المشروع لتنفيذ تقييم المخاطر. يمكن لهذا المستوى أن يغطي الموقع كاملاً، أو عناصر منتقاة من الموقع أو مناظر طبيعية أو كلاهما.
عناصر الموقع: هذا المستوى يتعلق بعنصر مميز لموقع تراثي يحوي أدلة على وجود أنشطة بشرية (توجيهات MEGA-J) كالمعالم والهياكل المنتصبة والكهوف والمعالم الطبيعية، الخ.
خاصية عنصر الموقع: يتعلق هذا المستوى بخصائص كل عنصر في الموقع، كالجدران والمنحوتات والمدخل والأرضية والسقف، الخ.

(الشكل رقم ٣: مستويات التفصيل في تقييم المخاطر)

الجدول الزمني

من أجل تحديد المخاطر الدقيقة في الموقع، ينبغي أن يتم التقييم بشكل دوري في أوقات مختلفة من السنة (على سبيل المثال المواسم المناخية و/أو السياحية)، مع الأخذ بعين الاعتبار حالة الطقس في المواسم المختلفة وأثرها على الموقع وعناصر الموقع. وكذلك فإنه يجب تقييم عدد الزوار ومدى تأثيرهم في المواسم السياحة المرتفعة والمنخفضة. ويبين الشكل ٤ هذه العلاقة وأهمية المراقبة المستمرة من أجل تقييم المخاطر للممتلكات وعناصرها.



(الشكل رقم ٤: مثال الجدول الزمني لتقييم المخاطر)

فريق تقييم المخاطر: الاختصاصات اللازمة

بشكل عام يجب على فريق العمل الميداني اعتماد نهج متعدد التخصصات. ولذلك فمن المهم أن يتضمن الفريق مهنيين، رجالاً ونساء، من خلفيات وحقول مختلفة، مثل علماء الآثار والمؤرخين وعلماء الجيولوجيا والمعماريين وعلماء المناظر الطبيعية، والترميم، والمهندسين، وعلماء المياه، وما إلى ذلك. كما ينبغي أن يتضمن الفريق مدير موقع أو ممثلاً عن السلطات المحلية. هؤلاء الأعضاء يجب أن يتم اختيارهم بعناية، ويجب أن يعملوا معاً كفريق واحد في جميع مراحل عملية تقييم المخاطر. أيضاً فإنه يحسن وجود فرد من المجتمع المحلي ضمن الفريق (بغض النظر عن جنسه)، فإن ذلك سيسهم في تحسين التقييم، لأن السكان المحليين لديهم أفضل ذاكرة حية لماضي الموقع وتاريخه وحالة عناصره عبر الزمن.

على الأقل ينبغي على أعضاء الفريق أن يكون لديهم إلمام مشترك بالمعايير التالية:

- المعرفة العامة بمواقع التراث
- فهم عميق للقيمة العالمية الاستثنائية لممتلكة التراث العالمي، ولقيم مواقع التراث المحلية، ولـ "تقرير الأهمية".
- فهم نوعية العناصر الأثرية الموجودة في الممتلكة (مثلاً: الهياكل المنتصبة والمنحوتة والمناظر الطبيعية).

معرفة شاملة بمنهجية المخاطر بما في ذلك ما يلي:

- الاختلالات والتهديدات وعوامل التدهور
- تقييم الحالة وعلاقتها بفقدان التكاملية
- تقييم المخاطر وتقدير حجمها
- استراتيجيات التخفيف الأولية: أساليب الرقابة

- المعرفة الفنية:

- مهارات الجرد
- معرفة معتدلة بمميزات تطبيقات نظم المعلومات الجغرافية (GIS).
- معرفة أساسية بتقنيات المسح، مثلاً: استخدام "Total Station"، ومعرفة معتدلة بالأجهزة المحمولة لنظم شبكات الأقمار الصناعية العالمية لتحديد المواقع (GNPSS)
- التصوير الفوتوغرافي الرقمي، وخصوصاً استعمال التصوير الشمولي (صور ٣٦٠ درجة ذات مرجعية جغرافية)
- وأن يكون ملماً بحزمة أوفس.

(٢) الكشف عن المخاطر

الاختلالات والتهديدات وعوامل التدهور

من أجل تعيين المخاطر فإنه لابد من تحديد العنصرين التاليين: ما يمكن أن يحدث والضرر المحتمل (التهديد)، وما هي الأسباب المحتملة (عوامل التدهور). عندما يتم تحديد فئات المخاطر، مثلاً: المؤثرات الطبيعية، وأنواع التهديدات الرئيسية كتآكل التربة، والرياح، فإن ذلك يساعد على تحديد التهديدات المحدقة بالموقع وتسجيلها بشكل أسهل. بالنسبة لهذا المنشور، فحيث أن منهجية المخاطر كانت في الأساس قد وضعت واختبرت ونفذت في موقع البتراء، فقد تقرر منذ البداية استخدام فئات التهديدات والاختلالات المتقدمة والموحدة في قاعدة MEGA-J للمواقع الأثرية في الأردن. وقد استخدمت هذه الفئات لتحديد وتسجيل حالة الموقع وعناصره والمخاطر التي تواجهها، ثم ربط البيانات الجغرافية بحالة المعالم الأثرية.

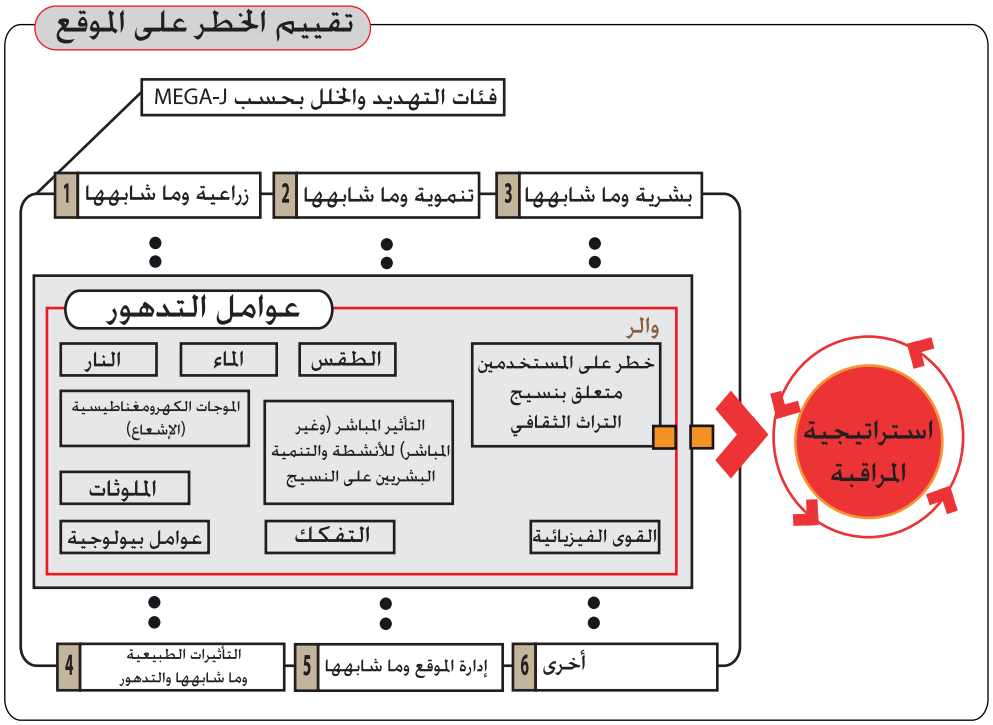
بحسب الـ (MEGA-J) فإن تعريف الاختلالات: أنها التأثيرات الحالية "التي يمكن الكشف عنها، ذات الأثر السلبي على الموقع أو على عناصر الموقع تتسبب بها قوى طبيعية أو أنشطة بشرية." أما التهديدات فهي: "الظواهر التي يمكن الكشف عنها سواء كانت ظواهر طبيعية أو أنشطة بشرية والتي تنذر بوقوع اختلال مستقبلي في الموقع أو في إحدى العناصر." وتقع التهديدات والاختلالات بحسب تعريف

(MEGA-J) ضمن ست فئات أساسية وهي: (١) زراعية، (٢) وتنموية، (٣) وبشرية، (٤) وطبيعة، (٥) وإدارية، (٦) وتأثيرات أخرى، كما هو مبين في الشكل رقم ٥. لمزيد من التفاصيل بشأن التهديدات من كل فئة، يرجى الرجوع إلى الملحق رقم ٩٩.

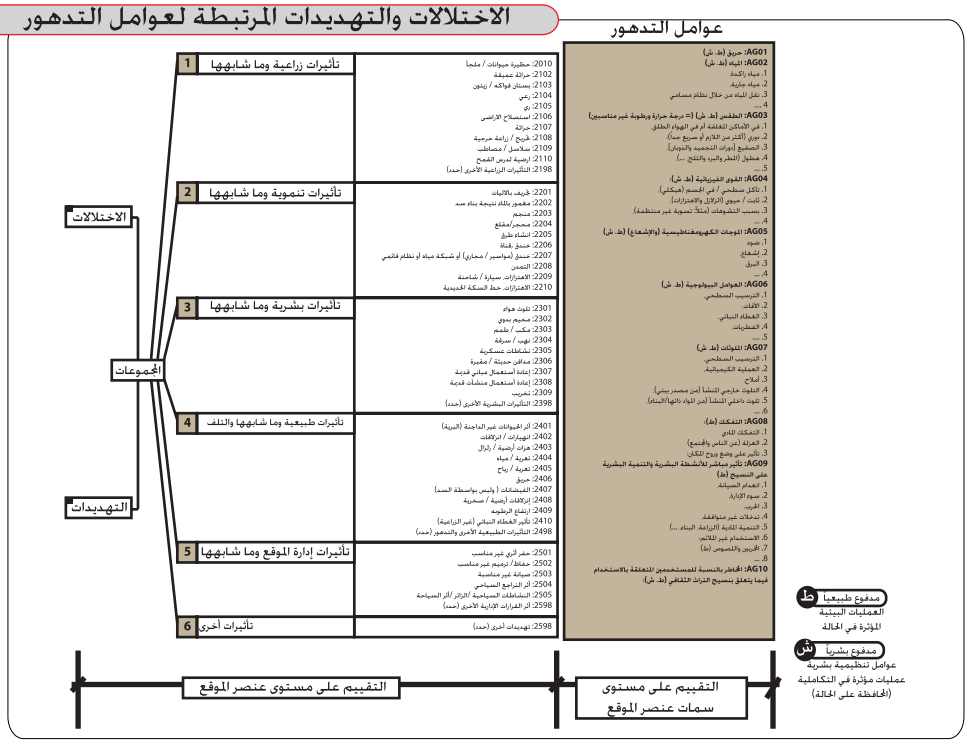
ويمكن استخدام هذه الفئات والمؤشرات المتعلقة بكل موقع من مواقع التراث، أو تلك التي وضعت لمواقع التراث في بلدان أخرى. كما بالإمكان تكميلها بواسطة فئات مشابهة كتلك المدرجة في المبادئ التوجيهية التشغيلية لتنفيذ اتفاقية التراث العالمي (٢٠١١)، كالعوامل التي تهدد القيمة العالمية الاستثنائية للممتلكة، ومنها: (أولاً) ضغوط التنمية (كالزحف العمراني، والتكيف، والزراعة، والتعدين) ، (ثانياً) الضغوط البيئية (كالتلوث، وتغير المناخ، والتصحر)، (ثالثاً) الكوارث الطبيعية ومدى الاستعداد للخطر (الزلازل والفيضانات والحرائق، وغيرها)، (رابعاً) الزيارة المسؤولة لمواقع التراث العالمي، (خامساً) عدد سكان الممتلكة والمنطقة العازلة.

كما هو مبين في الشكلين رقم ٥ و ٦، فإن الاختلالات والتهديدات بحسب MEGA-J، كمؤثرات قابلة للكشف، مرتبطة بعشرة من عوامل التدهور التي تستخدمها مبادرة فلاندرز لمراقبة المعالم[٤] (المبني على والر ١٩٩٥)، وذلك ليتم تحديد أسباب تلك الاختلالات والتهديدات. إن عوامل التدهور هي آليات وعمليات تسبب ضرراً أو تهدداً للتراث، سواء منفردة أو مجتمعة. فعلى سبيل المثال، عندما يتم التعرف على تهديد ما كنتيجة للعامل، وجرى تقييم احتمال حدوثه ومدى قسوته، فإنه بالإمكان تحديد حجم الخطر الناتج عنه. وستساعد العوامل المسجلة على أنها أسباب للتهديدات في تحديد طرق التخفيف والعلاج، وهو ما سيتم شرحه في القسم التالي.

[٤] للمزيد من المعلومات الرجاء زيارة www.monumentenwacht.be



(الشكل رقم ٥: المخاطر وعوامل التدهور القابلة للتأثير على تكاملية مواقع التراث)



(الشكل رقم ٦: التهديدات والاختلالات بحسب MEGA-J المرتبطة بعوامل التدهور. يرجى الرجوع إلى الملحق رقم ٩٩ للاطلاع على بطاقات رموز التهديدات والاختلالات وفقاً لـ MEGA-J)

(٣) تقييم تأثير الخطر

تتنبأ عملية تقييم المخاطر بالتهديدات المستقبلية المحتملة الناتجة عن عوامل التدهور (تايلور، ٢٠٠٥). فعندما يتم تحديد التهديدات وعواملها، يصبح من الممكن تقييم تأثيرات المخاطر ومستوياتها بناء على احتمال وقوع التهديد المحدد، بالإضافة إلى شدة تأثيره (والر، ٢٠٠٣). ويزداد تأثير الخطر بزيادة وتيرة أو حدة الخطر، ولذا، فإنه يجب تقييم وتيرة التهديدات واحتمال حدوثها وشدتها وأثرها، من أجل تقييم الأثر.

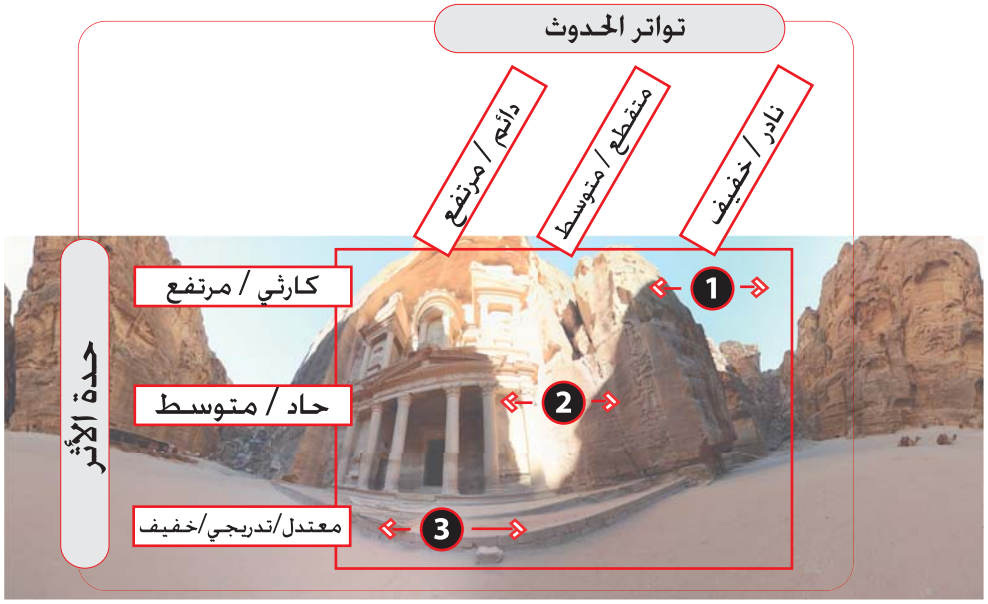
ويمكن تقييم مستوى المخاطر على أساس نهج ومعيار نوعي وكمي، وقد تم استعراض كل من النهجين في منهجية إدارة المخاطر هذه. ويستند النهج النوعي على بيانات وتحليل نوعيين، ويستخدم مصطلحات معينة لوصف مدى خطورة الضرر (تأثير الضرر) واحتمالية حدوثه. أما النهج الكمي فيستند على مؤشرات قابلة للقياس الكمي، حيث يستخدم القيم العددية لمعايير المخاطر، وتستند نتيجة حجم الخطر على نظام تسجيل النقاط. أما نوعية التحليل الكمي فتعتمد على دقة القيم العددية. كلا الأسلوبين

صحيح، ويمكن استخدامه تبعاً لمشاريع تقييم المخاطر وأهدافها، وكمية البيانات المتوفرة، والوقت، والموارد المتاحة، وذلك أنه ليس بالإمكان تفهم كل شيء عن طريق الأرقام.

أما في النهج النوعي فإنه يتم تحديد المخاطر استناداً الى شدة التأثير (معتدل، شديد، كارثي)، وعلى تردد واحتمالية وقوع الأضرار (نادر، متفرقة، مستمر). ويمكن تعريف ثلاثة أنواع رئيسية من المخاطر بحسب شدة التأثير والتردد:

- نوع ١: كارثية ونادرة
- نوع ٢: متوسطة ومتفرقة
- نوع ٣: معتدلة ومستمرة

ويبين الشكل ٧ مصفوفة الشدة والتواتر وفقاً لهذه الأنواع الثلاثة من المخاطر. باستخدام هذه المصفوفة، فإنه يمكن أن يدرج كل عامل وتهديد ضمن نوع واحد أو أكثر من أنواع المخاطر الثلاثة.



(الشكل رقم ٧: نطاقات وتيرة وحدة أنواع المخاطر: ١ و ٢ و ٣ (وفقاً لوالر ١٩٩٥))

عادة ما تكون المخاطر التي من النوع ٣ (المخاطر المستمرة) ذات تأثير معتدل على المدى القصير، ولكن على المدى البعيد يمكن أن يكون لها عواقب وخيمة. مثال ذلك الأضرار الناجمة عن العوامل الجوية التي تؤثر على الصخور الطبيعية، وبالتالي على المعالم، بحيث يؤدي استمرار هذا التأثير على مدى فترة طويلة

على القوة الهيكلية للمعالم. ويمكن لهذا الانخفاض في القوة الهيكلية أن يكون أكثر خطورة وأن تكون له عواقب فورية في حالة وجود أحداث نادرة ولكنها خطرة كالزلازل والفيضانات (النوع ١ من المخاطر).

إن أنواع المخاطر هي بمثابة مؤشر على درجة التأثير وتردده لكي يتم تحديد أولويات الإجراءات المطلوبة في موقع معين أو عنصر موقع و/أو منطقة من أجل تخفيف المخاطر.

في النهج الكمي، يمكن حساب مستوى وحجم المخاطر استناداً إلى ثلاثة معايير هي:

أ) احتمالية حدوث الأضرار ومداها
ب) درجة فقدان القيمة والتكاملية كنتيجة للأثر
ج) نسبة المنطقة المعرضة للتهديد، ودرجة الضعف

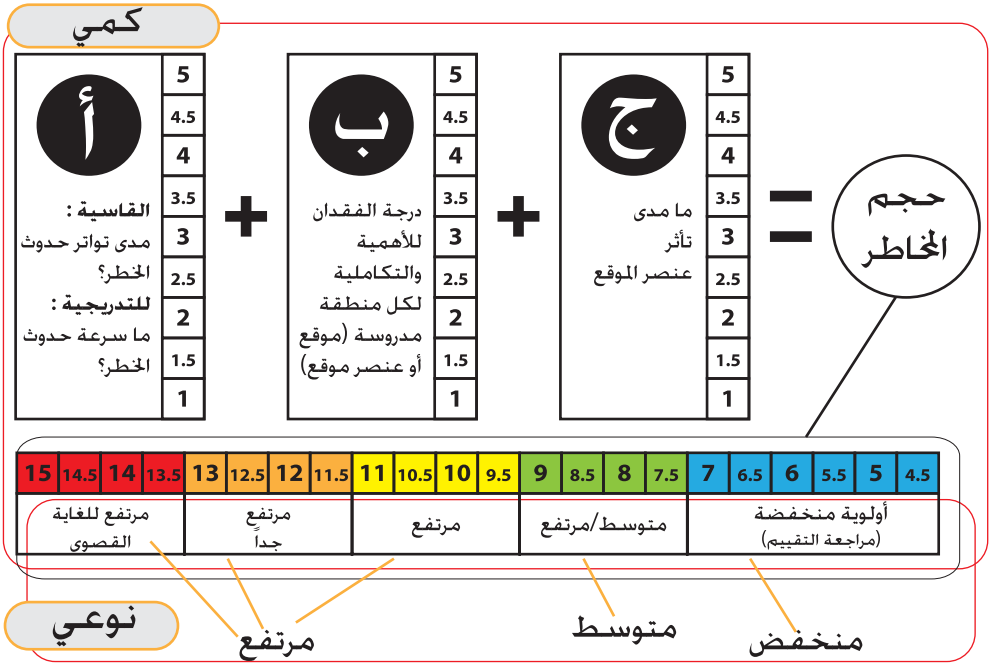
أحد العوامل التي تلعب دوراً في تقييم المخاطر باستعمال معايير أ ب ج هو جعل المعادلة تتضمن مقدار فقدان القيمة. تقييم المخاطر يتعلق مباشرة بالقيم و بفقدان التكاملية. وكما ذكر آنفاً فإنه ينبغي أن تؤخذ في الاعتبار قيمة الموقع والقيمة العالمية الاستثنائية للموقع من أجل تقييم أثر المخاطر التي تتعرض لها قيمة الموقع وتكاملية ككل. أما على مستوى المنطقة وعنصر الموقع، فإنه ينبغي إجراء تقييم يركز على تغطية العناصر قيد التقييم. وكذلك فإن مما ينبغي أن يؤخذ في الاعتبار أهمية الموقع بأكمله. إن هذه الطريقة في تقدير القيمة النسبية للمنطقة المدروسة تعرض ضمن عملية تقييم المخاطر: المجالات ذات الأولوية في التخفيف، وصناعة القرار.

بناء على دورة المركز الدولي لدراسة حماية وترميم الممتلكات الثقافية والمعايير الأسترالية/النيوزيلاندية لإدارة المخاطر ICCROM-CCI-ICN في سيبيو ٢٠٠٧، فإن الشكل رقم ٨ يقدم توجيهات بشأن كيفية حساب وتحديد حجم المخاطر المعينة، وتسهل مقارنة المخاطر.

أ (الاحتمالية) + ب (الخسارة في القيمة) + ج (الجزء المعرض للخطر) = حجم الخطر

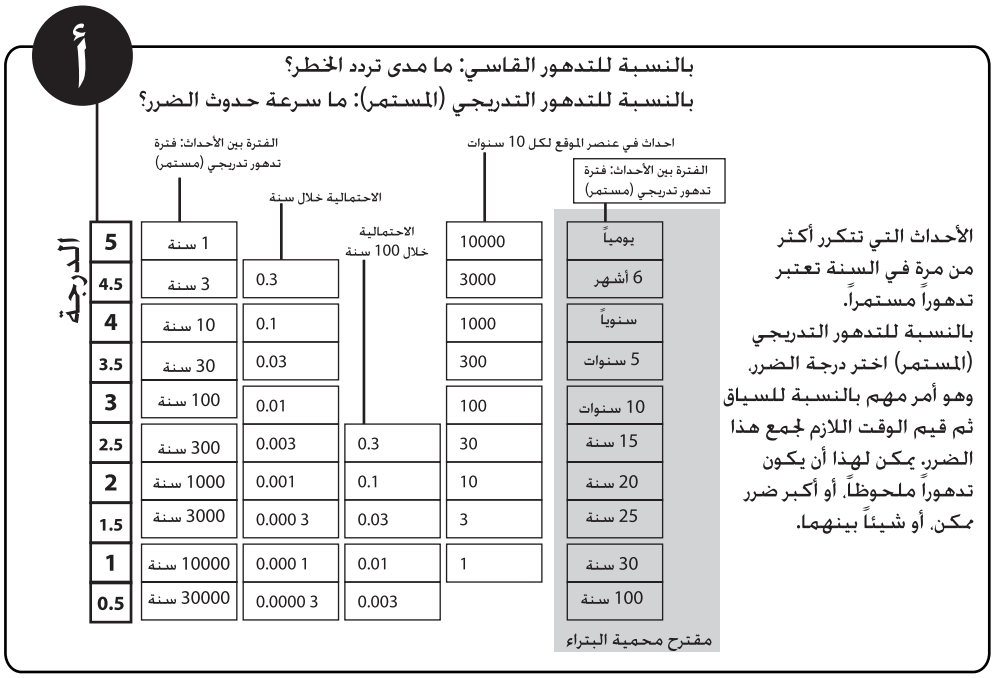
ويتم تقييم هذه المعايير (أ ب ج) على أساس نظام تسجيل النقاط من ٠،٥ إلى ٥، كما هو مبين في الأشكال رقم ٨-١١ أدناه. مجموع النقاط أ و ب و ج لتهديد ما يمثل حجم المخاطر الناتجة عن التهديد. وميزة هذا النهج هو أن نظام تسجيل النظام يوفر قاعدة لمقارنة التهديدات المختلفة، مما يسمح بمقارنة التأثيرات، وتحديد أولويات التهديدات بطريقة أسهل. فهو يوفر أداة لمقارنة المخاطر المختلفة. غير أن هذا النهج يعتمد إلى حد كبير على دقة حساب المعايير أ و ب و ج بناء على معرفة الخبراء القائمين على إجراء تقييم وتحليل المخاطر. إن النهج الكمي لتحديد حجم المخاطر يحتاج الى فهم وتعريف واضحين لعوامله المختلفة والتدريب على حسابه، وذلك بسبب نهجه العددي والمفصل.

بناء على نظام تسجيل النقاط، يتم احتساب حجم المخاطر وتحديد خمس مستويات للأولويات: مرتفع للغاية القصوى، ومرتفع جداً، ومرتفع، ومتوسطة/مرتفعة، وذات أولوية منخفضة.



(الشكل رقم ٨: حجم المخاطر (بناء على ICCROM-CCI-ICN، ٢٠٠٧)

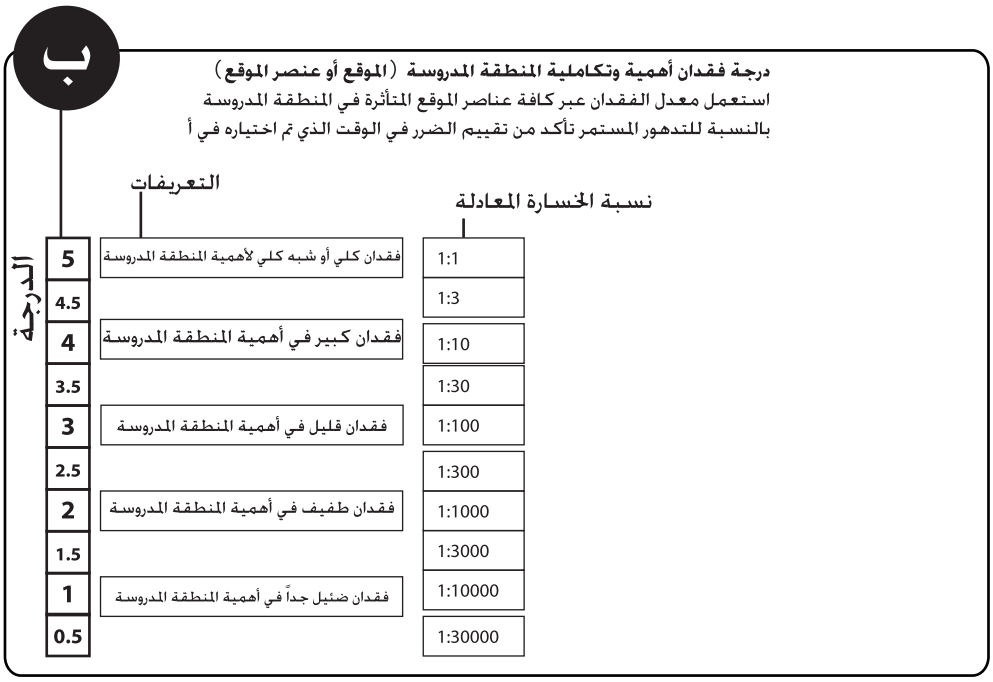
ولكي يتم تحديد حجم المخاطر، فإن إطار (أ ب ج) يوفر البيانات التالية. وينبغي ملاحظة أن الإطار تم تكييفه لتقييم المناطق وعناصر الموقع في مواقع التراث عن طريق قياس الأثر على فقدان الأهمية في عنصر الموقع.



(الشكل رقم ٩: الجدول أ – الاحتمالية (بناء على ICCROM-CCI-ICN، ٢٠٠٧)

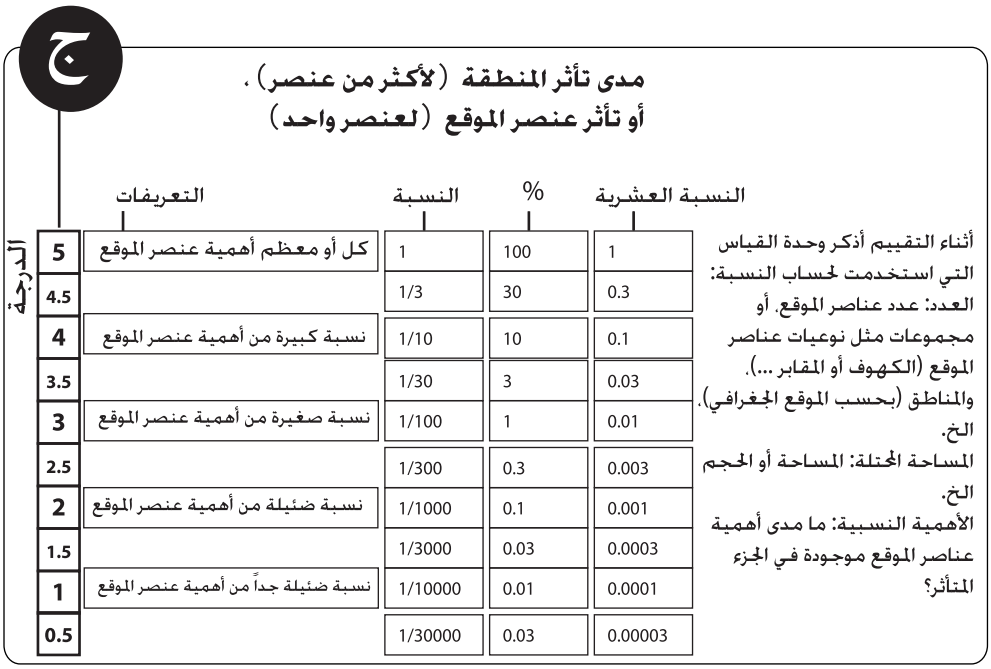
(أ) وهو معيار تقدير احتمالية حدوث خطر ما، وهو يتعلق بالتغييرات والتهديدات الجذرية. فمثلاً، الإجابة على السؤال: "ما وتيرة تعرض الموقع للفيضانات؟" يعد قيمة المعيار (أ). أما بالنسبة للتغييرات المستمرة، فإن المعيار (أ) يمثل احتمالية الضرر الذي ينتج عن التهديد. في هذه الحالة فإن السؤال الذي يجب طرحه هو "ما سرعة وقوع الضرر؟". على سبيل المثال، قد يتعرض الموقع لاهتزازات بسبب السيارات المارة فيه بشكل يومي، غير أن التأثير الفعلي للقوة المادية للاهتزازات ليس يومياً. هنا يكون المعيار (أ) قيمته في تقدير حدوث الأضرار والمخاطر الناتجة عن هذه القوى المادية اليومية.

فيما يتعلق بالعمل الميداني لتقييم المخاطر فقد تقرر في أحد اجتماع الخبراء تقليل فترات المعيار (أ) لكي تستوعب المدى الزمني لخطط الإدارة، من فترة ٦ أشهر إلى فترة ١٠٠ سنة بغرض تطبيقها في موقع البتراء. تجدر الإشارة إلى أن تعديل الفترات يحتاج الى المزيد من الوقت والدراسة، كما يحتاج إلى المزيد من التحليل على أساس تطبيقه على الموقع ونتائجه. وبالتالي فإنه ينصح بإعادة النظر في الجدول الفعال بالتشاور مع مختلف الخبراء، بما فيهم الرياضيين، وأن تتم إعادة حساب الفترات لتعكس تصنيف المخاطر الجذرية والمستمرة في موقع البتراء على حد سواء.



(الشكل رقم ١٠ – درجة فقدان الأهمية والتكاملية (بناء على ICCROM-CCI-ICN ٢٠٠٧))

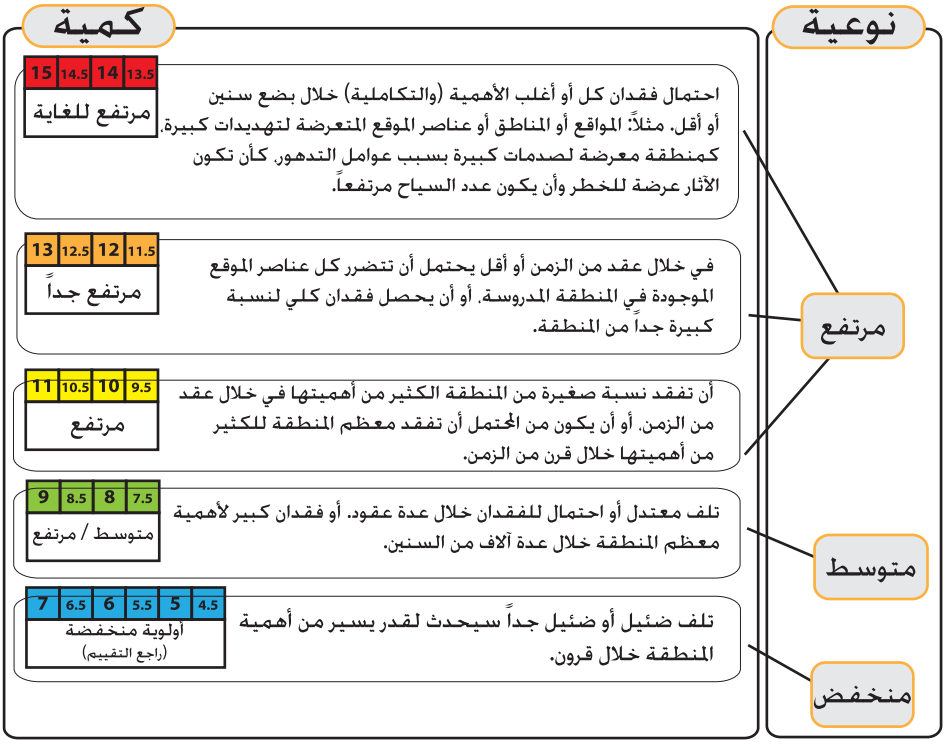
(ب) أثناء عملية تقييم المخاطر فإنه من المهم أن يتم حساب تقدير مجموع الخسائر الممكنة كنتيجة للخطر. يمثل المعيار (ب) درجة فقدان أهمية وتكاملية المنطقة قيد الدراسة سواء كانت عبارة عن موقع أو عنصر موقع. درجة فقدان القيمة هي نتيجة مباشرة للخطر الذي تواجهه الأهمية العامة للموقع أو عنصر الموقع. ويمكن تقدير هذه الخسارة على أساس الضرر الهيكلي وفقدان القيمة الجمالية والتاريخية والعلمية للعنصر، أو استناداً على مقدار الخسارة في القيمة الاقتصادية أو الاجتماعية أو البيئية.



(الشكل رقم ١١ – المنطقة المتأثرة (بناء على ICCROM-CCI-ICN ٢٠٠٧))

(ج) تمثل القيمة (ج) الجزء من منطقة الدراسة المتأثرة بالضرر الناتج عن الخطر. فعلى سبيل المثال، يعكس المعيار (ج) عدد عناصر الموقع التي يتوقع أن تتضرر بسبب خطر ما. لكن تجدر الإشارة إلى أنه ينبغي تطبيق وحدة القياس نفسها لمواجهة التهديدات المختلفة ضمن مشروع تقييم المخاطر نفسه. ومع ذلك، فإنه بالإمكان تحديد وحدة القياس وكيفية حساب المنطقة المتضررة من قبل فريق التقييم من بداية العملية.

من حيث الحجم، يمكن تعريف كل من مستويات الأولوية على النحو التالي:



(الشكل رقم ١٢ – جدول الحجم (بناء على ICCROM-CCI-ICN ٢٠٠٧))

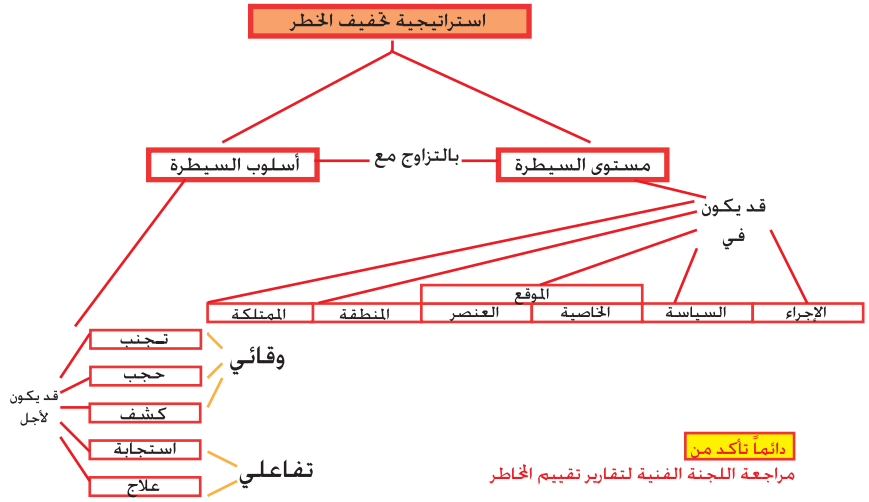
- ١/٢ ١٣ – ١٥: أولوية عالية للغاية القصوى: من المرجح فقدان كل الأهمية (والتكاملية) أو جزء كبيراً منها في غضون بضعة سنوات أو أقل. مثال ذلك المناطق والمواقع وعناصر الموقع المعرضة لتهديدات كبيرة، مثلاً: منطقة متأثرة لدرجة عالية بعوامل التدهور، كالمعالم المكشوفة وأعداد كبيرة من الزوار.
- ١/٢ ١١ – ١٣: أولوية عالية جداً: يحتمل فقدان أهمية كل عناصر الموقع في المنطقة قيد الدراسة، أو فقدان كلي لقسم كبير جداً من المنطقة في غضون عقد من الزمن أو أقل.
- ١/٢ ٩ – ١١: أولوية عالية: يحتمل فقدان الكثير من أهمية جزء صغير من المنطقة في غضون عقد من الزمن، أو فقدان الكثير من أهمية معظم المنطقة في غضون قرن من الزمن.
- ١/٢ ٧ – ٩: متوسطة/عالية الأولوية: ضرر معتدل أو احتمال فقدان على مدى عدة عقود. أو فقدان كبير لمعظم المنطقة في غضون عدة آلاف من السنين.
- ٧ أو أقل: أولوية منخفضة: ضرر صغير أو ضئيل في جزء صغير من أهمية المنطقة في غضون عدة قرون.

وينبغي لتقييم المقدار هذا ألا يقتصر على أثر المخاطر على السمات الملموسة للموقع وعنصر الموقع، بل يجب أن يأخذ في الاعتبار أثرها على الزوار والباحثين وأصحاب المصلحة، فضلاً عن المناظر الطبيعية للموقع. غير أن هذا النموذج، ومعظم الاستمارات المستخدمة قد صممت لتقييم حجم المخاطر على الجوانب الملموسة للممتلكات. أما نماذج تقييم المخاطر على الناس والطبيعة فقد تحتاج إلى معالجة بشكل مختلف ومنفصل. وفي دراسة حالة البتراء تم اختيار جزء من المنطقة النموذجية حيث الطبيعة والمناظر الطبيعية معرضة للخطر كذلك.

(٤) استراتيجيات التخفيف الممكنة

ويمكن استعراض استراتيجيات تخفيف المخاطر أو الاستجابة لها عند تحديد جميع المخاطر وتقييم حجمها. فعندما تكون المخاطر مرتفعة، وتكون الأهمية مرتفعة أيضاً، فإنه يجب إعطاء أولوية لإيجاد استراتيجية للتخفيف من الخطر. يبين الشكل ١٣ أن استراتيجية التخفيف من حدة المخاطر تتم عن طريق تحديد وسيلة للرقابة تطبق في مستوى رقابة معين (والر ٢٠٠٣، ص ١٠٤). كما أنها تقدم مصفوفة الرقابة والتي صممت أصلاً للمجموعات والمتاحف، ثم تم تعديلها لتتلاءم مع منهجية إدارة المخاطر، حيث مستويات الرقابة هي: الموقع/الممتلكة، والمنطقة (وتشمل المعالم الأثرية والمناظر الطبيعية)، وعنصر الموقع (الثقافي أو الطبيعي)، وميزة عنصر الموقع، وتحديد السياسة، والإجراء.

يوفر هذا النموذج أداة لمديري الموقع للنظر في أساليب تخفيف المخاطر ثم اختيار أسلوب الرقابة سواء الوقائية أو التفاعلية، وأن يتم أخذها في الاعتبار عند كل مستوى من مستويات الرقابة.



(الشكل رقم ١٣: استراتيجية التخفيف من حدة المخاطر، وأساليب الرقابة المطبقة على مستويات الرقابة)

أساليب الرقابة

فيما يلي تعريف خمسة طرق للرقابة، وهي: تجنب، واحجب، واكتشف، واستجب، وعالج:

- **تجنب:**

تجنب مصادر عوامل التدهور والأمور الجاذبة لها؛ وضع إشارات على المعلم مثل "لا تصعد"، أو إشارات مشابهة، تؤدي إلى إنهاء التهديد دون أي تدخل.
في معظم الحالات يكون القضاء على التهديد هو الأسلوب الرقابي المفضل.

- **احجب (اقامة حاجز)**

احجب جميع السبل والمسارات أمام عامل التدهور (حيث أن أسلوب "تجنب" قد لا يصلح أحياناً)؛ إغلاق سبل الوصول إلى منطقة معقولة هو وسيلة لإقامة الحواجز. والمخاطر التي تتعرض لها المعالم الأثرية المكشوفة تصلح مثالاً على تطبيق كل من الاستراتيجيات للمشكلة نفسها. وإذا كانت المشكلة في تآكل الهياكل، فإن بالإمكان تجنب ذلك من خلال ردم الانقاض المعرضة للخطر. وإذا كانت المشكلة في الجرف الذي تتسبب به الأمطار، فإنه بالإمكان جعل الأنقاض مضادة للماء من خلال إضافة طبقة واقية على قمة كل هيكل. غير أنه في هذه الحالة فإن وضع طبقة جديدة واقية قد يؤثر على أهمية عنصر الموقع.

- **اكتشف**

اكتشف التهديدات قبل حدوث المخاطر. مثال ذلك: الاكتشاف عن طريق تركيب نظام رصد وإنذار مبكر للفيضانات والزلازل.

- **الاستجابة (التعامل مع العامل)**

الرد على عامل التدهور بعد افتراض وجوده أو الكشف عنه.
عادة ما يتم التعامل مع العامل المسؤول عن الخطر بعد أن تفشل وسائل الرقابة الأخرى في الحد من الخطر بما فيه الكفاية.

- **عالج (الحفظ)**

عالج تأثير العامل على الموقع أو عنصر الموقع عن طريق القيام بأعمال حفاظ فعلية على الموقع أو عناصر الموقع من أجل المحافظة عليها؛ إعادة النظر فيما حدث من خطأ، وتطوير الخطط.

إن أساليب الرقابة: تجنب، احجب، اكتشف هي من وسائل الحفظ الوقائي. أما العاملان الآخران: الاستجابة والعلاج، فهما من الطرق التفاعلية للحفظ. وفي بعض الحالات فإن المراقبة الفعالة للمخاطر قد تتطلب استخدام أساليب متعددة في آن واحد. أما الصيانة والترميم العلاجيين فيصلحان فقط بعد فشل الوسائل

الوقائية. وفي مجال تقييم المخاطر وتحديد استراتيجيات التخفيف من تأثيرها على المواقع التراثية فإن أول ثلاث وسائل للرقابة هي ذات أهمية في إعداد استراتيجيات الصيانة الوقائية، في حين تتعلق الطريقتان الأخرتان بالمواقع أو عناصر المواقع التي تأثرت تكامليتها بشكل كبير بسبب الاختلالات والتهديدات.

ومما ينبغي وضعه في الاعتبار قبل اختيار وسيلة المراقبة واستراتيجية التخفيف هو: أهمية أثر اختيار نهج المراقبة على المدى الطويل. ففي المثال السابق، يعد ردم الأنقاض المعرضة للخطر تعاملاً مع العامل. لكن في حين أن هذا النهج المباشر كثيراً ما يتم استخدامه في المرحلة الأولى، فإنه قد يكون أسوأ خيار بالنظر في جميع التكاليف والمخاطر على المدى الطويل، وذلك بحسب مصدر وحجم المشكلة. في هذه الحالة، يمكن للردم أن يزيد من مخاطر الحرائق والفيضانات المحلية، لا سيما إذا لم يمكن تلبية متطلبات الصيانة والخدمة.

وهناك علاقة مباشرة بين اختيار أساليب السيطرة وعوامل التدهور التي يتم تحديدها - أسباب المخاطر. يعد "الاختلال" و "التهديد": الضرر وخطر حصول الضرر، أما "السبب" (عامل التدهور): فهو ما سوف يؤدي إلى تحديد استراتيجية التخفيف الصحيحة.

مستويات الرقابة

بالإمكان تطبيق كل من أساليب الرقابة الخمسة المعرفة أعلاه على كل مستوى من مستويات الرقابة: الموقع، والمنطقة، وعنصر الموقع، وسمة عنصر الموقع، ووضع السياسات، والإجراءات:

- **الموقع/الممتلكة/المنطقة**

يمكن للعديد من المخاطر المحدقة بعناصر الموقع أن تتأثر بشكل كبير بمكان ووجهة الموقع.

- **عنصر الموقع**

يمكن لعناصر الموقع أن تتأثر بشكل كبير بعوامل التدهور، كما أن التقييم المتمركز حول القيمة سيجري في هذه المرحلة. ويعد هذا المستوى أهم مستويات رقابة المخاطر من بين معظم عوامل التدهور.

- **سمة عنصر الموقع**

يمكن لعوامل التدهور أن تؤثر في كل سمة. مستوى الرقابة هذا مهم لكيلا تتأثر أهمية الموقع كثيراً.

- **وضع السياسات**

إن مستوى وضع السياسات للتخفيف من المخاطر مهم بشكل خاص من أجل التقليل من المخاطر التي يتسبب بها إهمال عمّال الصيانة. فمثلاً، بالإمكان وضع وفرض سياسة تحدد القدر الذي يسمح بحمله، وبذلك نحد من المخاطر على عنصر الموقع الذي يتسبب به الزوار.

- **الإجراءات**

أخيراً، إن الإجراءات الجيدة التي تم إنشاؤها بشكل جيد مهمة لعمل استراتيجية لإدارة مخاطر عامة وفعالة. في حالات كثيرة فإن هذه العمليات هي أقل أساليب تقليل المخاطر من حيث الكلفة.

إن تحديد استراتيجية التخفيف ينطوي على معرفة مجموعة من الخيارات لمعالجة وتخفيف المخاطر، مع الأخذ في الاعتبار الإطار الزمني للاستراتيجية، سواء كانت قصيرة أو متوسطة أو طويلة الأمد، وتقييم خيارات التخفيف من المخاطر.

كما ينطوي تحديد الخيار الأنسب للتخفيف على تحقيق التوازن بين تكلفة تنفيذ كل استراتيجية في مقابل الفوائد المستفادة منها. وينبغي النظر في كل وسائل الرقابة من أجل التخفيف من كل خطر كبير. وبناء على ذلك، فإن إحدى الطرق ستكون الأنسب وتتسم بأفضل توازن تكلفة/فائدة للتخفيف من المخاطر.

بعد تحديد استراتيجية التخفيف، ينبغي صياغة خطة عمل حول كيفية تنفيذ الخيار المحدد. وينبغي على كل خطة أن تحتوي على ما يلي:

- ملخص لأساليب خيارات الرقابة، والنتائج المتوقعة
- العمل المقترح للحفظ و/أو الصيانة
- الموارد المطلوبة (من حيث الموظفين، والميزانية، والبحوث، والتوثيق)
- الإطار الزمني للعمل

تجدر الإشارة إلى أن الرصد والإبلاغ ينبغي أن يكون جزء لا يتجزأ من الإجراءات.

نسبة الشك

من المهم تأمل مسألة نسبة الشك، ومعناها وتأثيرها على إدارة المخاطر وعملية صنع القرار. عند تحديد وتقييم المخاطر التي تتعرض لها المواقع التراثية، فإنه من المهم جداً إدراك ومجابهة وجود نسبة الشك خلال هذه العملية.

وترتبط نسبة الشك بمدى موثوقية المعلومات حول المخاطر ودقة القيم الكمية المعطاة للمعايير. والمقصود هو أن مدى موثوقية المعلومات حول احتمالية وقوع الحدث (الضرر)، وتأثيره على كل من قيم ومدى الضرر وحجم الخطر، كلها ينبغي أن تكون معلومة. وبالتالي، فلكي يتم اتخاذ أفضل قرارات التخفيف فإنه يجب إدراج معلومات حول نسبة الشك في عملية التقييم واتخاذ القرارات. وفي ضوء حدود المعلومات المتوفرة ودقتها، فإن الإقرار بوجود نسبة الشك يساعد صانعي القرار في صنع القرارات الأحكم، ووضع أولويات تخصيص الموارد من أجل تطبيق تدابير التخفيف، أو جمع المزيد من الوثائق، وعمل المزيد من البحوث.

كلما ازداد تأثير نسبة الشك على نتيجة تقييم المخاطر، كلما ازدادت الحاجة لإجراء المزيد من البحوث، وذلك للحد من نسبة الشك. مثلاً، قد يكون من غير الحكيم اللجوء إلى تدابير جذرية بناء على معلومات غير موثوقة، لأن ذلك سيؤثر كثيراً على القيمة التراثية. وللأسف فإن هناك أمثلة كثيرة على ذلك. وفي المقابل، إذا أسيء تقدير خطر مرتفع لتهديد ما على أنه خطر معتدل، فإن هذا سوف يؤدي إلى اتخاذ قرار بعدم اتخاذ تدابير التخفيف، ونتيجة لذلك فإن المخاطر المرتفعة ستستمر. وعليه فإن صنّاع القرار بحاجة إلى الإحاطة بمستوى المعرفة ودرجة اليقين بدقة نتائج تقييم المخاطر، فضلاً عن درجة اليقين لكل نتيجة من النتائج قبل الدراسة والبت في أي من استراتيجيات التخفيف. إن الإقرار بنسبة الشك، وشرحها، وتسجيلها، وتأثيرها على عملية تقييم المخاطر أمر أساسي في نهج إدارة المخاطر.

تنطبق نسبة الشك أيضاً على تقدير تأثير الحلول الممكنة وطرق الرقابة.

هناك طرق مختلفة للحد من نسبة الشك. وقد تؤدي زيادة المعلومات ومستوى المعرفة العالي في التقليل من نسبة الشك. ولكن كما سيتبين في قسم تقدير المخاطر، فإن مقدار الجهد والوقت والموارد اللازمة لتقليل نسبة الشك يجب أن توازن مع مقدار القيمة المضافة للمعلومات المتعلقة بتقييم المخاطر وعملية صنع القرار.

(٥) تقدير المخاطر

إن الهدف من تقييم المخاطر هو تقدير نتائج هذا التقييم -تحديد وتقدير المخاطر- من أجل إدارة المخاطر والتوصل إلى قرار حول الأخطار التي هي بحاجة إلى معالجة (تخفيف)، ومدى أولوية ذلك. ويهدف القرار إلى منع (أو إبطاء) الأثر السلبي للتدهور. وكذلك فإن معايير اتخاذ القرارات المتعلقة بعملية إدارة المخاطر والتي تم تحديدها في هذه المرحلة في خطوة تقييم سياق إدارة المخاطر، ينبغي أن يعاد النظر فيها للتأكد من أن القرارات التي اتخذت في هذه المرحلة تتماشى مع السياق المؤسسي الداخلي والخارجي.

من ضمن العناصر الهامة في عملية التقييم: مستوى حجم المخاطر، ودراسة الجدوى الاقتصادية لاستراتيجيات التخفيف، والمعايير التي ينبغي تقييم المخاطر بناء عليها، مثل: أهداف المنظمة، والربح أو الخسارة للمجتمع المحلي، والفوائد (أو الخسائر) الاقتصادية والتقنية والمالية والاجتماعية وغيرها من المعايير.

تحديد الأولويات وقرارات إدارة المخاطر

كما سبق بيانه، فإن نسبة الشك تلعب دوراً هاماً جداً في دقة تقدير حجم المخاطر. ومن أجل تحديد أولويات قرارات إدارة المخاطر، فإن مدير الموقع و/أو صانع القرار يحتاج إلى معرفة مستوى الخطر

ونسبة الشك لكل من نتائج تقييم المخاطر. وهذا هو سبب اعتماد قرار إدارة المخاطر على مستوى حجم المخاطر جنباً إلى جنب مع نسبة الشك. جدول الإعداد (الشكل رقم ١٣) لتقييم حجم المخاطر في مقابل نسبة الشك هو وسيلة فعالة لتسجيل نسبة الشك، وبناء عليه يتم إعطاء أولويات للقرار. هذا الجدول يبين اعتماد قرار الخطر على حجم المخاطر ونسبة الشك بالإضافة إلى الجدوى وتكاليف الحد من المخاطر من خلال التقليل من نسبة الشك. كما هو مبين في الجدول أدناه، عندما تكون نسبة الشك منخفضة، فإن الاستراتيجية تتمثل في التخفيف من المخاطر، وعندما تكون نسبة الشك مرتفعة فإن الاستراتيجية المثلى تتمثل بعمل المزيد من البحوث والتحليلات للحد من نسبة الشك. إن صانعي القرار في مواقع التراث مسؤولون عن اتخاذ القرار الأخير حول الاستراتيجية التي ينبغي اتخاذها، والجدول أدناه يساعد على تحليل وترشيد جزء من عملية صنع القرار هذه. لكن عندما يكون حجم المخاطر ونسبة الشك مرتفعين فإن الجدول يقترح أعلى أولوية ممكنة لاستراتيجية التخفيف وعقد البحوث. وكذلك فعندما تكون تكاليف التخفيف والبحوث متقاربة، فإن الأمر يصبح متروكاً لمدير الموقع وصانع القرار لاتخاذ القرار والنهج التاليين.

مقدار الشك	مرتفع للغاية القصوى	مرتفع جداً	مرتفع	متوسط/مرتفع	منخفض
مرتفع	إعطاء أعلى أولوية للبحث: وستوفر استراتيجيات التخفيف قصيرة المدى الوقت إلى أن يتقلص الشك. ويقترح عمل دراسة جدوى اقتصادية لاستراتيجيات التخفيف.	يقترح وضع أولوية عالية للبحث: استراتيجيات للتخفيف قصيرة المدى. ويقترح عمل دراسة جدوى لاستراتيجية التخفيف.	يقترح وضع أولوية عالية للبحث. دراسة الجدوى الاقتصادية لاستراتيجية التخفيف.	استعمل جدوى اقتصادية غير مكلفة لتخفيف المخاطر من أجل تقليص الشك بعد أن يتم التعامل مع المخاطر الكبيرة.	بحاجة إلى أبحاث لتقرير صحة التقييم. لكن الأولوية منخفضة
متوسط	تخفيف مخاطر من الأولوية الثانية. يقترح عمل دراسة جدوى اقتصادية لاستراتيجيات التخفيف والبحث.	وضع أولويات لتخفيف المخاطر بناء على دراسة الجدوى الاقتصادية للدراسة والمخاطر الأخرى.	وضع أولويات لتخفيف المخاطر بناء على دراسة الجدوى الاقتصادية: للدراسة والمخاطر الأخرى.	لا يلزم اتخاذ أي إجراء لكن حاول تقليص نسبة الشك. عمل دراسة جدوى اقتصادية للتخفيف مقابل الدراسة.	وجود قدر قليل من الخطر بنسبة شك متوسطة هو أمر مقبول. لا يتطلب فعل شيء.
منخفض	أولوية قصوى لتخفيف المخاطر. أولوية قصوى لتخفيف المخاطر.	اعطاء أولوية عالية لتخفيف المخاطر. ومن المسوغ عمل استراتيجيات بعيدة المدى.	وضع الأولوية بناء على دراسة الجدوى الاقتصادية لاستراتيجيات التخفيف.	تخفيف المخاطر بعد التعامل مع أكبر المخاطر. بناء على دراسات جدوى اقتصادية لاستراتيجيات التخفيف.	وجود قدر قليل من الخطر بنسبة شك منخفضة هو أمر مقبول. لا يتطلب فعل شيء.

حجم الخطر

(الشكل رقم ١٤: مصفوفة الأولويات بناء على مستوى حجم المخاطر ومستوى نسبة الشك)

تقدير التكاليف والفوائد المرتبطة بكل استراتيجية

المرحلة النهائية في تقييم المخاطر والتي تعقب تحديد جميع المخاطر، وتقييم حجمها وتحديد استراتيجيات التخفيف، هي تقدير الخيارات المتاحة لتخفيف المخاطر وتقييم التكاليف والمنافع المرتبطة بكل استراتيجية لكي يتسنى تحديد الخيارات الأكثر ملاءمة. وينبغي أن يؤخذ في الاعتبار تأثير كل استراتيجية على كل تهديد وكل عامل من عوامل التدهور. وكذلك ينبغي أن تترافق التكاليف والفوائد مع مراحل التنفيذ ومراحل الصيانة. كما يجب الأخذ في الاعتبار أثر الاستراتيجية على عوامل الخطر غير تلك المتعلقة بالأماكن التراثية وأهميتها، والمخاطر التي يتعرض لها الزوار، والباحثون وأصحاب المصلحة، والمناظر الطبيعية.

(٦) تنفيذ الاستراتيجية

(١) ويستند تنفيذ استراتيجية التخفيف لمعالجة المخاطر على نتائج تقييم المخاطر، وينبغي التحقق منها بواسطة لجنة فنية (كما هو محدد في النقطة التالية). وهذه الإجراءات إما أن تكون وقائية أو نشطة. أما وسائل الرقابة الوقائية فهي أكثر فعالية من حيث التكلفة للحد من المخاطر على المدى البعيد، كما يمكن حجب عدد كبير من المخاطر أو تجنبها عن طريق سن السياسات والإجراءات.

ويمكن أن تستند القرارات المتعلقة باستراتيجيات التخفيف (الرقابة على المخاطر، وقرارات إدارة المخاطر) على معايير مالية أو تشغيلية أو قانونية أو سياسية أو اجتماعية أو بيئية، أو غيرها.

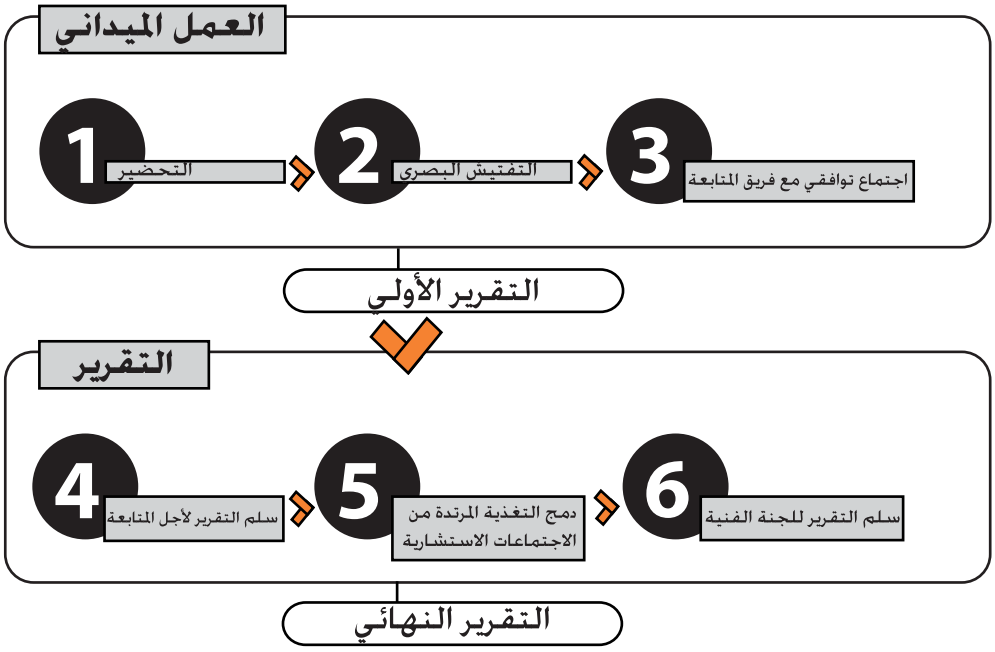
(٢) ينبغي توثيق الأسباب التي أدت إلى اتخاذ هذه الإجراءات في تقرير معالجة المخاطر (التخفيف)، والذي ينبغي أن يشتمل على تحديد واضح لمختلف خيارات تخفيف ومعالجة المخاطر. ويجب تقييم كل من هذه الخيارات بوضوح، كما يجب شرح كيفية تنفيذ كل من استراتيجيات التخفيف بشكل واضح.

الرصد والمراقبة

من الأهمية بمكان أن تتم مراقبة الخطوات المختلفة لتقييم المخاطر، وإعادة النظر في حجم المخاطر ومدى ملاءمة استراتيجيات التخفيف المعتمدة للتأكد من أنها لا تزال ملائمة. العوامل التي تؤثر على الممتلكة، والإجراءات المتخذة هي عرضة للتغيير مع مرور الوقت. ولذلك، ينبغي اعتماد دورة تقييم المخاطر بانتظام.

ويتم تقديم عناصر مختلفة للرقابة أو التحقق، من أجل ضمان دقة تقارير تقييم المخاطر والمعلومات التي اتخذت في هذا المجال. أولاً، ينبغي تشكيل فريق متابعة (أو فريق مكتبي) لمراجعة تقرير فريق العمل الميداني والتحقق من أدائه، وذلك من خلال عقد اجتماعات توافق قبل صياغة مسودة التقرير واقتراح

استراتيجيات التخفيف. وينبغي على فريق المتابعة دعم كافة الإجراءات التي اتخذت خلال المراحل المختلفة من تقييم المخاطر التي تمت من قبل فريق العمل الميداني وتوضيحها من قبل فريق المتابعة في مراحل مختلفة من عملية التقييم. ثانياً، عملية التحقق تتم من خلال إقامة ندوات واجتماعات مائدة مستديرة -اجتماعات استشارية- مع خبراء متعددي التخصصات من أجل توفير التغذية المرتدة والمشورة بشأن التقارير ونتائج العمل. والأسلوب الأخير هو إنشاء لجنة فنية كجزء من لجنة إدارية مؤلفة من خبراء من مختلف الحقول، وممثلي السلطات المحلية ومدراء الموقع لمراجعة التقارير النهائية، واتخاذ القرارات، وتطبيق استراتيجيات التخفيف والعلاجات التي حددت أولوياتها. يمكن لهذه العملية أن تساعد أيضاً في تحديد أفضل الممارسات المطبقة في موقع التراث، والتي قد تتكرر في وقت لاحق، أو التي قد يتم تعلمها من قبل من هم أقل نجاحاً. ويساهم الاحتفاظ بسجل لكل الإجراءات التي اتخذت في تحسين أداء الإدارة مستقبلاً.



(الشكل رقم ١٥: خطوات إعداد التقرير)

ISBN 978-92-3-001073-7

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Cultural Organization

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