THE HASHEMITE KINGDOM OF JORDAN
PETRA DEVELOPMENT AND TOURISM REGION AUTHORITY

PREPARATORY SURVEY ON THE PROJECT FOR THE CONSTRUCTION OF THE PETRA MUSEUM IN THE HASHEMITE KINGDOM OF JORDAN

FINAL REPORT

JUNE 2014

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)

FREETIME INTERNATIONAL INC.
YAMASHITA SEKKEI INC.
ORIENTAL CONSULTANTS CO., LTD.

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Preface

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to Preparatory Survey on the Project for the Construction of the Petra Museum in the Hashemite Kingdom of Jordan Project Study Team (consisting of FreeTime International Inc., Yamashita Sekkei Inc. and Oriental Consultants Co., Ltd.).

The study team held a series of discussions with the officials concerned of the Government of The Hashemite Kingdom of Jordan, and conducted a field investigations. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Hashemite Kingdom of Jordan for their close cooperation extended to the study team.

June, 2014

Akira Nakamura

Director General,

Economic Infrastructure Department

Japan International Cooperation Agency

Summary

1. Outline of Country

The land area of the Hashemite Kingdom of Jordan (hereafter "Jordan") is 89,000 km^2 (around a quarter of Japan, the Japanese Ministry of Foreign Affairs), and the population is 6,318,000 (2012, the World Bank). Jordan is a constitutional monarchy that is located in the Middle East and West Asia. The climate of Jordan, more than 80% of which land is covered with desert, is dry in general; however, it is a rainy season from December to March, and sometimes snow falls.

GNI of Jordan is 29,850,000,000 US$ (2012, the World Bank), and the economic growth rate is 2.8% (2012, the Japanese Ministry of Foreign Affairs). Having such structural problems as an incoming gap between urban and rural areas, a poverty ratio and unemployment that have been changing at a high level, a chronic financial gap, and so on, Jordan still has vulnerability that tends to be influenced by financial assistance from foreign countries, the situation of regional law and order, the trend of short-term capital inflows and so on.

As tourism resources, Jordan has plenty of cultural heritages as well as peculiar natural views. The tourism industry accounts for around 13% of GDP (2013, prediction, Jordanian Ministry of Tourism and Antiquities), and is the major industry for earning foreign currency in Jordan that has a structural trade deficit. In Jordan, the unemployment rate of the whole laborer is 12.9% (2011, the Japanese Ministry of Foreign Affairs), the tourism industry is expected to develop offering new jobs to the younger generation (under 24) who occupy around half of the unemployed in Jordan.

2. Background, Course and Outline of Project

In the national development plan of Jordan, "Executive Development Programme 2011-2013" (EDP) , the tourism sector is regarded as one of the pillars to develop Jordan's economy. As one of the tourism sector objectives, the following items are included in EDP, such as the diversification of tourism merchandise, the archaeological site conservation, the promotion to change people's awareness of the importance of conserving the archaeological sites with the population, and so on.

Petra is one of the world heritages that Jordan boasts and one of the largest tourist sites in which around 630 thousand tourists (2012, Department of Statistics-Jordan), among around 8 million and 250 thousand tourists (2012, Department of Statistics-Jordan) to Jordan, visit annually. However, as Petra is mainly focused on the archaeological site tourism, and tourist sites and commercial facilities in Petra that attract tourists are not prepared satisfactorily except for the archaeological sites, a lot of tourists stay in Petra very shortly. Hence, in order to share an economic effect achieved by the tourism industry with the locals.

A lot of cultural properties from the Prehistoric Times to the Middle Ages; e.g. the Nabataean remains,

have been excavated in the ruins of Petra and its surrounding areas; however, it can not be said that the conservation and exhibition of the remains are properly managed. Hence, it is requested to improve the management condition.

Under such situations the Government of Jordan requested the Government of Japan to implement the Grant Aid cooperation for the Petra Museum Construction Project with the aim of enhancing the dispatch function of information regarding the importance of the exhibition of historical and cultural properties as well as the conservation of ruins, promoting and developing the tourism industry attractive as tourism resources of the region and contributing to creating a job opportunity by developing a museum in the adjacent area of the entrance to the Petra Archaeological Park (hereafter "PAP") in Wadi Musa in the Ma'an province. The items requested from the Government of Jordan regarding the Petra Museum Construction Project are as follows:

Table i: Requested Items regarding the Petra Museum Construction Project

(Source: PDTRA)

Outline of Facilities	· Size of Facilities: Floor Area 3,000m^2 · Components of Facilities: Museum, Laboratory, Workshop for Traditional Industry, Multi Function Room, Office, Guard Room, Electromechanical Room, Storage, Toilets, etc.
Outline of Equipment	· Laboratory Equipment: X-ray Radiography Unit, Optical Microscope, Binocular Microscope, Metallurgical Microscope, Petrological Microscope, Digital Camera with High Resolution Lenses, Operations Microscope, Hand Lenses, Infra-red Lamp, Ultra-violet Lamp, air Brush Machine, Water Distillation & Deionization Unit, Dist Total Dissolved Solids Tester, Heavy Duty Flex-shaft Rotary/Grinding Tool & Bits, Ultrasonic Dental Chisel, Air Abrasive Unit, Drying Oven, Vacuum Oven, Tool Cabinet, Electronic Balance/Scale, Ultrasonic Cleaner, Refrigerator, Large Deep Freezer, Steam Cleaner, and Stirring Hotplate · Other Equipment: Showcases, Graphic Panels, audiovisual Devices, Mountings, Exhibition Lighting, Loom, Kiln, and Potter's Wheels

Responding to the request from the Government of Jordan, the Government of Japan decided to carry out a study and JICA dispatched a preparatory study team for three times in order to collect relevant information and confirm the requested items. As a result of the study, it was concluded that Japanese assistance would be appropriate because the requested cooperation project aimed to newly construct a facility for exhibiting and conserving history and culture regarding the ruins of Petra as well as for doing enlightenment activities. As a result of discussions through the study, JICA and the Jordanian side agreed to the following items:

Table ii: Agreed Items of Grant Aid Cooperation Components through Preparatory Study

(Source: PDTRA/JICA)

Outline of Facilities	· Facility Area: Floor Area 2,300m^2 · Facility Components: Library, Multifunction Room, Office, Storage, Toilets, Guard Room, Electromechanical Room, etc. · To be constructed in the adjacent area to the existing Visitor Center located at the entrance to PAP, and to be united with the Visitor Center.
Outline of Equipment	· Equipment for Exhibition and Storage: Showcases, AV Devices, Exhibition Lighting, Graphic Panels, Mountings, and Steel Racks · Equipment for Management

3. Outline of Study Results and Project

Based on the above, JICA dispatched the Preparatory Study Team on Cooperation for two times from September 2013 to January 2014. In particular, as there was a possibility that the site proposed for the museum, which was owned by the Jordanian counterpart, became the ruins buffer zone prescribed by UNESCO, the Environment Impact Assessment, the Heritage Impact Assessment and the Traffic Flow Investigation were carried out. The Study Team collected the facility plan and the equipment plan based on the domestic analysis after coming back to Japan, explained the outline of the results of the preparatory study on cooperation to the Jordanian counterpart in April 2014, and prepared the Final Report.

3.-1 Scope of Cooperation Targets

As a result of the study, the reasonability to implement the construction of the Petra Museum and procure relevant equipment was confirmed based on the following reasons; in order to achieve the above national objectives the project would aim to construct the Petra Museum, arrange the tourism resources and the place for historical education, conserve and exhibit the excavated artefacts of the ruins of Petra, and save them as cultural properties of Jordan.

Specifically, the following functions will be realized:

Table iii: Main Facility Component

(Source: Study Team)

Division / Room	Main Functions and Remarks
Display Division	
Outdoor exhibition	Located next to the entrance in parallel to the pedestrian passage.

Division / Room	Main Functions and Remarks
space	The promenade and rest area connect the entrance, outdoor lounge, and exit space.
Exhibition room	Provide large space flexible for changing exhibition layouts. Install exhibition equipment fitted with various exhibition technologies.
Artefact Division	
Storage	Stores the artefacts, finds, objects for exhibition and cultural properties. Includes space for sorting the stored items, installs shelves and prepares photo-shooting space.
Preparation Room	Prevents fresh air from entering into the storage. Used for treatment works (washing, arranging, loading, unloading etc.) of the artefacts. Apply to forklift usage.
Entrance / Service Division	
Entrance Lobby Courtyard	Installs a reception counter, ticket counter, cloakroom, and information corner for visitors. The outdoor entrance lobby is covered with louvers in the upper part so that solar radiation is shaded and connected with the courtyard; which functions as outdoor exhibition space.
Outdoor Lounge	Functions as both emergency exit from the interior exhibition space and rest/café space.
Museum Shop	Provides a space for selling museum guidebooks and replicas. Oversees the museum exit.
Administration Division	
Administration Offices	Provide rooms for the director and administration space, meeting space and stores. The room is planned for persons in charge of security & maintenance and administrative staff.
Library	Collects and arranges books, materials, etc. regarding the Petra archaeological site.
Mech/Elec. Rooms	A substation, reservoir room, pump room, and rooms necessary for facility operation are planned.
Others	Provide a service yard for loading/unloading and forklift space on the north

Division / Room	Main Functions and Remarks
	side of the site.

3.-2 Study on Candidate Sites

The results of the study on the candidate sites are as follows, and it was concluded that there was no problem as a construction site of the project.

Table iv: Results of Study on Project Site

(Source: Study Team)

Study on Natural and Infrastructure Conditions	· Topographic State: The site has a gradual slope, but faces to a promenade. The visitors' access is easy, and there is no obstacle to the museum plan. · Geological State: The underneath of the surface soil is a hard sandstone stratum, and suitable for a supporting ground of a building. · Infrastructure State: As there are an electrical supply network and a water supply & drainage network near the candidate site, it is easy to connect an infrastructure necessary for the facility with them.
Environment Impact Assessment	· According to the EIA, the negative impacts caused by the museum construction project are temporary, and most of them are limited to the surroundings of the project site. It is estimated that they can be minimized by implementing a mitigation plan. · As for the mitigation plan, refer to "2-2-3-5 Study on Mitigation Plan".
Heritage Impact Assessment	· Under the supervision of PDTRA and DOA, a test excavation was carried out at 5 spots in the candidate site and the surrounding area. It was confirmed that there was no archaeological ruins in the site and the surrounding area. · DOA submitted the results of the test excavation to UNESCO.
Traffic Flow Investigation	· As a result of the traffic flow investigation of motorcars and pedestrians carried out at 5 spots such as Wadi Musa, the surrounding area of the candidate site, the sightseeing bus parking, the motorcar parking and the entrance to the park, it was concluded that a large traffic difficulty would not be caused by implementing the project. · However, aiming at securing smoother traffic flow in the future, a traffic management plan (short and middle/long terms) regarding the regulation of parking on the streets, the arrangement of an additional parking, the development of pedestrian environment, etc. was proposed.

3.-3 Study on Proposed Items

Based on the requested items from the Jordanian counterpart, the scope of the cooperation target was

prepared according to the exhibition plan, and the levels and functions & sizes corresponded to practical capabilities of similar public facilities in Jordan. In specific, the outline is shown in the table v, and the facility floor plan was prepared aiming at securing the exhibition room as large as possible in order to maximize the effect of the project implementation.

Table v: Outline of Plan

(Source: Study Team)

<table>
<tr><th></th><th>Outline of Plan</th></tr>
<tr><td>Facilities</td><td>
Facilities (one-story reinforced building)
<table>
<tr><th colspan="2">Division</th><th>Floor Area (m^2)</th></tr>
<tr><td rowspan="5">Facilities to be cooperated</td><td>Display Division</td><td>953.17</td></tr>
<tr><td>Artefact Division</td><td>172.40</td></tr>
<tr><td>Entrance Division</td><td>303.86</td></tr>
<tr><td>Administration Division</td><td>267.37</td></tr>
<tr><td>Service Division (Electromechanical Room, etc.)</td><td>48.22</td></tr>
<tr><td></td><td>Others (Shop, etc.)</td><td>38.35</td></tr>
<tr><td colspan="2">Total</td><td>1,783.37</td></tr>
</table>
Supplementary Facilities

External Facilities: Outdoor Exhibition Space, Rest Space (Café), Forklift Truck Shed, etc.
Exhibition Facilities: Exhibition Cases (including Exhibition Stands and Shelves), Reconstructed Models, etc.
Electrical Facilities: Power Supply Facilities (Main Power Facilities), Lighting Facilities (including Exhibition Lighting), Outlet Facilities, Communication Facilities (including LAN Facilities), Transmission Facilities, Security Cameras, Automatic Fire Alarm Facilities, etc.
Mechanical Facilities: Air Conditioning Facilities, Ventilation Facilities, etc.
Water Supply/Drainage/Sanitary Facilities: Sanitary Instruments & Facilities, Water Supply Facilities, Drainage Facilities, Fire Fighting Facilities, etc.

</td></tr>
</table>

Equipment	· Projection Equipment for Interior: Projector for Spherical Screen, Projector for Interior · Sound Equipment: Parametric Speaker Set, Speaker Set for Interior, speaker Set for Gallery 1 · Monitors: Liquid Crystal Television, Touch Panel · Acting Lighting Equipment: Lighting Set for Gallery 1, Acting Lighting Set · Equipment for Control Room: Equipment Set for Control Room, Desktop PC, Switching Hub, Data Server, PC Chair · Transportation Equipment: Electric Forklift, Hand Pallet, Plastic Pallet · Shelves for Storage: Steel Shelf Set · Furniture for Workshop: Whiteboard, Table, Chair, Hand Cart

3.-4 Study on Exhibition Plan

As a result of discussions with the Jordanian counterpart, it was concluded that the exhibition plan should be prepared based on the following concepts.

Basically the exhibition follows the chronological flow of Petra from the Neolithic Age to the present day. We will try to show various articles not only telling the stories of objects for exhibition themselves but also telling the stories of their backgrounds; e.g. how they were actually used in the life scenes of Petra, for example, by reconstructing parts of the life scenes such as El-Khazneh and Ez-Zantur.

Table vi: Concepts of Exhibition Plan

(Source: Study Team)

· In parallel with designing the exhibition plan, we will make an operation plan and present the exhibition plan that is closely related with the operation plan.
· We will prepare an exhibition system that can easily upgrade exhibition contents such as exhibition themes, objects for exhibition and exhibition interpretations as well as exhibition methods such as exhibition lighting, sound effects and utilization of natural materials.
· We will adopt exhibition methods and exhibition techniques that can certainly be maintained and operated in Petra located far from the capital, Amman.
· We will speedily offer exhibition data that can promote facility and equipment plans effectively and efficiently.
· We will closely confirm the mutual scopes of responsibility, between the Jordan side and the Japan side, for not only the factors regarding planning contents and working scopes but also the institutional and administrative factors related to the plan implementation, and fix, in detail, the matters to be borne by the counterpart.

- Closely examining the counterpart's implementation organisation and capacity, we will fix the contents of technical support (soft components) for strengthening project sustainability. Furthermore, we will examine the technical support that can develop the Visitors Centre together with.

4. Period and Rough Costs of Project

Taking account of the size of facilities, construction conditions of Petra, budgetary systems of both governments, clearance schedule of the project site and so on, the period necessary for implementing the project is expected to around 24 months; i.e. 7 months for the detailed design and tendering, 14 months for the facilities construction works and 2 months for the installation works of equipment and inspection.

5. Evaluation of Project

5-1 Relevance

From the following viewpoints the project can be judged to be relevant as a cooperation project utilizing the Japan's Grant Aid cooperation.

Petra is one of the world heritages that Jordan boasts and one of the largest tourist sites. However, as Petra is mainly focused on the archaeological site tourism, and tourist sites and commercial facilities in Petra that attract tourists are not prepared satisfactorily except for the archaeological sites, a lot of tourists stay in Petra very shortly. By developing an attractive spot that collects a lot of tourists through the project implementation, it is expected to increase the number of tourists and their staying time, and its beneficial effect will be large.

In the national development plan of Jordan, "Executive Development Programme 2011-2013" (EDP), the tourism sector is regarded as one of the pillars to develop Jordan's economy. As one of the tourism sector objectives, the following items are included in EDP, such as the diversification of tourism merchandise, the archaeological site conservation, the promotion to change people's awareness of the importance of conserving the archaeological sites with the population, and so on. Hence, the expected effects of the projects agree to the above. Furthermore, as the "National Tourism Strategy 2011-2015" positions the project as a base for the conservation of ruins and the promotion of tourism, the priority of the project is high.

5-2 Effectiveness

The presumed outputs from implementing the project are as follows, and the effectiveness of the project can be expected.

Table vii: Quantitative Effects

(Source: Study Team)

Index	Basic Value (2013)	Targeted Value (3 years after the project completion: 2019)
The number of cultural properties of Petra that are exhibited in a form with explanations regarding dates and historical cultural properties	0	300 items

Table viii: Qualitative Effects

(Source: Study Team)

- Valuable cultural properties excavated in the ruins of Petra and the surrounding areas can be conserved appropriately.
- As one of the representative tourism spots in Petra, the project can contribute to enhancing the value as tourism resources in Petra.
- The project can promote activities for education and popularization regarding the ruins of Petra toward local people and visitors to the ruins of Petra.

Contents

Appendices

Location Map / Perspective

Figure i: Location of Jordan

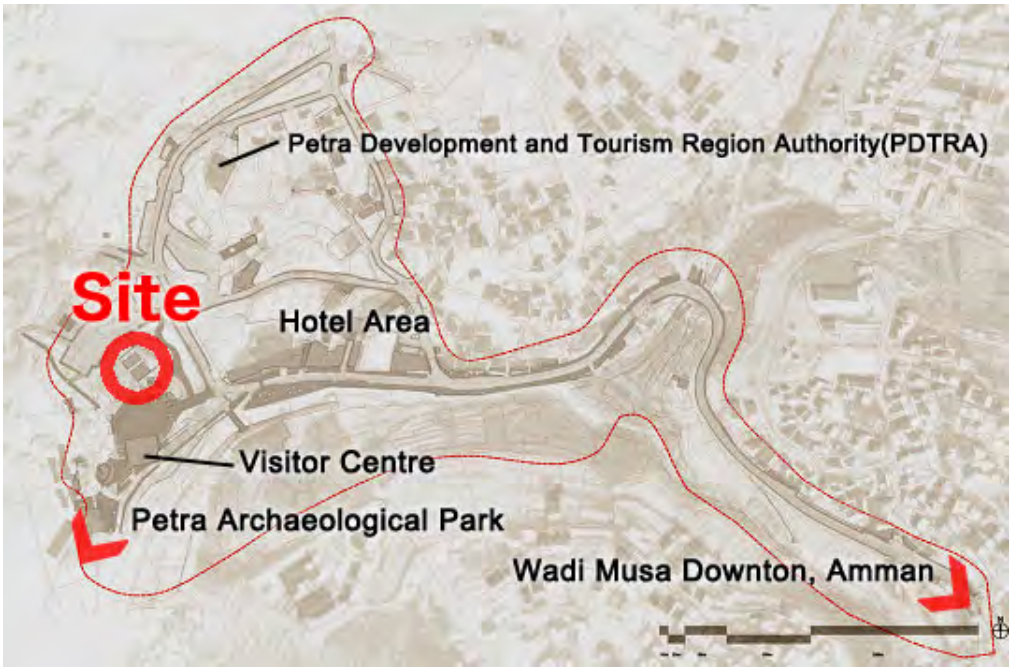


Figure ii: Location of Project Site

Figure iii: Completion Image (Facilities)

List of Figures & Tables

Abbreviations

DOA	Department of Antiquities
E/N	Exchange of Notes
EDCO	Electricity Distribution Company
EDP	Executive Development Program
EIA	Environment Impact Assesment
ESIA	Environmental and Social Impact Assesment
G/A	Grant Agreement
GDP	Gross Domestic Product
GNI	Gross National Income
HP	Heat Pump
I-HIA	Initial Heritage Impact Assessment
LAN	Local Area Network
LED	Light Emitting Diode
MOTA	Ministry of Tourism and Antiquities
PAP	Petra Archaeological Park
PDTRA	Petra Development and Tourism Region Authority
RSCN	The Royal Society for Conservation of Nature
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development

Chapter 1 Background of the Project

1-1 Higher Objectives and Project Objectives

As tourism resources, Jordan has plenty of cultural heritages from the Neolithic Age to the Ottoman era, as well as peculiar natural views such as the Dead Sea. The tourism industry accounts for around 13% of GDP (2013, prediction), and is the major industry for earning foreign currency in Jordan that has a structural trade deficit. In Jordan, the unemployment rate of the whole labourer is 12.9% (2011, the Japanese Ministry of Foreign Affairs), the tourism industry is expected to develop offering new jobs to the younger generation (under 24) who occupy around half of the unemployed in Jordan.

Petra is one of the world heritages that Jordan boasts and one of the largest tourist sites in which around 630 thousand tourists (2012, PDTRA), among around 8 million and 250 thousand tourists (2012, the Jordanian Statistical Department) to Jordan, visit annually. However, as Petra is mainly focused on the archaeological site tourism, and tourist sites and commercial facilities in Petra that attract tourists are not prepared satisfactorily except for the archaeological sites, a lot of tourists stay in Petra very shortly. Hence, in order to share an economic effect achieved by the tourism industry with the locals. Due to the unstable situation of the surrounding countries caused by the political fluctuation in the Middle East, the number of tourists to Jordan has been decreasing. It is necessary to take measures for increasing economic results per tourist.

In the national development plan of Jordan, “Executive Development Programme 2011-2013” (EDP) , the tourism sector is regarded as one of the pillars to develop Jordan’s economy. As one of the tourism sector objectives, the following items are included in EDP, such as the diversification of tourism merchandise, the archaeological site conservation, the promotion to change people’s awareness of the importance of conserving the archaeological sites with the population, and so on. Hence, the above objectives match to the expected results achieved by the project. In the “National Tourism Strategy 2011-2015”, the project is regarded as a central base of conserving the archaeological sites and promoting the tourism.

By constructing a museum at the location adjoining the entrance to the Petra Archaeological Park in Wadi Musa in the Ma’an province, the project aims to strengthen the function of offering information regarding the importance of exhibiting the historical and cultural heritages as well as conserving the archaeological sites, and accordingly promote and develop the attractive tourism industry as the region’s tourism resources as well as contribute to creating job opportunities.

1-2 Outline of Project

In order to achieve the above objectives, the project will be implemented with the aim of constructing the Petra Museum, managing the tourism resources and the place for historical education, conserving and exhibiting excavated articles from the Petra archaeological site, and retaining them as Jordan’s

cultural heritages. The cooperation project will establish facilities for exhibiting and conserving the history and culture regarding the Petra archaeological site, and promoting enlightenment activities as well as procuring equipment for the facilities.

1-3 Natural Conditions

(1) Meteorology

1) Climate

The climate of Petra is characterized by the cool and wet winter and the hot and dry summer, and is of the greatly declined type of the Mediterranean climate. Usually the period of spring and autumn is very short. The rain mainly falls in the mountainous lands and the rainfall is 150 – 300mm. The rainfall decreases very greatly in the lands below 800m, and is around 50mm in the Wadi Araba mountainous lands, the far western area.

2) Temperature

The temperature as well is affected by heights. In the high area, the maximum temperature of summer is usually recorded in July, and 24.5°C in average. The absolute maximum temperature is 38.5°C. The winter temperature is comparatively low as its climatic zone, and the minimum temperature is usually recorded in February and 8.1°C in average. The absolute minimum temperature is -4°C. The annual average temperature is 21.4°C.

3) Rainfall

The rainfall is characterized by a short and big downpour; however, in a long wet year, the rain gently falls accompanied with a front trough. The snow sometimes falls in the high lands. The annual total rainfall changes greatly, and according to the past 30 year data, the tendency becoming drier is outstanding.

4) Wind

The wind mainly blows from west and southwest, and gentle. The daily average evaporation amount is big. The annual evaporation amount at the Wadi Musa weather station is 2500mm, and the monthly maximum evaporation amount is recorded at 300mm in July.

Table 1-1: Summary of Climatic Values

(Source: PDTRA)

		Petra
Rainfall (mm)	Average	240
	Maximum	300
	Minimum	193
Tempariture (C)	Mean Annual	21.4
	Mean Monthly Maximum	24.5
	Mean Monthly Minimum	8.1
	Absolute Maximum	38.5
	Absolute Minimum	-4

Table 1-2: Climatic Data by Wadi Musa Weather Station

(Source: Jordan Climatological Handbook, 2000)

Month	Temperature °C		Rainfall (mm)		Snowy days
	Period (1984 - 2000)		Period (1976 - 2000)		Period (1976 - 2000)
	Max. Temp.	Min. Temp.	Total	Max.	Mean
Jan	11.5	4.1	40.5	55.2	0.9
Feb	12.0	4.0	36.0	35.0	0.7
Mar	15.3	6.1	36.1	65.0	0.0
Apr	21.7	10.7	9.6	32.0	0.0
May	26.1	14.3	4.1	7.5	0.0
Jun	28.4	16.6	0.0	0.0	0.0
Jul	29.6	18.1	0.0	0.0	0.0
Aug	29.5	18.2	0.0	0.0	0.0
Sep	27.7	16.5	0.0	0.0	0.0
Oct	23.9	13.9	5.2	32.0	0.0
Nov	18.4	9.5	13.0	23.0	0.0
Dec	13.5	5.5	32.7	51.0	0.0

Table 1-3: Amount of Rainfall in Wadi Musa (1999-2012/3)

(Source: PDTRA)

Period	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1999/2000	4	0	1.1	52.2	5.7	22.6	0	0	0	0	0	0	85.6
2000/2001	38.1	23.7	32	37.1	22.8	12	32.1	40	0	0	0	0	237.8
2001/2002	0	12	27.5	77.9	91.8	8.4	9.2	0.2	0	0	0	0	227
2002/2003	7.2	13.3	72.2	26.3	1.6	23	7.8	1.4	0	0	0	0	152.8
2003/2004	0	1	37.3	151.1	26.3	6	0.4	0.3	0	0	0	0	222.4

Period	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
2004/2005	8.2	22.5	22.1	40.5	6.4	0	0	0	0	0	0	0	99.7
2005/2006	0.2	0.2	2.2	11.8	49	0	37	100.4	0	0	0	0	200.8
2006/2007	0	5.6	55.2	29.9	37	20	6.6	6.3	0	0	0	0	160.6
2008/2009	0	0	11	65	35	0	0	0	0	0	0	0	111
2009/2010	0	13.5	35	40	73	22	0	0	0	0	0	0	184
2010/2011	0	0	10	5	24	10	16	0	0	0	0	0	65
2011/2012	0	12	3	32.5	20	8	-	-	-	-	-	-	75.5

(2) Geology

The ground condition was confirmed at 5 test pits for the Heritage Impact Assessment in the construction site and the surrounding areas, It was proved that the depth of the sandstone layer which was a supporting layer for building foundations was 10 – 30cm below the topsoil.

1-4 Environmental and Social Consideration

(1) Confirmation of Environmental Impact Assessment System in Jordan

The Environmental Impact Assessment (EIA) Bylaw No.37 was issued in 2005. According to EIA Bylaw No.37, the project shall be classified in one of the following categories by decision of the Secretary General on the basis of the recommendations of the competent party at the Ministry of Environment:

1. Category 1: includes the projects that require a comprehensive environmental impact assessment.
2. Category 2: includes the projects that require a preliminary environmental impact assessment;
   if necessary a comprehensive environmental impact assessment will be conducted.
3. Category 3: includes the projects that require neither a preliminary environmental impact assessment nor a comprehensive one.

The proposed project might be classified as Category 2, but it should be confirmed by the Ministry of Environment.

Based on the EIA Bylaw No. 37, the report should include the following content which is familiar with the content requested by the “JICA Guideline of Environmental Impact Assessment for Category B project (June 2011)”.

- Executive summary
- Legal framework, policy and administrative system

- Project description
- Baseline data
- Environmental Impact Assessment
- Analysis of alternatives
- Mitigation plan
- Environmental monitoring and subsequent environmental audit plan

A summary of the legislation and administrative framework applicable during both phases (construction and operation) is shown in the Table below:

Table 1-4: Relevant Legislation and Responsible Authority

(Source: Study Team)

Legislation	Responsible Authority
Cross-Sectorial	
Environmental Law No. 52, 2006	Ministry of Environment
EIA Regulation No. 37, 2005	Ministry of Environment
Petra Development and Tourism Region Authority Law No.15, 2009	
Agriculture Law No. 44, 2002	Ministry of Agriculture
Renewable Energy & Energy Efficiency Law No. 3, 2010	Ministry of Energy and Mineral Resources
Public Heath Law No. 47, 2008	Ministry of Health
Labour Law No. 8, 1996	
Heritage	
Protection of Cultural Heritage and Sites No. 5, 2005	Ministry of Tourism and Antiquities
Antiquities Law No. 21,1988	
Waste Management	
Solid Waste Management Regulation No. 27, 2005	Ministry of Environment
Regulation No. 24, 2005 for the Management of Hazardous and Dangerous Materials	Ministry of Environment
The Regulations for Sewage Systems No. 66, 1994	Water Authority
Air Quality, Noise and Soil Protection	
Air Quality Protection Regulation No. 28, 2005	Ministry of Environment
Soil Protection Regulation No. 25, 2005	Ministry of Environment
Traffic Law No. 49, 2008	Ministry of Interior
Noise Level Control Instructions, 2003	
Water – Reclaimed Domestic Wastewater (JS 893:2006)	Jordanian Institute for Standardization and Metrology
Environmental – Air Quality – Ambient Air Quality Standards (JS 1140:2006)	
Nature Conservation	
Natural resources and National Parks bylaw of 2005	Ministry of Environment
Protection of Birds and Wildlife bylaw No. 113 of 1973	RSCN

(2) Confirmation of Current Environmental and Social Condition in Study Area

Based on the existing documents, such as the results of the Heritage Impact Assessment (HIA) and Traffic Survey, the interviews with stakeholders, the current status of environmental and social conditions of the project area was reviewed.

Table 1-5: Current Status of Environmental and Social Conditions in the Project Area

(Source: Study Team)

	Item	Outline of Current Status
Pollutant Control	Air Quality	· The National Environmental Standard for air quality is specified in the Ambient Air Quality Standards (1140:2006); however, there is no Ambient Air Quality monitoring station located near the project area. · According to the report provided by PDTRA, the present traffic and transportation situation in the Petra region, and particularly in Wadi Musa, is considered as one of the most critical issues in the region. One of the main reasons is the fact that most of the traffic for tourists visiting PAP currently needs to go through the narrow and often quite steep streets in the downtown Wadi Musa.
	Water Quality	· Water supply within Jordan is regulated by the national government. The per-capita water allotment in Ma'an Governorate for the year 2007 was 214 litre per day. Due to water scarcity in Jordan, this rate may well be lowered. · The drinking water is currently supplied using ground water from the well fields in the region. The principal groundwater sources are in good condition and show little evidence of any surface originating pollution. The spring sources for other use are however showing evidence of stress from a mix of urban pollutants.
	Waste	· Regarding solid waste disposal, PDTRA has started to undertake initial measures by creating a dedicated unit for this issue. By using six vehicles, PDTRA operates collection of solid waste. Six communities generate approximately 45 ton solid waste per day, however, it becomes twice or three times in the tourist high season (April and October). · PDTRA promotes waste separation and re-cycle. There are two types of trash boxes located in the area. (Blue colour: Papers and carton, Green colour; metal and grasses) · The communities that are connected to the sewer system are Wadi Musa, Taybeh, Umm Sayhoun and Baidha and the current WWTP is designed to treat 3400 cubic meters per day.
Natural Environment	Climate	· The climate of Petra is influenced mainly by the southern mountains agro-climatic zone, which is characterized by arid climate condition with average annual precipitation over the catchment area of approximately 180 mm. Temperatures are influenced by elevation, with an average temperature between 32°C and 35°C in summer, and a minimum temperature of 4°C in February, as recorded by Wadi Musa weather station. · Winds are predominantly from the west and southwest, and gentle.
	Protected Area	· The project area is located by the Petra Archaeological Park (PAP). · The Petra Buffer Zone study has been conducted, and the project area will be defined as the "Special area for enhancement and management of PAP".

	Item	Outline of Current Status
Natural Environment	Ecosystem	· The Petra region is a unique place for plant geographers and of great interest to botanists for its diversity. However, no comprehensive studies on the flora have been undertaken until now. The fauna of Petra is of equally great diversity: 332 species (PNT 1996) have been identified within the region, of which the majority is insects and birds. · The project area had already been developed and there are the secondary forests such as pine trees.
	Hydrology	· The natural rainwater streams in the project area are the downstream of catchments that extend 60 km^2 to the north and south of Wadi Musa. The water streams discharge to the main Wadi course located to the right of the tourist's street, a maximum street length of 12 km. · The problem with this Wadi is that it is in a dry region and, considering the extent of the catchment, a flash flood is probable. The risk to the tourists by the flash flood was reported.
	Topography and Geology	· The project area is dominated by sandstone sedimentary rocks. The Quaternary and recent deposits are also present in the area. They consist of beds of sandstone that belong to the Umm Ishrin sandstone and Disi sandstone geologic formations of the Rum group of the Cambrian to Ordovician Age of Paleozoic.
Social Environment	Land Use	· A significant amount of land in the Petra region is owned by the government and, by law, must not be transferred to private ownership. Therefore, the total amount of private land for development and agriculture is limited. · Five forms of land use currently exist within the Petra region: 1) urban development, 2) agriculture, 3) forestry, 4) protected areas and 5) tourism zones as represented by the Petra Archaeological Park. · The project area is located by PAP, and will be defined as the "Special area for enhancement and management of PAP". This area is an intense tourism zone in the region with the commercial sector such as hotels and souvenir shops, while there are few residential buildings, but no schools or health facilities.
	Resettlement	· Several buildings (i.e. Tourist police and Crowne Plaza hotel's facilities) exist in the project area, but there are no households which are needed resettlement by the proposed project. · The tourist police will move to the underground of the Visitors Centre. On the other hand, an agreement on the land exchange will be singed between PDTRA and the owner of the hotel's facilities.
	Tourism	· Petra mainly depends on the tourism sector. In the last decade, tourism has greatly improved in the region, while the traditional sector of agriculture has increasingly declined due to the growing water shortage and the comparatively easy income opportunities in tourism. The entire region has a population of 30,710 people (DOS 2012), and increased pressures on housing and social-welfare services are expected, which are already inadequate in some of the communities.

	Item	Outline of Current Status
Social Environment	Living and Livelihood	· The social structure of the population is characterized by a variety of tribes, subdivided by clans, which have a tendency to favour members of the same clan when it comes to hiring employees. This explains to some extent why members of one tribe and/or one community are often dominating some businesses (e.g. tour operators). As a result, benefits from tourism are not shared equally among all the tribes and communities of the region. · Overall, the workforce in the Petra region is well educated and includes many academics, especially in Wadi Musa where the College for Archaeology, Tourism and Hotel Management is located. The regional unemployment rate is at 9% lower than the Jordanian average of 12% (Al-Hasanat, 2009). Unemployment in the Petra region mostly affects women as well as the population group aged between 21 and 25.
	Infrastructure and Public Services	· Water shortage due to the drying out of natural springs is one of the major issues threatening the future of the Petra region. The 214 litres per capita per day that were available in 2007 are predicted to drop to 145 litres by 2030 if the population keeps growing at the present rate, 20%. In order to address the water needs of the region, it would be necessary to increase the intensive water harvesting and water re-use efforts. · Besides the crucial water issue, the ability of the region to support urban development is also directly related to the availability of infrastructure – roadways and transportation systems, sewer, waste disposal, electricity and telecommunications. Much of the existing urbanized areas require an improved and adequate infrastructure. · Available public services such as schools, hospitals and leisure facilities (e.g. youth or sports centres) are unevenly and insufficiently distributed across the region.
	Transportation	· The main roads of the region are in good condition but smaller roads that lead to less touristic places are in poorer condition. The town of Wadi Musa is suffering from serious traffic congestions during peak business hours, which is accentuated by the tourism traffic passing through town. · Based on the traffic survey conducted on 3rd, 4th 5th, and 7th October 2013, the daily maximum number of visitors was about 2,800 on a Friday, the busiest time for entering PAP was from 08:00 to 09:00, on the other hand, the busiest time for exiting PAP was from 15:00 to 16:00. · About 40% of the travel mode of the people moving around PAP entrance was occupied by private cars. The ratio of the tourist buses was only 7%, but the average number of passengers on a tourist bus was 31.5 persons.

	Item	Outline of Current Status
Social Environment	Heritage	· The Initial Heritage Impact Assessment was conducted between 9th and 24th of September 2013. · From the survey of the surrounding area, it is thought that the planned construction site is located on the top of bedrock with thin top soil to the west of a small valley. Seventeen historical ruins were confirmed in the area surrounding the planned construction site: 10 remains thought to be underground burial sites from the excavation of bedrock, such as two water tanks, three irrigation facilities, one kiln remain and one area of scattered remains. Looking at the surrounding historical ruins, aside from the kiln remains and the scattered earthenware fragments located on the top of a deep sedimentary layer, all of the ruins are either remains excavated from the bedrock or remains comprising stones immediately on the top of the bedrock. · The Trial Excavation Survey was conducted on the planned construction site. The results of the Trial Excavation Survey show that the museum site was a purely agricultural area, and the area is completely clear from any antiquities or cultural properties.
	Landscape	· Characteristics of the landscape were confirmed through the preparatory survey of the Wadi Musa Tourist Zone - Urban Design and Landscaping (June 2013). The following observations could be made based on the views experienced in the area surrounding the project site: ➢ While descending to Wadi Musa, the visitor can see the scenic mountains of Petra with the hotels in the foreground. The mountains provide a unique colour scheme and interesting texture. The trees in Al-Dara and among the houses with different shades of green add to the brownish colour scheme of the mountains. ➢ Khirbet Al-Hlalat also provides interesting views with the traditional architecture, the stairs integrated with the rock formations and the terraces planted with olive trees. Furthermore, views from Al-Hlalat into the ravine (Al-Dara) are unique. ➢ In general, there is a clutter that has an adverse effect on some of the remarkable views.

(3) Scoping

Based on the result of review of the environmental and social conditions of the project area, potential impacts of the project were identified. (Scoping)

The potential impacts were evaluated by the project phase (Before/during construction, Operation) and by environmental items, taking into consideration of the activities in each project phase.

The types of the impact are shown as the following legend;

A +/- : Significant positive/negative impact is expected.
B +/- : Positive/negative impact is expected to some extent.
C +/- : Extent of positive/negative impact is unknown.
(A further examination is needed, and the impact could be clarified as the study progresses)
D : No impact is expected.

The result of the scoping is shown in the table below.

Table 1-6: Scoping of the Potential Impact of the Project

(Source: Study Team)

Item			Before/During Construction	Operation	Evaluation
Pollutant Control	1	Air Quality	B-	B-	**Construction:** The use of construction machinery and vehicles, carrying staff and supplies, could cause an increase in the concentration of gases and particulate matter. However, it would be limited and temporary. The calm conditions of the winds in the project area would not lead to spread air pollutants. **Operation:** Based on the estimation of future traffic demand, the recommendation on traffic control and management was made, and will be implemented for the area surrounding PAP. Countermeasures for current traffic situation had been proposed in the "Strategic Master Plan for Petra Region". If these countermeasures are not implemented, traffic congestion, which causes air pollution, will continue to occur due to local traffic and tourist buses.
	2	Water Quality	B-	D	**Construction:** Construction activities such as washing machinery and vehicles will cause effluent. **Operation:** Sewage generated from the museum will be connected to the existing waste water line and will be treated at Al Baida Waste Water Treatment Plant. (If tourist numbers increase in the future, expansion of the wastewater treatment system will be needed.)
	3	Waste	B-	D	**Construction:** Construction waste (waste soil, concrete) will be generated from reconstruction of the existing buildings. **Operation:** The museum cafeteria will use re-useable bottles to serve beverages. Solid waste generated by tourists will be separated, collected and re-cycled.
	4	Soil Pollution	B-	D	**Construction:** Soil pollution might occur due to vehicles' engine oil leakage and washing heavy machinery.

Item			Before/During Construction	Operation	Evaluation
Pollutant Control	5	Noise and Vibrations	B-	D	**Construction:** The use of construction machinery and vehicles, carrying staff and supplies, could cause noise and vibrations. **Operation:** The museum will not cause noise or vibrations. Even if the museum will operate in the night time, the noise generated by the tourists is limited and there are no residences in the surrounding area.
	6	Ground Subsidence	D	D	The project will not cause ground subsidence.
	7	Offensive Odours	D	D	The project will not cause offensive odours.
	8	Bottom Sediment	D	D	The project will not affect bottom sediment in the surrounding area.
Natural Environment	9	Protected Area	D	D	The project area will be defined as the "Special area for enhancement and management of PAP"; therefore, the project will follow its rules.
	10	Ecosystem	B-	B+	**Construction:** A few pine trees will be cut down for the construction, but most existing secondary forests can continue to exist. The project area had been developed and the buildings were constructed, so that impact of the project will be limited. **Operation:** The area surrounding the museum will be replanted, taking into account local flora, so it will contribute to conserve the local ecosystem.
	11	Hydrology	D	D	The project will not affect the current hydrology.
	12	Topography and Geology	D	D	**Construction:** Excavation works will be limited, so that the project will not affect the current topography or geology.
Social Environment	13	Resettlement	D	D	There is no involuntary resettlement for the project. The existing tourist police will move to the underground of the new Visitors Centre, and the hotel facilities will move out of the area surrounding PAP.
	14	Poor, Indigenous, or Ethnic People	D	A+	**Construction:** There is no involuntary resettlement for the project. **Operation:** In the museum, handicrafts and other local products will be introduced and sold as the culture of Petra. This will contribute to promoting local economies and increasing incomes of households.

Item			Before/During Construction	Operation	Evaluation
Social Environment	15	Local Economies, such as Employment, Livelihood, etc.	B+	A+	**Construction:** Employment and procurement for the museum construction will be expected. New construction techniques will also be introduced to this area. **Operation:** In the museum, handicrafts and other local products will be introduced and sold as the culture of Petra. This will contribute to promoting local economies and increasing incomes of households.
	16	Land Use and Utilization of Local Resources	D	D	The project will not affect the current land use or utilization of local resources.
	17	Water Usage	B-	B-	**Construction:** Construction activities will use water for preparation of materials and washing heavy machinery, etc. **Operation:** The museum will use water for its exhibitions and toilets.
	18	Existing Social Infrastructure and Services	B-	B-	**Construction:** Countermeasures for the current traffic situation had been proposed in the "Strategic Master Plan for Petra Region". If these countermeasures are not implemented, traffic congestion will continue to occur due to local traffic, tourist buses and vehicles for the construction. **Operation:** Based on the estimation of future traffic demand, a traffic plan will be proposed and implemented for the area surrounding PAP. Countermeasures for the current traffic situation had been proposed in the Master Plan. If these countermeasures are not implemented, traffic congestion will continue to occur.
	19	Local Institutions, Decision Making	D	D	The project will be implemented by PDTRA in coordination with related institutions.
	20	Misdistribution of Benefits and Damages, Local Conflicts of Interest	D	D	An operation plan for the Petra Museum will be developed, taking into account distribution of benefits among the local communities.

Item			Before/During Construction	Operation	Evaluation
Social Environment	21	Heritage	C	A+	**Construction:** According to the Initial Heritage Impact Assessment, archaeological remains were not found in the project area. However, archaeological monitoring should be implemented before construction works such as reconstruction of existing buildings and land clearing. **Operation:** Heritage and archaeological remains will be managed appropriately, and they will be introduced to Jordanian and foreign tourists. This will help to conserve these cultural heritages.
	22	Landscape	B-	D	**Construction:** Construction works and temporary facilities will affect the current landscape of the project area. **Operation:** In order to harmonize with the surrounding landscape, the height of the museum is limited and local materials whose colours will be natural such as white, beige or gray will used for its exterior.
	23	Gender	D	A+	**Operation:** The proposed Petra Museum can assist female participants in standing on their own feet economically and socially and improving their social position.
	24	Children's Rights	D	A+	**Operation:** The proposed Petra Museum can enhance local peoples' as well as children's knowledge concerning PAP and the archaeology of Petra.
	25	Infectious Diseases such as HIV/AIDS	C	C	**Construction:** There is a possibility that temporary workers from outside of the area will bring infectious diseases. If, the workers take a health and safety education program, the risk can be reduced. **Operation:** Petra is one of the most famous world heritage sites, and tourists will come from all over the world. So there is a possibility that tourists will bring infectious diseases.
	26	Working Conditions	B-	D	**Construction:** The project proponent will follow all laws and ordinances associated with the working conditions in Jordan.

Item			Before/During Construction	Operation	Evaluation
Other	27	Accidents	B-	B-	**Construction:** There is a possibility that traffic accidents and other accidents will occur during the construction. If the workers take a health and safety education program, the risk can be reduced. **Operation:** There is a possibility that traffic accidents involving tourist buses will occur, so a traffic plan for PAP should be considered to avoid these accidents.
	28	The impacts to Trans-boundary or Global Issues	D	B+	The Project will not cause any impacts to trans-boundary or global issues. By using high-energy efficiency technologies, energy consumption can be reduced and this will contribute to preventing the global warming.

(4) Comparison of Alternatives

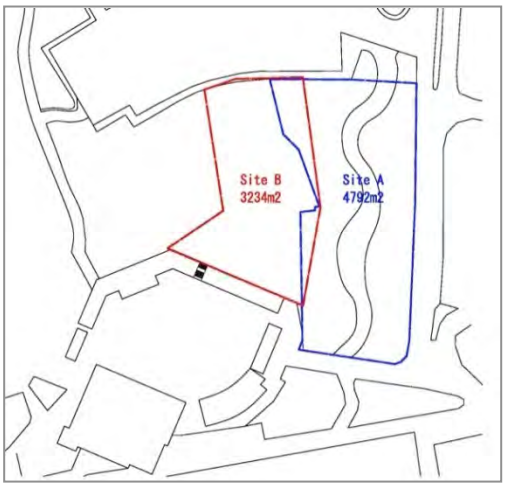
The location of the museum was selected from several candidates, taking into account such indicators as the current land use, the relationship of traffic conditions and tourist flows, the available area for the museum, the costs, etc. Based on this evaluation, the area located in the northern part of the PAP Visitors Centre was selected as the final candidate.

To decide the project site, two alternatives shown below were proposed and evaluated.

Table 1-7: Comparison of Alternatives

(Source: Study Team)

	Site A	Site B
Area	4,792 m^2	3,234 m^2
Current land use	There is a pedestrian street linking the bus/ car parking area to the main gate of PAP. The landowner is PDTRA.	The building of the Tourist Police and Crowne Plaza hotel's facilities exist in this location. The land ownership will be transferred to PDTRA
Access from the parking area to PAP	A new access path will be needed or the sidewalk can be used as the access path to the PAP main gate.	The tourists can use the existing pedestrian street.
Vegetation	Secondary forests (e.g. pine trees) are located between the sites A and B.	
Heritage Impact Assessment	There are no archaeological remains.	There are no archaeological remains.
Advantage	The area is bigger than the site B.	Due to reconstruction of the existing buildings, impacts from construction will be limited compared to the new construction. The tourists can use the existing pedestrian street and get to the PAP main gate smoothly. An open area on the west side of the site B can be used as a storage yard during the construction. The open area in the site A can be used for a green area with the museum exhibitions.
Challenges	A new access path will be needed. If the sidewalk is used as the new access path to the PAP main gate, the risk of traffic accidents will increase.	A few pine trees will need to be cut down for the construction.
Conclusion		***Selected***



(5) Mitigation Measures

Mitigation measures to minimize negative impacts of the Project are shown in the table below.

Table 1-8: Mitigation Measures (Construction Phase)

(Source: Study Team)

Items	Causes of Impact	Mitigation Measures
Air Pollution	Construction works (land cleaning, reconstruction of the existing buildings) and the use of heavy machinery and vehicles	· Regular maintenance of heavy machinery and vehicles · Sprinkle water for prevention of dust spread (dry season) · Enclosure and covering of dusty material stockpiles with impervious sheeting · Cover haul trucks transporting soil, sand, or other loose materials to the site · Set prevention walls or curtains/screens · Identify the use of hazardous materials and report them to the responsible authorities · Promote safe driving and operation (minimize an idling time) · Prohibit the combustion of solid waste
Water Quality	The use of heavy machinery and vehicles	· Prevent the leakage of effluent to natural water ways · Identify the use of hazardous materials and report them to the responsible authorities
Noise and Vibrations	Construction works and the use of heavy machinery and vehicles	· Regular maintenance of heavy machinery and vehicles · Use low-noise or low vibration machines · Apply construction methods to reduce noisy work · Enclose the noise sources by setting prevention walls or curtains/screens · Prohibit construction work during the night time
Waste	Construction waste generation	· Prepare the dumps for the waste soil · Identify the use of hazardous materials and report them to the responsible authorities · Implement separation of solid waste and promote reuse · Implement proper management of discharged water from the dump site

Items	Causes of Impact	Mitigation Measures
Ecosystems	Deforestation of the secondary forest Construction works and the use of heavy machinery and vehicles	· Avoid deforestation of existing trees · Avoid undertaking construction work during the nesting season of avifauna · Replant the local species
Living and Livelihood	Employment for construction	· Priority in hiring should be given to the qualified locals from nearby villages
	Traffic congestion by construction vehicles	· Scheduling trips to the construction site to avoid any major disruptions in traffic flows resulting from the movement of heavy machinery and construction materials · Construction materials should be securely packed and covered on trucks to prevent roads from falling off or generating dust · Control the use of vehicles off the site
	Gas and noise from the use of heavy machinery and vehicles	· Avoid affecting the social infrastructures which are used by local communities · Respect culture in this area and avoid interrupting or interfering · Implement communication activities to local communities (explanation of the project, education, etc…) · Control the use of vehicles off the site
Water Demand	Construction works including preparation of construction materials	· Handle water resources efficiently and rationalize water use
Cultural Heritage	Construction works (land cleaning, reconstruction of the existing buildings)	· Monitor the existence of archaeological remains before the construction and report the results to the responsible authorities · Avoid building structures and land cleaning near the site of archaeological remains · Exhibit the actual preserved remains
Landscape	Deforestation Construction activities, Stockyard of materials, equipment	· Avoid deforestation of existing trees · Set prevention walls or curtains · Replant the local species
Working Conditions	Accidents and Infectious diseases during the construction	· Conduct the health and safety education program for the workers

Table 1-9: Mitigation Measures (Operation Phase)

(Source: Study Team)

Items	Causes of Impact	Mitigation Measures
Traffic Congestion/ Air Pollution	Traffic congestion by tourist traffic	· Implement the traffic management plan proposed · Restrict/prohibit on-road parking · Establish the designated taxi bays at a section of the road with sufficient width and regulate the parking and dwelling locations of taxis · Restrict entry of heavy vehicles to the Tourist Road in the vicinity of the PAP entrance and promote using the alternative routes · Improve the current pedestrian walkways and enhance pedestrian environment
Waste	Waste generated from the cafeteria and toilets	· Use reusable bottles for beverages · Separate solid waste and take appropriate treatment
Water and Energy Usage	Water use for exhibitions and toilets	· Introduce energy-saving design and technologies (e.g. a natural ventilation system, a high efficiency lighting system, etc…)
Living and Livelihood	Employment for museum operation	· New job opportunities should be distributed equally to the local communities.
	Conflict between culture differences Night time operation of the museum Traffic congestion in Wadi Musa down town	· Respect culture in this area and avoid interrupting or interfering them · Promote involvement of the local communities to the museum (education for children and promotion of local products, etc.) · Implement the countermeasures
Landscape	Existing of the museum	· The height of the museum will be limited. · Local materials whose colour will be natural colour such as white, beige or gray will be used for the exterior of the museum.

(6) Environmental Monitoring Plan

The environmental condition should be monitored in both construction phase and operation phase of the proposed Petra Museum.

The tentative environmental monitoring plan is shown below. A detailed plan shall be prepared based on the detail design and the construction plan before implementing the project.

During the construction phase, the responsible entity will be the contractor and the enforcing entity will be PDTRA. On the other hand, during the operation phase, the responsible entity will be PDTRA.

Table 1-10: Environmental Monitoring Plan

(Source: Study Team)

Stage	Items		Frequency	Location	Remarks
Before and During Construction	Air Quality	PM10, PM2.5, NOx, SO2, CO	To be decided referring to the construction schedule *	Near the construction site	24hr or 8 hr (in average)
	Noise and Vibration				Taken as a maximum allowable noise level in the area
	Ecosystem		2 (before and after)		
	Cultural Heritage		1		
	Traffic Condition		To be decided referring to the construction schedule *	The roads which construction vehicles use.	
During Operation	Air Quality	PM10, PM2.5, NOx, SO2, CO	Twice a year (high/low season)	The congestion points by tourist vehicles	24hr or 8 hr (in average)
	Traffic Condition		Once a year (high season)		

Note: * Depending on the construction schedule, the construction machinery and vehicles will change. So the sampling should be conducted at the time when the influence becomes the greatest.

(7) Conclusions and Recommendations

Based on the result of this study, potential environmental and social impacts from the proposed project are identified. It is evaluated that the identified negative impacts are temporary or limited, and they could be minimized by implementing the above mitigation measures.

On the other hand, it is expected that this project could obtain the following positive impacts.

- The Petra Museum will contribute to introducing the unique and valuable culture of Petra to the world
- The Petra Museum will contribute to increasing the attraction of Petra region to tourists and this will lead to increase the length of stay of the tourists.
- The Petra Museum will contribute to promoting local products (e.g. handicrafts, medicinal herbs, other agriculture products, etc.) to the tourists who come from all over the world.

- The Petra Museum will contribute to promoting cultural and ecological education for children. This will perpetuate the culture and living environment of the local communities.

To obtain understanding of and interest in the project from the local communities, it is very important that PDTRA should explain these positive impacts to the local communities.

In order to develop the Petra Museum project, the next steps PDTRA needs to take for the EIA are the following;

- To submit a project basic design and an initial environmental and social consideration report to the Ministry of Environment, and confirm the EIA category and conduct necessary surveys. (e.g. The air quality monitoring requires to set a baseline.)
- To explain the project basic design and the initial environmental and social considerations to the related authorities of this project.

Chapter 2 Contents of the Project

2-1 Basic Concept of Project

2-1-1 Higher Objectives and Project Objectives

As tourism resources, Jordan has plenty of cultural heritages such as the Roman era, the Crusaders, the Ottoman era, and so on as well as peculiar natural views such as the Dead Sea. The tourism industry accounts for around 13% of GDP (2013, prediction), and is the major industry for earning foreign currency in Jordan that has s structural trade deficit. In Jordan, the unemployment rate of the whole labourer is 12.2% (2012), the tourism industry is expected to develop offering new jobs to the younger generation (under 24) who occupy around half of the unemployed in Jordan.

Petra is one of the world heritages that Jordan boasts and one of the largest tourist sites in which around 630 thousand tourists (2012), among around 8 million and 250 thousand tourists (2012) to Jordan, visit annually. However, as Petra is mainly focused on the archaeological site tourism, and tourist sites and commercial facilities in Petra that attract tourists are not prepared satisfactorily except for the archaeological sites, a lot of tourists stay in Petra very shortly. Due to the unstable situation of the surrounding countries caused by the political fluctuation in the Middle East, the number of tourists to Jordan has been decreasing. It is necessary to take measures for increasing economic results per tourist.

In the national development plan of Jordan, “Executive Development Programme 2011-2013” (EDP) , the tourism sector is regarded as one of the pillars to develop Jordan’s economy. As one of the tourism sector objectives, the following items are included in EDP, such as the diversification of tourism merchandise, the archaeological site conservation, the promotion to change people’s awareness of the importance of conserving the archaeological sites with the population, and so on. Hence, the above objectives match to the expected results achieved by the project. In the “National Tourism Strategy 2011-2015”, the project is regarded as a central base of conserving the archaeological sites and promoting the tourism.

By constructing a museum at the location adjoining the entrance to the Petra Archaeological Park in Wadi Musa in the Ma’an province, the project aims to strengthen the function of offering information regarding the importance of exhibiting the historical and cultural heritages as well as conserving the archaeological sites, and accordingly promote and develop the attractive tourism industry as the region’s tourism resources as well as contribute to creating job opportunities.

2-1-2 Outline of Project

In order to achieve the above objectives, the project will be implemented with the aim of constructing the Petra Museum, managing the tourism resources and the place for historical education, conserving and exhibiting excavated articles from the Petra archaeological site, and retaining them as Jordan’s

cultural heritages. The cooperation project will establish facilities for exhibiting and conserving the history and culture regarding the Petra archaeological site, and promoting enlightenment activities as well as procuring equipment for the facilities.

2-2 Outline Design of Requested Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Basic Policy

(1) Basic Policies

- Considering the actual conditions of the project site and operational scheme, valid and appropriate exhibition, facilities, equipment scope, scale, and contents are applied as a museum adapted to operational capacity.
- The scheme has coherence and unity with the existing development plan of Visitors Centre and avoid the functional redundancy with it.
- An appearance design is well considered so that a historical and cultural scene may not be destroyed.
- In order to prevent degradation of remains and cultural assets, the insulation and homeothermy of the institution are considered.
- While utilizing the site area to the utmost and integrating the exterior, the function of the facility required within the limited scale is satisfied.
- In consideration of visitor's circulation in the ruins, the approach to the museum is well visible and easy to access.
- Regarding the equipment plan, the condition of existing equipment and budget, technical level, and capability of operation & maintenance of the Jordan side are well considered in order to make the scope, scale and contents of the plan be appropriate and efficient. The selection of the suppliers is also well considered so that the acquisition of spare parts can be carried out smoothly and easily.
- The Jordan side carries out some parts of the exhibition works; e.g. the installation of objects for exhibition, soft contents and graphic panels production, etc which are out of the scope of the Japan side construction works.
- The project implementation program shall be planned in consideration with the work to be done by Jordanian side as well as construction schedule.

(2) Scope of Project Facility

It was agreed through the discussions with the counterpart that the exhibition function should be

maximised and the facility size should be around 1,750m^2. It was discussed and agreed that the museum should have the following prime functions and the plan should be based on them.

Table 2-1: Main Facility Component

(Source: Study Team)

Division / Room	Main Functions and Remarks
Display Division	
Outdoor exhibition space	Located next to the entrance in parallel to the pedestrian passage. The promenade and rest area connect the entrance, outdoor lounge, and exit space.
Exhibition room	Provide large space flexible for changing exhibition layouts. Install exhibition equipment fitted with various exhibition technologies.
Artefact Division	
Storage	Stores the artefacts, finds, exhibits and cultural properties. Includes space for sorting the stored items, installs shelves and prepares photo-shooting space.
Preparation Room	Prevents fresh air from entering into the storage. Used for treatment works (washing, arranging, loading, unloading etc.) of the artefacts. Apply to forklift usage.
Entrance / Service Division	
Entrance Lobby Courtyard	Installs a reception counter, ticket counter, cloakroom, and information corner for visitors. The outdoor entrance lobby is covered with louvers in the upper part so that solar radiation is shaded and connected with the courtyard; which functions as outdoor exhibition space.
Outdoor Lounge	Functions as both emergency exit from the interior exhibition space and rest/café space.
Museum Shop	Provides a space for selling museum guidebooks and replicas. Oversees the museum exit.
Administration Division	
Administration Offices	Provide rooms for the director and administration space, meeting space and stores. The room is planned for persons in charge of security & maintenance and administrative staff.
Library	Collects and arranges books, materials, etc. regarding the Petra archaeological site.
Mach/Elec. Rooms	A substation, reservoir room, pump room, and rooms necessary for facility operation are planned.
Others	Provide a service yard for loading/unloading and forklift space on the north side of the site.

(3) Selection of Project Site

Most of tourists visit in Petra by tourist bus from Amman. From the bus parking lot, the tourists will walk through the pedestrian street and the gate plaza in front of the Visitors Centre, and enter PAP.

The project site is gently sloped along with the pedestrian street between the bus parking lot and the Visitors Centre. The project site has high prominence for visitors to PAP.

There were various infrastructure lines across the site. However, since all the lines are located nearby the southern boundary, those will not disturb bases of the museum building.

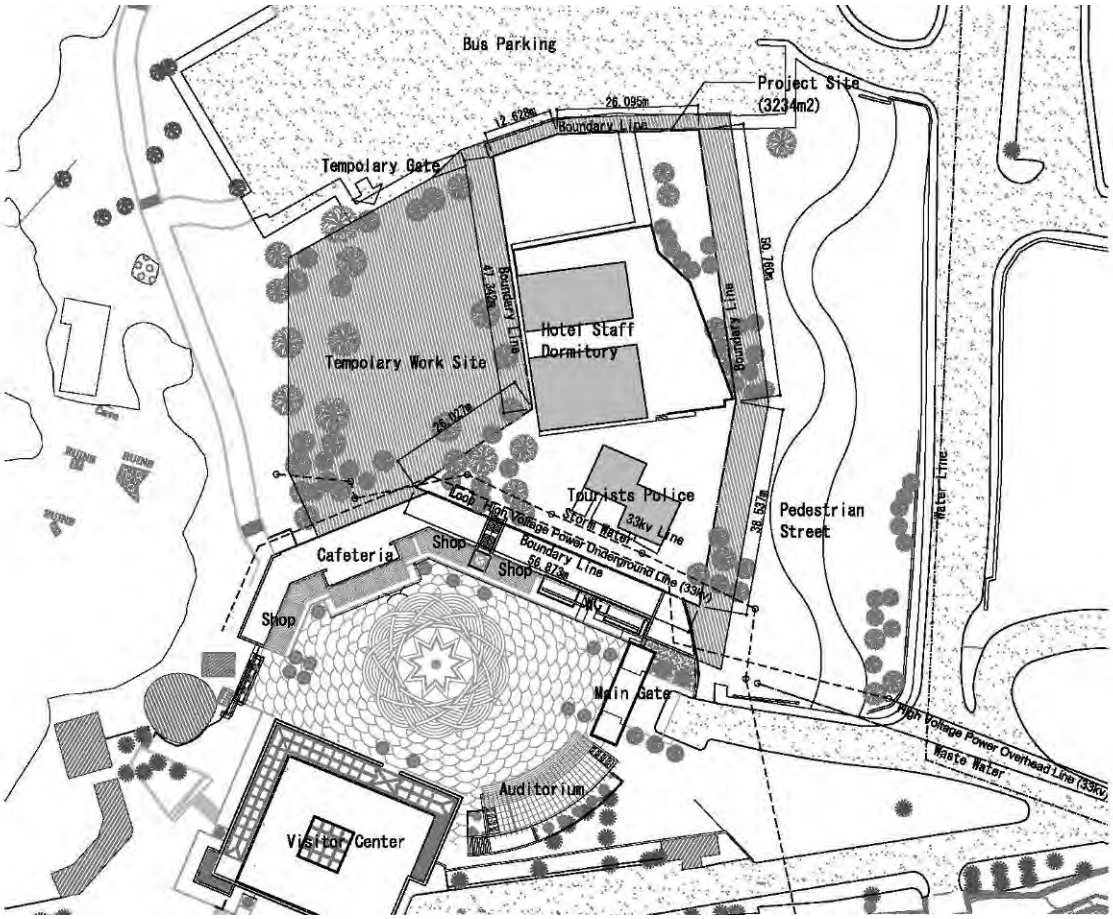
In order to verify that there are no ruins that should be saved in the project site, the test excavation investigations were conducted at five locations by PDTRA. As a result of the investigation, we could make it sure that there were no ruins which should be protected.

A vacant lot is located on the west side of the site, and we will make it sure that it will be possible to use it temporarily as a workplace during the construction period.

As mentioned above, it was judged that this site was suitable for the construction site of the museum.

Figure 2-1: Project Site Condition

(Source: Study Team)



(4) Exhibition Policies

An exhibition plan will be made on the basis of the following exhibition policies:

a) As the exhibition space is very much limited such as less than 1000m^2, it is impossible to

make an encyclopaedia-type museum. Hence, the exhibition will focus on several main topics among plenty of elements in the whole Petra.

b) In order to make a museum that is compact but comprehensive as well as not to make a static museum that is composed of showcases and graphic panels only, a dynamic museum shall be made by preparing as many active scenes and messages as possible in the museum, the scenes and messages which tell a lot of profound stories of overall Petra to visitors.

c) As the museum is next to the gigantic and powerful Petra Archaeological Park, with such images as peculiar to Petra from the viewpoints that are completely different from the real images shall be offered to visitors.

d) As it is expected that most of visitors will visit the museum after they finish their hard walking trip in the Park, the museum shall offer visitors something that visitors can not directly see in the Park or something that are not introduced in various Petra guidebooks.

e) As far as indispensable, any kinds of scale model, showcase and graphic panel shall not be displayed.

According to the classification discussed between PDTRA and the JICA study team, PDTRA shall prepare an objects for exhibition list as follows:

A. Top Priority: Maximum 300 objects for exhibition

B. Second Priority: Maximum 200 objects for exhibition

C. Third Priority: Maximum 200 objects for exhibition

PDTRA shall prepare a sample of the objects for exhibition list as soon as possible, and complete the objects for exhibition list until the end of March 2014.

PDTRA shall carry out the following tasks:

1) Installation of archaeological objects for exhibition

2) Production of graphic panels and soft contents such as interpretations, special effects and so on

2-2-1-2 Policy on Natural Conditions

(1) Temperature / Sunshine

In Petra, where the project site is situated, the temperature difference betwen summer and winter and the daily range of temperature are large, and both of air conditioning for winter and heating for summer are required. For this reason, the top priority is given to thermal insulation and air tightness in designing the building since natural ventilation is likely to have negative effects on indoor exhibition environment, e.g. an air-conditioning load by letting in the cold and hot fresh-air. In practice, the walls and roofs will be externally insulated, the windows will be double

glazed and their area will be reduced to minimum requirements for efficient thermal insulation that results in reduction of an air-conditioning load.

(2) Sand Dust

Exterior finishing materials that are highly resistant to drying, sunlight and dust storms will be selected to cope with the harsh environment of the region. The openings and air-conditionings are considered for the dust invading to interior space.

2-2-1-3 Policy on Socioeconomic Conditions

(1) Consideration on Religion

In Jordan, since 90% or more of people are Muslims, space for prayer is prepared in this facility.

(2) Reduction of Operation Cost

In order to secure the administrative maintenance expenses over the long period of time and to aim for saving resources and energy, the following measures are planned.

- Long-life and little power consumption electric bulbs, such as LED, are selected as priority.
- In order to reduce air-conditioning loads, the facility is high thermally insulated.
- A general and simple system is selected as priority so that the maintenance management of the local external agent can be carried out.

2-2-1-4 Policy on Building Regulations / Laws

In Jordan there are well-organized laws, regulations and procedures pertaining to construction and building permit application. The building construction plan will therefore be drawn up in strict compliance with the relevant local laws and regulations so that the building permit application procedures may be completed smoothly.

About construction permission procedure and group regulation, the Petra area needs to follow the instruction of the PDTRA construction permission office.

For this reason, to proceed architectural planning, local laws and regulations will be observed and mutual deliberations with PDTRA departments at each stage will be conducted.

2-2-1-5 Quality and Procurement of Local Equipment and Materials

Although Jordan has its own industrial standards applicable to building materials, the British and American industrial standards are applied mutatis mutandis. Main building materials are imported from neighbouring countries, Europe, and Asian countries besides domestic materials. In implementing this project, according to the above construction situation, the common methods of construction in Jordan will be adopted and the materials, which are easily obtained in the local market, will be used.

2-2-1-6 Policy on Local Contractors

In Jordan, many buildings of official bodies and private businesses have been constructed by using local construction consultants and contractors. Furthermore, they have been used for many projects funded by Japan and other foreign countries. It is therefore a precondition to use the local consultants and contractors where needed as it is considered easy and effective for implementing the project.

2-2-1-7 Policy on Capabilities of Operation and Maintenance

Regarding the facility maintenance, there is a plan to employ a full-time engineer to take charge of general facility maintenance/management. For this reason, those items of equipment that require advanced maintenance/management techniques and which are not common in Jordan will not be selected for this project. In selecting equipment that requires daily operation and maintenance, priority is given to 1) low operation and maintenance costs so that it would not put much burden on operation of the museum and 2) availability of necessary consumables and spare parts.

2-2-1-8 Policy on Grade of Facilities and Equipment

The priority of grading the planned facilities will be given to durability, ease of maintenance and management for the museum by referring the grades of similar projects, museums, and common public cultural buildings in Jordan supported by Japan. Building materials, which are highly durable and easily obtainable in the country, will be used. High priority is given to easy maintenance and management.

Regarding the equipment grade, it is set in terms of user's level, frequency in use, durability, costs and advisability of maintenance management by the agencies in Jordan, and competitiveness quality at the time of the bidding.

2-2-1-9 Policy on Construction Period

In a setup of the construction period, local situation such as Ramadan, the influence of the work on extremely hot season, etc are taken into consideration.

A sufficient drying/aging period after concreting needs to be secured for protection of the relics and artefacts against moisture and ammonia gas that are emitted from concrete before starting exhibition and storage of them in the facilities.

The simple alkali examination method, which makes it possible to determine the condition of concrete on construction sites in Jordan, will be used to determine the drying/aging period.

2-2-1-10 Policy on Equipment Plan

The equipment for the exhibition and the equipment for transporting and storing the new museum collection are procured by Japan’s Grant Aid. An equipment plan should be based on an exhibition plan. Therefore, the composition, quantity and specifications of equipment should be planned

corresponding to the final exhibition plan. Besides, the installation work should be designed in accordance with the dimension and layout of exhibition room.

The required list from PDTRA is as follows;

Table 2-2: The Required List from PDTRA

(Source: PDTRA)

No.	Item No.	Description	Q'ty	Priority
1	PE-01	Projection equipment set for exterior	1	A
2	PI-01	Projection equipment set for interior	1	A
3	SE-01	Sound equipment set	1	A
4	MO-01	Monitor set	1	A
5	PC-01	Computer set for operation	1	A
6	EX-01	Exhibition case set	1	A
7	LT-01	Lighting equipment set	1	A
8	CC-01	Contents creation equipment set	1	A
9	TE-01	Transportation equipment set	1	B
10	SS-01	Shelf set for storage	1	A

PDTRA puts priority “B” on transportation equipment in their request for the reasons that PDTRA has already possessed it. However, it is not efficient to convey the existing transportation equipment from the existing museum to the new museum each time the collections are moved with the equipment. For that reason, it is preferable that the transportation equipment is procured by the Project.

The exhibition cases and associated equipment should be included in the construction work scope for the reasons that most exhibits are stone-made monuments and earthen potteries so that it is not necessary to put them in the exhibition cases with special specification of such as moisture-proof. The cost is also high if the ready-made exhibition cases are procured in Japan. It is considered appropriate to procure them locally and be installed by the construction contractor. It is difficult to include projection equipment set for exterior and speaker for exterior of sound equipment set in the equipment procured by Japan’s Grand Aid Project because they should be installed outside the project site fixed after site survey in October 2013. In addition, it is also difficult to include a video camera or an editing computer for contents creation in the equipment procured by Japan’s Grand Aid Project because the frequency of use is not so high and the equipment can be used for the other purpose other than the project objectives. As these soft contents are planned to be created by Jordan side or by the assistance of the Technical Cooperation Project which is planned to be implemented, these items

should be procured by Jordan side or the Technical Cooperation Project.

Since other requested equipment is required to be installed in association with the construction team during the construction period, the equipment shall be included in the project.

2-2-2 Basic Plans

2-2-2-1 Site / Facility Layout Plan

(1) Form and Scale Restrictions of Building

When checked with the construction permission department of PDTRA about restriction of the scale and form over the project site, there is no restriction of quantitative building coverage, floor area ratio, height, setback, etc. and administrative guidance was given to it for each project.

However, it was required to lower the building height as much as possible for the consideration of ruins scenery and the highest level was determined to be 6.5 m. In order to the control building height with slope condition of the site, we decided to set up most floor levels in the facility lower than the ground level. Based on these conditions, in regards to the layout of the facility, the construction site was utilized to the utmost.

(2) Zoning and Access of the Site

PDTRA confirmed the layout planning such as an access for museum visitor, museum staff, and artefacts loading, and a setback distance from boundary lines as follows.

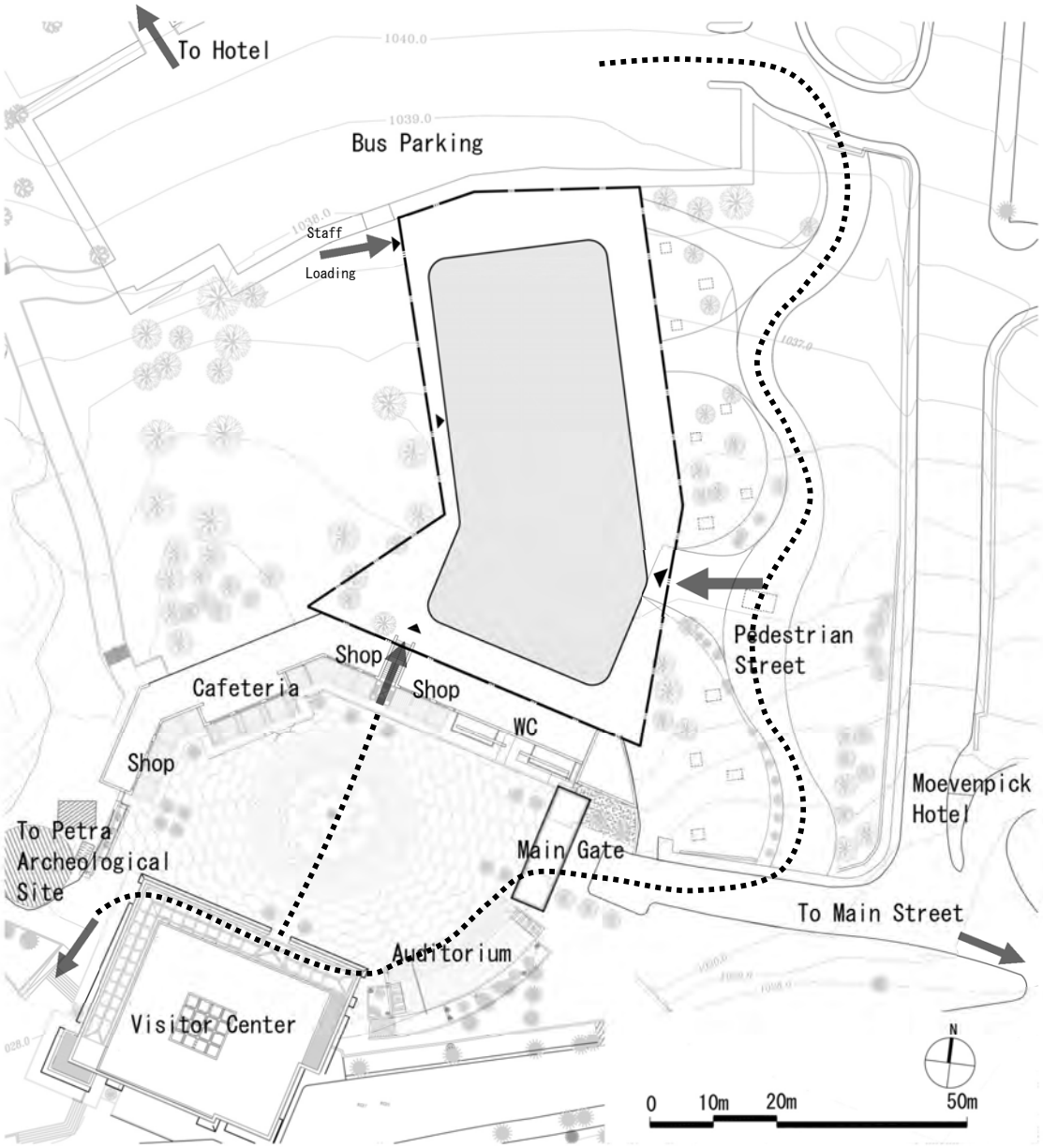


Figure 2-2: Concept of Facility Layout Planning

(Source: Study Team)

2-2-2-2 Architectural Plan

(1) Floor Plan

1) Facility Zoning

The layout planning of each zone of the facility was discussed with PDTRA and the fundamental consent was obtained with the following facility zoning proposal.

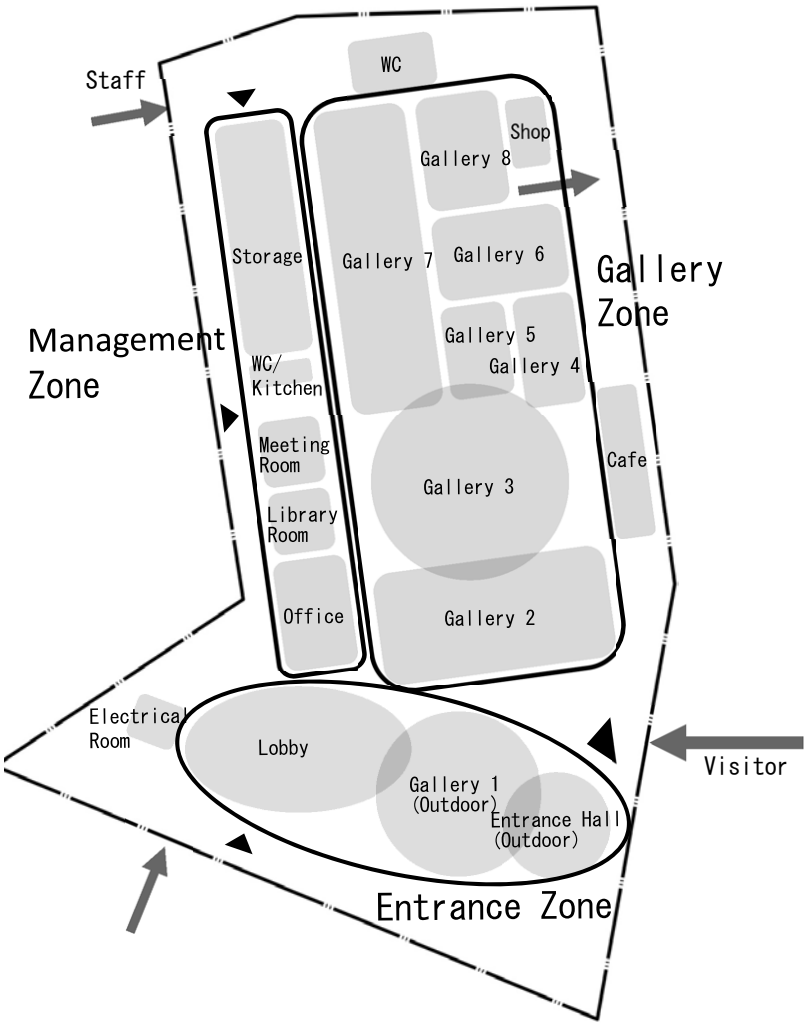


Figure 2-3: Facility Zoning Plan

(Source: Study Team)

Since it was requested that the exhibition section should be maximized within the limited building scale, the proposed plan maximized the exhibition space area, and required rooms were discussed.

Furthermore, since the big toilet space for visitors was already installed near the entrance of the new museum, the toilet in the museum lobby for visitors was not installed but it was agreed to improve the efficiency rate of the facility usable area.

About an administration area and a storage area, based on the operation scheme, the rooms related to staff were put together so that the minimum number of staff could manage them. About the storage for artefacts, based on the quantity of the collections in the existing museum and the quantity of the relocated artefacts, the required area was setup.

2) Function and Required Rooms of New Museum

Based on the deliberation at the time of a field research, the major components of the facility

corresponding to the activities of the museum are as follows.

Table 2-3: Facility Components and Floor Area of Each Room

(Source: Study Team)

Division	Room	Planned floor area(m^2)	Scale, Grounds for layout planning, Remarks
Display/Artifact division	Permanent Gallery	902.16	The layout and area are to be determined according to the exhibition plan.
	Outdoor Gallery	-	Outdoor space
	Preparation Room	21.60	To separate the storage from outside air
	Storage	140.40	To store finds, exhibits and cultural properties
	Storage (Maintenance)	10.40	To store display equipment,etc.
	Forklift Space	-	To store forklift
	WC	51.01	For men: WC's;3, urinals;4 and washbowl;2 for women: WC's;5 and washbowls; 3 For disabled persons:WC's;1
Entrance division	Lobby	63.07	Two Entrances Including Information Corner (Information Terminals, Desks, Chairs)
	Reception	15.81	Including reception counter and ticket counte
	Cloak	6.73	Space for visitors to check in their coat and luggage
	Entrance Hall (Outdoor)	218.25	Outdoor space
Administration division	Office	67.74	5 persons x 7m2 for staff members, passages and storage spaces
	GM Office	22.20	Desk plus space for preliminary discussions
	Meeting Room	24.00	To be used for joint meetings with the staff of the research/clerical divisions (10 seats at maximum)
	Library	22.80	Space to store specialty books for common use
	Server Room	11.66	Server is installed. Storage for digital data
	Control Room	16.73	Space for controlling equipment in exhibition space
	Staff Entry	24.53	Entrance and exit for staff
	Security	14.00	To serve also as the guards' office
	WC	6.82	1 WC and 1 washbowl each for men and women
	Kitchen	4.18	Space for Range and sink including refrigerator
	Pray Room	15.71	Room for pray
	Storage (Office)	7.00	Store for maintenance tools
	Corridor	30.00	
Service	Water Tank Room	19.01	
	Pump Room	7.28	
	Electrical Room	8.85	Substation is installed next to this room
	EPS	7.85	
	Panel Room	5.23	
Others	Shop	22.55	Space for selling guidebooks and souvenirs
	Café	15.80	Space for selling drinks mainly
	Rest Space	-	Outdoor space
Total Area (center line of structure)		1,783.37	

3) Setup of Scale for Facility

In regards to facility planning, proper scale is setup in consideration of the contents of the museum activities, exhibition circulation, equipment, furniture arrangement, etc.

The scales for each room are setup in consideration of the consistency of the exhibition scheme, the circulation of the big party of visitors, the required areas of each room, the required width of corridor, entrance, and exit, and the layout of the furniture and equipment.

(2) Elevation and Section Scheme

According to the request of building height reduction, the facility was divided and lowered from the surrounding ground level.

Furthermore, according to the administrative guidance of PDTRA, in regards to the façade colour and material scheme, it is necessary to consider the unification with the surrounding scenery and existing building. For this reason, sandstone is mainly utilized for the façade design of the building.

Figure 2-4: Concept of Building Shape

(Source: Study Team)

(3) Structure Scheme

1) Ground Condition and Foundation Structure Scheme of Project Site

In this area including the project site where the sandstone layer is spread to near the topsoil, this building will have a spread foundation because standard buildings of about four stories are directly built on the spread foundation. Since the soil has strong acid ingredient that influences concrete badly in particular in the Middle East, the concrete that touches the soil shall include exterior waterproofing and be protected by bricks, etc. over the concrete.

2) Superstructure Plan

Since the building has one story, a reinforced concrete structure is applied, which is recently

utilized in many buildings in Jordan.

The outer wall and inner wall that are not bearing walls are made with concrete block masonry generally used in the local area.

3) Guidelines of Structure Plan

The structural design standard of Jordan is based on the "Jordan National Building Code (JC)". The earthquake-resistant criteria are based on the Chapter 5 Earthquake Forces in 2. Loads and Forces Code of JC. The method of calculating the seismic force 'Fz' is shown in the following formula.

$$Fz = \alpha \cdot \beta \cdot \gamma z \cdot \delta \cdot \theta \cdot \eta \cdot Wz$$

Here

α: Local coefficient

It is divided into four from A 'quake-prone area' to D 'few areas'. Petra is the 2nd from the larger one at Zone B, and the value is 0.5.

ß: Oscillation characteristic coefficient, depending on the own natural period of a building.

γz: Height coefficient, equivalent to Japanese Ai distribution.

δ: Foundation modulus, depending on the own natural period of a foundation, and the own natural period of a building.

θ: Behaviour factor, it is based on the structure form and the toughness of a building.

η: Importance factor

Wz: Earthquake load of a story

The figure of the local coefficient α is shown in the following figure.

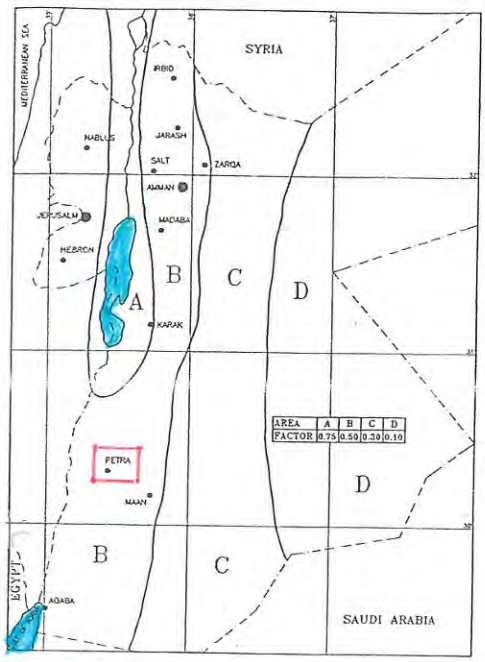


Figure 2-5: The Seismic Region Coefficient Distribution Map of Jordan

(Source: Study Team)

(4) Electrical Facility Plan

1) Power Incoming Line / Substation Facility

In the organization of the electric power sector of Jordan, the private corporation manages the power distribution enterprise. In Petra, the Electricity Distribution Company (EDCO) undertakes the power distribution enterprise. The existing high-voltage wire of 33kv is laid underground near the south boundary of the project site, and it is possible by applying to EDCO for the substation facility to be installed in the site and to receive low-voltage. It becomes clear that the incoming-line position is at the southwest corner of the site according to the deliberation with EDCO. Spare circuit is to be provided for potential emergency power supply connection.

2) Main Power Supply Facility

In order to receive the electric power supply by low voltage (380V/220V), underground conduits, hand holes, etc. will be installed between the substation facility and the electric room. The connection work from the substation to the electric incoming panel in the electric room will basically be done by EDCO (construction work by Jordan side). Distribution switchboards, power control boards and main cables shall be installed in all the required places.

3) Telephone Line

Underground conduits, hand holes shall be installed between the connection point at the east side of the site and the electric room. Installation of cables for the incoming power line shall be carried out by the telephone company (Jordan side). An extension network system shall be established with PBX to be installed in the server room of the facilities. Telephones are installed

in the exhibition room and each room for the facility operation.

4) Lighting and Receptacle Facilities

Distribution switchboards will be installed on each floor with an appropriate circuit system. The secondary side piping and wiring for the lightings from distribution switchboards and for the electric outlets are planned.

- Lighting Facilities

  General Lightings: The lights will be mainly fluorescent general lamps.

  Exhibition Lightings: Lightings with a little power consumption; LED lightings are selected.

  Emergency Electric Lighting System: Wall hanging type emergency electric lightings with built-in battery will be installed in rooms and corridors.

- Receptacle Facilities

  General electric outlets will be grounded outlets, and they will be installed near the exhibition equipment on the ceiling and at the upper part of walls.

5) LAN Facilities

LAN outlets and LAN cables will be installed in the limited rooms necessary for the facility operation. (Server equipment is separate work)

6) Automatic Fire Alarm System

For early detection of fire and expediting evacuation, fire detectors are to be installed to cover the building and a receiving panel is to be installed at the security room. .

7) Security Camera System

Surveillance camera system is to be installed for exhibition rooms and entry areas for the purpose of facility management and security.

(5) Mechanical Facilities Plan

1) Air Conditioning Facilities

The room temperature environment with the consideration of protection for exhibited objects is required, because this facility is a museum.

The air conditioning facility will be installed, since various heat loads caused by outdoor temperature change due to the climate change between summer and winter in Jordan. The necessity of amenity lightings and outside air for ventilation shall be taken into consideration.

Electric power will be utilized as an air conditioning heat source in consideration of the facility scale and the surrounding infrastructure condition.

Based on the reduction of maintenance and operation costs, measures for equipment failure and the facility scale, the air conditioning system will be of the distributed air-conditioning system with an air-cooled heat pump (HP) type, and will be responded to air-conditioning loads in summer and winter.

The air conditioning systems in each zone are shown below.

- Gallery Zone: Air-cooled HP roof top type air conditioning system (duct system)
- Office Entrance Zone: Air-cooled HP/VRV outdoor air conditioning system with indoor equipment (multisystem)
- Storage Zone: Air-cooled HP package air conditioning system (split type)
- Server Room: Air-cooled package air conditioning system (split type, special for cooling)
- Control Room: Air-cooled package air conditioning system (split type, special for cooling)

2) Ventilating Facilities

The machine ventilation equipment for taking fresh air into each room will be installed. Furthermore, fans for discharging bad odour in the rest room and electric room, and fans for heat, dust, etc. will be installed. Filters at the air intakes in each room will be installed.

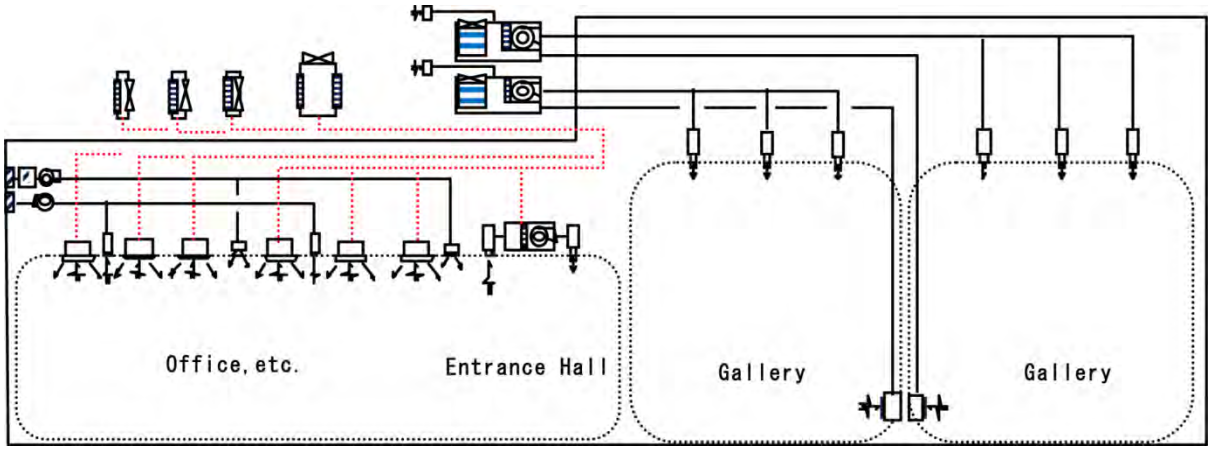


Figure 2-6: Air Conditioning and Ventilation Concept

(Source: Study Team)

(6) Plumbing Facilities

1) Sanitary Fixture Facilities

In conformity with the architectural plan, sanitary fixtures such as low tank type closet bowls, automatic flush valve type urinals, and various washbasins will be installed. The closet bowls are of the western style (with a hand shower).

2) Water Supply Facilities

A water supply system supplies water to the required places by a pressure feed system with a booster pump after storing in a water tank near the facility.

- Approximate water supply quantity

  Number of possible visitors annually: 169,020 persons *

  Opening days annually: 313 days

  Number of possible visitors daily: 169,020 persons /year ÷ 313 days/year

  = 540 persons/day

  In consideration of a peak period, the number of the maximum visitors per day is assumed to be 1.5 times: 540 persons/day × 1.5 = 810 persons/day

  Staff: 11 persons × 100 lit/day = 1,100 lit/day

  Visitor: 810 persons × 10 lit/day = 8,100 lit/day

  Total: 9,200 lit/day (Approximately 10 m^3/day)

- Water tank capacity: capacity for a day 10 m3

* The maximum possible number of visitors per year is calculated as follows:

- Gross Floor Area of the Exhibition Room: 902.16m2 (say, 900m^2)
- Gross Area of Walkways for Museum Visitors: 900 m^2 x 0.6 = 540m^2
- Gross Area Occupancy per Museum Visitor: 6m2
- Instantaneous Maximum Capacity: 540 m2 / 6 m2 = 90 visitors
- Number of Exhibition Programs per day: 6 times

  (12 hours of operation,
  2 hours for observation)
- Maximum Visitor Capacity per day: 90 x 6 = 540 visitors
- Maximum Visitor Capacity per year: 540 x 313 = 169,020 visitors

  (closed 1 day per week)

3) Drainage Facilities

Sewage drainage from every place of the facility will be discharged directly to the drainpipe near the site. Rainwater drainage will be discharged to rainwater manholes in the site.

4) Fire-fighting Facilities

Fire extinguishers will be installed according to the instruction of the local fire department.

(7) Materials Method Plan

1) Basic Policies

In consideration of the climate of Jordan, the construction condition, construction period, construction costs, maintenance expenses, operation system, etc. of the museum, following directions will be conducted based on the proposed design direction.

a) Local materials will be utilized as much as possible so that reduction of construction costs and the shortening of construction period will be achieved.

b) The finishing materials will be selected in harmony with the scenery of the site and the administrative guidance of PDTRA.

2) Materials

a) Construction Materials

The combination of reinforced concrete which is recently utilized in Jordan and concrete block walls will be applied. Concrete, sand, coarse aggregate and cement can be obtained easily at the site.

b) Exterior Finishing Materials

The following shows the main exterior finishing materials.

Outer wall: Local stone finish (limestone)

Roof: Protective layer on asphalt waterproofing

Outer sash: Aluminium sash with double-glazed glass

c) Interior Finishing Materials

The following table shows the main interior finishing materials selected, and the rationale for their selection.

Table 2-4: Interior Finishing Materials

(Source: Study Team)

Room	Floor	Wall	Ceiling	Remarks
Exhibition Room	Stone or Carpet Tile	Paint or Sound-absorbing Material	Metal Open Grid Ceiling	Emphasis is put on acoustic effects and maintenance
Entrance / Terrace, etc.	Stone	Stone	Plaster Board Painted	Emphasis is put on toughness and aesthetics
Office	Carpet Tile	Paint	Sound Board	Emphasis is put on ease of maintenance

Room	Floor	Wall	Ceiling	Remarks
				and cleaning.
Toilet	Ceramic Tile	Ceramic Tile	Sound Board	Emphasis is put on water resistance and ease of cleaning

2-2-2-3 Exhibition Plan

(1) Directions of Exhibition Plan

Basically the exhibition follows the chronological flow of Petra from the Neolithic Age to the present day. We will try to show various articles not only telling the stories of objects for exhibition themselves but also telling the stories of their backgrounds; e.g. how they were actually used in the life scenes of Petra, for example, by reconstructing parts of the life scenes such as El-Khazneh and Ez-Zantur.

(2) Designing of Exhibition Plan

According to the directions of the exhibition plan we will design the exhibition plan; however, as the designing period is limited, we will achieve appropriate results of the design in accordance with the following design guidelines:

1) In parallel with designing the exhibition plan, we will make an operation plan and present the exhibition plan that is closely related with the operation plan.

2) We will prepare an exhibition system that can easily upgrade exhibition contents such as exhibition themes, exhibits and exhibition interpretations as well as exhibition methods such as exhibition lighting, sound effects and utilization of natural materials.

3) We will adopt exhibition methods and exhibition techniques that can certainly be maintained and operated in Petra located far from the capital, Amman.

4) We will speedily offer exhibition data that can promote facility and equipment plans effectively and efficiently.

5) We will closely confirm the mutual scopes of responsibility, between the Jordan side and the Japan side, for not only the factors regarding planning contents and working scopes but also the institutional and administrative factors related to the plan implementation, and fix, in detail, the matters to be borne by the counterpart.

6) Closely examining the counterpart's implementation organisation and capacity, we will fix the contents of technical support (soft components) for strengthening project sustainability. Furthermore, we will examine the technical support that can develop the Visitors Centre together with.

2-2-2-4 Equipment plan

(1) Equipment Plan

The planned equipment is categorized as 1) Projection equipment for the interior, 2) Sound equipment, 3) Monitors, 4) Acting lighting equipment, 5) Equipment for control room 6) Transportation equipment, 7) Shelves for storage, and 8) Furniture for workshop. All equipment will be installed and used in the new museum. The quantities and the contents of equipment are determined based on the final exhibition plan and the layout of exhibition rooms. Regarding the installation of the audio visual equipment, the arrangement with the construction team shall be conducted, since the installation places of the audio visual equipment are away from the operation room.

(2) Equipment Category

1) Projection equipment for the interior;

The equipment to project visual software contents in the exhibition rooms, the equipment to deliver contents, and the equipment for playing control are planned.

2) Sound equipment;

The sound equipment is planned for playing sound effects at both exterior and interior. The equipment needs parametric specifications not to interfere other sounds in adjacent exhibition rooms.

3) Monitors;

The wide-size monitor in the Gallery 1, and the touch panels in other exhibition rooms are planned for explaining exhibits. Besides the common specifications of the monitors, the picture quality better than Full-HD will be required.

4) Acting lighting equipment;

The room lightings in the exhibition rooms are usually planned as the construction works. However, the acting lightings for the Gallery 1 and the tunnel to the Gallery 7 are planned as the equipment works in the project.

5) Equipment for control room;

The equipment necessary for operating visual software contents in the control room is planned. The operation computers shall satisfy high-specifications to control soft-contents that will be prepared by Jordanian side. Besides, the servers for saving data and the network switching hubs are also planned.

6) Transportation equipment;

A reach forklift, hand pallet truck and plastic pallet are planned for transporting the museum collections.

7) Shelves for storage;

Steel shelves with high load bearing are planned to install the above collections in the storage room.

8) Furniture for workshop;

The exhibition plan designs space for small workshop in the Gallery 7; therefore, necessary items for the workshop such as a mobile white board, folding desks and chairs are planned. The capacity of workshop area is 20 persons.

The list of principal equipment is shown below;

Table 2-5: List of Principal Equipment

(Source: Study Team)

Equipment Name	Main Specifications	Q'ty	Usage
Projector for Spherical Screen	Projector for ceiling Type: Laser light source projector Brightness: 3000 lm or more Resolution: WUXGA(1920x1200 dpi) HDMI connector: Equipped Frame synchronizer Usage: quartering play of image Projector for floor projection Type: Laser light source projector Brightness: 3000 lm or more Resolution: WUXGA(1920x1200dpi) HDMI connector: Equipped Projector mirror mount: Equipped Lens supporter: Equipped Fish-eye conversion lens Usage: Alleviation of projection to spherical screen Digital signage player Type: To be able to do digital signage playing with above projector SD card Capacity: 32GB HDMI distributor Type: To be able to do digital signage playing with above projector	1 set	For projection inside the museum
Touch Panel	Touch Panel Screen size: 32 inch or more(in case of longitudinally-halved using 1 panel), or 21 inch or more(in case putting in 2panels one above the other) Aspect rate: 16:9 Resolution: 1920x1060dpi or more Mount bracket: Equipped Digital signage player Type: To be able to do digital signage schedule playing on above panel SD card Capacity: 32GB Switching hub Port: 16ports or more	1 set	For explanation of exhibition contents
Acting Lighting Set	Type: Laser light source projector Brightness: 3000 lm or more	1 set	For acting lighting inside a

Equipment Name	Main Specifications	Q'ty	Usage
	Resolution: WUXGA(1920x1200 dpi) HDMI connector: Equipped Mount bracket: Equipped Digital signage player Type: To be able to do digital signage schedule playing with above projector		museum
Equipment Set for Control Room	Digital signage player Usage: For playing check of audio and soft contents Playing check software function: To be able to check the playing of all signage players Default setting software for player Function: To be able to do default setting of all signage player SD card Capacity: 32GB Touch panel Screen size: 18 inch or more Mount bracket: Equipped Usage: For checking the playing soft contents Multi-media speaker Max. output: approx. 6W Rated impedance: approx. 4ohm Frequency range: 100 - 20,000Hz LCD monitor Screen size: 21 inch or more Usage: For playing control	1 set	For control of soft contents in the control room
Electric Reach Forklift	Rated capacity: 2000kg or more Type: Electric reach forklift Reach: 2,700mm or higher Max. gredeability: 10% or more(loaded 3min.) Battery voltage: 48V or more Battery capacity: 320Ah/5 hours or more Recharger: Equipped	1 unit	For transporting the museum collections

The list of equipment is shown below;

Table 2-6: List of Equipment

(Source: Study Team)

Category	No.	Description	Q'ty	Unit
Projection Equipment for Interior	1	Projector for Spherical Screen	1	Set
	2	Projector for Interior	6	Set
Sound Equipment	3	Parametric Speaker Set	22	Set
	4	Speaker Set for Interior	1	Set
	5	Speaker Set for Gallery 1	1	Set
Monitors	6	Liquid Crystal Television	1	Set
	7	Touch Panel	1	Set
Acting Lighting Equipment	8	Lighting Set for Gallery 1	2	Set
	9	Acting Lighting Set	1	Set

Category	No.	Description	Q'ty	Unit
Equipment for Control Room	10	Equipment Set for Control Room	1	Set
	11	Desktop PC	2	Set
	12	Switching Hub	1	Set
	13	Data Server	1	Set
	14	PC Chair	2	Set
Transportation Equipment	15	Electric Forklift	1	Set
	16	Hand Pallet	1	Set
	17	Plastic Pallet	10	Set
Shelves for Storage	18	Steel Shelf Set	8	Set
Furniture for Workshop	19	Whiteboard	1	Set
	20	Table	10	Set
	21	Chair	20	Set
	22	Hand Cart	1	Set

2-2-3 Outline Design Drawings

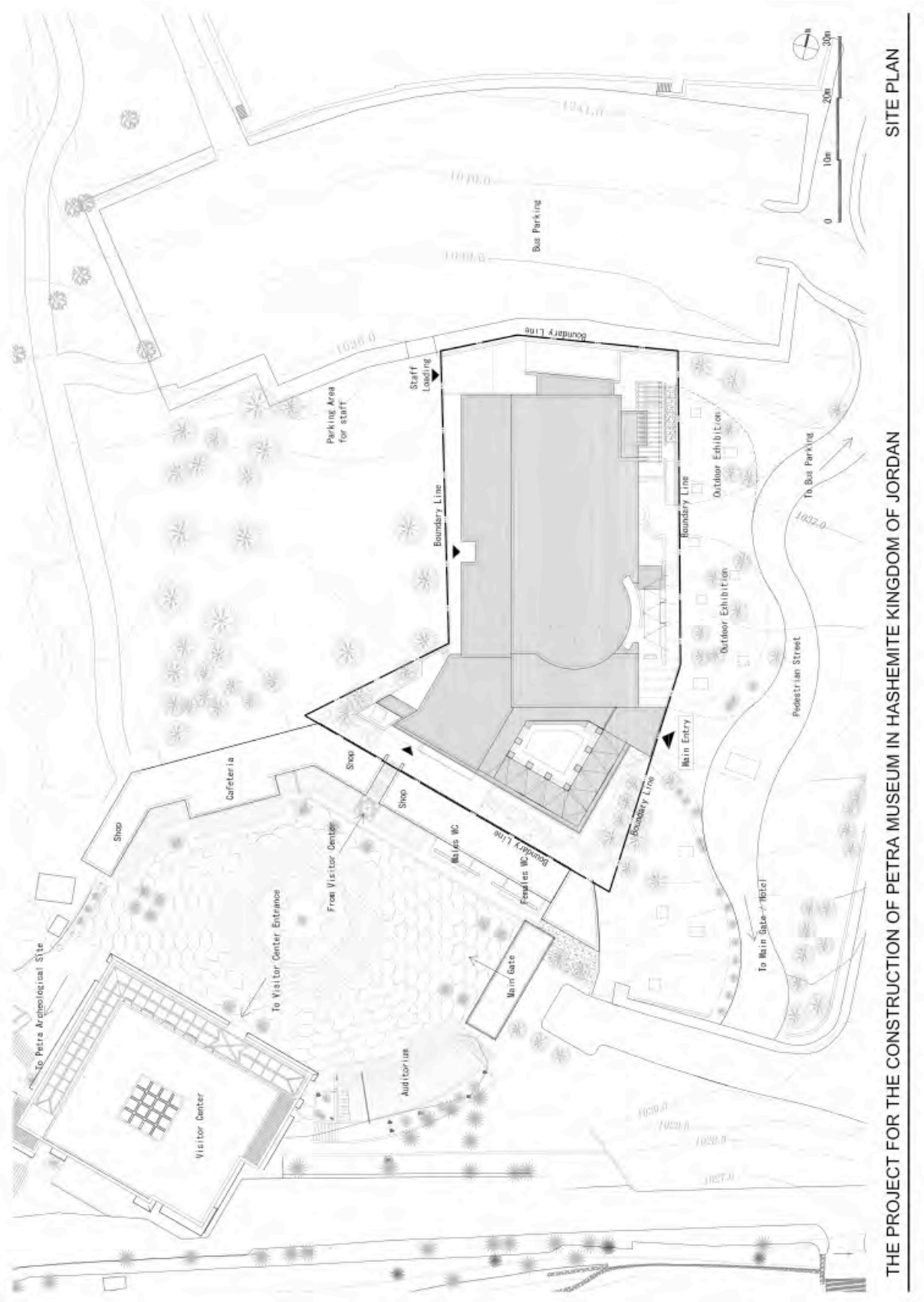


Figure 2-7: Site Plan

(Source: Study Team)

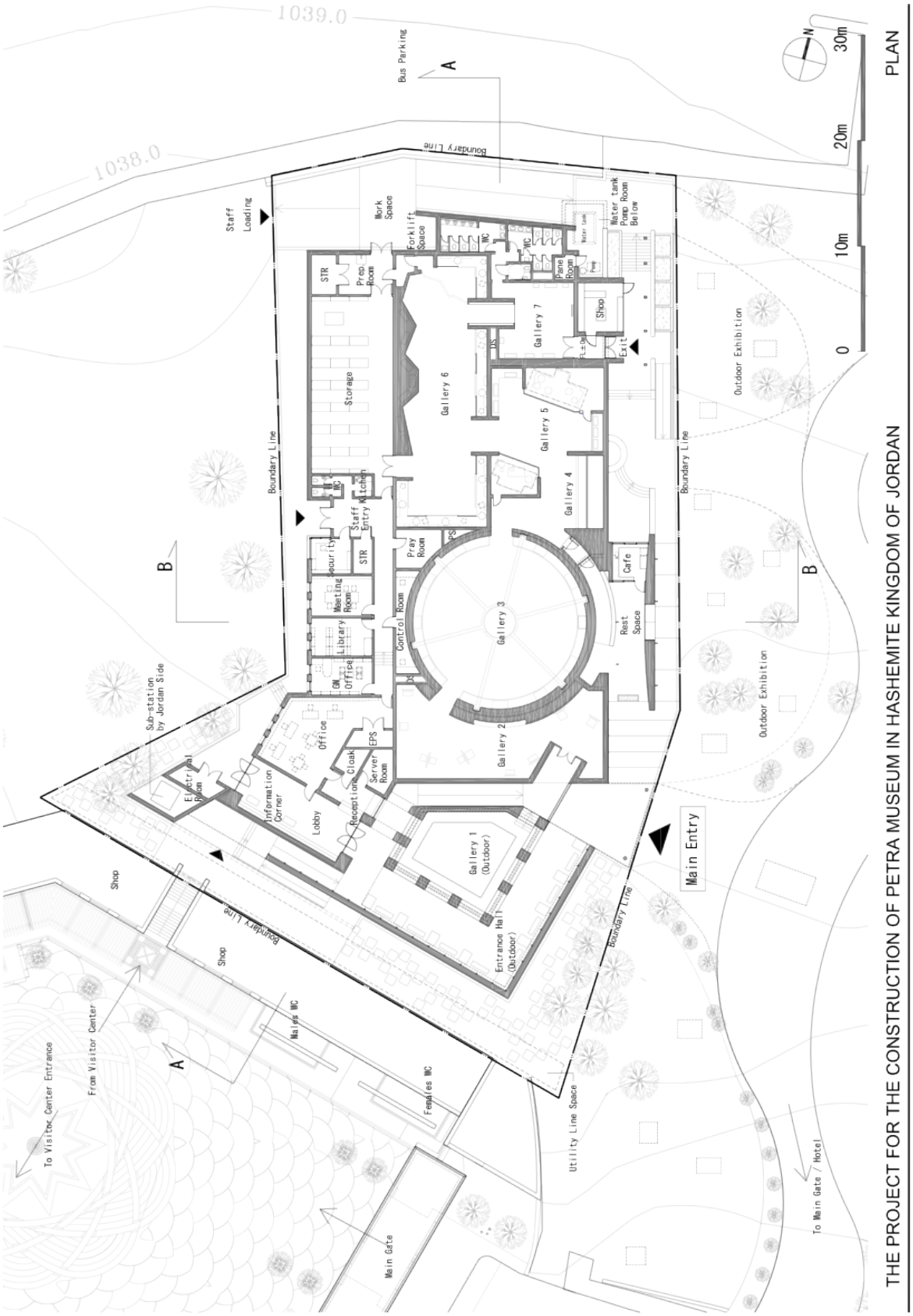


Figure 2-8: Plan

(Source: Study Team)

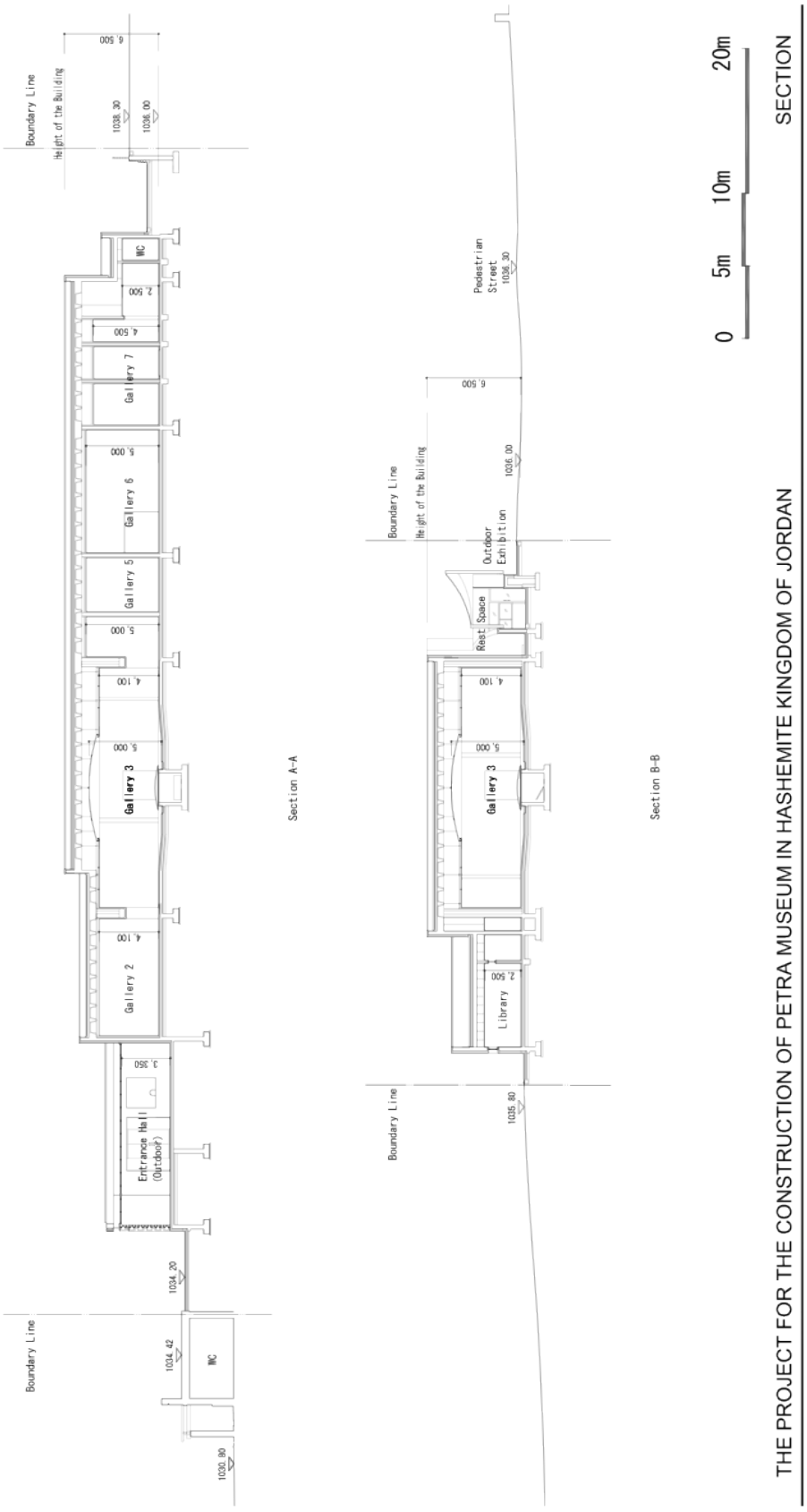


Figure 2-9: Section

(Source: Study Team)

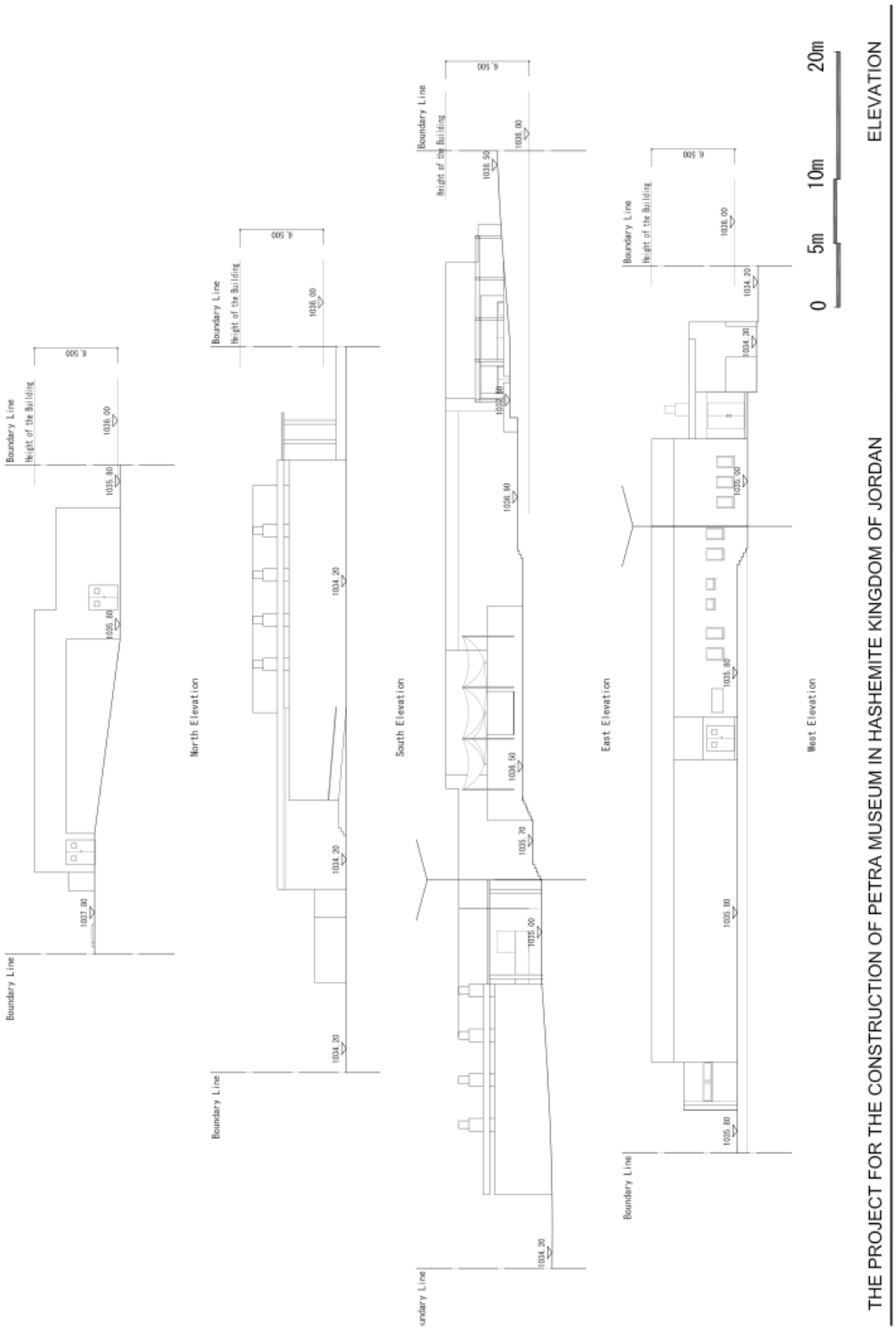


Figure 2-10: Elevation

(Source: Study Team)

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

This project consists of the construction works of museum facilities and the procurement and installation works of equipment. The scope of Japan's cooperation shall be carried out within the framework of the Grant Aid scheme of the Government of Japan (GOJ).

After the Cabinet of Japan approves the Project, the Exchange of Notes (E/N) will be signed between the GOJ and the Government of Jordan (GOJO), which is followed by the conclusion of the Grant Agreement (G/A) between JICA and GOJO. After the signing of G/A, GOJO will conclude a consulting services agreement for the project with a consultant in Japan, and the consultant will start the detailed design and the preparation of tender documents for the project. Upon the completion of the tender documents, the tender procedure will take place for selecting a construction contractor and an equipment supplier, who are Japanese companies or juridical persons. The respective contractors will execute the construction of facilities and the procurement and installation of equipment.

The agreement with the consultant and the contract with the construction contractor and the equipment supplier shall be verified by JICA to be eligible for the Grant Aid.

(1) Implementing Organization

The Grant Agreement (G/A) will be signed by the Ministry of Planning and International Cooperation (MOPIC) representing GOJO. The responsible organization of the GOJO for the project is PDTRA, who will be a signatory of the consulting services agreements and construction works contracts. PAP, who is going to make use of the facilities/equipment, will be in charge of overall coordination of the works during implementation of the project.

(2) Consultant

After the signing of E/N and G/A, PDTRA will conclude a consulting services agreement for the detailed design and supervision of the project with a consultant in Japan and obtain the verification of JICA in accordance with the Japan's Grand Aid scheme. The consultant will prepare the detailed design documents and tender documents based on the Preparatory Survey Report (Report), and obtain the approval of PDTRA.

In implementing the tenders and construction works, the consultant shall assist the tendering procedure of facilities, and supervise the construction works based on the detailed design documents and the tender documents. In the equipment works, the consultant shall assist the tendering procedure, and supervise the procurement, installation and operation training works.

1) Detailed Design

The services shall design the facilities in detail, review the equipment plan based on the Report,

and prepare the tender documents including drawings, specifications, instructions to tenderers and draft contracts for the construction works and equipment works. They shall include cost estimation for the construction works and equipment works.

2) Assistance of Tendering

The services shall assist the tendering by the implementing agency to select a construction contractor and an equipment supplier and conclude the contracts, and assist reporting the results to GOJO and JICA.

3) Supervision

The services shall confirm whether or not the construction contractor and the equipment supplier are carrying out their respective works in accordance with the provision of the relevant contracts, respectively, and ensure that the contracted obligations are properly fulfilled. In addition, the consultant shall give instructions and advices to the construction contractor and the equipment supplier, and coordinate their works for smooth implementation of the project on the stance of fairness. Details of the supervision services are as follows,

- Examine and confirm the implementation plan, shop drawings, specifications of equipment and the other relevant documents submitted by the contractor and the supplier.
- Examine and confirm the construction materials and quality and the performance of equipment delivered.
- Examine building services and equipment for delivery, installation and instruction for the operation of equipment.
- Observe the progress of the construction works and equipment works
- Inspect completed facilities and installed equipment

In addition to the services mentioned above, the consultant shall report the progress of the project, procedure of payment, handover after completion, etc. to the relevant agencies of GOJO and JICA.

(3) Construction Contractor and Equipment Supplier

The construction contractor and the equipment supplier shall be selected by the open tender intended for Japanese firms. PDTRA will conclude a construction works contract and the equipment works contract with the lowest tenderers as a general rule of the Japan's Grand Aid scheme. The construction contractor and the equipment supplier shall construct the facilities, procure and install the equipment and provide the operation training of equipment to the Jordan side in accordance with the contracts.

(4) JICA

JICA provides necessary services for executing the project as the implementing agency of the GOJ for the Grant Aid in accordance with the Japan's Grant Aid scheme.

(5) Local Consultants and Local Construction Companies

It is assumed that the working time and area of the supervisor of the Japanese consultants are limited. Local consultants will be utilized in order to cover the issue. Local major construction companies have enough capability and manpower, and are expected to work on the project as subcontractors of the Japanese construction contractor.

2-2-4-2 Implementation Conditions

(1) Construction Conditions

The construction market in Amman is dominating the construction market in Jordan, and its construction conditions are as follows:

- Construction companies in Jordan are classified into five classes by the Ministry of Public Works and Housing (MPWH) and this classification is renewed every year by MPWH.
- Construction costs in the Petra area is higher than those in Amman, because the large building and high quality building construction in the Petra area has been performed by the contractors from Amman.
- In general, the technological capability of the 1st class contractors under the MPWH classification is acceptable to the type of the project.
- The most popular construction method in Jordan is a reinforced concrete structure with concrete block walls, and steel structural construction is very few.
- Highly skilled stonemasons can be recruited easily as stone paving and cladding are the most common finishes in Jordan, since limestone quarries are widely available elsewhere in Jordan.
- The building permission for facilities is belongs to PDTRA, and the facilities permission may be obtained by PDTRA in about one month.

(2) Points to be Considered on Construction

1) Schedule Control

- The annual precipitation in the Petra area is little, since Petra belongs to the desert area. It is anticipated that less erosion occurrence during the excavation and foundation works, as the soil characteristic of the project site is a limestone stratum; however, the foundation works shall be carried out with care.
- Close co-ordination with PDTRA will be required for progress of the work, such as demolition of the existing buildings and site grading in the proposed site shall be executed by PDTRA within the agreed period and prior to the handover of the site to the contractor.

- It is common in Jordan that 30 to 45 days extension of time for completion per annum, as the inclement weather will be granted and officially announced by the Jordan Government. Considering this fact, it is necessary to establish a construction period and progress control procedures considering the aforementioned factor.
- The characteristic of the project as a museum, the interior works and/or the M&E works shall be completed prior to installing showcases and setting artefacts in order to minimize dusts and alike resulting from the building works activities. It is necessary to maintain close coordination among PDTRA, the consultant and the contractor.

2) Safety Control

There is the Visitors Centre adjacent to the site and a pedestrian path along the project site, and those facilities will be in operation and used by visitors during the construction of the project. Full time pedestrian safety control personnel shall be assigned in order to maintain the safety passage of pedestrian, especially during the construction activities required outside the project site.

3) Security Measures

The security situation in Petra is relatively good, but the deployment of 24 hours with 2 security guards during the construction period shall be considered with close coordination among PDTRA, the consultant and the contractor, as the anti-theft measures, especially during the artefacts display period will be necessitated.

(3) Points to be Considered on Procurement of Equipment

The performance test and pre-inspection of the audio-visual equipment shall surely be carried out before shipment, because such equipment will be controlled as a completed system. And also, some pieces of equipment to be procured in Jordan will be either furniture made to order or products to be imported from third countries, so the procurement schedule of such equipment shall carefully be considered. Before delivering and installing the equipment, the equipment supplier shall have close talks and meetings with the construction contractor to ensure the installation schedule of the equipment.

The equipment procured in Japan can be transported from the Aqaba port to Petra directly. Besides, the Aqaba port has been expanded and renovated within few years so that the unloading and customs clearance will be conducted smoothly.

2-2-4-3 Scope of Works

The project will be implemented through mutual cooperation between GOJO and GOJ. In the case that the project will be implemented under the Japan's Grant Aid, the works borne by each government are as follows:

(1) Works Borne by Grant Aid from GOJ

The consulting services, the construction of facilities and the procurement and installation of equipment such as follows are borne by GOJ.

1) Consulting Services

- Preparation of the detail design documents and tender documents of the facilities and equipment
- Assistance for the selection of and contracting with a contractor and an equipment supplier
- Supervision of the construction of facilities and the procurement, installation and operation training of equipment.

2) Construction of Facilities, and Procurement and Installation of Equipment

- Construction of the facilities
- Procurement, transportation to the project site and installation of equipment
- Trial operations and adjustment of equipment
- Explanation and instruction of operation & maintenance of equipment

(2) Works Borne by GOJO

1) Related to Construction

- Provision of the project site
- Levelling of the project site such as demolition of the existing buildings
- Obtaining and installation of objects for exhibition
- Provision of gardens in the project site after completing the facilities
- Obtaining of the building permission
- Infrastructure connection works including a low voltage power line, telephone line, water supply and sewer
- Rerouting of the existing sewer line in the project site
- Provision of the temporary working yard and stock yard during the construction
- Securement and installation of exhibit items

2) Related to Operation

- Procurement and installation of general furniture, that are not borne by Japan’s Grant Aid
- Procurement of spare parts and consumables necessary for the proper maintenance
- Appropriate and effective operation of the facilities and equipment

3) Related to Procedures

- Costs related to the Banking Arrangement (B/A) and the Authorization to Pay (A/P)
- Applying for the building permission
- Obtaining of relevant permissions, licenses and other authorizations as may be necessary for the project
- Prompt execution of the unloading, customs clearance, tax exemption and inland transportation of equipment and materials
- Exemption of Japanese nationals from the custom duties, internal taxes and fiscal levies
- According of Japanese nationals with such facilities for their entry into Jordan and stay therein
- Bearing all expenses, other than those borne by Japan's Grant Aid, necessary for the implementation of the project

2-2-4-4 Consultant Supervision

(1) Supervision Policy

In accordance with the Grant Aid scheme of GOJ, the consultant shall form a project team to ensure their smooth implementation of the project based on the Report. The policies for supervision of the construction works and the equipment works are stated below.

- To keep close contacts with the officials in charge of the project of both governments to ensure the completion of construction of the facilities and procurement of the equipment without delay.
- To give prompt and proper instructions and advices with justice to the building contractor, the equipment supplier and other concerned parties.
- To give proper instructions and advices on operation and maintenance of the facilities and the equipment after the handover. To confirm the completion of construction works and equipment works in compliance with the contents of the contract, to witness the handover of the facilities and equipment, and to conclude the consulting services by obtaining the consent of PDTRA.

(2) Construction Supervision Plan

In view of the complexity of the project, the consultant shall dispatch a qualified Japanese engineer with local engineers to the project site throughout the project implementation period, and send the following engineers to the project site as needed from time to time.

- Chief Consultant / Deputy Chief Consultant: Overall supervision

- Architectural Design: Explanation of the design intent, check of the shop drawings and material specifications
- Exhibition Design: Explanation of the design intent, check of the shop drawings and material specifications
- Structural Design: Check of the bearing capacity of soil and materials
- Mechanical Design: Midterm and final inspection of the pluming works and air conditioning works
- Electrical Design: Midterm and final inspection of the wiring works and the power receiving and transforming facilities
- Equipment Planning: Instruction of the equipment installation, coordination with the construction works, witness of the numerical examination, check of the operation training by GOJ and the operation and maintenance manuals, etc.

(3) Construction Supervision by Building Contractor

In order to complete the facilities within the scheduled period in conformity with the contract documents, the building contractor needs to coordinate the local contractors and manage the construction works. Moreover, the resident supervisors need to be familiar with the local construction conditions in order to complete the project in the required quality.

(4) Equipment Supervisory Plan

1) Equipment Supervisory Plan

The equipment will be procured in Japan or Jordan. The pre-shipment inspection of equipment shall be conducted at the Japanese loading port by an entrusted and neutral inspection agency. The consultant shall check the certificate of shipment inspection provided by the inspection agency and issue the inspection report to the implementing agency of Jordan after confirming the completion of inspection. All the equipment procured in the project shall be inspected and provisionally handed over at the project site. The final handover shall be conducted in the presence of the buyer, supplier and consultant. The names of the models, product origin, names of manufacturers, stickers printing the name of the Japanese Grant Aid attached or not and the appearance shall be inspected following the items in the contract documents.

2) Procurement Supervision Plan

Regarding the procurement supervision, the following consultants will be assigned:

- Resident Procurement Supervision Engineer: 1 person

  Procurement supervision during the whole period of installation and initial operational instruction for operation and maintenance

- Inspection Engineer 1: 1 person

  Confirmation of the procurement schedule, preparation for the third party inspection prior to shipment, and checking of the inspection certificate

- Inspection Engineer 2: 1 person

  Inspection before the expiration of one year warranty

2-2-4-5 Quality Control Plan

To ensure the quality of the construction works for the project, the supervision work will be implemented in accordance with the following standard of Jordan or Japan. The supporting layer of the ground is sandstone, consequently the foundation works shall be done with drilling of the hard layers, which shall be controlled with the construction execution plan to keep the quality of the construction works.

The quality control plan of the main construction works is as followed:

Table 2-7: Quality Control Plan

(Source: Study Team)

Work Type	Control Parameter	Control Value	Test Method	Quality Standards	Frequency of Measurement	Analysis of Results
Earth work	Bearing capacity of ground	Ra=98kN/m^2 or 196kN/m^2 (long-term)	Plate bearing test	BS	1 location per each site	Test report
	Slope angle	Within planned range	Gauge, visual	JIS	As needed	Photos, documents
	Bedding accuracy	Within +0 to -5cm	Level, visual		Ditto	Ditto
	Foundation work height	Within +0 to -3cm	Ditto		Ditto	Ditto
	Thickness of replaced soil	+5cm to 0	Ditto		Ditto	Ditto
Reinforcement bars	Reinforcement cover thickness	Places not in contact with soil: 30m/m	Visual, measurement	Specifications	As needed	Photos, documents
		Places in contact with soil:	Ditto	Ditto	Ditto	Ditto
		Footing 60m/m	Ditto	Ditto	Ditto	Ditto
		Other 40m/m	Ditto	Ditto	Ditto	Ditto
	Processing accuracy	Stirrup, hoop ±5m/m	Ditto	Ditto	Ditto	Ditto
		Other ±10m/m	Ditto	Ditto	Ditto	Ditto
	Tensile test	Standard strength or more	On-site sampling or sampling at shipping	BS	1 test on 3 test pieces per 200t of steel bars with given diameter*	Test result report
Concrete work (mixing plant)	Compressive strength	Designed strength 24N/mm^2 or more	Attending at test site (any time)	BS, ASTM	3 or more test pieces for each placing and per 50m^3	Test result report
	Slump value	15cm±2.5cm	Attending at	Ditto	For each	Photos,

Work Type	Control Parameter	Control Value	Test Method	Quality Standards	Frequency of Measurement	Analysis of Results
			work site		placing	documents
	Chloride content	0.3kg/m^3 or less	Test pieces, attending at work site	Ditto	Ditto	Ditto
	Air content	45% ±1.5%	Attending at work site	Ditto	For each placing	Ditto
	Concrete temperature	35 deg. or less	Attending at work site	Ditto	For each placing	Ditto
	Performance accuracy	10mm per 1m or less	Measuring	JIS	After form removal	Ditto
Masonry	Compressive strength of concrete blocks	Factory standard	Attending at test site after selection of manufacturer	Jordan standard/BS	Once before shipment from factory	Test result report
Plastering, Painting, Roof waterproofing, Fixtures	Materials, storage methods, work methods, mixing, coating thickness, curing, work accuracy	According to separate specifications	Same as left	Same as left	As needed	Photos, documents
Water supply & drainage	Water supply pipes	Leaking	Water pressure test(1.75MPa for 60 min.)	BS	On completion of pipe laying, for each system	Test result report
	Drainage pipes	Ditto	Water filling test	Ditto	Ditto	Ditto
Electrical work	Cables	Within planned range	Insulation test	BS	Ditto	Ditto
			Conductivity test			

2-2-4-6 Procurement Plan

(1) Building Materials

1) Procurement Policy

Most of the building materials can be procured locally. This is favourable for maintenance after the completion of the project.

The building materials that cannot be procured locally or need to have specified quality for the facilities functioning will be imported from Japan or third countries.

2) Procurement Plan

- Building Frame Works

  The local materials can be procured for reinforcing bars, concrete materials and formworks, etc. and concrete blocks for partition walls can be procured locally.

- Interior and Exterior Works

Materials for the interior and the exterior can be procured in the local markets easily, including imported products, such as aluminium sashes, wood, tiles, cement roof tiles, paint and glasses, etc.

- Exhibition Works

  Showcases, panels and equipment for the exhibition works can be purchased in the local market including imported products.

- Air-conditioning and Sanitary Works

  Air conditioning equipment, exhaust fans, pumps and sanitary wares, etc. can be procured in the local markets, including imported products.

- Electrical Works

  Lighting fixtures, power panels, cables/wires, conduits/pipes, telephone equipment, fire alarms and power generators, etc. can be procured locally.

- Exhibition Works

  Show cases, graphic panels and exhibition equipment including imported materials can be procured locally.

Table 2-8: Procurement Plan of Major Construction Materials

(Source: Study Team)

Item	Procurement Plan			Remarks
	Local	Japan	Third Country	
Temporary Work				
Scaffold	√			Steel pipe scaffolding is common in Amman
Temporary Fence	√			Corrugated metal sheet, plywood with paint
Temporary Office	√			Concrete block structure
Building Material				
Portland Cement	√			Local produced cement is available
Gravel	√			Available from “Wadi Musa”
Reinforcing bar	√			Main in Middle-east or China is available from Local market
Veneer Form	√			Ditto
Ready Mixed Concrete	√			Ditto
Concrete Block	√			Local produced Concrete Block is available
Waterproofing Material	√			East Asia / Europe production is available from local market
Light Weight Steel Frame	√			Europe production is available from local market
Coloured metal folded-plate	√			Ditto
Aluminium Door/Window	√			East Asia / Europe production is available from local market

Item	Procurement Plan			Remarks
	Local	Japan	Third Country	
Wooden Door	√			Ditto
Glass	√			Europe production is available from local market
Ceramic Tile	√			Ditto
Acoustic Ceiling Board	√			Ditto
Cement Board	√			East Asia / Europe production is available from local market
Paint	√			Ditto
Mechanical/Electrical Fixtures				
Water Tank	√			East Asia / Europe production is available from local market
Pump	√			Ditto
Pipe	√			Ditto
Sanitary Fixtures	√			Ditto
Distribution Board	√			Ditto
Wire/Cable	√			Ditto
Lighting Fixture	√			Ditto
Lightning conductor	√			Ditto

(2) Equipment

The equipment such as steel storage shelves, computers and transportation is generally used in Jordan. It ensures adequate quality and competitiveness with multiple manufactures handling these items. Therefore, the equipment will be procured from Japan or third countries, which is distributed locally. The equipment such as projectors and monitors requiring high specifications and installation by specialized engineers will be procured in Japan. Jordanian side shall procure consumables and spare parts.

The below list shows the equipment plan and procurement plan.

Table 2-9: Procurement Plan of Equipment

(Source: Study Team)

Item	Procurement Plan		
	Local	Japan	Third Country
Projection Equipment for Interior			
Projector for Spherical Screen		√	
Projector for Interior		√	
Sound Equipment			
Parametric Speaker Set		√	
Speaker Set for Interior		√	
Speaker Set for Exterior		√	
Speaker Set for Gallery 1		√	
Monitors			

Item	Procurement Plan		
	Local	Japan	Third Country
Liquid Crystal Television		√	
Touch Panel		√	
Acting Lighting Equipment			
Lighting Set for Gallery 1		√	
Acting Lighting Set		√	
Equipment for Control Room			
Equipment Set for Control Room		√	
Desktop PC	√		
Switching Hub	√		
Data Server	√		
Chair	√		
Transportation Equipment			
Electric Reach Forklift	√	√	
Hand Pallet Truck	√	√	
Plastic Pallet	√	√	
Shelves for Storage			
Steel Shelf Set	√	√	
Furniture for workshop			
Whiteboard	√	√	
Desk	√	√	
Chair	√	√	
Hand Cart	√	√	

(3) Transportation Plan

1) Transportation Route

Imported materials and equipment are shipped mainly to the Aqaba port. The regular mixed loading liner service is available from Japan to the Aqaba port. After the custom clearance at the bond warehouses of the Aqaba port, they will be transported to the project site on trailers by the building contractor and equipment supplier. The roads from the Aqaba port to the project site are well developed, which put no problem on the inland transportation.

Ocean Transportation　　Inland Transportation

Japan - Aqaba Port - Project Site

(Third Countries)

2) Transportation method

It takes approximately one and half month from the shipping in Japan to the arrival at the project site, including the custom clearances. In addition, the inland transportation process for equipment procured in Jordan is the same as this method.

3) Packing

Equipment will be transported with wooden moisture-proof packing. Each item will be packed by manufactures or agents of the manufacture pack equipment for the inland transportation in Japan, and they will be packed with the wooden packing at a predetermined warehouse.

2-2-4-7 Operation Guidance Plan

After the installation and performance tests of equipment, the instruction will be implemented. The engineer of manufacturer or agent of manufacturer from Japan or Jordan will be dispatched for system building onaudio visual equipment, instructionof PCs and material handling equipment. The instruction for other equipment will be implemented by the equipment supplier. The consultant shall check whether the instruction be properly performed. The consultant shall also confirm if the persons in charge at each department of PDTRA well understand the instruction by conducting interviews with the responsible persons in PDTRA during the handover..

2-2-4-8 Implementation Schedule

In the project implemented by the Japan's Grant Aid, the implementation schedule until the commencement of the construction works is as follows:

- E/N will be signed between GOJO and GOJ, and G/A will be signed between GOJO and JICA.
- JICA will recommend a Japanese consultant to GOJO.
- The agreement of consulting services for the project will be concluded between PDTRA and the consultant.
- The construction/equipment works will be commenced after the detailed design, the tender in Japan and the conclusion of the contract with the construction contractor/equipment supplier.

(1) Detailed Design Phase

The consultant will prepare the detailed design documents and the tender documents based on the Report, which will consist of the detailed design drawings, specifications, calculation, and tender documents, etc. The consultant will have close talks and meetings with PDTRA and PAP at the beginning and the end of the detailed design phase, and complete the detailed design after submitting the final deliverables.

(2) Tender Assistance / Supervision Phase

After the detailed design phase, the prequalification (P/Q) of the facilities construction tender will be announced in Japan. According to the result of the evaluation of P/Q, PDTRA will invite construction contractors. The equipment suppliers will be tendered separately from the

construction tender, and PDTRA will invite equipment suppliers who declare the intent to participate. Then PDTRA will conduct the tenders respectively in the presence of persons involved, and the tenderers who bid the lowest prices will make contracts as the winning bidders with PDTRA respectively.

(3) Construction / Equipment Procurement

The construction contractor and the equipment supplier will be verified by JICA and commence the construction works and the equipment works respectively. They will take totally approximately 14 months being judged from the scale of the project and the situation of the local construction conditions, realization of the factors which need smooth procurement of building materials and equipment, prompt execution of relevant procedures by the Jordan side and implementation of the scope of works borne by the Jordan side.

Table 2-10: Implementation Schedule

(Source: Study Team)

2-3 Obligations of Recipient Country

(1) Related to Construction

- To remove the existing facilities and level/clear the land
- To provide gardens in the project site after completing the facilities as needed
- To obtain the building permission (approval by the relevant departments of PDTRA)
- To connect the infrastructure (electricity, telephone line, city water, sewer)
- To implement the exhibition works (securement of artefacts, preparation of exhibition software, interpretation texts, booklets for publicity)

(2) Related to Operation and Maintenance

- To procure and install general furniture, equipment and fittings, etc. that are not borne by Japan's Grant Aid
- To procure spare parts and consumables necessary for the proper maintenance of the facilities and equipment
- To operate the facilities and equipment appropriately and effectively

(3) Related to Procedures

- To bear such commissions as advising commissions of A/P and payment commissions to a Japanese bank for the banking services based on B/A
- To apply for the building permission
- To obtain relevant permissions, licenses and other authorization as maybe necessary for the implementation of the project
- To ensure prompt unloading, customs clearance and tax exemption, and to assist inland transportation of the equipment and materials imported from Japan and/or other third countries based on the verified contracts
- To exempt Japanese nationals engaged in the project implementation from the custom duties, internal taxes and other fiscal levies which may be imposed in Jordan based on the verified contracts
- To accord Japanese nationals engaged in the project implementation with such facilities for their entry into Jordan and stay therein
- To bear all the expenses, other than those borne by Japan's Grant Aid, necessary for implementing the project

2-4 Operation and Maintenance Management Plan of Project

2-4-1 Operation and Maintenance Management Organisation

2-4-1-1 Operation Organization

The Petra Archaeological Park & Cultural Heritage of PDTRA will operate the project. As this section is located near the museum, the number of operation staff who will permanently station in the museum shall be kept minimum, and the museum shall be operated efficiently. The maintenance of special equipment will be outsourced to the external professional companies.

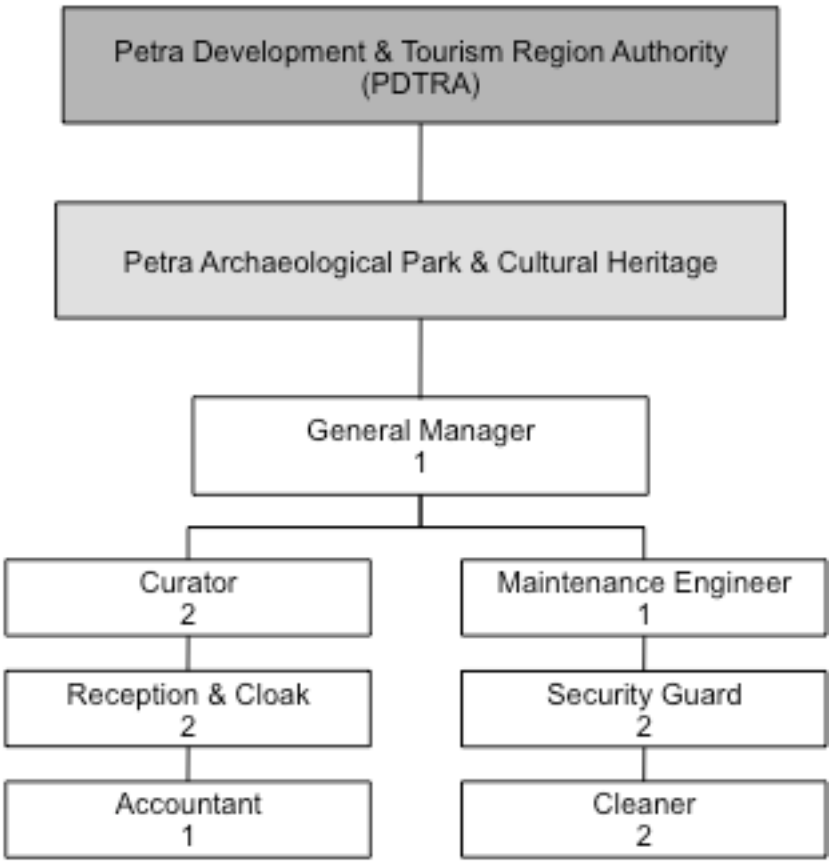


Figure 2-11: Petra Museum Organisation Chart

(Source: Study Team)

The technical levels required for respective personnel are as follows:

(1) General Manager

- Doctor or Master of cultural anthropology
- Academic training in museology is preferable
- Experience in working in a similar museum for more than 10 years
- Experience as a museum manager is preferable
- Profound knowledge of cultural and natural resources in PAP and the Petra region

(2) Curator

- Doctor or Master of archaeology
- Academic training in museology is preferable
- Experience in working in a similar museum for more than 5 years
- Special knowledge of cultural heritage in PAP and the Petra region

(3) Maintenance Engineer

- Bachelor of electromechanical engineering
- Academic training in building maintenance
- Experience as a maintenance engineer for more than 5 years
- Practical knowledge of building technology

(4) Accountant

- Bachelor of accounting
- Experience in working as an accountant for more than 3 years

(5) Reception & Cloak

- Proficient in English
- Sufficient knowledge of cultural heritage and natural resources in PAP and the Petra region is preferable

(6) Security Guard

- Experience as a security guard for more than 3 years
- Experience in working in a similar facility is preferable

(7) Cleaner

- Experience as a cleaner for more than 1 year
- Experience in working in a similar facility is preferable

2-4-1-2 Maintenance Plan

It is not planned to employ a specialized facility/equipment maintenance staff; however, it is expected to request outside construction contractors for repairing works of the facilities as well as to outsource maintenance/repair of the equipment to manufacturer's agents. Therefore, the mechanical / electrical equipment of the new facilities are planned based on the equipment or systems which are available in Petra.

It is considered that much difficulty will not be caused in maintaining the equipment, since the

equipment does not require high-skill for its daily operation and maintenance. Maintenance of the equipment such as procurement of consumables and spare parts, repair of the equipment and regular checks and cleaning will be required. Basically, local agents shall provide these processes for the maintenance.

2-4-2 Operation Plan

(1) Facilities

Daily cleaning and repair of attrition, break and aging are important for maintenance of the facilities. Cleaning the facilities needs patience; however, the operation staff shall take good care of the facilities

Repair is carried out mainly for the finishes of the interior and the exterior which protect the structure of the facilities. In the case of Japan, refurbishment is expected to be necessary every 10 years for maintaining facilities' functions.

The items for periodical inspection and repair which affect a lifespan of the facilities will be shown in the Maintenance Manuals to be submitted by the construction contractor at the handover of the new facilities, which explain methods of inspection and regular cleaning. In general, the outline of the periodical inspection of the facilities is as follows:

Table 2-11: Outline of Periodical Inspection (Facilities)

(Source: Study Team)

	Contents of Inspection	Numbers of Inspection
Exterior	・Repair/repaint of exterior walls	Repaint once/5 years, Repair once/3 years
	・Inspection and repair of roofs	Inspection once/3 years, Repair once/10 years
	・Regular cleaning of drainpipes	Once/1 year
	・Inspection and repair of sealing of exterior fittings	Once/1 year
	・Regular inspection and cleaning of gutters and manholes	Once/1 year
Interior	・Review of the interior	As needed
	・Repair/repaint of partition walls	As needed
	・Renewal of ceiling materials	As needed
	・Adjustment of doors and windows	Once/1 year
	・Exchange of fixtures of fittings	As needed

(2) Building Utilities

Building utilities needs preventive maintenance on a daily basis before repairing breaks and exchanging parts. The lifespan of equipment can be extended by normal operation and daily inspection/fuelling/cleaning/repair, etc. carried out in additional hours. These daily inspections can prevent accidents happening and expanding.

The equipment such as pumps requires periodical maintenance, and outside companies shall carry out a periodical inspection once a year. The lifespans of main equipment are as follows,

Table 2-12: Lifespan of Equipment

(Source: Study Team)

	Equipment	Life-span
Electrical	・Distribution Frame ・Fluorescent Lamp ・Incandescent Lamp ・Emergency Generator	20 - 30 years 5,000 - 10,000 hours 1,000 - 1,500 hours 30 years
Plumbing	・Pump, Pipe ・Tank ・Sanitary Ware	15 years 20 years 25 - 30 years
Air-conditioning	・Pipe ・Exhaust Fan ・Air Conditioning Equipment	15 years 20 years 10 years

(3) Equipment

Regarding audiovisual equipment, there are some agents of Japanese manufactures in Jordan, and they can do basic repair of equipment and procurement of consumables and spare parts although it takes time between 2 weeks and 1 month. Computers and associated equipment made in Japan or third countries have been widely distributed in Jordan, and there are some agents and shops supplying computers and associated items inside Amman. Regarding a forklift, there are some agents of Japanese manufactures, and they can provide maintenance service, consumables and spare parts. Thus, the procurement plan of the equipment will focus on products and specifications, the maintenance service of which can be provided by local agents or local manufactures, in order not to cause a serious problem.

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

The project costs to be borne by the Jordan side are estimated as follows:

Table 2-13: Estimated Project Costs to be borne by the Jordan

(Source: Study Team)

Items to be borne by the Jordan side	Estimated Cost (JOD)
(1) Related to Construction	
Clearing of Project Site	32,600
Planting of Project Site as needed	9,500
Infrastructure Connection Works	24,500
(2) Related to Operation and Maintenance	
Procurement of General Furniture, Equipment and Fittings	13,886
(3) Related to Procedures	
Commissions of A/P and B/A	3,000
Total	83,486

2-5-2 Operation and Maintenance Management Costs

2-5-2-1 Trial Calculation of Operation and Maintenance Management Costs

The results of the trial calculation of the operation and maintenance management costs that will be necessitated after the project implementation are as follows:

Table 2-14: Annual Operation and Maintenance Management Costs

(Source: Study Team)

Items	Costs (JOD)
(1) Operation Costs	
Personnel Expenses	92,000
Exhibition Related Costs	19,400
Costs of Cultural Assets Conservation and Research	9,700
Energy Costs	53,900
(2) Maintenance Management Costs	
Facilities & Equipment	7,200
Total	182,200

(1) Trial Calculation Bases: Personnel Expense

Referred to the personnel expenses of the Jordan Museum

General Manager	20,000 x 1 =	20,000
Curator	9,000 x 2 =	18,000
Accountant	7,000 x 1 =	7,000
Maintenance Engineer	9,000 x 1 =	9,000
Reception & Cloak	7,000 x 2 =	14,000
Security Guard	6,000 x 2 =	12,000
Cleaner	6,000 x 2 =	12,000
Total		92,000

(2) Trial Calculation Bases: Maintenance Cost (Facilities/Equipment)

- Facilities maintenance cost

  Although the facilities maintenance cost varies year by year, the average for 10 years after the project completion is assumed to be 0.1 per cent of the direct construction cost.

  2,160 JOD (300,000 JPY)

- Building utilities maintenance cost

  The building utilities maintenance cost will be small for the first five years after the project completion. However, after that period, the exchange of parts or equipment itself will be necessary. The average cost of equipment maintenance for first 10 years is assumed to be approximately 0.2 per cent of the direct construction cost of equipment.

  1,440 JOD (200,000 JPY)

- Equipment maintenance cost

  The equipment maintenance cost will be occupied by procurement of consumables and spare parts. The estimated cost is about 3,600 JOD..

  3,600 JOD (500,000 JPY)

2-5-2-2 Balance Prediction after Project Implementation

According to the data of PDTRA, the number of visitors to the Petra Archaeological Park widely changes depending on the social situations in the Middle East; however, it has gradually been increasing and reached 909,701 in 2010. However, due to the deterioration of the Syrian societal

situation in recent years, it decreased to 554,535 in 2013. According the data of the Petra National Trust, the number of visitors from Arabic countries was around 16% among the whole visitors

Table 2-15: The Nomber of Visitors to the Petra Archaeological Park

(Source: Study Team)

Year	Int'l Tourist	Jordanian	Children (Int'l)	Children (Jor.)	Students	Offical Guests	Total
1995	287,635	39,562	5,274	4,750	...	...	337,221
1996	319,050	42,500	6,375	4,900	...	...	372,825
1997	304,400	35,793	6,588	3,541	18,151	10,753	379,226
1998	282,650	35,483	5,933	3,588	17,927	1,528	347,109
1999	360,932	36,350	8,342	3,771	18,548	36,685	464,628
2000	419,785	36,550	5,086	1,929	13,929	2,819	480,098
2001	182,731	33,284	...	...	13,475	1,713	231,203
2002	98,966	43,716	...	...	16,155		158,837
2003	98,257	48,750	...	...	13,651		160,658
2004	209,068	76,814	...	...	24,389		310,271
2005	311,318	51,586	...	...	30,282		393,186
2006	269,880	60,900	...	...	28,586		359,366
2007	438,839	94,200	...	...	44,821		577,860
2008	711,503	73,200	...	...	18,163		802,866
2009	621,908	84,700	...	...	20,850	929	728,387
2010	819,713	69,232			17,260	3,496	909,701
2011	472,361	80,876	...		19,619	2,421	575,277
2012	481,337	73,092			14,265	59,928	628,622
2013	462,477	75,372			14,806	1,880	554,535

Assuming that the Syrian situation will be stabilised in the near future, the number of visitors to the Petra Archaeological Park is predicted to be one million per year (the visitors ratio from Arabic countries will be the same as above). The balance prediction is estimated based on the following conditions. Both number of visitors and entrance fees are based on the balance prediction data of the Jordan Museum. Including the museum entrance fees into the park entrance fees will be very effective for increasing the number of museum visitors; however, the museum entrance fees are independently calculated for the balance prediction estimation. In the Arabic countries such as Egypt, it is general to classify the museum entrance fees into two groups; i.e. international visitors and Arabic ones. The entrance fees into the Petra Archaeological Park also follow the above. The following number of visitors is predicted during around 3 years after the museum opening.

International Visitors (Adult)	Entrance Fee 5JOD	
	Number (10% of international park visitors)	84,000
International Visitors (Child)	Entrance Fee 2JOD	

	Number (2% of international adult visitors)	1,680
Visitors from Arabic Countries (Adult)	Entrance Fee 1JOD	
	Number (8% of Arabic park visitors)	12,800
Visitors from Arabic Countries (Child)	Entrance Fee 0.5JOD	
	Number (10% of Arabic adult visitors)	1,280
The total of the annual number of visitors		99,760
	Around 60% of the annual number of the maximum possible visitors (169,020)	

Annual income of entrance fees:

$$(5 \times 84{,}000) + (2 \times 1{,}680) + (1 \times 12{,}800) + (0.5 \times 1{,}280) = 436{,}800$$

The estimation value of the annual entrance fees is 436,800JOD, while the estimation value of the annual operation and maintenance management costs is 182,200JOD. Hence, it is judged that the entrance fees can cover the operation and maintenance management costs after the project implementation. The income from the café and museum shop in the museum can be added to the entrance fees; however, as it is difficult to predict the balance, the above income is not included in the estimation of the balance prediction

Chapter 3 Project Evaluation

3-1 Preconditions

The Government of Jordan shall carry out the following items in order to implement the project:

- Obtain the approval of EIA until July 2014.
- Obtain the approval of construction until the start of construction.
- Prepare a list of cultural properties for exhibition.

3-2 Necessary Inputs by Recipient Country

The Government of Jordan shall carry out the following items in order to produce and sustain the project effects:

- Secure cultural properties for exhibition until the implementation period of the exhibition works.
- Produce interpretation texts and mountings for exhibition.
- Secure budgets necessary for operation and management of the Petra Museum after the project completion.
- Connect such infrastructure as electric power, telephone lines, city water, drainage, etc. with the facilities to be cooperated.

Procure general office furniture and equipment that are out of the scope of the Japan's cooperation, and purchase consumption articles and spare parts necessary for operating and managing the facilities and equipment.

3-3 Important Assumptions

In order to produce and sustain the project effects, the following external conditions shall be satisfied:

- The law and order of Petra and the surrounding areas will not be worsened. It is expected that the Middle East situation will not be worsened excessively because the number of international tourists increases or decreases depending on the Middle East situation.
- The Government of Jordan will prepare the opening of the facilities immediately after handing over the facilities.

3-4 Project Evaluation

3-4-1 Relevance

From the following viewpoints the project can be judged to be relevant as a cooperation project utilizing the Japan's Grant Aid cooperation.

Petra is one of the world heritages that Jordan boasts and one of the largest tourist sites. However, as

Petra is mainly focused on the archaeological site tourism, and tourist sites and commercial facilities in Petra that attract tourists are not prepared satisfactorily except for the archaeological sites, a lot of tourists stay in Petra very shortly. By developing an attractive spot that collects a lot of tourists through the project implementation, it is expected to increase the number of tourists and their staying time, and its beneficial effect will be large.

In the national development plan of Jordan, "Executive Development Programme 2011-2013" (EDP), the tourism sector is regarded as one of the pillars to develop Jordan's economy. As one of the tourism sector objectives, the following items are included in EDP, such as the diversification of tourism merchandise, the archaeological site conservation, the promotion to change people's awareness of the importance of conserving the archaeological sites with the population, and so on. Hence, the expected effects of the projects agree to the above. Furthermore, as the "National Tourism Strategy 2011-2015" positions the project as a base for the conservation of ruins and the promotion of tourism, the priority of the project is high.

3-4-2 Effectiveness

The presumed outputs from implementing the project are as follows, and the effectiveness of the project can be expected.

Table 3-1: Quantitative Effects

(Source: Study Team)

Index	Basic Value (2013)	Targeted Value (3 years after the project completion: 2019)
The number of cultural properties of Petra that are exhibited in a form with explanations regarding dates and historical cultural properties	0	300 items

Table 3-2: Qualitative Effects

(Source: Study Team)

- Valuable cultural properties excavated in the ruins of Petra and the surrounding areas can be conserved appropriately.
- As one of the representative tourism spots in Petra, the project can contribute to enhancing the value as tourism resources in Petra.
- The project can promote activities for education and popularization regarding the ruins of Petra toward local people and visitors to the ruins of Petra.

Appendix 1. Member List of the Study Team

Name	Tasks in Charge	Corporation Name
Yusuke Namba	Team Leader / Architectural Plan 1a / Operation Plan	FreeTime International Inc.
Tadayoshi Tsumoto	Vice Team Leader / Architectural Plan 1b	Yamashita Sekkei Inc.
Takaaki Kimura	Architectural Plan 2 / Natural Conditions Examination 1	Yamashita Sekkei Inc.
Ikko Takenaka	Exhibition Plan	Ikko Takenaka Co., Ltd. Support for FreeTime International Inc.
Tomoo Nitta	Facilities Plan	Tomoo Nitta Architects Support for Yamashita Sekkei Inc.
Tomohiro Tamaki	Equipment Plan	INTEM Consulting, Inc. Support for Oriental Consultants Co., Ltd.
Makoto Makoto	Construction Plan / Cost Estimation	OPM Co., Ltd. Support for Yamashita Sekkei Inc.
Ohara Misato	Procurement Plan / Cost Estimation 2	INTEM Consulting, Inc. Support for Oriental Consultants Co., Ltd.
Eiko Watatsu	Environmental Impact Assessment	Oriental Consultants Co., Ltd.
Mohammad Najjar	Heritage Impact Assessment	Jordan's Landscapes Tours Support for FreeTime International Inc.
Takayuki Hagiwara	Traffic Plan	Oriental Consultants Co., Ltd.
Kino Sawanobori	Business Coordination / Natural Conditions Examination 2	FreeTime International Inc.

Appendix 2
Study Schedule/1st Site Survey :8/Sep/2013 - 13/Oct/2013 (36 days)

	Date		Consultant Members											
			1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)
			Team Leader / Architectural Plan 1a / Operation Plan	Vice Team Leader / Architectural Plan 1b	Architectural Plan 2 / Natural Conditions Examination 1	Exhibition Plan	Facilities Plan	Equipment Plan	Construction Plan / Cost Estimation	Procurement Plan / Cost Estimation 2	Environmental Impact Assessment	Heritage Impact Assessment	Traffic Plan	Business Coordination / Natural Conditions Examination 2
			Yusuke Namba	Tadayoshi Tsumoto	Takaaki Kimura	Ikko Takenaka	Tomoo Nitta	Tomohiro Tamaki	Makoto Makoto	Ohara Misato	Eiko Watatsu	Mohammad Najjar	Takayuki Hagiwara	Kino Sawanobori
1	8/Sep	Sun	Narita >											Narita >
2	9/Sep	Mon	> Amman Purchase of Equipment											> Amman Purchase of Equipment
3	10/Sep	Tue	Amman > Petra									Amman > Petra Discussion w/PDTRA		Amman > Petra
4	11/Sep	Wed	Mtg w/PDTRA Mtg w/HIA									Mtg w/HIA Study on Site Data		Mtg w/PDTRA Mtg w/HIA Confirmation of Site Surrounding Areas (VC etc)
5	12/Sep	Thu	Mtg w/PDTRA 1 Mtg w/HIA Mtg w/PDTRA 2									Mtg w/HIA		Mtg w/PDTRA 1 Mtg w/HIA Mtg w/PDTRA 2 Inspection of Existing Petra Museum
6	13/Sep	Fri	Mtg w/JICA									Site Survey		Confirmation of VC Data
7	14/Sep	Sat	Mtg w/JICA									Site Survey		Inspection of Wadi Musa
8	15/Sep	Sun	Mtg w/PDTRA Mtg w/HIA Mtg w/JICA									Mtg w/HIA		Mtg w/PDTRA Mtg w/HIA Mtg w/JICA
9	16/Sep	Mon	Mtg w/PDTRA Mtg w/HIA Mtg w/JICA									Mtg w/HIA Site Survey		Mtg w/PDTRA Mtg w/HIA Mtg w/JICA
10	17/Sep	Tue	M/M Signature between PDTRA/JICA Petra > Amman									Site Survey		Study of VC Data
11	18/Sep	Wed	Mtg w/MOTA Mtg w/DOA Amman > Petra									Site Survey		Study of VC Data
12	19/Sep	Thu	Mtg w/HIA									Mtg w/HIA Site Survey		Mtg w/HIA Business Coordination
13	20/Sep	Fri	Survey of PAP					Narita >					Narita >	Survey of PAP
14	21/Sep	Sat	Preparation of Exhibition Plan	Narita >	Narita >	Narita >		> Amman Study Preparation	Narita >				> Amman Study Preparation	Business Coordination
15	22/Sep	Sun	Preparation of Exhibition Plan Supervision of HIA	Amman Mtg w/JICA > Petra	Amman Mtg w/JICA > Petra	Amman Mtg w/JICA > Petra		Amman > Petra	Amman Mtg w/JICA > Petra			Supervision of HIA Site Survey	Discussion w/Local Consultants Amman > Petra	Business Coordination
16	23/Sep	Mon	Mtg w/PDTRA Preparation of Exhibition Plan Supervision of HIA	Mtg w/PDTRA Study of Facilities Plan	Mtg w/PDTRA Study of Facilities Plan	Study of Exhibition Plan		Mtg w/PDTRA Survey of Petra Ruins	Mtg w/PDTRA Study of Facilities Plan			Supervision of HIA Data Arrangement	Mtg w/PDTRA Survey of PAP	Mtg w/PDTRA Survey of PAP

	Date		Consultant Members											
			1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)
			Team Leader / Architectural Plan 1a / Operation Plan	Vice Team Leader / Architectural Plan 1b	Architectural Plan 2 / Natural Conditions Examination 1	Exhibition Plan	Facilities Plan	Equipment Plan	Construction Plan / Cost Estimation	Procurement Plan / Cost Estimation 2	Environmental Impact Assessment	Heritage Impact Assessment	Traffic Plan	Business Coordination / Natural Conditions Examination 2
			Yusuke Namba	Tadayoshi Tsumoto	Takaaki Kimura	Ikko Takenaka	Tomoo Nitta	Tomohiro Tamaki	Makoto Makoto	Ohara Misato	Eiko Watatsu	Mohammad Najjar	Takayuki Hagiwara	Kino Sawanobori
17	24/Sep	Tue	Mtg w/PDTRA1 Preparation of Exhibition Plan	Mtg w/PDTRA1 Study of Facilities Plan	Mtg w/PDTRA1 Study of Facilities Plan	Study of Exhibition Plan		Mtg w/PDTRA1 Discussion w/Experts	Mtg w/PDTRA 1 Survey of Construction Conditions			Mtg w/PDTRA2	Mtg w/PDTRA1 Survey of Existing Conditions of Traffic Facilities in Petra Surrounding Areas	Mtg w/PDTRA1 Preparation of Museum Exhibition Plan
18	25/Sep	Wed	Mtg w/PDTRA Preparation of Exhibition Plan	Mtg w/PDTRA Study of Facilities Plan	Mtg w/PDTRA Study of Facilities Plan	Mtg w/PDTRA Study of Exhibition Plan	Narita >	Mtg w/PDTRA Discussion w/Experts	Mtg w/PDTRA Survey of Construction Conditions	Narita >	Narita >		Mtg w/PDTRA Preparation of Re-commision of Traffic Survey	Mtg w/PDTRA Preparation of Museum Exhibition Plan
19	26/Sep	Thu	Survey of Storages of Petra Archaeological Museum Preparation of Exhibition Plan	Study of Facilities Plan	Study of Facilities Plan	Survey of Storages of Petra Archaeological Museum	> Amman Mtg w/Parties Involved > Petra	Survey of Storages of Petra Archaeological Museum	Petra > Amman	> Amman Mtg w/Parties Involved > Petra	> Amman Mtg w/Parties Involved > Petra		Mtg w/PDTRA Preparation of Re-commision of Traffic Survey Data Collection	Survey of Storages of Petra Archaeological Museum
20	27/Sep	Fri	Preparation of Exhibition Plan	Study of Facilities Plan	Study of Construction Conditions	Study of Exhibition Plan	Site Survey	Survey of PAP	Preparation of Estimation Request of Constuction Materials & Equipment	Survey of Equipment Procurement	Site Survey		Analysis on Traffic Facilities in Petra Surrounding Areas Data Arrangement	Survey of PAP
21	28/Sep	Sat	Preparation of Exhibition Plan	Mtg w/PDTRA Architects Study of Facilities Plan	Mtg w/PDTRA Architects Study of Facilities Plan	Preparation of Exhibition Study Plan	Mtg w/PDTRA Architects Study of Facilities Plan	Survey of Equipment Plan	Preparation of Estimation Request of Constuction Materials & Equipment	Survey of Equipment Procurement	Survey of Authorities Concerned		Analysis on Traffic Facilities in Petra Surrounding Areas Data Arrangement	Business Coordination
22	29/Sep	Sun	Mtg w/PDTRA Preparation of Exhibition Plan	Mtg w/PDTRA Study of Facilities Plan	Mtg w/PDTRA Study of Construction Conditions	Mtg w/PDTRA Preparation of Museum Exhibition Plan	Mtg w/PDTRA Study of Equipment Plan	Mtg w/PDTRA Survey of Equipment Plan	Collection of Unit Price Data from MPWH Hearing from Contractors	Mtg w/PDTRA Survey of Equipment Procurement	Mtg w/PDTRA Survey of Authorities Concerned		Mtg w/PDTRA Preparation of Re-commision of Traffic Survey Data Analysis	Mtg w/PDTRA Preparation of Museum Exhibition Plan
23	30/Sep	Mon	Mtg w/PDTRA Preparation of Exhibition Plan	Study of Facilities Plan Data Preparation for Estimation Request	Request for Natural Conditions Survey Estimation Survey of Storages of Petra Archaeological Museum	Preparation of Exhibition Study Plan	Study of Equipment Plan Data Preparation for Estimation Request	Study of Equipment Plan Survey of Storages of Petra Archaeological Museum	Study of Construction Plan	Survey of Equipment Procurement Survey of Storages of Petra Archaeological Museum	Survey of Authorities Concerned		Mtg w/PDTRA Preparation of Re-commision of Traffic Survey Data Analysis	Confirmation Survey of Storage Mtg w/PDTRA Preparation of Museum Exhibition Plan
24	1/Oct	Tue	Mtg w/PDTRA Department of Agriculture: Collection of Meteorological Data Mr. Radwan: Collection of Tourism Data	Study of Facilities Plan Data Preparation for Estimation Request	Request for Natural Conditions Survey	Mtg w/PDTRA Study of Exhibition Plan	Study of Facilities Plan Data Preparation for Estimation Request	Discussion w/PDTRA on Equipment Plan Petra > Amman	Study of Construction Plan	Petra > Amman Mtg w/PDTRA Discussion w/PDTRA on Equipment Plan	Site Survey		Mtg w/PDTRA Explanation of Survey Commission	Mtg w/PDTRA
25	2/Oct	Wed	Mtg w/PDTRA Water Authority: Collection of Data Preparation of Presentation Material	Study of Facilities Plan	Study of Facilities Plan	Study of Exhibition Plan	Study of Facilities Plan	Study of Equipment Maintenance & Management	Study of Construction Plan	Survey of Equipment Procurement	Site Survey		Final Discussion on Survey Commission of Traffic Flow w/PDTRA & President of Petra College for Tourism & Archaeology	Study on Meteorological Data Business Coordination
26	3/Oct	Thu	Mtg w/PDTRA Preparation of Technical Note	Mtg w/PDTRA Preparation of Technical Note	Study of Facilities Plan	Mtg w/PDTRA Preparation of Technical Note	Study of Facilities Plan	Study of Equipment Maintenance & Management	Study of Construction Plan	Survey of Equipment Procurement	Mtg w/Environmental Expert of PDTRA		Traffic Flow Survey	Business Coordination
27	4/Oct	Fri	Preparation of Technical Note	Preparation of Technical Note	Contract of Natural Conditions Survey Study of Facilities Plan	Preparation of Technical Note	Preparation of Technical Note	Preparation of Technical Note	Survey of Construction Estimation	Preparation of Technical Note	Preparation of Technical Note		Traffic Flow Survey Preparation of Technical Note	Preparation of Technical Note Business Coordination
28	5/Oct	Sat	Preparation of Technical Note	Preparation of Technical Note	Mtg on Cost Estimation Amman >	Preparation of Technical Note	Preparation of Technical Note	Study of Similar Facilities	Mtg on Cost Estimation	Study of Similar Facilities	Preparation of Technical Note		Traffic Flow Survey Preparation of Technical Note	Preparation of Technical Note
29	6/Oct	Sun	Mtg w/PDTRA Petra College for Tourism & Archaeology	Preparation of Technical Note	> Narita	Preparation of Technical Note	Preparation of Technical Note	Study of Equipment Plan	Survey of Construction Estimation	Study of Equipment Procurement	Site Survey		Petra College for Tourism & Archaeology	Preparation of Technical Note
30	7/Oct	Mon	Mtg w/PDTRA	Mtg w/PDTRA		Petra > Amman	Petra > Amman	Study of Equipment Plan	Survey of Construction Estimation	Study of Equipment Procurement	Petra > Amman Mtg w/Authorities Concerned		Petra > Airport	Petra > Amman
31	8/Oct	Tue	Mtg w/Parties Involved	Mtg w/Parties Involved Arrangement of Local Work		Amman >	Amman >	Amman >	Mtg on Cost Estimation Survey of Construction Estimation	Amman >	Mtg w/Authorities Concerned Amman >		> Narita	Mtg on Cost Estimation Mtg w/Parties Involved
32	9/Oct	Wed	Modification of Technical Note Mtg w/JICA	Mtg w/Local Estimation Consultants Mtg w/JICA		> Narita	> Narita	> Narita	Mtg w/Local Estimation Consultants Mtg w/JICA	> Narita	> Narita			Modification of Technical Note Mtg w/JICA
33	10/Oct	Thu	Mtg w/Embassy of Japn in Jordan Mtg w/PDTRA	Mtg w/Embassy of Japn in Jordan					Survey of Construction Estimation					Business Coordination
34	11/Oct	Fri	Mtg w/HIA	Arrangement of Local Work					Survey of Construction Estimation					Mtg w/HIA
35	12/Oct	Sat	Amman >	Amman >					Amman >					Amman >
36	13/Oct	Sun	> Narita	> Narita					> Narita					> Narita

Fri/Sat
In Petra
In Amman

Appendix 2

Study Schedule/2nd Site Survey : 4/Jan/2014 - 15/Jan/2014 (12 days)

	Date		Consultant Members		
			1)	2)	4)
			Team Leader / Architectural Plan 1a / Operation Plan	Vice Team Leader / Architectural Plan 1b	Exhibition Plan
			Yusuke Namba	Tadayoshi Tsumoto	Ikko Takenaka
1	4/Jan	Sat	Narita >		
2	5/Jan	Sun	Amman > Petra Mtg w/PDTRA		
3	6/Jan	Mon	Mtg w/PDTRA		
4	7/Jan	Tue	Mtg w/PDTRA		
5	8/Jan	Wed	Petra > Amman Report to JICA		
6	9/Jan	Thu	Amman > Petra Mtg w/PDTRA		
7	10/Jan	Fri	Petra > Feynan Site Survey		
8	11/Jan	Sat	Site Survey Feynan > Petra		
9	12/Jan	Sun	Petra > Amman Data Preparation		
10	13/Jan	Mon	Data Preparation		
11	14/Jan	Tue	Amman >		
12	15/Jan	Wed	> Narita		

Fri/Sat
In Petra
In Amman

Appendix 2

Study Schedule/3rd Site Survey : 21/Apr/2014 - 27/Apr/2014 (7 days)

	Date		Consultant Members	
			1)	2)
			Team Leader / Architectural Plan 1a / Operation Plan	Vice Team Leader / Architectural Plan 1b
			Yusuke Namba	Tadayoshi Tsumoto
1	21/Apr	Mon	Narita >	
2	22/Apr	Tue	Amman > Petra Mtg w/PDTRA	
3	23/Apr	Wed	Mtg w/PDTRA	
4	24/Apr	Thu	Mtg w/PDTRA, JICA	
5	25/Apr	Fri	Petra > Amman Data Preparation	
6	26/Apr	Sat	Amman >	
7	27/Apr	Sun	> Narita	

Fri/Sat

In Petra

In Amman

Appendix 3. List of Parties Concerned in the Recipient Country

Organization / Section		Position	Name
Embassy of Japan in Jordan		Second Secretary	Shinya KUWANA
JICA Jordan Office		Resident Representative	Toshiaki TANAKA
		Senior Representative	Junji WAKUI
		Representative	Mitsuhiro OSAKI
			Mitsutaka Hoshi
		Eng., JICA Expert (Heritage Tourism Development Advisor)	Koji OYAMA
Petra Development and Tourism Region Authority		Chief Commissioner	Eng. Mohammad A.M. Abulghanam
	Petra Archeological Park	Deputy Chief Commissioner	Dr. Emad Hijazeen
		Director of Culture Resources	Eng. Tahani Al-Salhi
			Eng. Yahya Hasanat
		Curator	Mohammad Abdelaziz Almrahleh
		Director of Environment	Majed N. Al- Hasanat
			Mohammad Marahlah
			Samia Falahat
			Harun Amarat
Department of Antiquities		General Director	Monther Dehash Jamhawl PhD
			Hani Falahat
The Jordan Museum		Deputy.Director /Technical Affairs	Dr. Khairieh Amr
Petra College for Tourism and Archaeology		Vice Dean	Dr. Mohammad Taraeneh
The University of Jordan Faculty of Archaeology and Tourism		Department of Tourism Management	Dr. Suleiman A. D. Farajat
Red Rock Tours		General Manager	Radwan Farajat
Tour Guide/ Archaeologist			Mr. Mahmouel Fageer

Organization / Section		Position	Name
Ministry of Public Works and Housing	Government Tender Department	Director General	Eng. Moh'd Khaled Al-Hazaimeh
Consolidated Consultants		Senior Road Engineer	Anan M. Halaseh
		Deputy Head of Building and Architecture	Fahed Abujaber
	Water & Environment Division	Water & Enviroment Engineer	Eng. Rania AlOmari
	Business Development Group	Marketing Department Manager	Ahmed Al-Khatib
Habash-Deir Contracting Co.		General Manager	Eng. Mechael Deir
Engineer		Resident Engineer	Eng. Reema Abu Baker
ACES (Geographic Survey Company)		Senir Geologocal Engineer	Eng. Abdel Fattah l Al Afami
ARABTECH JARDANEH		International Operation and Marketing Director	Hamzeh A. Awwad
			Maysoum Al Dissi
SIGMA Architect & Engineers		Deputy Director of Engineering Affairs	Sana Nazer

TECHNICAL NOTES

Preparatory Survey

on the Project for theConstruction of Petra Museum

inthe Hashemite Kingdom of Jordan

Subsequent tothe Minutes of Meetings signed on September17, 2013 between Japan International Cooperation Agency and Petra Development and Tourism Region Authority (hereinafter referred to as "PDTRA"), the Preparatory Survey Team (hereinafter referred to as "the Team") conducted a field survey at the study area and held discussions with the officials concerned of PDTRA. Through the field survey and the discussions, PDTRA and the Team confirmed the following items described in the attached sheets, and ensured to further consider them in Japan.

Attachments:

1. Development Master Plan
2. Operation& Management Plan
3. Project Site
4. Exhibition Plan
5. Building Plan
6. Equipment Plan
7. Text Excavation
8. Environmental and Social Consideration
9. Traffic Management Plan

Note: The above "Test Excavation" and "Environmental and Social Consideration" are tentative reports including their conclusions observed by the Team. JICA will officially submit the final reports later on.

10th October2013

Yusuke NAMBA
Chief Consultant
Preparatory Survey Team

For Japan International Cooperation Agency

Emad Hejazeen
Deputy Chief Commissioner
Petra Development and Tourism Region Authority
The Hashemite Kingdom of Jordan

The Minutes of Meeting
on the Mission for the Preparatory Survey
on the Project for
The Construction of the Petra Museum
in the Hashemite Kingdom of Jordan

Agreed Upon
Between the Government of Hashemite Kingdom of Jordan
And Japan International Cooperation Agency

Based on the discussions in previous surveys held between the Government of the Hashemite Kingdom of Jordan (hereinafter referred to as "the GOJo") and the Government of Japan (hereinafter referred to as "the GOJa") from August 2012, Japan International Cooperation Agency (hereinafter referred to as "JICA") has conducted the Outline Design Survey on the Project for the Construction of the Petra Museum (hereinafter referred to as "the Project").

JICA dispatched the Team to explain and discuss Draft Final Report of the Outline Design Survey (hereinafter referred to as "the Team"), headed by Mr. Toshiyuki IWAMA, Executive Technical Adviser to the Director General, Economic Infrastructure Department of JICA HQ from April 23rd to April 27th, 2014. As a result of a series of discussions, both parties confirmed the main issues described in the attached documents and sheets. The Team will proceed to further works and prepare the Preparatory Survey Report.

Petra, April 24, 2014

Dr. Mohammed A. Al Nawafleh
Chief Commissioner,
Petra Development and Tourism Region Authority,
THE HASHEMITE KINGDOM OF JORDAN

Mr. Toshiyuki Iwama
Leader of the Team
Japan International Cooperation Agency
JAPAN

< 1 > Components of Draft Report

The Government of the Hashemite Kingdom of Jordan agreed and accepted in principle the components of the Draft Report explained by the Team

< 2 > Japan's Grant Aid Scheme

The Jordanian side understands the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of the Hashemite Kingdom of Jordan as explained by the Team and described in Annex 2 and Annex 3 of the Minutes of Meetings signed by both parties on August 29, 2012, and the Minutes of Meetings on January 7, 2014.

< 3 > Schedule of Study

JICA will complete the final report in accordance with the confirmed item and send it to the Government of the Hashemite Kingdom of Jordan by the end of June 2014.

< 4 > Confidentiality of the Project Design

Both side confirmed that all information related to the Project design including detailed specifications of equipment and other technical information shall not be released to any outside parties before the signing of all the Contract(s) for the Project.

< 5 > Confidentiality of the Project Cost Estimation

The Team explained the cost estimation of the Project as described in the Annex-1. Both sides agreed that the Project Cost Estimation SHALL NOT be duplicated or released to any outside parties before the signing of all the Contract(s) for the Project. Both sides understand that the Project Cost Estimation described in Annex-1 is not final and is subject to change.

< 6 > Functions and Demarcation between the New Museum and the Visitors Centre

As both Japanese and Jordanian sides agreed on the last Minutes of Meetings (January 7, 2014), it is important to determine clear functions between the New Museum and the Visitors Centre (hereinafter referred to as "VC"), and both of them should have mutually complementary function in order to contribute to the betterment of tourism management. Both Japanese and Jordanian sides continue discussions as the function of VC.

< 7 > Site Clearance

As agreed on the last Minutes of Meetings (January 7, 2014), the Jordanian side is requested to finish the site clearance (demolishing the existing buildings, removing pipes, underground and levelling) soon after the signing of the Exchange of Notes (E/N) by the Japanese and Jordanian Governments. The Exchange of Notes (E/N) was signed on March

1, 2014. Therefore, the Japanese side asked the Jordanian side to implement the site clearance again. The Jordanian side agreed to complete it by May 20, 2014.

< 8 > Potential Inventory of Artefacts

As discussed on the last Minutes of Meetings (January 7, 2014), the Japanese side asked the Jordanian side to prepare a potential inventory of Artefacts. The Jordanian side agreed to submit it to the Japanese side by the end of May, 2014.

< 9 > Environmental Assessment

As agreed on the previous Minutes of Meetings, the Jordanian side is requested to "carry out the environmental assessment based on the Jordanian laws/regulations".
The Jordanian side agreed to implement environmental assessment by June 15, 2014, which is indispensable for the detailed design and report to JICA Jordan Office.

(End)

Project Cost Estimation

(1) Project Cost borne by the Japanese Side

This Page is closed due to the confidenciality.

(2) Project cost borne by the Jordanian Side

This Page is closed due to the confidenciality.

(3) Calculation Conditions

1)	Current as of	December, 2013
2)	Exchange rate	1US$=99.03JPY, 1JOD=139.68JPY
3)	Period	Design and procurement period details are as noted in workflow process of Draft Report
4)	Other	The project will be carried out in compliance with the Japanese government's Grant Aid system

Technical Notes

Index

Attachment 1: Development Master Plan

1.1 Positioning of Development

Under the Grant Aid Scheme of the Government of Japan, PDTRA will push forward with the development of Petra Museum in cooperation with MOTA (Ministry of Tourism and Antiquities), DOA (Department of Antiquities) and SSC (Social Security Corporation).

Considering the above participants in the development, the project can be positioned as a national project of Jordan assisted by Japan.

1.2 Functional Demarcation between Visitors Centre and Petra Museum

The functions of the Visitor Centre and the Petra Museum shall clearly be demarcated from each other in order to encourage their respective capacities to the maximum.

However, considering the fact that the Petra Museum will open in the future, the ongoing Visitors Centre plan will not be changed.

Attachment 2: Operation & Management Plan

2.1 Fundamental Operation& Management Factors

In order to prepare a draft of the operation& management plan, PDTRA shall set, in cooperation with the Team, the following fundamental operation& management factors by the end of March 2014 referring to the attached reference material "Guidelines of Jordan Museum Operation & Management Activities" prepared by JICA expert in 2010.

1) Organisation chart to operate and manage the museum
2) Methods to allocate necessary staff
3) Methods to allocate a necessary budget
4) Methods to operate and manage the museum
5) Presumption of the number of visitors
6) Annual activities plan

2.2 Storage

There 3 storages in and near the Petra Archaeological Museum: 2 in the museum and 1 near the museum. Around 9,200 articles are numbered as museum materials. The storage condition is not so satisfactory; however, it is an average level in Jordan.

The new museum is planned to have a 120m^2 storage.

PDTRA and the Team agreed to use both storages, existing ones and new one, even after the new museum completion considering the number of existing articles and their sizes. The new storage and the existing storage will store respective articles as follows:

1) New Storage

   Valuable articles such as jewels, accessories and coins
   Articles to be carefully preserved such as fresco paintings
   Articles to be periodically displayed in the exhibition hall such as statues and potteries

2) Existing Storages

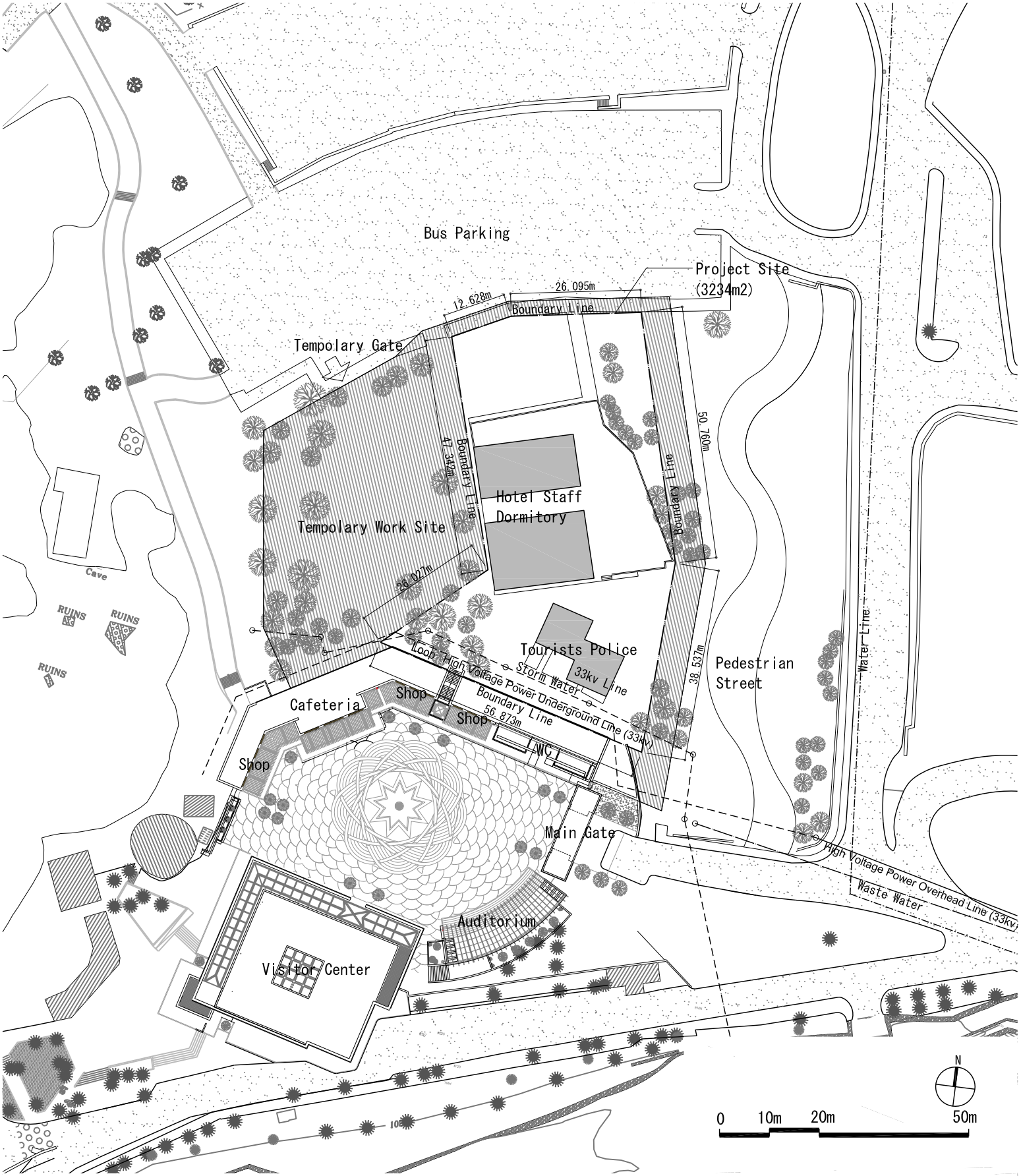
   Large and heavy articles such as stone structure decorations and parts
   Fragmental articles not yet classified
   Articles to be conserved or examined in the laboratory in the near future

PDTRA shall classify their articles and prepare a collection list with photographs through the preparation work of the exhibit list.

2.3 Library

According to the request of PDTRA, 2 libraries are planned in the new museum. One is opened to the public, and another is limited to the staff. PDTRA will collect as many materials related to Petra as possible, e.g. Petra excavation and research reports, books, old maps and photographs, etc.

Attachment 3
The Project Site
Scale 1/1000



Attachment 4

Exhibition Plan

The Exhibition Plan is prepared on the basis of the following policies:

1) As the floor area of the exhibition hall is so much limited, less than 1000 m^2, it is impossible to make an encyclopaedia-type museum. Hence, we shall focus on several subjects among numerous aspects of the whole Petra.

2) In order to make an attractive museum, compact but comprehensive, we shall develop not a static museum composed of showcases and graphic panels but a dynamic museum by providing the museum with as many active scenes and messages as possible.

3) As the museum is located just adjacent to the gigantic and powerful Petra Archaeological Park, the museum shall offer visitors distinctive images of Petra that are completely different from the real ones.

4) As it is predicted that most of visitors will come to the museum after finishing not an easy foot-trip in the Park, the museum shall offer them something that are neither existed in the Park nor introduced in various Petra guidebooks.

5) We will neither display any kind of scale models nor use showcases or graphic panels unless they are indispensable.

Aqua Kaleidoscope

↓

Welcoming Deities

↓

Petra Powers of Ten

↓

El Khazneh

↓

Capital with Deity

↓

The Breath of Petra

✚

Wealth and Flavour

✚

Power and Language

✚

Life and Love

↓

Petra Time Tunnel

↓

Petra Today

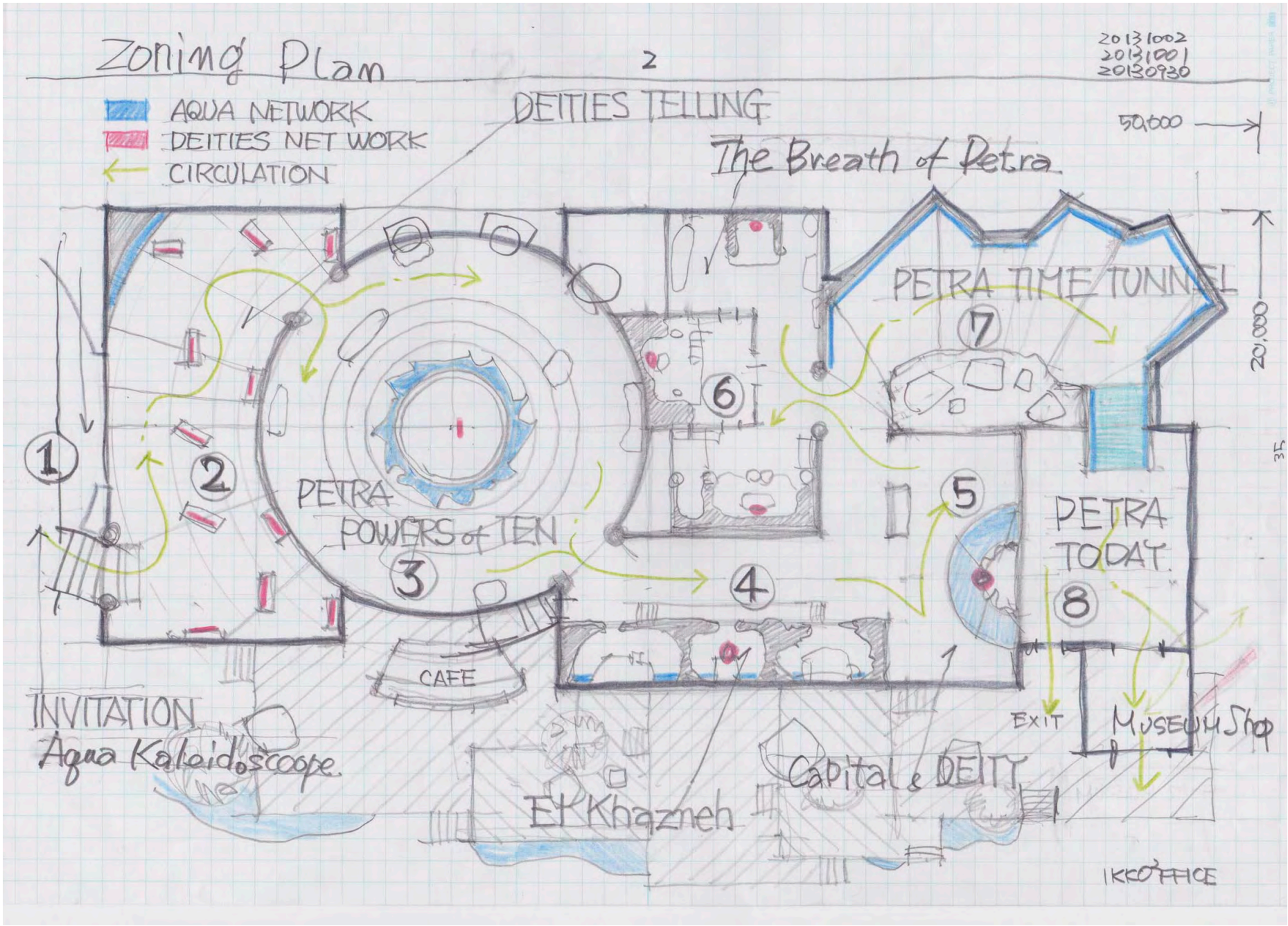
↓

Art Promenade

★

Petra Symphony

Appreciate and approach the attractions of Petra Museum presented by the project mapping system.


Zoning Plan
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20131001
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AQUA NETWORK
DEITIES NET WORK
CIRCULATION
DEITIES TELLING
The Breath of Petra
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PETRA TIME TUNNEL
PETRA
POWERS of TEN
PETRA
TODAY
CAFE
INVITATION
Aqua Kaleidoscope
Ek Khazneh
Capital e DEITY
EXIT
Museum Shop
IKKO OFFICE
1
2
3
4
5
6
7
8

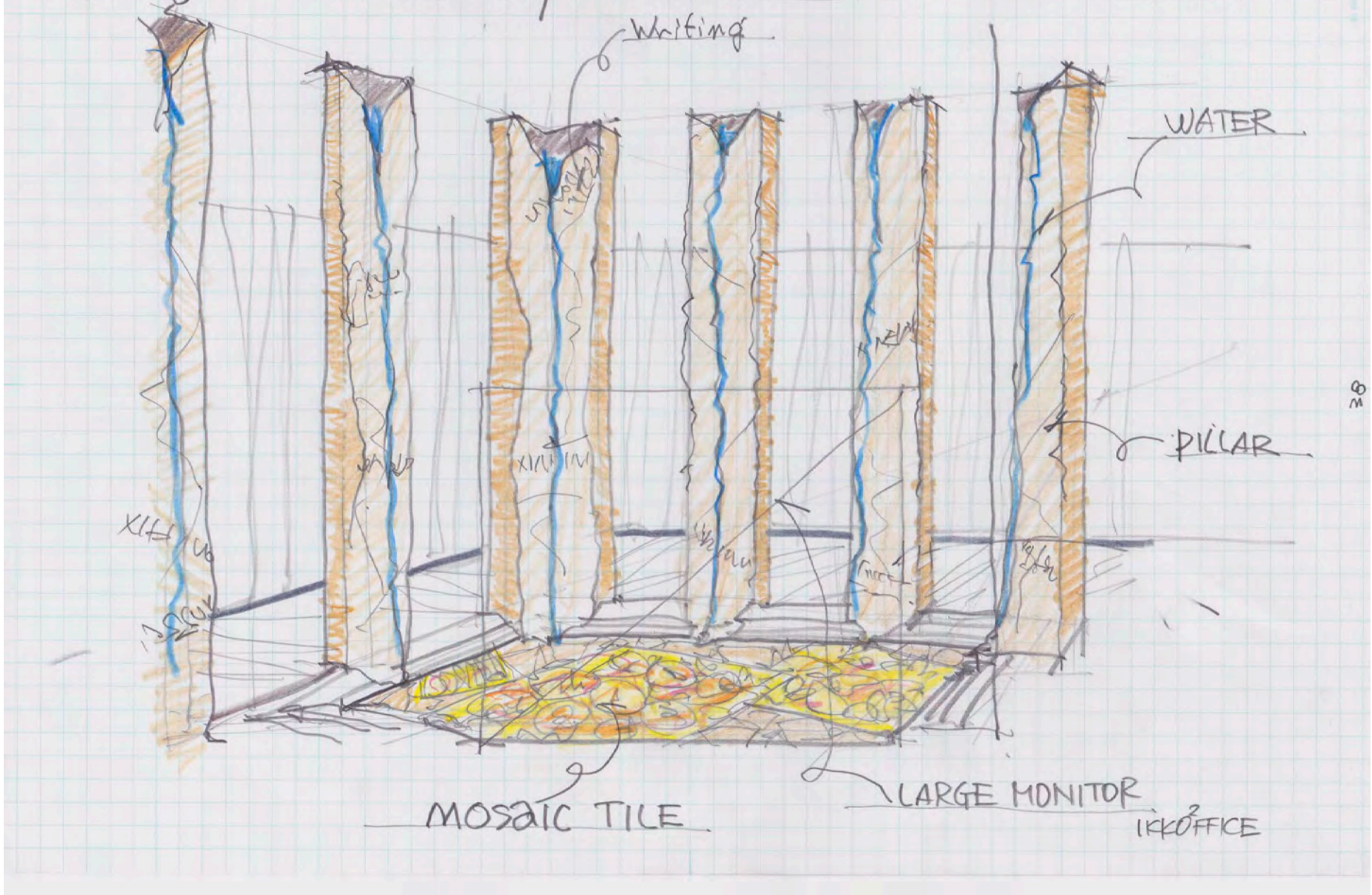
4.3.1 Aqua Kaleidoscope

A comfortable space firstly relaxes visitors, most of them are tired after the PAP tour, and an aqua kaleidoscope entices them into the unknown Petra world.

In the dim light threads of water are trickling down in narrow rock crevices making water sound.
The aqua kaleidoscope starts the wondrous journey of water usage that is one of the essential keys to stepping into the unknown Petra world.

① Aqua Kaleidoscoope 3

2013.002



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Monitor Soft

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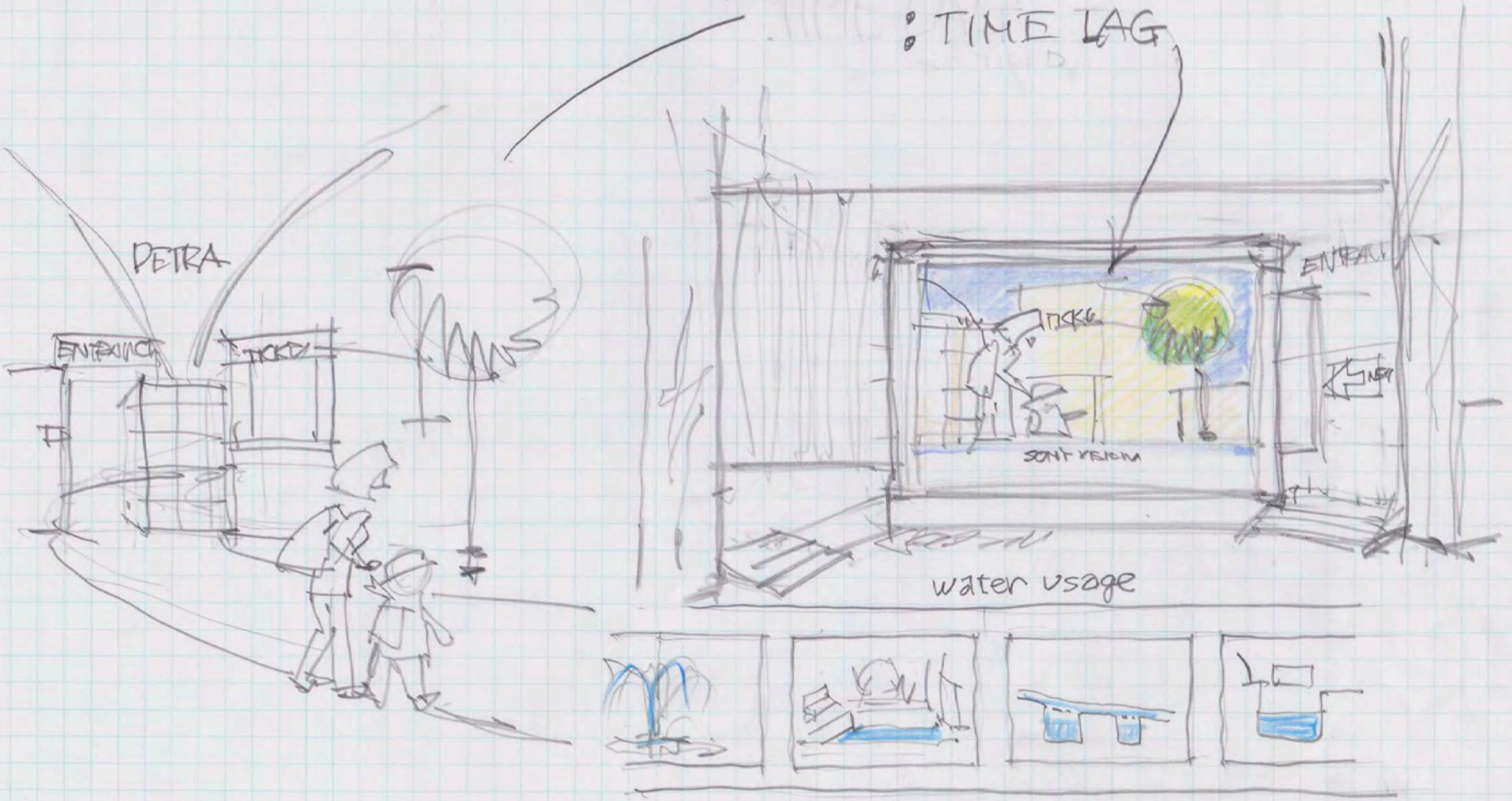
VISUAL : WATER USEGE
: TIME LAG



IKKO OFFICE

4.3.2 Welcoming Deities

A variety of deities tell the miracles of Petra happened in its long history.

A variety of deities made of stone and bronze such as the Artemis surrounding the eye-idol in the middle give welcome to visitors.
A projection system projects images of some deities, if the real statues of which do not exist.
They tell and show the stories of Petra including their own miraculous events with visual images and light & sound effects.
Finally the eye-idol gravely shouts "Let's enjoy a wondrous space trip from Petra to the universe and to the depths of the earth.


2
Welcoming Deities
5
PROJECTON MAPPING
2013100
20130927
VARIOUS DEITIES TELLING
WATER
IKKOFFICE

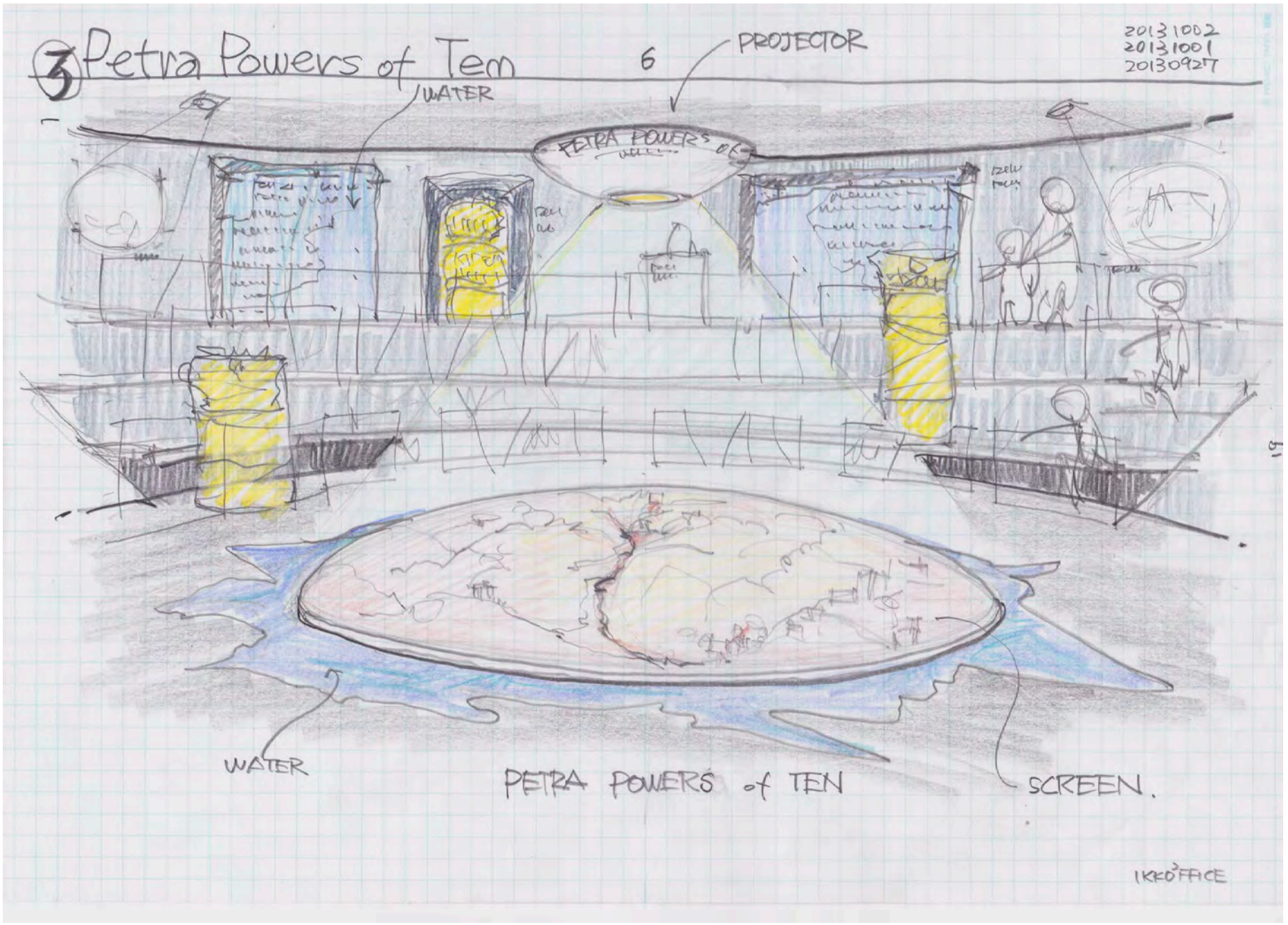
4.3.3 Petra Powers of Ten

A trip in space shows 'where is Petra' from the bottom to the top end.

A projection system gives the exciting trip of the "Petra Powers of Ten" with vivid sound effects:
Petra - Jordan - the earth - the solar system - the Galaxy - returns to Petra -goes down to the depths of the earth - magma - returns to Petra.
During the trip several deities related to the earth, sun, universe and underground appear occasionally.
Statues such as torsos and busts surround the theatre, and are spotlit in synchronisation with the story.

③ Petra Powers of Ten

6



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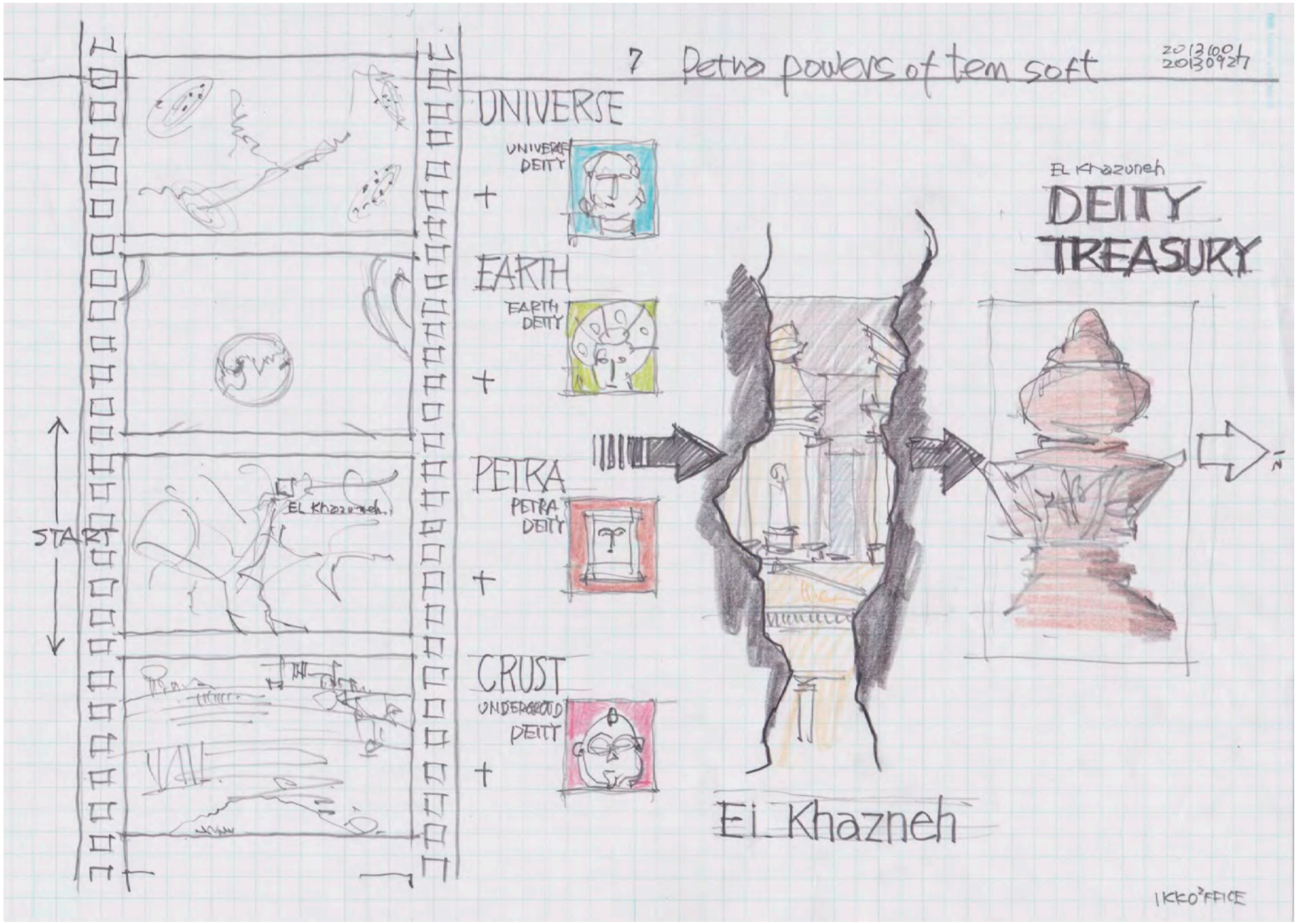
7 Petra powers of ten soft
20121001
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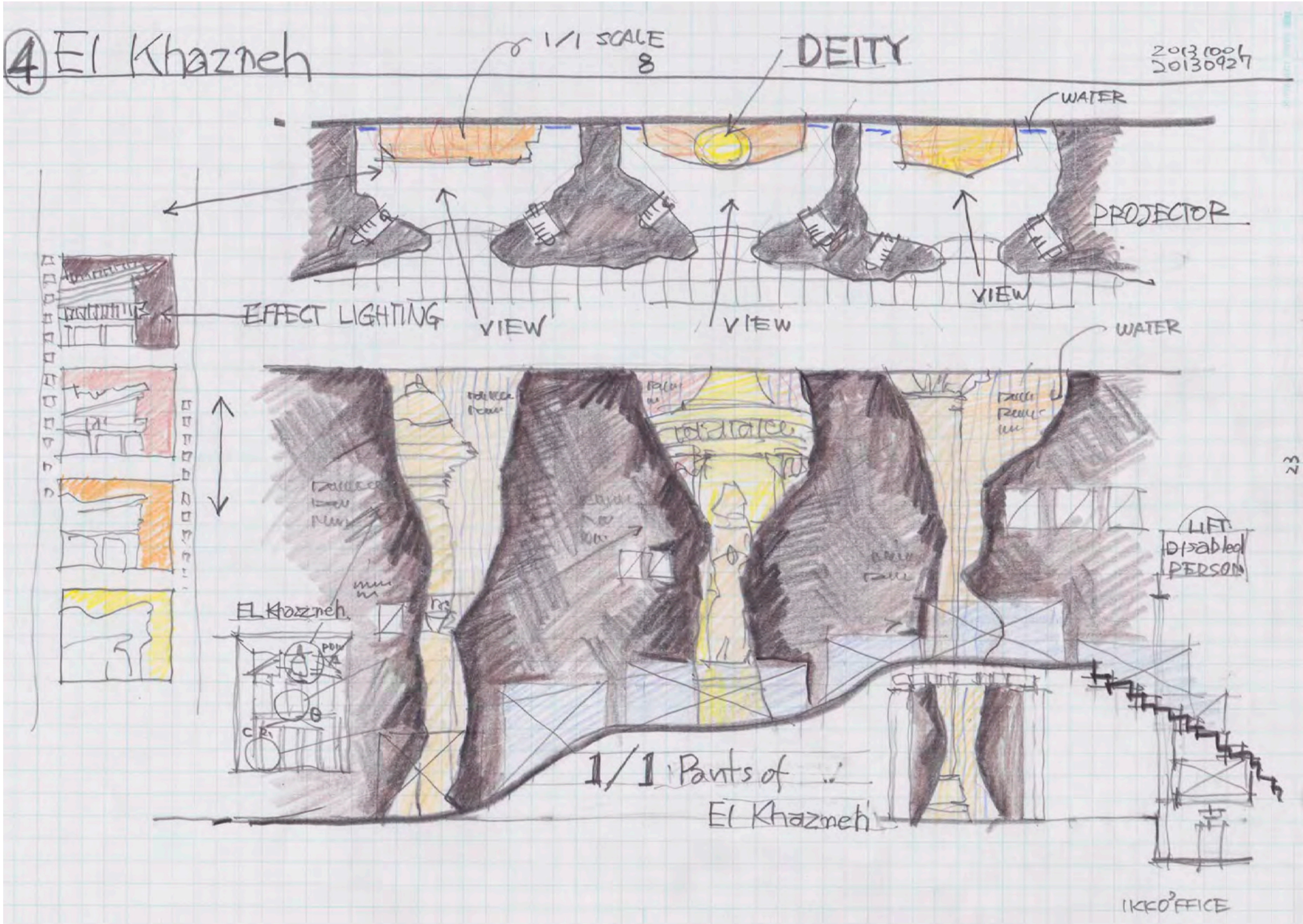
UNIVERSE
UNIVERSE DEITY
+
EARTH
EARTH DEITY
+
PETRA
PETRA DEITY
+
CRUST
UNDERGROUND DEITY
+
START
El Khazneh
El Khazneh
DEITY TREASURY
Ei Khazneh
IKKO'FFICE

4.3.4 El Khazneh

The secrets of El-Khazneh are revealed fantastically but neatly.

Several parts of El-Khazneh reconstructed at actual size exist behind the Siq-like crevices.
A projection system projects a variety of interpretation texts onto the part and its surroundings together with relevant images such as photos and diagrams.
A faint sound of the water flow can be heard sometimes.
Several articles excavated in the underground in front of El-Khazneh are displayed surrounding the parts.
The articles are spotlit on and off rhythmically.

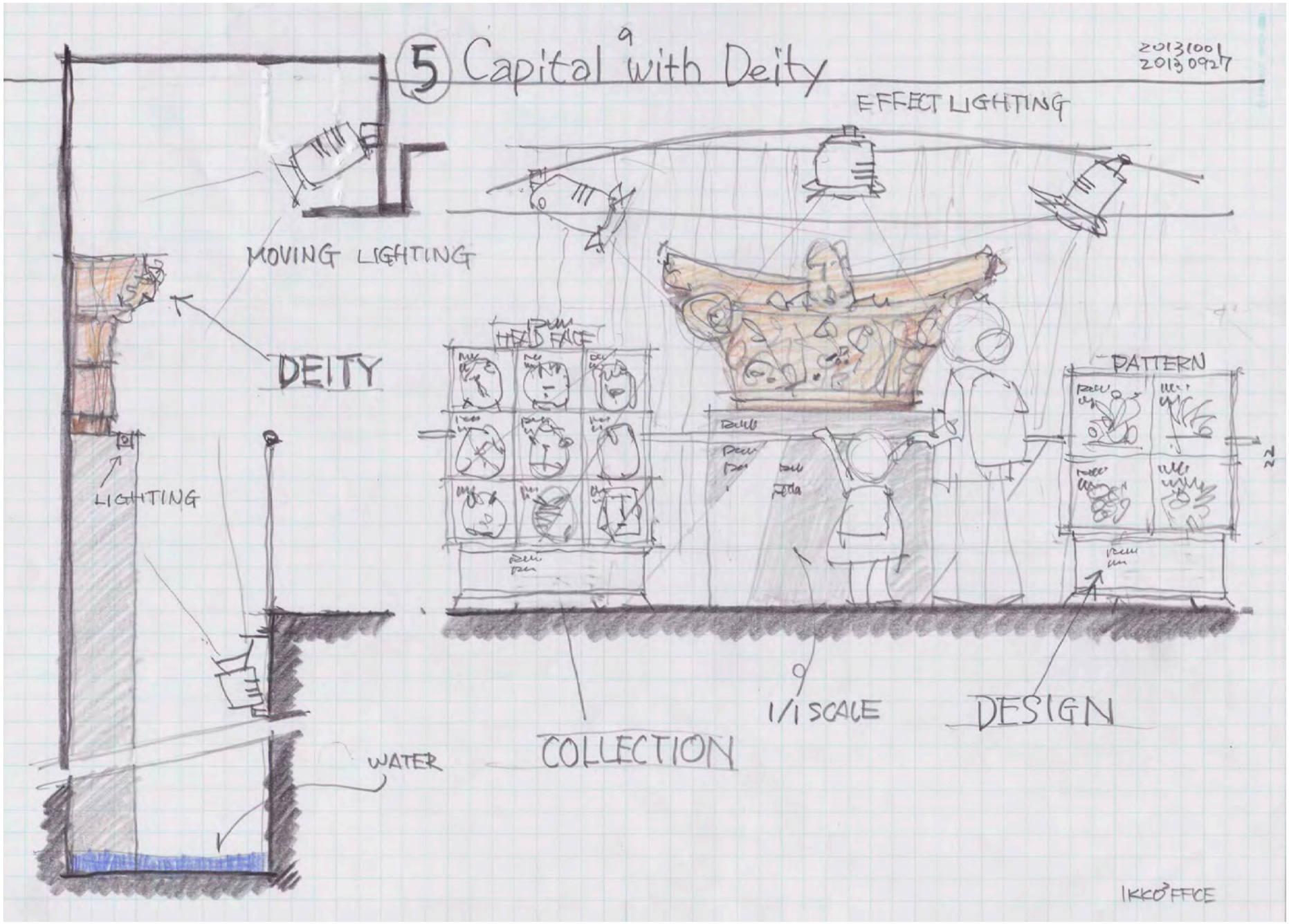


4 El Khazneh
1/1 SCALE
8
DEITY
20131004
20130927
WATER
PROJECTOR
EFFECT LIGHTING
VIEW
VIEW
VIEW
WATER
EL Khazneh
LIFT
Disabled
PERSON
1/1 Parts of
El Khazneh
IKKO'FFICE

4.3.5 Capital with Deity

Find a variety of small deities carved in the capitals excavated near Little Petra.

An elaborately carved capital excavated near Little Petra is set on a column covered with stainless steel that is reconstructed at actual size.
As the capital is at the height of a human's eye-level, it is easy to observe the capital details such as a small deity and vegetable decorations.
The column reaches a pond located at 5m below the floor.
Various small statues of the deities are displayed surrounding the capital.
Moving spotlights give diverse expressions to both capital and small deities; they look like a moving statue.
A variety of decoration patterns on the capital are displayed.
A projection system projects a variety of interpretation texts onto the background of the capital together with relevant images such as photos and diagrams.
Animals and birds cry occasionally near the capital.


5 Capital 9 with Deity
20131001
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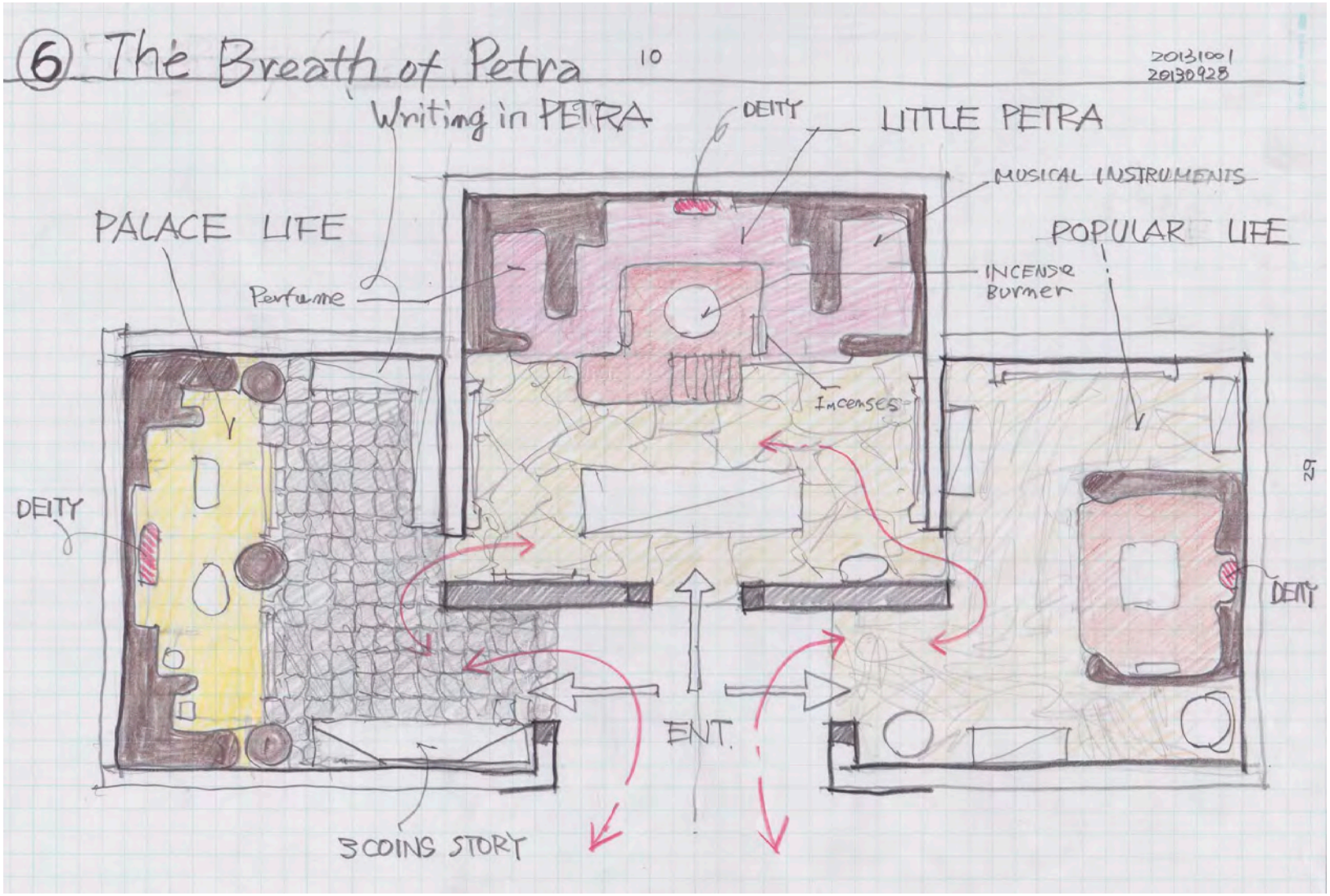
EFFECT LIGHTING
MOVING LIGHTING
DEITY
LIGHTING
HEAD FACE
PATTERN
WATER
COLLECTION
1/1 SCALE
DESIGN
IKKOFFICE

4.3.6 The Breath of Petra

A variety of breaths of Petra warmly entice visitors into the ancient but active life scenes in Petra.



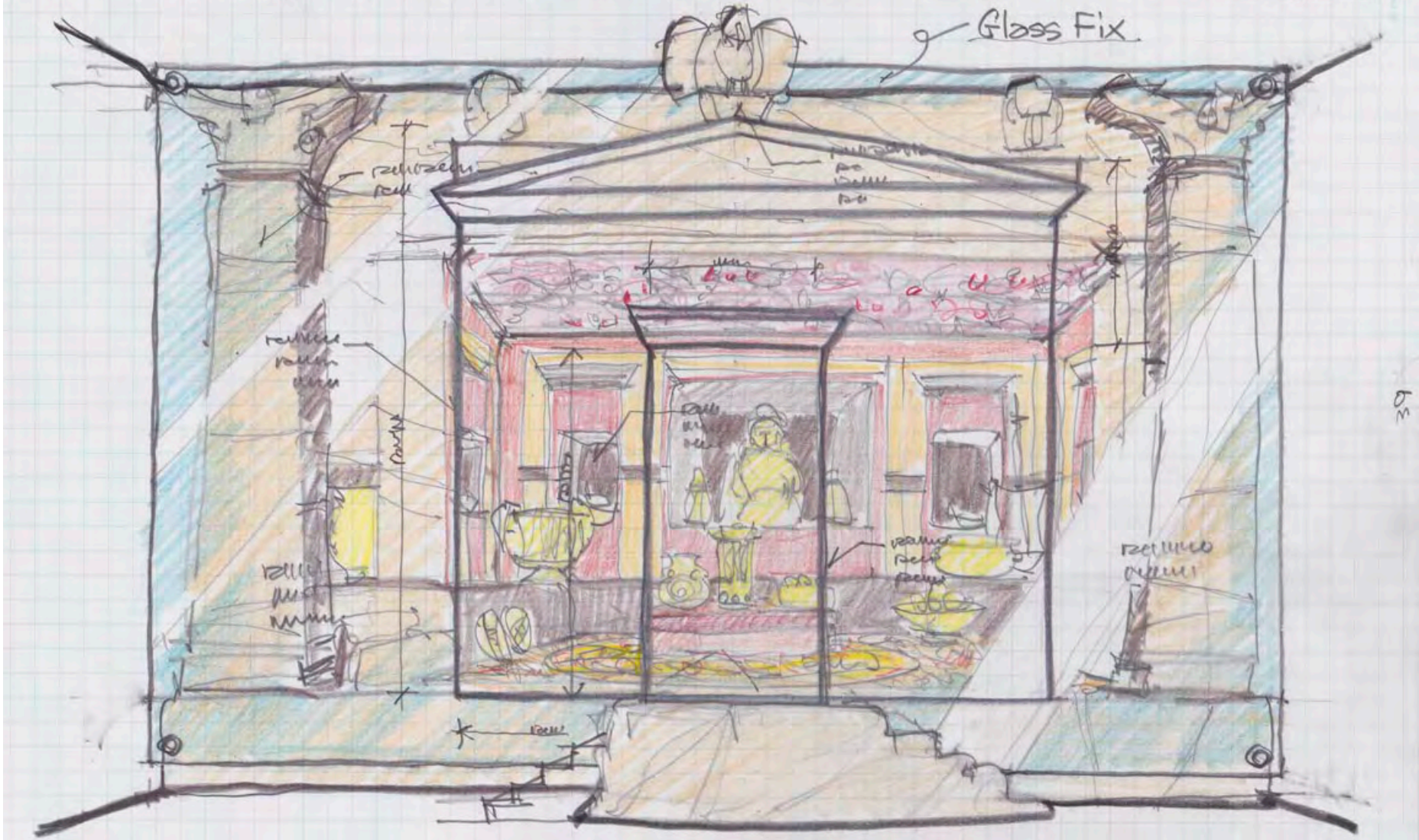
4.3.6.1 Wealth and Flavour

The flavour trade of frankincense and myrrh brought uncountable wealth to Petra.

In the middle of the caravansary in Little Petra an incense burner makes fragrance by such fuels as pine resin.
Real pieces of frankincense and myrrh are displayed around the incense burner.
Bottles of perfume such as olive oil and cinnamon are displayed along the wall; some bottles are ones found in Qasr Al-Bint and others are replicas.
The surrounding ceiling and wall are decorated with mural paintings reproduced from the ones in Little Petra.
The floor is covered with reproduced mosaic tile decorations.
Tools for caravanning are also displayed before a big trade map showing several trade routes on land and sea.
Some of the tools reveal the secrets how to continue caravanning in the harsh caravan routes such as the desert and mountainous areas.
One of the most vital secrets, how to secure water during the caravanning, is revealed with a fresh water display.
The incense burner and perfume bottles are gently silhouetted by spotlights.
A projection system projects a variety of interpretation texts onto the wall together with relevant images such as photos and diagrams.
A variety of stone, metal and pottery articles and decorations are displayed here and there in the caravansary.
Musical instruments are displayed at the comers of the caravansary, and local players sometimes play them.
Ancient music gently resounds around the caravansary.

Wealth and Flavour

20131004

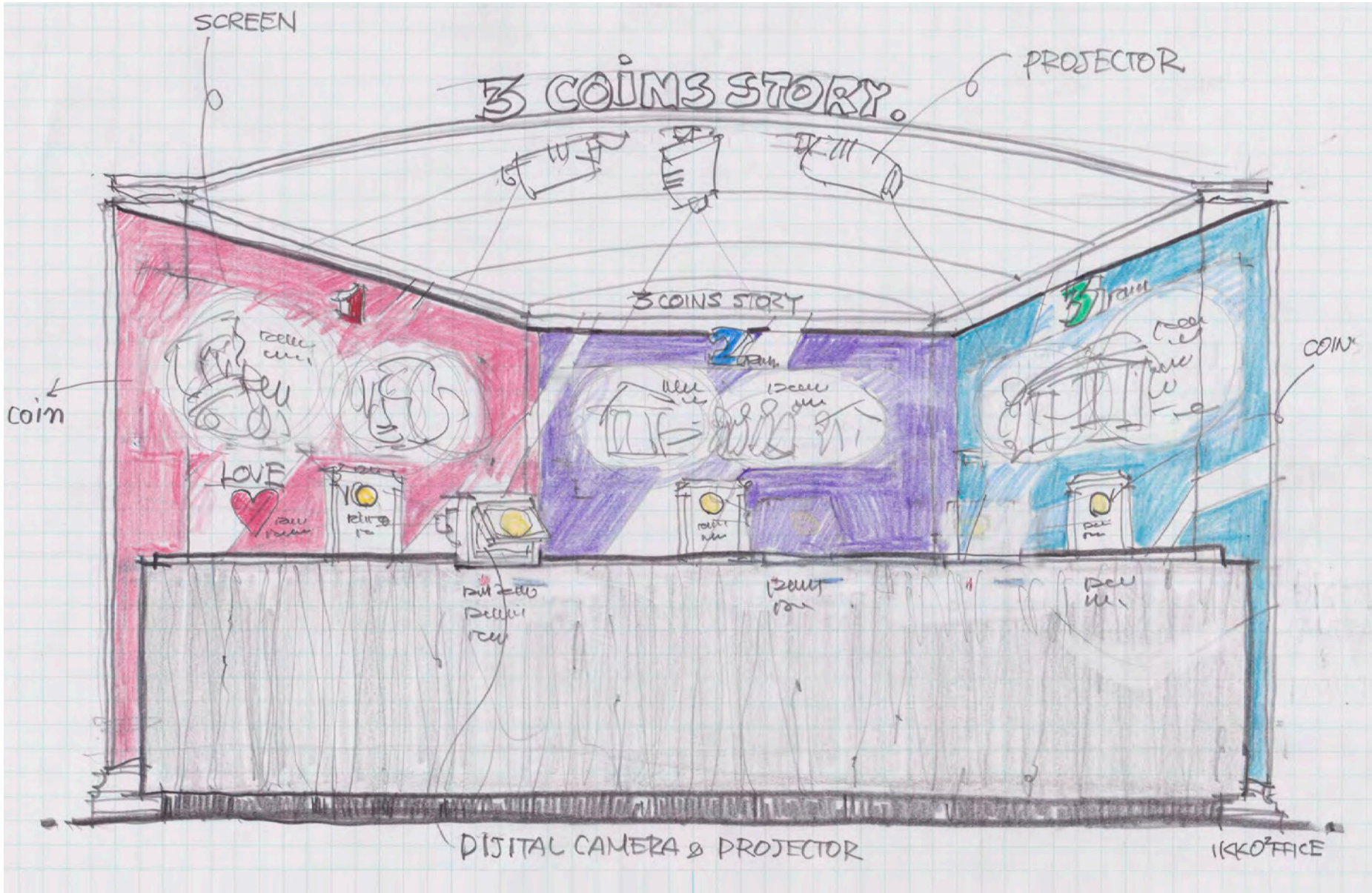


IKKOFFICE

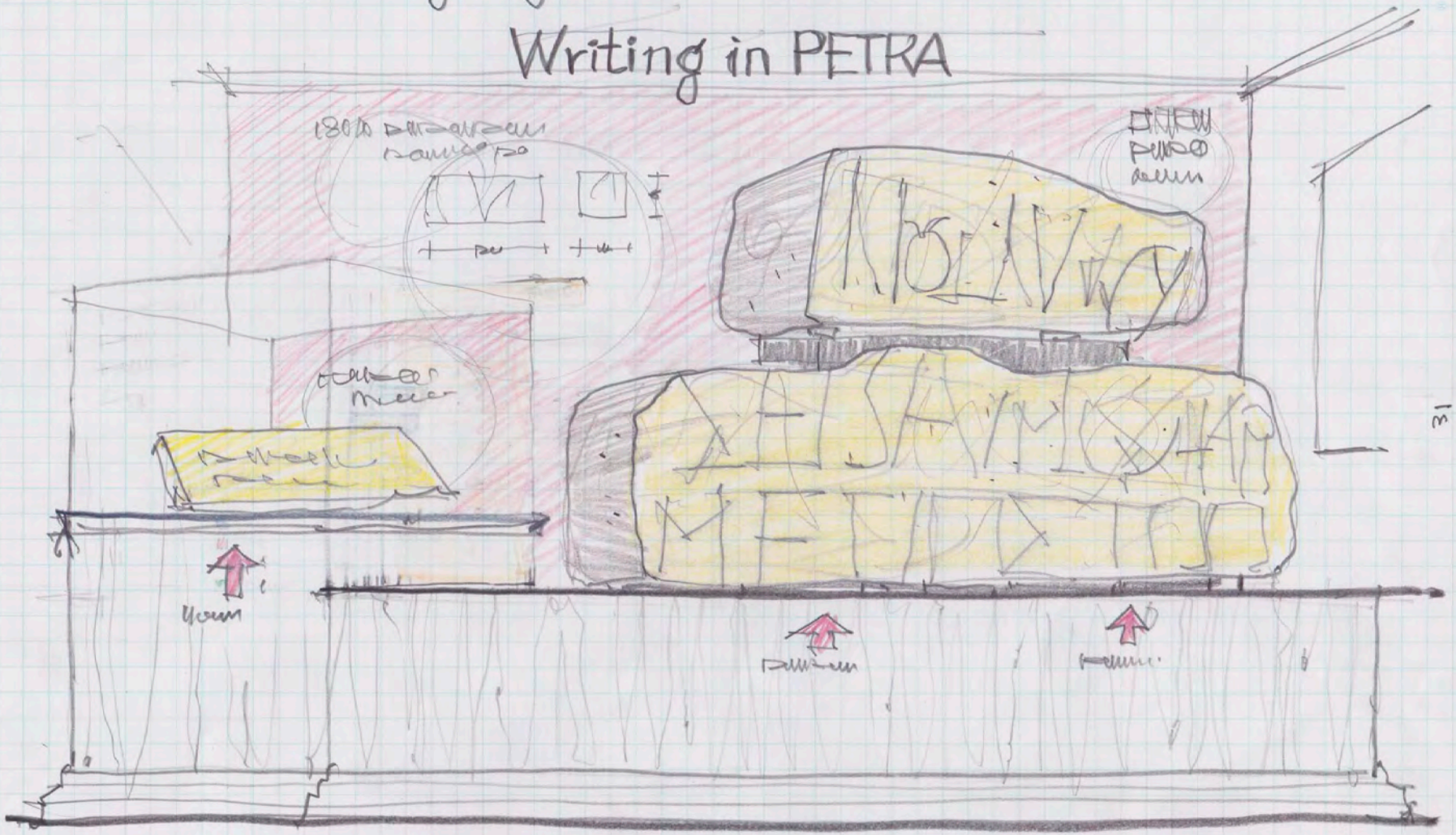
4.3.6.2 Power and Language

The enormous wealth strengthened the power, both inside and outside of Petra, and enriched the languages used in Petra by developing letters.

Carefully selected coins such as the Nabataean one, which uniquely depicts both king & queen, are displayed in boxes attached to the palace-like wall.
The backsides of the boxes have mirrors that show the reverse sides of the coins.
The coins were minted or found in Petra.
Projection systems set with digital cameras tell stories surrounding the coins with ancient music & sound effects together with relevant images.
Not only coins are shown but also figures depicted on coins are focused on.
Stone blocks and tablets inscribed in various letters are displayed adjacent to the coins.
Spotlights light up the blocks and tablets one by one synchronising with text & image interpretations by a projection system.
Sounds reading individual letters can be heard when the languages concerned are lit up.
Images and diagrams of water pools enjoyed by the nobles and riches are projected onto the palace-like wall with text & image interpretations.
The images of water pools sometimes extend to the full size of the wall with splashing water sound.


SCREEN
3 COINS STORY.
PROJECTOR
3 COINS STORY
1
2
3
coin
coin
LOVE
DIJITAL CAMERA & PROJECTOR
IKKO OFFICE

Writing in PETRA



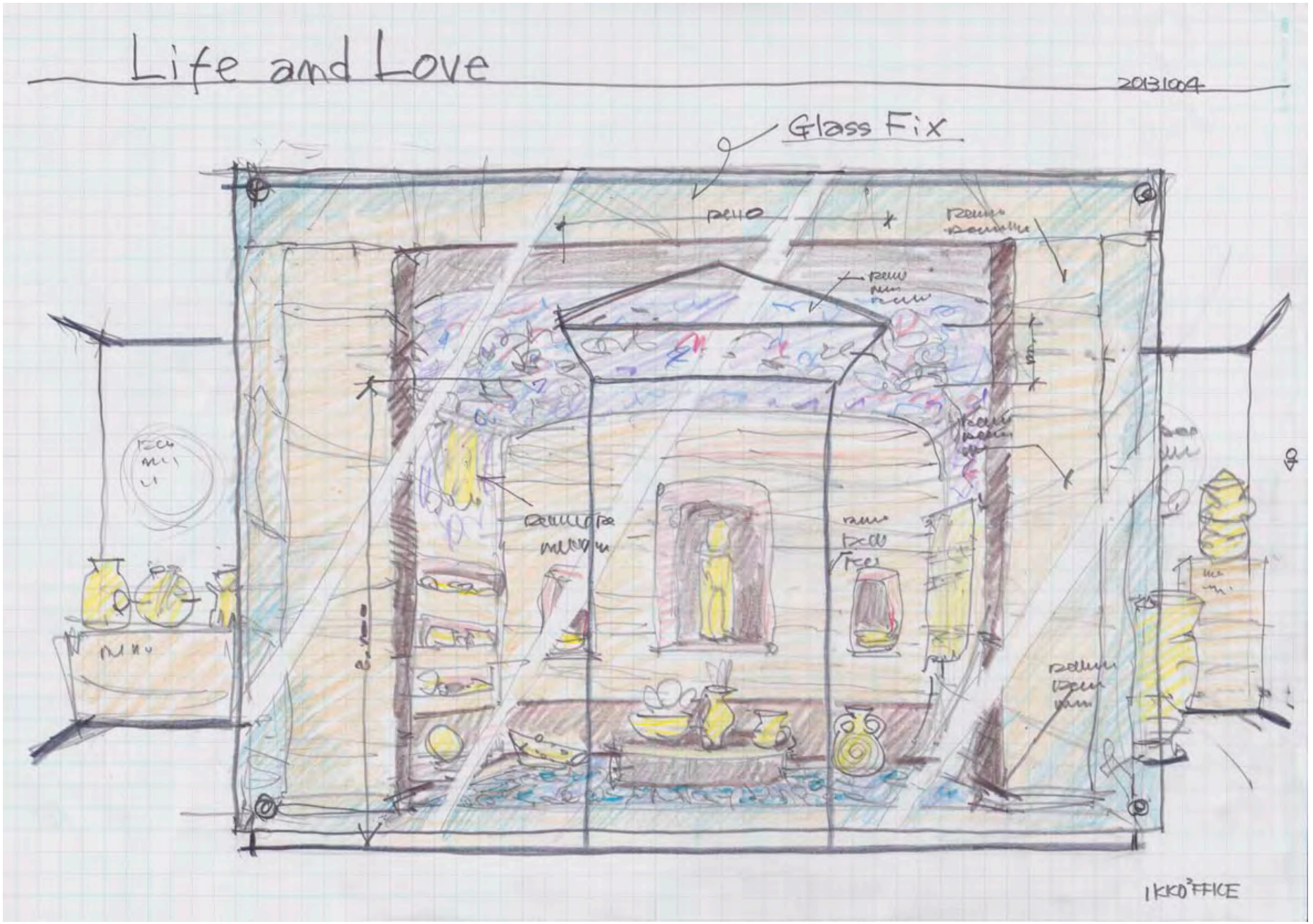
4.3.6.3 Life and Love

Ordinary people as well could enjoy their plain but pleasant life sharing the wealth accumulated in Petra.

A small house is reconstructed at actual size with annexed small rooms.
The walls are decorated with fresco mural paintings, and the floor is covered with mosaic tiles.
A variety of furniture and household goods realistically reproduce a lifestyle of the Nabataean period.
A projection system tells stories surrounding people's life such as a family and community including some epochs with text & image interpretations.
The projection system produces one-day life scenes by changing the lighting and the life scenes from morning to night.
Foods, cloths and toys are introduced by real articles and projected images.
Various noises of life scenes such as family's conversations, meal preparation and children's cries can be heard in synchronisation with the images.
Potteries and accessories are displayed the house, and small projectors project respective brief interpretations.

Life and Love

20131004



4.3.7 Petra Time Tunnel

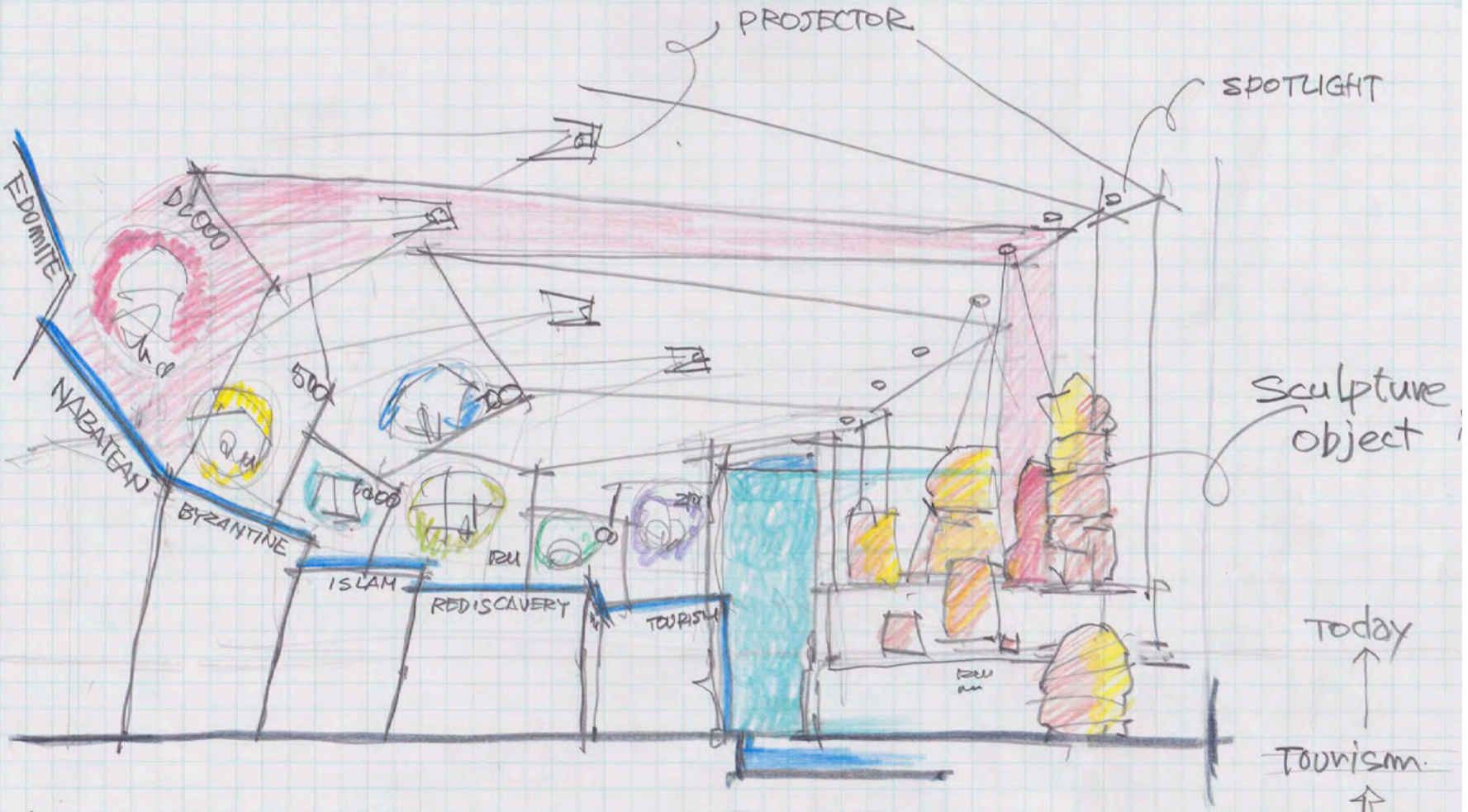
The historical stories and scenes surrounding Petra ends with summarised chronological images, and continues to the exhibition of "Petra Today".

A time travel shown by a projection system clarifies the sequence of chronological events happened throughout Petra with visual images and sound effects.
One of the main focuses of the time travel is the Islamic Period, the period which has not yet been clarified adequately until today.
The time travel leaves not records but memories of Petra in visitors' mind.
Stone Age - Edomite Kingdom - Nabataean Kingdom - Roman Empire - Byzantine Empire - Big Earthquake - Islamic Period and Bedouin - Rediscovery, Research and Tourism
A variety of archaeological articles are displayed on the show stage on the opposite side of the time travel presentation.
The archaeological articles are spotlit one by one in synchronisation with the time flow.
The time travel ends with a flood in a water tunnel at the exit of the time travel.
The flood image is made by a projection system.
Water flows through water channels on the wall towards the water tunnel floor that is covered with a transparent panel.

⑦ Petra Time Tunnel

13

2013.10.01



4.3.8 Petra Today

After the history of Petra is washed away, a new story of today's Petra begins.

A variety of well selected traditional arts & crafts developed and produced by local people are displayed.
The current excavation activities in Petra are introduced together with the latest outcomes such as new findings and analyses.
A projection system shows various archaeological findings on the wall one by one.
A variety of education programmes and workshops are held in the morning and daytime; participants can enter the Petra Today space through the exist.
The "Petra Today" bridges the indoor and outdoor exhibitions, and continues to the museum shop in the garden.

⑧ Petra Today & Museum Shop

14

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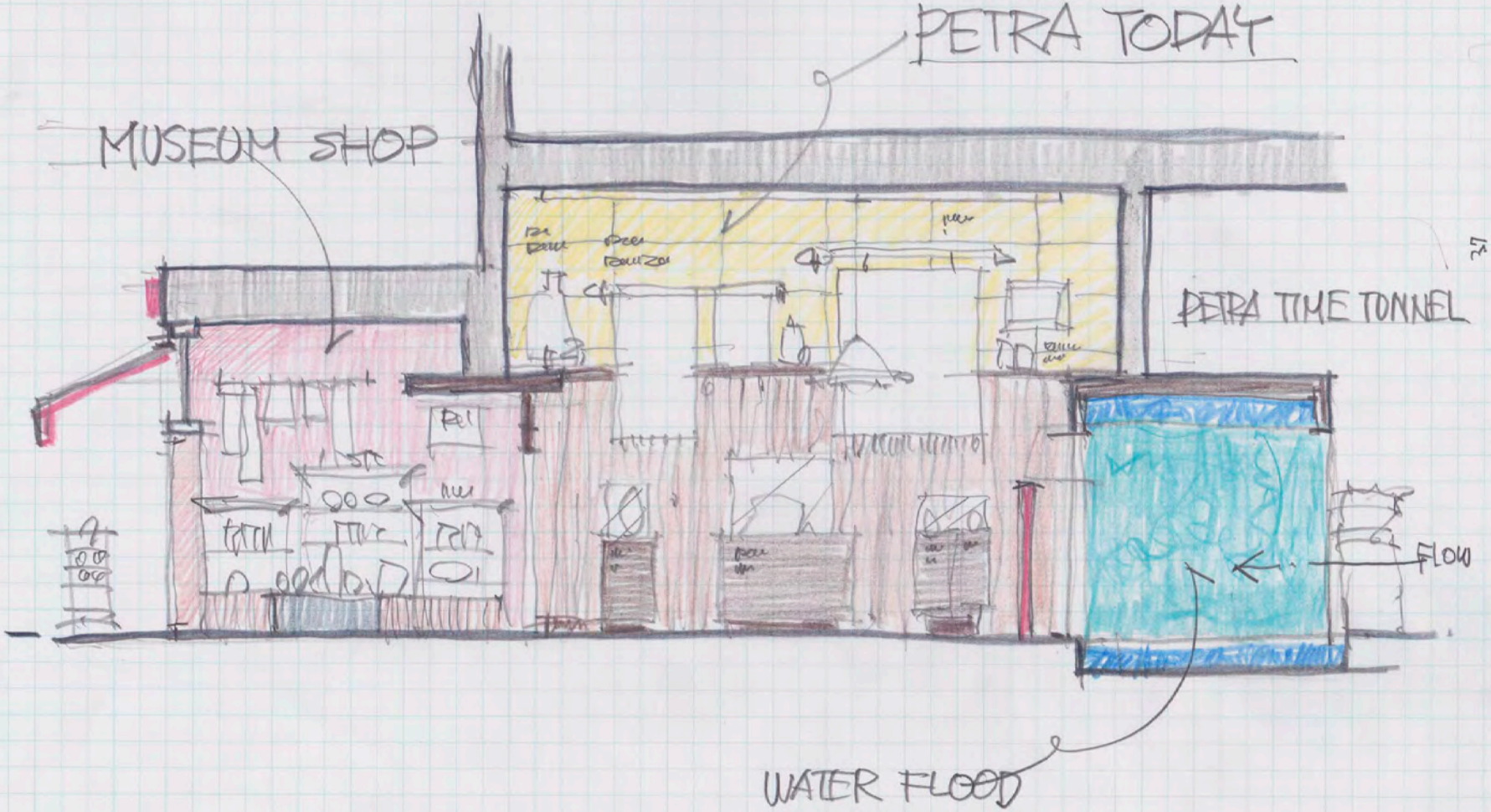


IKKO OFFICE

4.3.9 Petra Symphony

Wonder at a grand show and approach the attractions of Petra Museum.

A projection mapping system displays a variety of dynamic images with sounds on the Petra Museum building.

*Image photos: TOKYO STATION 2013

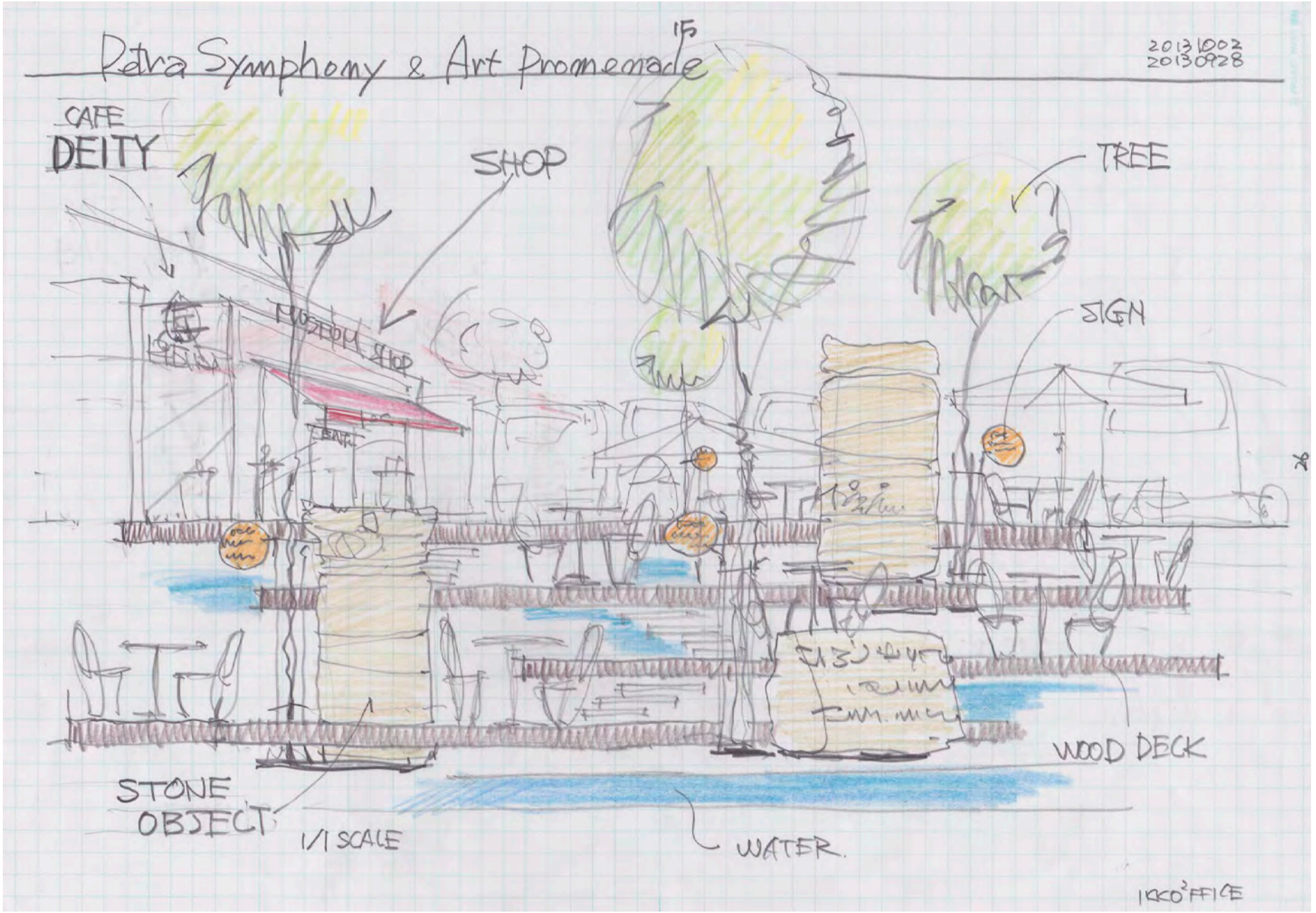
4.3.10 Art Promenade

Appreciate and touch elaborate works of stone art strolling in the garden.

Stone sculptures and building decorations & parts are displayed along promenades in the surrounding garden.
An open-style cafeteria serves beverages along the promenade.
An open-style museum shop in the garden sells high quality handicrafts including children's goods produced by local people.

Petra Symphony & Art Promenade

2013.10.02
2013.09.28



IKKO OFFICE

The Team shall further develop the exhibition pan, estimate the exhibition cost, and submit the advanced plan to PDTRA in January 2014.

PDTRA shall prepare an exhibit list according to the classification discussed between PDTRA and the Team.
The classification of exhibits is as follows:

A: Top priority (max 300 exhibits)
B: Second priority (max 200 exhibits)
C: Third priority (max 200 exhibits)

PDTRA will complete the exhibit list by the end of March 2014, while PDTRA will prepare the sample of the exhibit list as soon as possible.

It shall be noted that PDTRA shall carry out the following work at their own expense:
1) Display of the archaeological exhibits
2) Production of software such as audio-visual interpretations, programmes and effects

Attachment 5: **Building Plan**

1. Project Site

1.1 Boundary line of the Project site

The final position, size and area of the Project site are defined as the Attachment 3.

1.2 Temporary work boundary

During the construction works under the Japan's Grant Aid, a temporary work area shall be provided as indicated in the Attachment 3.

1.3 Access and the functional use of the site

In accordance with the sloped site condition, limited access and tourist circulation, the attached functional diagram was confirmed for the building planning conditions.

2. Building Plan

2.1 Height of the building

The building height is preferred to be maximum 6.5 meters from the natural ground level, and minimized as per building requirements. In order to make it possible at the sloped site, considerable part of the building floor will be at underground level.

2.2 Floor plan

To maximize the exhibition hall within the limited area is preferred. Visitors' toilets are planned within the exhibition area only, because large visitors' toilets are located at the main gate of Visitors Centre near the museum lobby.

The attached site layout plan and building plan are confirmed as a "tentative plan" for the further analysis and cost estimation in Japan.

2.3 Building façade

Façade materials and colors shall be decided in harmonization with the PDTRA town planning guidelines.

3. Utilities

3.1 Electrical power supply

- Power Incoming line: Low voltage distribution shall be connected to Main Distribution Board of the new museum through the substation installed by the Jordanian sideas shown in the Attachment 3.

- Emergency backup system: a power generator is not covered under the Japan's Grant Aid.
- Telephone System: A trunk line from the public line shall be connected to the switchboard system at the new museum by the Jordanian side.

3.2 Fire fighting system

- Fire fighting system requirements for the new museum shall be urgently confirmed. PDTRA shall give answers to the questionnaire of the Team within a week after signing this Technical Note.

3.3 Sanitary/plumbing system

- A city potable water supply line shall be extended to the Project site by the Jordanian side.
- A public sewer line shall be extended to the Project site by the Jordanian side.
- Sanitary drainage of the new museum will be directly connected to the public sewer line manhole within the site by gravity without treatment.
- Storm water will be connected to the existing storm water manhole inside of the Project site.
- Western-style water closets with manual wash hose sprays shall be installed in the toilets.

3.4 The Team submitted other clarifications on the building utilities, and PDTRA shall give answers to them without delay.

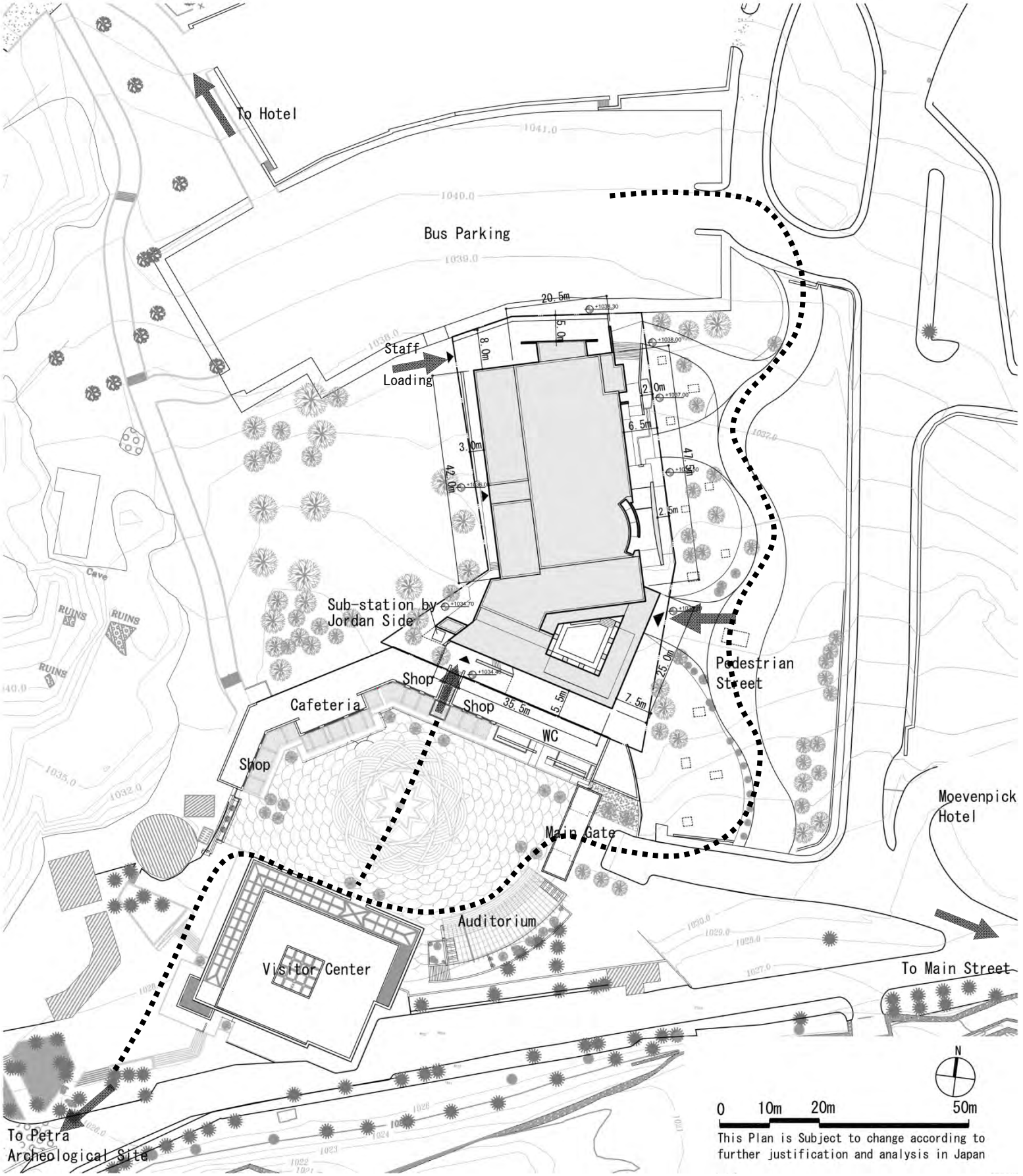
4. Building Permission and other Regulatory Requirements

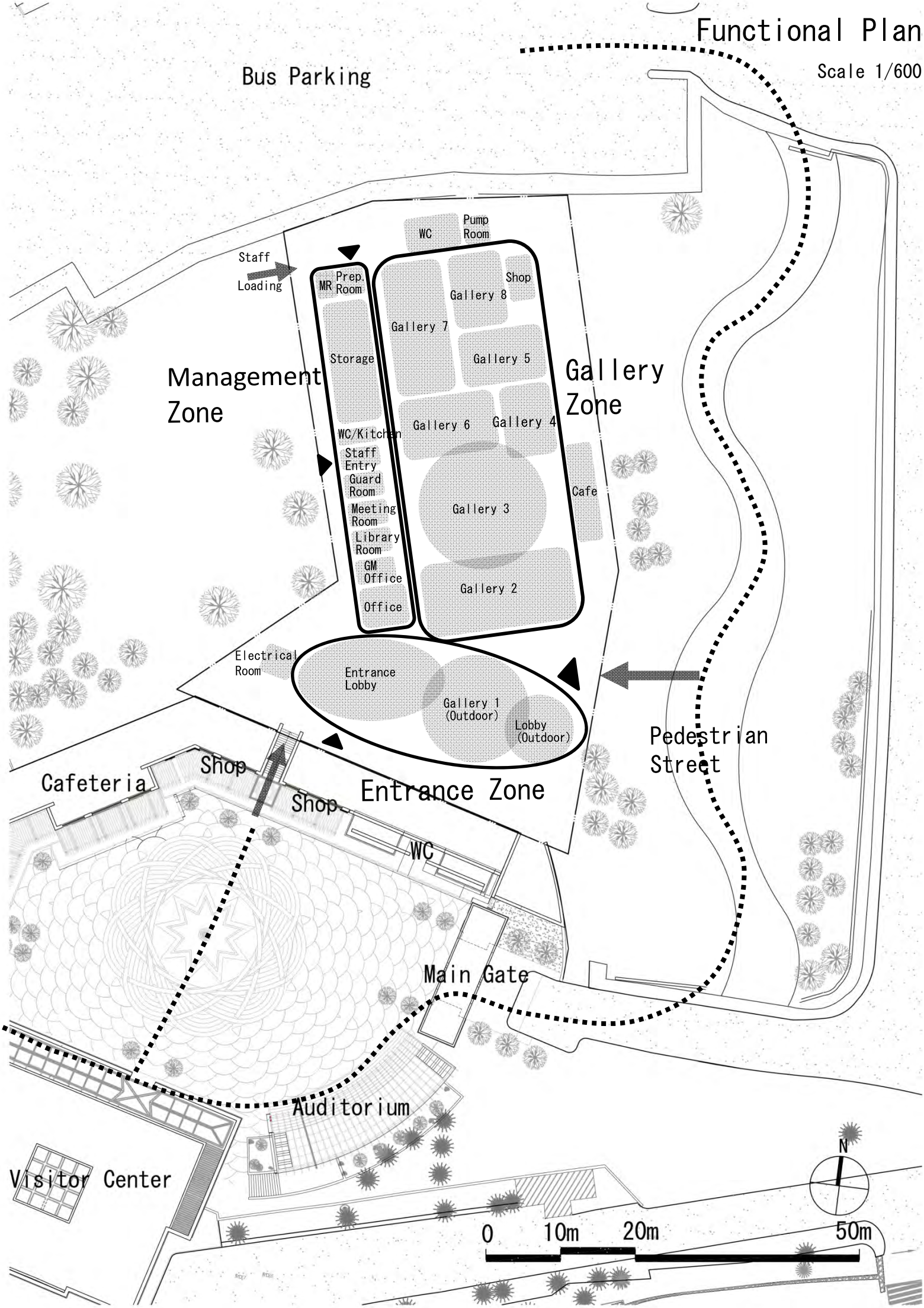
4.1 The Team explained that the Jordanian side shall be responsible for all the building permission relevant to the Project under Japan's Grant Aid.

4.2 The Team submitted the clarifications on building permission, and PDTRA shall give answers to them within a week after signing this Technical Note together with the other relevant regulatory requirements, if any.

Site Plan

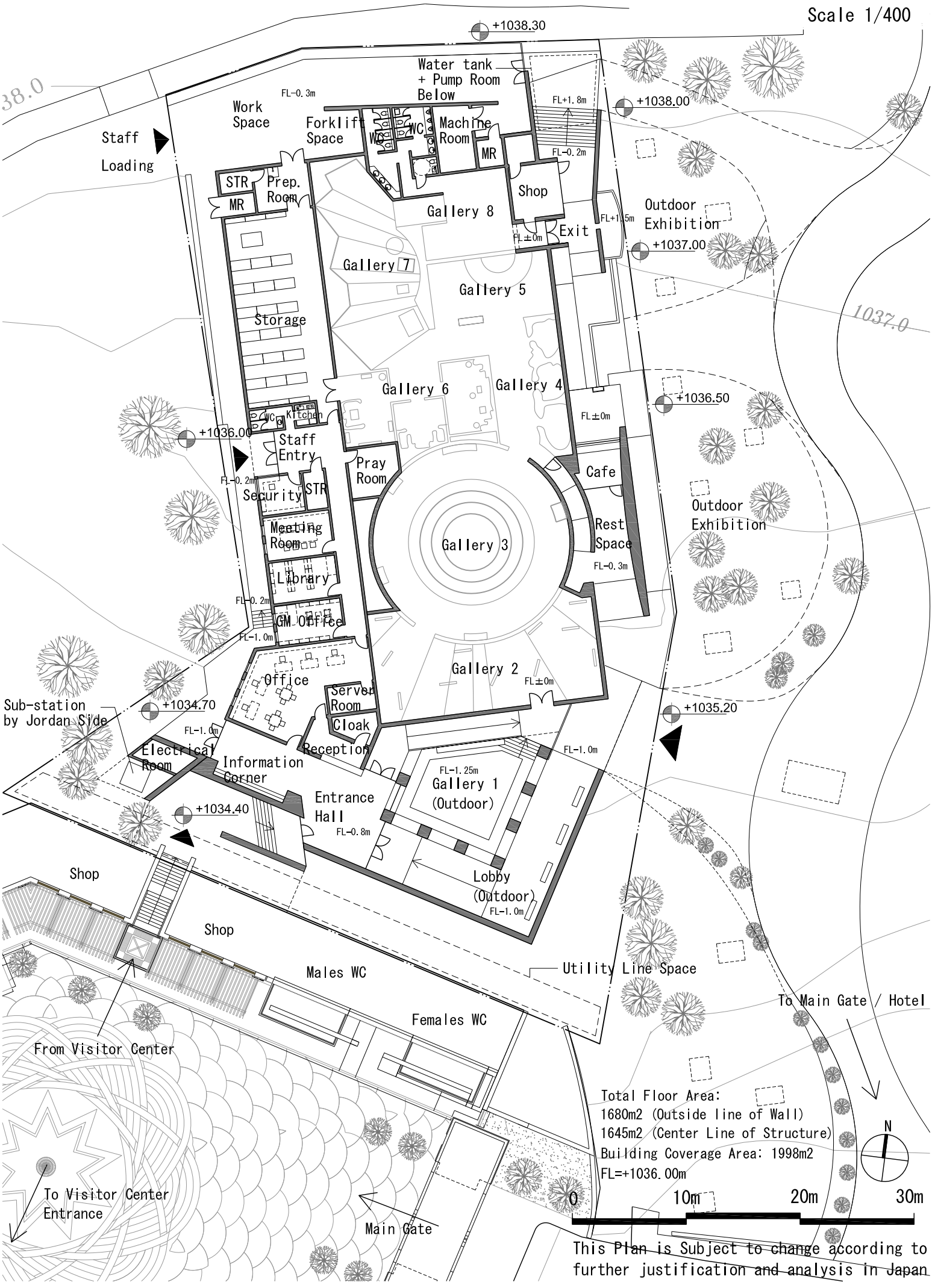
Scale 1/1000




Functional Plan
Scale 1/600
Bus Parking
Staff
Loading
Prep Room
MR
WC
Pump Room
Shop
Gallery 8
Gallery 7
Gallery 5
Storage
Management Zone
Gallery Zone
Gallery 6
Gallery 4
WC/Kitchen
Staff Entry
Guard Room
Meeting Room
Library Room
GM Office
Office
Gallery 3
Cafe
Gallery 2
Electrical Room
Entrance Lobby
Gallery 1 (Outdoor)
Lobby (Outdoor)
Pedestrian Street
Cafeteria
Shop
Shop
Entrance Zone
WC
Main Gate
Auditorium
Visitor Center
N
0
10m
20m
50m

Ground Floor Plan

Scale 1/400



Attachment 6: Equipment Plan

6.1 Equipment List

The requested equipment list was not attached in the application form. Therefore, based on the draft of exhibition plan, the Team proposed the list of necessary equipment set to PDTRA, and PDTRA agreed this content. Both PDTRA and Team confirmed the quantities and gave priority to the above list as follows:

No.	Item No.	Description	Q'ty	Priority
1	PE-01	Projection equipment set for exterior	1	A
2	PI-01	Projection equipment set for interior	1	A
3	SE-01	Sound equipment set	1	A
4	MO-01	Monitor set	1	A
5	PC-01	Computer set for operation	1	A
6	EX-01	Exhibition case set	1	A
7	LT-01	Lighting equipment set	1	A
8	CC-01	Contents creation equipment set	1	A
9	TE-01	Transportation equipment set	1	B
10	SS-01	Shelf set for storage	1	A

The Team will consider the compositions of each set and the quantities of each item according to the final draft of the exhibition plan through further analysis in Japan, and propose the detail list of equipment at the next survey in January 2014.

6.2 Procurement Plan of Equipment

With a final list of equipment after confirming the compositions of each set and the quantities of the compositions, a procurement plan for this project will be conducted surveying cost estimation. The planning of equipment procurement will be prepared based on the guidelines for the Japanese Grant Aid Project.

Attachment 7: Test Excavation

1. Introduction

The overall objective of the project is to create a state-of-the-art museum in the World Heritage Site of Petra as part of the visitors' management plan with the aims of enhancing the visitors' experience and better understanding of Petra mainly focusing on the Nabataean culture and civilization that flourished in Southern Syria, Jordan, Palestine and North Arabia starting from the 4th century BCE and reaching its peak during the 1st century BCE and 1st century AD.

The proposed area for the museum is located within the boundaries of the buffer zone of the PAP (Petra Archaeological Park) (Pic 1 and Fig 1). The size of the proposed area is app. 6,000 m^2. It is recently being occupied by the tourism street in its eastern part, two housing buildings that belong to the SSC (Social Security Corporation) and the Tourism Police building in its central part while the western part is covered by pine, pepper and eucalyptus trees. The area is bordered by the bus terminal from the northwestern side and Petra Visitors' Centre Plaza from the southeast (Pic 2, 39 and Fig 2).

The general local name of the area is Zurrabah which has many meanings in Arabic including the entry way or the gate, the hiding place of a hunter who is waiting for the pray, the combination of colours yellow, red and green, and finally the water way among many others. Some other name is attributed, specifically to the area where the museum will be located. The name is al Quf which means in Arabic the elevated terraces. Till the 60s of the last century the area was used for processing agricultural products, especially wheat using old traditional methods. To the west of Quf, a place called al-Ramdhah, is situated (the place with hot sands used for curing joints' diseases). All these physical properties fit well with the nature of the studied area and indicate a specific use of it that includes industrial (Zurrabah), agricultural (Quf), or hunting activities.

2. Objectives

As a preparation for this project a series of subprojects were conducted including the Heritage Impact Assessment Project. The main objective of this subproject that was conducted between 9th and 24th of September 2013 was to survey the area around the proposed location for the museum and to document any archaeological remains in the proposed area and then to evaluate them and assess the impact of the project on these remains and finally to suggest mitigation measures to ensure the preservation of any archaeological remains if any.

3. Methodology

To achieve the above-mentioned goals it was decided to use different approaches for assessing the area for any heritage/archaeological remains. These approaches include:

a) Desk research for any available information of the area in special publications;
b) Surface examination and documentation of the area not only of the proposed for the museum plot of land but also to the surrounding area in a radius of not less than 200 metres to contextualize the results of the research;
c) And finally to select 5 locations for test pits that would be excavated down to the bedrock or to the virgin soil to document any human activities in the area.

4. Fieldwork Survey

The fieldwork was started with two day survey of the adjacent to the site area to the north, east and west. Various archaeological remains had been revisited. That include:

- Az-Zurrabah pottery kilns: (Pics 46,47,49,50, and 51). Az-Zurrabah is the largest industrial complex known in Petra area. Pottery pots including fine wares, kitchenware, oil pottery lamps, pottery water pipes and roof tiles were being produced at the site from the 1st century through the 6th century. 12 pottery kilns and several underground pottery workshops were uncovered.

- Az-Zurrabah water reservoir: (Pics7,52,53). Water was always an issue in the rocky area of Petra and that is why the Nabataean were harvesting literally every drop of water. They constructed sophisticated water harvesting and storage installations including reservoirs and cisterns, water aqueducts. The remnants of water canals to bring water to the reservoir and then to bring it to the town is still visible in the area of Az-Zurrabah to the left and the right of the paved road. Some later 12-13 century AD reuse of the area is documented at the reservoir itself and in the area adjacent to the Mövenpick Hotel (Pics 8,9, 10, 45).

- Rock cut tombs to the south west of the proposed for the museum area: (Pics 41,42,43).

- Al-Khan, caravanserai (Pics40,48). This monument is utilized now as a cave bar. It consists of a chamber and a plaza in front of it formed by two side porticos with pillars and Doric columns. In the funerary chamber, in its southern wall 6 niches are curved. Two square chambers and a recess located at the back of the chamber.

- A short segment of a water channel (Pic 35) is identified in the area to northwest of the bus park. Most probably this channel was running in the area of the bus park and continued to the area of the Visitor Centre. Unfortunately a small segment in the above-mentioned area is the only preserved part of it.

Within the surveying work the surface of the proposed museum site was closely examined for any archaeological remains. Almost the whole surface of the site was covered by agricultural red soil that was brought to the area in the 70s of the last century and later by PDTRA (Pics 3,4). On the less covered red soil and more intact area, pottery sherds had been found in a few surfaces (Pics 5,44). Obviously these pottery sherds were brought from outside, most probably by rainwater.

Excavations:

The excavations took place between 14th and 24th of September 2013. They were supervised by: Hani Falahat (DOA), Mohammad Marahlah, Samia Falahat and Harun Amarat (PAP: Petra Archaeological Park). The surveying works of plotting the trenches were done by Mahmud al-Hasanat (PDTRA). To all of them I want to express my sincere thanks for doing a good job. The workers were provided by the PAP and PDTRA. 12 of workers were involved in the excavations.

5. Results

Test trenches were chosen and plotted to cover both proposed the museum areas A and B. 5 test trenches were excavated: (Figs 2,3)

Test Trench 1 (TT1) (Fig 4 and Pics 11,12,13,14,15,20)

4 loci were identified in this trench:
Locus 1 is the loose red soil (5-10 cm thick),locus 2 is a compacted sandy soil (app.50 cm), locus 3 (h.60xw.15xl.50 cm) is probably a remnants of a corner of a water channel and finally locus 4 (50 cm.) is a compacted sandy soil, the same as locus 2. The compacted sandy soil is homogeneous in loci 2 and 4 and these loci were separated arbitrary after having 50 cm of homogeneous fill. The deepest point reached in the trench is 120 cm, and we decided to stop because no cultural materials were found in the fill.

Test Trench 2 (TT2) (Fig 5 and Pics 16,17,18,19,21)

5 loci had been identified in this trench:
Locus 1 (2-5 cm) red agricultural soil, locus 2 (50 cm) compacted sandy soil, locus 3 (50cm) compacted sandy soil, the same as the one above and the one beneath, locus 4 (35 cm) of the same compacted sandy soil, locus 5 (60-70 cm) of the same compacted sandy sterile soil with no cultural material. The depth of the trench is app. 200 cm.

Test Trench 3 (TT3) (Fig 6 andPics 25,26,27,28)

5 loci were also identified in this trench:
Locus 1 (10-15 cm) of whitish gravel mixed with red soil, locus 2 (30-40 cm) of loose sandy soil, locus 3 (15 cm) of 10 cement bricks covering an electric cable trench, locus 4 (28-35 cm) of compacted sandy soil, locus 5 (80 cm) of compacted sandy soil, the same as the one above. Three metallic water pipes are running within locus 2.

Test Trench 4 (TT4) (Fig 7,8 and Pics 22,23,24,34)

7 loci had been identified in this trench:
Locus 1 (14-16 cm) of dark gray soil with grass roots covering the northwestern part of it, locus 2 (16-30 cm) of gravel and loose building material, locus 3 (10cm) of concrete extending to a distance of 50 cm from the foundation of the Tourism Police building, locus 4 (40x50 cm channel of electric cable), locus 5 (25-60 cm) of compacted sandy soil, locus 6 (5-10 cm) of concrete under the foundation of the Tourism Police building, locus 7 (55-60 cm) of compacted sandy soil like the one above it.

Test Trench 5 (TT5) (Fig 9 and Pics 29,30,31,32,33)

2 loci had been identified:
Locus 1 (40-45 cm) of red agricultural soil, and locus 2 (60 cm) of compacted sandy soil with extremely hard surface. The trench lacks any cultural material.

5. Conclusions and Recommendations

The proposed area lacks any kind of cultural material that might indicate any human activities in the ancient periods. The only exception is that small segment of what could be interpreted as a corner of a water channel. The area demonstrated a homogeneous compacted sandy layer that covered the whole proposed museum area and had been revealed virtually in all the excavated test trenches.

It can be said with a big margin of certainty that the heritage impact will be minimal. Nevertheless it is recommended to keep a close eye on the area during the actual construction of the museum.

Fig 1 Site location	Fig 2 Distribution of test trenches

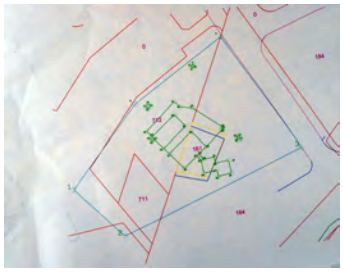
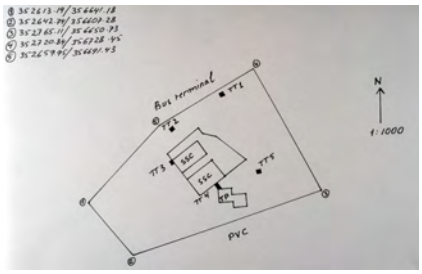

	

Fig 3 Coordinates of the test trenches	Fig 4 Test trench 1 plan and section

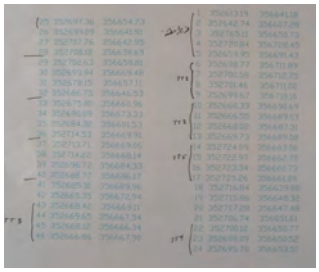
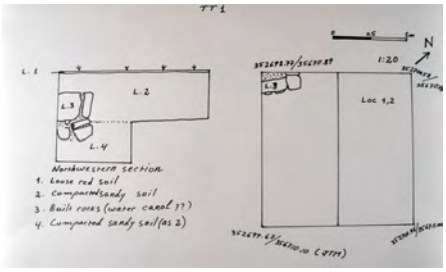

	

Fig 5 Test trench 2 plan and section	Fig 6 Test trench 3 plan and section

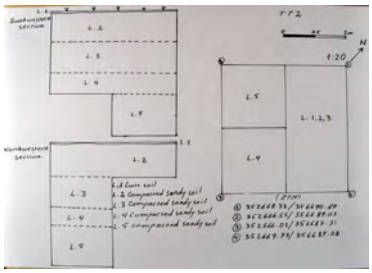
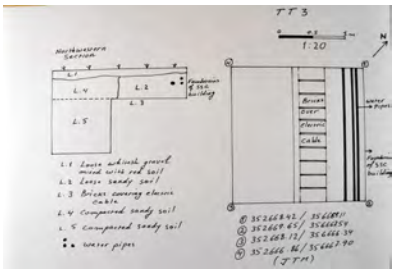

	

Fig 7 Test trench 4 plan	Fig 8 Test trench 4 section

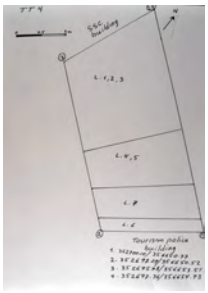
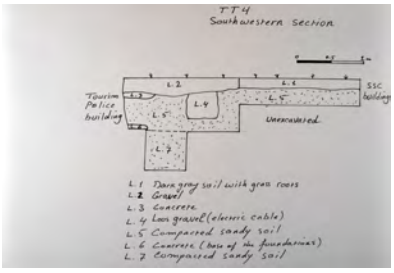
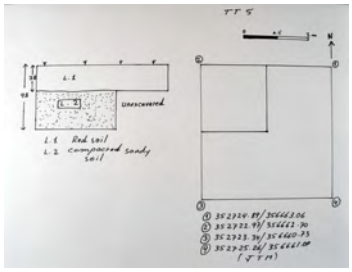
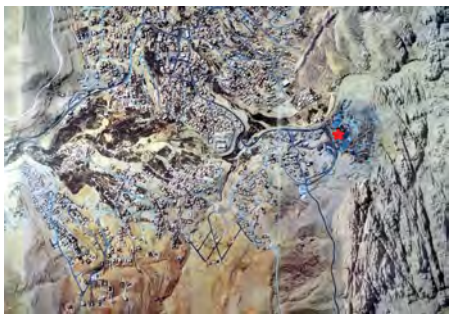
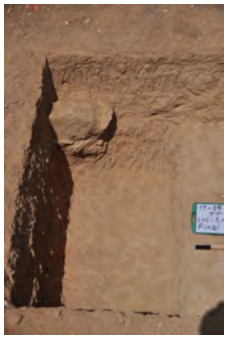
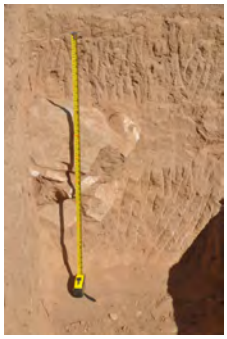

	

Fig 9 Test trench 5 plan and section	
	

Pic 1 Wadi Musa and project site location	Pic 2 Project site location (SSC houses and tourism police building
	
Pic 3 Project site location looking west. Red agricutural soil covering the surface	Pic 4 Project site location looking west. Red agricutural soil covering the surface
	
Pic 5 The area in front of the SSC buildings	Pic 6 Project site location. In the background Zurabah water reservoir and PAP building
	
Pic 7 Zurabah water reservoir	Pic 8 Water systern/tomb at Zurabah
	
Pic 9 Water channel across the paved road from Zurabah water reservoir	Pic 10 Medieval pottery sherds collected from the surface of the site
	

Pic 11 Test trench 1. General view looking northwest	Pic 12 Test trench 1. General view looking southwest
	
Pic 13 Test trench 1. Locus 1,2,3	Pic 14 Test trench 1. Locus 2
	
Pic 15 Test trench 1. Locus 2. Details	Pic 16 Test trench 2. General view looking northwest
	
Pic 17 Test trench 2. Locus 5	Pic 18 Test trench 2. Deatails
	
Pic 19 Test trench 2. Details	Pic 20 Test trench 1. Locus 1 and 2
	

Pic 21 Test trench 2. Locus 5	Pic 22 Test trench 4 before the excavations. Looking northeast
	
Pic 23 Test trench 4. General view	Pic 24 Test trench 4
	
Pic 25 Test trench 3. Details	Pic 26 Test trench 3. General view
	
Pic 27 Test trench 3. Electric cable trench	Pic 28 Test trench 3
	
Pic 29 Test trench 5. Looking east	Pic 30 Test trench 5. Looking east. General view
	

Pic 31 Test trench 5. Details	Pic 32 Test trench 5. Details
	
Pic 33 Test trench 5. Locus 2	Pic 34 Test trench 4. General view
	
Pic 35 Water channel across the paved road from Zurabah water reservoir	Pic 36 Backfilling TT 2
	
Pic 37 Backfilling TT 5	Pic 38 Backfilling TT 4
	
Pic 39 Site location in relation to Zurrabah water reservoir	Pic 40 Al-Khan (caravansarai). Tower tomb 4
	

Pic 41	Rock cut tomb	Pic 42	Rock cut tomb. Details
			
Pic 43	Rock cut tomb. Details	Pic 44	Collected on the surface pottery sherds
			
Pic 45	Tower tomb	Pic 46	Zurrabah pottery kilns
			
Pic 47	Zurrabah potteryworkshops	Pic 48	Al-Khan (caravansarai). Tower tomb 4
			
Pic 49	Zurrabah pottery kilns	Pic 50	Pottery production waste
			

Pic 51 Pottery production waste	Pic 52 Water channel
	
Pic 53 Zurrabah water reservoir	Pic 54 Project's site location. General view
	

Attachment 8: Environmental and Social Consideration

Summary

1. General Information

1.1 Study area

The target area for the analysis of current environmental condition is Petra Region, Wadi Musa and PAP in particular.

The target area for the environmental impact evaluation is the Project site and the Project itself.

1.2 Methodology of the Study

The study method follows JICA Environmental and Social Consideration Guideline (April 2010).

The Jordanian Environmental Impact Assessment (EIA) Bylaw of 2005 is also referred.

According to the JICA Guideline, this study is at the Initial Environmental Examination (IEE) level. It means that the study will be conducted by using existing data/information mainly with minimum site survey (i.e. HIA and Traffic Flow Survey), and will evaluate the potential impact and prepare mitigation measures and a monitoring plan.

1.3 Schedule of the Study

At present, almost all-necessaryinformation can be collected in cooperation with PDTRA.

Brief analysis of current condition and identification of potential impacts/scoping has been finished. (See the following Particulars)

Detail evaluation will be conducted based on the condition of future prediction. (e.g. future tourist population, capacity of the museum, and traffic demand forecast, etc…)

The report of Environmental and Social Consideration will be completed by the end of October 2013.

2. Analysis of Current Condition

2.1 Collected data

Analysis of current condition is conducted by using the following documents:

- ✓ Strategic Master Plan for Petra Region (June 2011)
- ✓ State of Conservation Report - Petra Archaeological Park (January 2013)
- ✓ Wadi Musa Tourist Zone - Urban Design and Landscaping (Preparatory Works Phase Report - July 2013)
- ✓ Other environmental monitoring data and survey reports provided by PDTRA

These data include not only the Project Area but also all over Petra Region. To understand the condition of Project Area, Buffer Zone Study Report (Phase 1) will help

the JICA study team a lot. Moreover, the ESIA study report of the Back Road Project is very useful in order to understand the process and contents of ESIA in Jordan.

2.2 Luck of data

There is no data on air pollutant in the area covered with the Project Area and Wadi Musa down town. However, air pollutant is one of the key issues for this project, because local and tourist transportation causes traffic congestion in Wadi Musa down town and it leads to generate air pollutants.

There is no data on drinking water qualities. These data shall be received from the Ministry of Water.

There are data on an ecosystem, but it is not enough information on endangered species. There are several lists prepared by the Petra National Trust and theMaster Plan study team.

3. Evaluation of the Environmental Impact

Brief identification of potential impacts/scoping has been finished.

Identified negative impacts are; air quality, water quality, waste, noise, ecosystem, water usage, existing social infrastructures (traffic jam), landscape, etc.

However, these negative impacts are temporary or limited, and they can be minimized by implementing mitigation measures. Detail evaluation will be conducted for the negative impact mainly.

Particulars

(1) Objectives

This document was prepared in compliance with the Jordanian Environmental Impact Assessment (EIA) Bylaw of 2005, and JICA Environmental and Social ConsiderationGuideline (April 2010). The primary objectives of this study are:

· Ensure that environmental and social issues are taken into consideration in the design phase.
· Identify and assess the potential environmental and social impacts of the project alternatives.
· Propose mitigation measures to minimize the potential impacts of the project on the environment and assign appropriate entities to measure implementation and monitoring.

(2) Environmental Impact Assessment System in Jordan

1) Outline of the Environmental Impact Assessment System in Jordan

The Environmental Impact Assessment (EIA) Bylaw No.37 was issued in 2005 to ensure that the anticipated impacts any development project may have on the social, economic, and natural environment in Jordan are identified. Its aim is to limit these impacts in order to achieve sustainable development in the country. The bylaw applies to all industrial, agricultural, commercial, construction, residential, and tourism projects.

The project shall be classified in any of the following categories by decision of the Secretary General on the basis of the recommendations of the competent party at the Ministry:

1. Category 1: includes the projects which require a comprehensive environmental impact assessment.
2. Category 2: includes the projects which require a preliminary environmental impact assessment, based on which the need to conduct a comprehensive environmental impact assessment will be determined.
3. Category 3: includes the projects that require neither a preliminary nor a comprehensive environmental impact assessment.

General information about the project, which requires a thorough environmental assessment or apreliminary environmental impact assessment are shown in below;

1. Description of the Project
2. List of Major Alternatives to the Proposed Project
3. Identification of the Most Important Environmental Aspects

2) Laws and Regulation on Environmental Impact Assessment in Jordan

Laws and regulation on Environmental Impact Assessment in Jordan are shown below.

- Laws

• Environment Protection Law No. 52 for the year 2006

· Protection of Cultural Heritage and Site No. 5 for the year 2005

• Antiquities Law No. 21 for the year 1988

· Petra Development and Tourism Region Authority Law No.15 for the year 2009

• Ministry of Agriculture Law No. 44 for the year 2002

• Renewable Energy & Energy Efficiency Law No. 3 of the year 2010

• Public Heath Law No. 47 for the year 2008

• Traffic Law No. 49 for the year 2008

•Labor Law No. 8 for the year 1996

- Regulations

• ESIA Regulation No. 37 for the year 2005

• Air Quality Protection Regulation No. 28 of the year 2005

• Soil Protection Regulation No. 25 of the year 2005

• Regulation No. 24 of the year for the Management of Hazardous and Dangerous Materials

• Regulation No. 27 for the year 2005 for the Management of Solid Waste

• Regulation No. 66 for the year 1994 for the Sewage System

• Underground Water Regulation No. 85 of 2002

• Environment Protection from Pollution in Emergency Case No. 26 for the year 2005

• Natural resources and National Parks bylaw of 2005

• Protection of Birds and Wildlife bylaw No.113 of 1973

- Instructions

• Noise Level Control Instructions for the year 2003

• Instruction for the Limitation and Control of Noise for the year 2003 Standards

• Water – Reclaimed Domestic Wastewater (JS 893:2006)

• Environment – Air Quality – Ambient Air Quality Standards (1140:2006)

(3) Current Status of Environmental and Social Condition in the Project Area

Based on the existing documents shown as below, current status of environmental and social condition of the project area was reviewed.

- Strategic Master Plan for Petra Region (June 2011)
- State of Conservation Report - Petra Archaeological Park (January 2013)
- Wadi Musa Tourist Zone - Urban Design and Landscaping (Preparatory works Phase Report July2013)
- Other environmental monitoring data and survey reports provided by PDTRA

Table 8-1Current Status of Environmental and Social Condition in the Project Area

	Item	Outline of current status
Pollutant Control	Air Quality	· National Environmental Standard for air quality is provided by Ambient Air Quality Standards (1140:2006), however there is no Ambient Air Quality monitoring station located near the project area. · According to the report provided by PDTRA, the present traffic and transportation situation in the Petra Region and particularly in Wadi Musa is considered by all parties concerned as one of the most critical issues in the region. One of the main reasons is the fact that most of the traffic for tourists visiting the PAP currently needs to go through the narrow and often quite steep streets of downtown Wadi Musa; this not only consumes time but also causes considerable traffic jams and pollution.
	Water Quality	· Water supply within Jordan is regulated by the national government. The per-capita water allotment in Maan Governorate for the year 2007 was 214 liter per day. Due to water scarcity in Jordan this rate may well be lowered.The water is currently supplied using ground water from the well fields in the region. · The quality of thesesources is variable: The principal groundwater sources are in good condition and show little evidence of any surface originating pollution, with the major settlements sited well away from the ground water recharge area. · The spring sources are however showing evidence of stress from a mix of urban pollutants.
	Waste	· Regarding solid waste disposal, the PDTRA has started to undertake initial measures by creating a dedicated unit for this issue. By using six vehicles, PDTRA operates collection of solid waste. Six communities generate appoloximately 45t solid waste per day, however, it becomes twice or three times in tourist high season (April and October). · PDTRA promotes waste separation and re-cycle. There are two types of trash boxes located in the area. (Blue color: Papers and carton, Green color; metal and grasses)

	Item	Outline of current status
Natural Environment	Climate	· The climate of Petra is influenced mainly by the southern mountains agro-climatic zone, which is characterized by arid climate condition with average annual precipitation over the catchment area of approximately 180 mm. Temperatures are influenced by elevation, with a maximum temperature of 29.6°C in July, and a minimum temperature of 4°C in February, as recorded by Wadi Mousa weather station. · Winds are predominantly from the west and Southwest and light.
Natural Environment	Protected Area	· Project area is located by Petra Archaeological Park (PAP). · Petra Buffer Zone Study has been conducted and the Project area will be defined as “Special area for enhancement and management of PAP”.
	Ecosystem	· The Petra region is a unique place for plant geographers and of great interest to botanists for its diversity. However, no comprehensive studies on the flora have been undertaken until now. The fauna of Petra is of equally great diversity: 332 species (PNT 1996) have been identified within the region, of which the majority is insects and birds. However, also in this case a proper mapping of the wildlife in the region is currently lacking. · The project area had already been developed and there are the secondary forests such as pine trees.
	Hydrology	· The natural rainwater streams in the project area are the downstream of catchments that extend 60 km2 to the north and south of WadiMusa. The Water streams discharge to the main Wadi course located to the right of the tourist’s street, a maximum street length of 12 km. The challenge of this Wadi is that the Wadi lays in a dry region and regarding the extent or the catchment a flash flood is probable in this Wadi.
	Topography and Geology	· The project area is dominated by sandstone sedimentary rocks. Quaternary and recent deposits are also present in the area. The general geology along Petra back exit road shows that the rock outcrops are of sedimentary origin. They consist of beds of sandstone, which belong to the Umm Ishrin Sandstone and Disi Sandstone Geologic Formations of Rum Group of Cambrian to Ordovician Age of Paleozoic.
Social Environment	Land use	· A significant amount of land in the Petra region is owned by the government and, by law, must not to be transferred to private ownership. Therefore the total amount of private land for development and agriculture is limited. · Five existing forms of land use currently exist within the Petra Region: 1) urban development, 2) agriculture, 3) forestry, 4) protected areas and 5) tourism zones as represented by the Petra Archaeological Park. · The project area is located by Petra Archaeological Park (PAP), and will be defined as “Special area for enhancement and management of PAP”. · This area is highly tourism zone in the region with commercial sector such as hotels and souvenir shops, while there are few residential buildings, no schools and health facilities.
	Resettlement	· Several buildings (i.e. Tourist police and Crowne hotel’s facilities) exist in the project area, but there are no households which are needed resettlement by the proposed project. · Tourist police will move to underground of the Visitor Center. On the other hand, agreement on land exchange will be singed between PDTRA and the owner of the hotel’s facilities.

	Item	Outline of current status
	Living and Livelihood	· Petra mainly depends on the tourism sector. In the last decade, tourism has greatly improved in the region, while the traditional sector of agriculture has increasingly declined due to the growing water shortage and the comparatively easy income opportunities in tourism. The entire region has a population of 30,710 people (DOS 2012), and increased pressures on housing and social-welfare services are expected, which are already inadequate in some of the communities.
Social Environment	Living and Livelihood	· The social structure of the population is characterized by a variety of tribes, subdivided by clans, which have a tendency to favor members of the same clan when it comes to hiring employees. This explains to some extent why members of one tribe and/or one community are often dominating some businesses (e.g. tour operators). As a result, benefits from tourism are not shared equally among all the tribes and communities of the region. · Overall, the workforce in the Petra Region is well educated and includes many academics, especially in Wadi Musa where the College of Archaeology, Tourism and Hotel Management is located. The regional unemployment rate is at 9% lower than the Jordanian average of 12% (Al-Hasanat, 2009). Unemployment in the Petra Region mostly affects women as well as the population group aged between 21to25.
	Infrastructure and public services	· Water shortage due to the drying out of natural springs is one of the major issues threatening the future of the Petra region. The 214 liters per capita per day that were available in 2007 are predicted to drop to 145 liters by 2030 if the population keeps growing at the present rate. Critical to addressing the water needs of the region would be the increased inclusion of intensive water harvesting and water re-use efforts. · Besides the crucial water issue, the ability of the region to support urban development is also directly related to the availability of infrastructure – roadways and transportation systems, sewer, waste disposal, electricity and telecommunications. Much of the existing urbanized areas require an improved and adequate infrastructure. · The main roads of the region are in good condition but smaller roads that lead to less touristic places are in poorer condition. The town of Wadi Musa is suffering from serious traffic congestions during peak business hours, which is accentuated by the tourism traffic passing through town. · Available public services such as schools, hospitals and leisure facilities (e.g. youth or sports centers) are unevenly and insufficiently distributed across the region.
	Heritage	· Heritage Impact Assessment(HIA) was conducted by JICA study team, and confirmed that there is no possibilities that the project will affect archaeological remains in the area.

	Item	Outline of current status
	Landscape	· Characteristics of landscape were confirmed through the preparatory survey of Wadi Musa Tourist Zone - Urban Design and Landscaping. The following observations could be made based on the views experienced in the Site: ➢ While descending to Wadi Musa, the visitor can see the scenic mountains of Petra, with the hotels in the foreground. The mountains provide a unique color scheme and interesting texture. The trees in the Dara, and among the houses, add to the brownish color scheme of mountains different shades of green. ➢ Khirbet Al Falahat also provides interesting views as the traditional architecture and the stairs integrated with rock formation and the terraces planted with olive trees. Furthermore, views from the Khreibt al Falahat into the Ravine (al Dara) are unique. ➢ - In general, there is clutter that could add an adverse effect on some of the remarkable view.

(4) Scoping

Based on the result of review of the environmental and social condition of the project area, potential impacts of the project were identified. (Scoping)

The potential impacts were evaluated by the project phase (Before/ during construction, Operation) and by environmental items, taking into consideration of the activities in each project phase.

The types of the impact are shown as the following legend;

A +/- : Significant positive/ negative impact is expected.

B +/- : Positive/ negative impact is expected to some extent.

C +/- : Extent of positive/ negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses.

D : No impact is expected.

The result of the scoping is shown in the table below.

Table 8-2 scoping of the potential impact of the Project

Item			Before/ During Construction	Operation	Evaluation
Pollutant Control	1	Air Quality	B-	B-	**Construction :** The use of heavy machinery and vehicles carrying staffs and supplies, could cause an increase in the concentration of gases and particulate matter. However, it would be limited and temporary. The calm conditions of the winds in the Project Area would not lead to spread air pollutants. **Operation :** Based on the estimation of future traffic demand, traffic plan will be proposed and implemented for the surrounding area of PAP. Countermeasures for current traffic situation had been proposed in the Master Plan for Wadi Musa down town. If these countermeasures will not be realized, trafficcongestion which causes air pollutantswill continue to occur by local traffic and tourist buses.
	2	Water Quality	B-	D	**Construction :** Construction activities such as washing heavy machinery and vehicles will cause effluent. **Operation :** Sewage generated from the museum will be connected to the existing waste water line and will be treated at Al Baida Waste Water Treatment Plant. (If tourist will increase in the future, expansion of waste water treatment system will be needed.)

Item			Before/ During Construction	Operation	Evaluation
	3	Waste	B-	D	**Construction :** Construction waste (waste soil, concrete) will be generated from reconstruction of the existing buildings. **Operation :** Museum cafeteria will use re-useable bottle to serve beverages. Solid waste generated from tourist will be separated, collected and re-cycled.
	5	Noise and vibrations	B-	D	**Construction :** The use of heavy machinery and vehicles carrying staffs and supplies, could cause noise and vibrations. **Operation :** The museum will not cause noise and vibrations. Even if the museum will operate in night time, the noise generated from tourist is limited and there are no residences in surrounding area.
Natural Environment	9	Protected Area	D	D	The project Area will be defined as “Special area for enhancement and management of PAP”, the Project will follow its rule.
	10	Ecosystem	B-	B+	**Construction :** A few pine trees will be cut off for the construction, but most existing secondary forests can exist. The project area had been developed and constructed the buildings, so that impact of the project will be limited. **Operation :** Surrounding area of the museum will be replanted, taking into account local flora, so it will contribute to conserve local ecosystem.
	11	Hydrology	D	D	The project will not affect current hydrology.
	12	Topography and Geology	D	D	**Construction :** Excavation works will be limited, so that the project will not affect current topography and geology.
Social Environment	13	Resettlement	D	D	There is no involuntary resettlement for the Project. Existing tourist police will move to the underground of new visitor center, and hotel facilities will move out of the surrounding area of PAP.
	14	Poor, indigenous, or ethnic people	D	A+	**Construction :** There is no involuntary resettlement for the Project. **Operation :** In the museum, handicrafts and other local products will be introduced and sold as culture in Petra. It will contribute to promote local economies and increase incomes of households.

Item			Before/ During Construction	Operation	Evaluation
	15	Local economies, such as employment, livelihood, etc.	B+	A+	**Construction:** Employment and procurement for the museum construction will be expected. New construction technique also will introduce this area. **Operation :** In the museum, handicrafts and other local products will be introduced and sold as culture in Petra. It will contribute to promote local economies and increase incomes of households.
	16	Land use and utilization of local resources	D	D	The project will not affect current land use and utilization of local resources.
	17	Water usage	B-	B-	**Construction :** Construction activities will use water for preparation of materials and washing the heavy machinery, etc. **Operation :** The museum will use water for its exhibitions and toilets.
Social Environment	18	Existing social infrastructures and services	B-	B-	**Construction :** Countermeasures for current traffic situation had been proposed in the Master Plan for Wadi Musa down town. If these countermeasures will not realize, traffic congestion will continues to occur by local traffic, tourist buses and vehicles for construction. **Operation :** Based on the estimation of future traffic demand, traffic plan will be proposed and implemented for the surrounding area of PAP. Countermeasures for current traffic situation had been proposed in the Master Plan for Wadi Musa down town. If these countermeasures will not be realized, traffic congestion will continue to occur.
	19	Heritage	C	A+	**Construction:** Heritage Impact Assessment was conducted by JICA study team and archaeological remains (water way) was founded near the project area. So archaeological monitoring should be implemented before construction works such as reconstruction of existing buildings and land cleaning. **Operation:** Heritage and archaeological remains will be managed appropriately, and they will be introduced to Jordanian and foreign tourist. It will help to conserve these cultural heritages.
	20	Landscape	B-	D	**Construction :** Construction works and temporary facilities will affect current landscape of the project area. **Operation :** In order to harmonize surrounding landscape, the height of the museum is limited and local materials whose color will be natural color such as white, beige or gray will used for its exterior.

Item			Before/ During Construction	Operation	Evaluation
	21	Infectious diseases such as HIV/AIDS	C	C	**Construction :** There is possibilities that temporary workers from outside of the area will bring infectious diseases. If, the workers will take the health and safety education program, the risk can be reduced. **Operation :** Petra is one of the most famous world heritage site and tourist will come from all over the world. So there is possibilities that tourist will bring infectious diseases.
	22	Working conditions	B-	D	**Construction :** Project proponent will follow any laws and ordinances associated with the working conditions in Jordan.
Other	23	Accidents	B-	B-	**Construction :** There is possibilities traffic accidents and other accidents will occur during construction. If, the workers will take the health and safety education program, the risk can be reduced. **Operation :** There is possibilities traffic accidents of tourist buses will occur, so traffic plan of the PAP should be considered to avoid these accidents.
	24	The impacts to transboundary or global issues	D	B+	The Project will not cause the impacts to transboundary or global issues. By using high energy efficiency technologies such as XXXXX, energy consumption can be reduced and it will contribute to prevent global warming.

(5) Comparison of alternatives

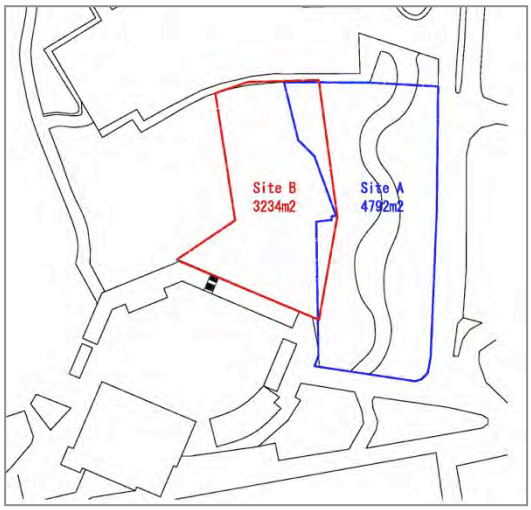
The location of the museum had been selected from several candidates, taking into account indicators such as current land use, the relation of traffic condition and tourist flow, available area for the museum, and cost, etc… Based on this evaluation, the area where north part of visitor center is was selected for the final candidate.

Based on the result of scoping, two alternatives were compared for that area.

Table 8-3 Comparison of alternatives

	Site A	Site B
Area	4792 m2	3234m2
Current land use	There is an approach linking parking to the gate of PAP. The land owner is PDTRA.	Tourist police building and Crowne plaza hotel's facilities exist. The land ownership will be transferred to PDTRA
Access from	New approach will be needed or	The tourist can use existing

Parking to the PAP	the side way can be used as new approach.	approach.
Vegetation	Secondary forests (e.g. pine trees) locate between site A and B.	
Heritage Impact Assessment	The archeological remains (water way) were found.	There are no archeological remains.
Advantage	The area is bigger than site B.	The tourist can use existing approach and get to the PAP gate smoothly. Open area of site-A can be used for temporary stock yard during the construction. Open area of site-A can be used for green area with the museum exhibitions
Challenges	Archeological survey has to be conducted, and it will take time. If the side way can be used as new approach for the PAP gate, the risk of traffic accidents will increase.	A few pine trees will need to cut off for the construction.
Conclusion		***Selected***



(6) Mitigation measures

Mitigation measures to minimize negative impacts of the Project are shown in the table below.

Table 8-4 Mitigation measures (Construction phase)

Items	Causes of Impact	Mitigation measures
Air pollution	Construction works (land cleaning, reconstruction of existing building) and the use of heavy machinery and vehicles	· Regular maintenance of heavy machinery and vehicles · Sprinkle water for prevention of dust spread (Dry season) · Identify and report to the responsible authorities on use of hazard materials · Safety drive and operation · Prohibitatation of combustion of solid waste
Water Quality	The use of heavy machinery and vehicles	· Prohibitatation of leakage of effluent to natural wate way
Noise and vibrations	Construction works and the use of heavy machinery and vehicles	· Regular maintenance of heavy machinery and vehicles · Prevention walls or curtains
Waste	Construction waste generation	· Preparation of dumps for the waste soil · Separation of solid waste and appropriate treatment · Identify and report to the responsible authorities on use of hazard materials
Ecosystems	Deforestation of the secondary forest	· Avoid deforestation of existing trees · Replant the local species
Living and Live hood	Gas and noise from the use of heavy machinery and vehicles Traffic congestion in Wadi Musa down town	· Avoid to affect the social infrastructures which are used by local communities · Respect culture in this area and avoid to interruptor interfere · Implement communication activities to local communities (Explanation of the project, education, etc…) · Implement the countermeasure (e.g. Development of car parking in the Wadi Musa down town.)
Cultural heritage	Construction works (land cleaning, reconstruction of existing building)	· Monitor and report to the responsible authorities on the existence of archaeological remains before the construction · Avoid to build the structures, land cleaning near the site of archaeological remains
Landscape	Deforestation Construction activities, Stock yard of the materials, equipment	· Avoid deforestation of existing trees · Prevention walls or curtains
Working Conditions	Accidents and Infectious diseases during the construction	· Conduct the health and safety education program for the workers

Table 8-5 Mitigation measures (Operation phase)

Items	Causes of Impact	Mitigation measures
Air pollution	Traffic congestion in Wadi Musa down town	· Implement the traffic plan proposed in the Master plan and in this study
Waste	Waste generated from the cafeteria and toilets	· Use reusable bottle for beverages · Separation of solid waste and appropriate treatment
Water and energy usage	Water use for exhibitions and toilets	· Introduce energy- saving design and technologies (e.g. natural ventilation system, high efficiency lighting system, etc…)
Living and live hood	Conflict between culture difference Night time operation of the museum Traffic congestion in Wadi Musa down town	· Respect culture in this area and avoid to interrupt or interfere them · Promote involvement of local communities to the Museum (Education for children and promotion of local products, etc.) · Implement the countermeasure
Landscape	Existing of the Museum	· Local materials whose color will be natural color such as white, beige or gray will use for the exterior of the museum.

(7) Conclusion and Suggestion

Based on the result of this study, potential environmental and social impacts from proposed project are identified. It is evaluated that identified negative impacts are temporary or limited, and they could be minimized by implementation of mitigation measures.

On the other hand, this project could expect to obtain the following positive impacts.

- The Petra museum will contribute to introducing unique and valuable culture in Petra to the world
- The Petra museum will contribute to increase a tourist attraction of Petra Region. It leads to increase the length of stay of tourists.
- The Petra museum will contribute to promoting the local product (e.g. Handicraft, medicinal herbs, other agriculture product, etc) to the tourist who comes from all over the world.
- The Petra museum will contribute to promoting cultural and ecological education for children. It leads to keep culture and living environment of their own.

To obetain understading and interest to the Project from local communities, it is very important that PDTRA will explain these positive impacts to the local communities.

In order to develop the Petra Museum Project, the next step PDTRA needs to perfom for EIA are the followings;

- To complete the Project basic design and the initial environmental and social consideration report (including HIA, Traffic survay) in cooperation with JICA
- To submit above information to the Ministry of Environment and confirm the EIA category and conduct necessary survey. (e.g. Air quality monitoring requires to set baseline.)

- To explain the Project basic design and the initial environmental and social consideration to the stakeholders such as the advisory committees, UNESCO, and other related authorities to this Project. PDTRA should explain the evaluation process of the selection of the museum location in detail.

Attachment 9: Traffic Management Plan

9.1 General

Non-smooth traffic flow at morning arrival and afternoon dismissal times has been an increasing issue particularly at two locations in the vicinity of Petra Archaeological Park (PAP), namely around the corner of Mövenpick Hotel and at the junction in Wadi Musa, from which one way section begins.

It is pointed out by UNESCO that the establishment of the Petra Museum (PM), to be located at the opposite side of Mövenpick Hotel, may even worsen the traffic flow (including pedestrian environment) and generate additional air pollution.

Therefore, the Project must ensure that its adverse effects to traffic are clearly understood, properly mitigated, and effectively managed through an introduction of traffic management schemes.

9.2 Existing Traffic Issues

Existing traffic issues in the vicinity of PAP include:

- Some locals park their vehicles (taxis, delivery vehicles, and family cars) in the main road causing congestion problems (illegal parking).
- Designated taxi bays are not provided, allowing taxi drivers to park anytime, anywhere without any regulatory control.
- Alternative routes to the designated public parking are underused and resultantly traffic is concentrated on the main road due to low awareness and relatively steep gradients.
- Some sections of roads are unreasonably narrowed due to encroachment of the establishments along such roads.
- The existing parking lots are not marked or divided by medians to arrange the cars/buses parking spaces, or the circulation in and out the parking lot.
- Some sidewalks aren’t properly designed to provide good pedestrian environment.

These issues can be addressed through enhanced traffic management schemes and small adjustments of facilities without causing major investments on physical infrastructure.

9.3 Traffic Survey

In the course of this study, a traffic flow survey was carried out at four locations in the vicinity of PAP with the aim to:

- Understand the present traffic volume at the road around the Mövenpick Hotel and present parking demand on the tourist bus parking lot,
- Estimate future traffic volume, pedestrian passage and parking space requirements after the full commissioning of PM,
- Assess if the current capacity of the concerned sections of roads/pedestrian and the existing parking lots can meet the future traffic demand after the commissioning of PM,
- Estimate the future exhaust gas emission (e.g. NOX, CO, SOX, SPM and CO_2) and assess if the projected emission is within the permissive level.

For this purpose, the Classified Vehicle Count Survey and the Parking Survey were performed in a total of 4 days (3rd, 4th, 5th and 6th October 2013) from 6am to 8pm. The subsequent reports by JICA Survey Team shall incorporate the assessment of the collected data, future traffic volume in comparison with the existing capacity, and future exhaust gas emission in comparison with the permissive level.

9.4 Traffic Management Plan

The data obtained from the Traffic Flow Survey will be used to prepare a Traffic Management Plan around the parking lot, the PM and the visitor centre, as well as recommending, as appropriate, necessary additional infrastructure development in the area.

The Traffic Management Plan shall help address the above-mentioned traffic issues and have a positive impact on traffic congestion at arrival and dismissal times. These changes shall be made with the cooperation of the Tourist Police, and PDTRA herein agrees to provide police support as the entity to implement the Traffic Management Plan.

Obviously, the most important factor in the success of this Plan will be the cooperation of locals, hotels, restaurants, business establishments, and others who drop off and pick

up tourists. Therefore, PDTRA will play as the focal entity to make the Plan functional.

The measures to be taken will include, but not limited to, the following:

- The roads around the Mövenpick Hotel may be changed to one way going north till the start of the divided road in order to decrease the congestion near the median dividing the touristic main road and the secondary road heading north towards the bus stop and the Crown Plaza Hotel.
- Some traffic signage or traffic regulator personnel, whichever appropriate, will be provided at the intersections to promote the use of alternative roads to reach the public parking lot.
- Designated taxi bays will be provided, as appropriate, with an effective enforcement by the traffic police.
- The on-road parking will be restricted within a few hundreds meters near the PAP entrance and/or specific peak hours of a day, perhaps with imposing fines to the violators.
- The open space above the bus parking will be used as extra parking lots. Other sites for additional parking lots, as necessary, will be identified to meet the future demand.
- The access to the main road near PAP entrance may be restricted to the guests and workers of Guest House Hotel.

Attachment 10: Dr. Khairieh's Comments

COMMENTS ON A-4 EXHIBITION PLAN

The exhibition plan is interesting and vibrant. The flow and variety have potential for a good experience to the visitors.

Of course more discussions with specialists (especially archaeologists and tourism professionals) are needed for theme elaboration, and further consideration of the available objects for displays should be used to guide the evolvement of the exhibitions.

Please also note the nearby archaeological remains (e.g. the cisterns and pottery workshops of Zurraba) that could be indicated/ referred to in the outdoor exhibition of the museum.

This is a good base to work from towards the achievement of the museum; the following are point specific comments:-

- Slide 2: "In order to make an attractive museum, compact but comprehensive, we shall develop not a static museum composed of showcases and graphic panels but a dynamic museum by providing the museum with as many active scenes and messages as possible".

This is a very good idea, but I am worried about projected info, as projectors may break down, plus some people may want to concentrate on a certain subject which projection cannot provide. Add to this that in cases of breakdown it would take quite a long time for technicians from the concerned company to come from Amman, thus leaving a gap in the exhibition.

I suggest projection be restricted to photos, graphics and short few-words messages, while actual interpretation be more conventional. The "panels" may be on transparent film/ acrylic so that they do not add visual weight to the exhibition.

There is also the problem of labels for objects which people tend to like. These may need to be 'conventional'.

- Slides 3, 9, 10, 12, etc.: The concept of "welcoming by deities" needs to be discussed further considering local sensitivities…

In general, I feel there is too much concentration on deities in the proposal, but not enough on technologies, food production, "why and how" Petra, the milieu of Petra, the bigger Nabataea… etc.

Also, the later religions, especially Christianity then Islam, should be introduced with more weight, not only in the "Petra Time Tunnel" especially that there is a significant number of objects available for their illustration.

- **Slide 10**: Petra Powers of Ten is a good proposal, but does not deserve the large space it is allocated in the design (Slide 4). It offers visual/ audio effects but not much else in terms of learning, interaction, etc. Also this exhibition is very technology-dependent so if anything goes technically wrong this big space will be lost and could be a downer for visitors.

I recommend that an alternative exhibit for this space be considered.

- Slides 12-14: For this relatively large exhibit, I suggest concentrating on what is UNDER the Khazneh (not the top), which people would have had a glimpse of but not seen properly during their visit to the site. This exhibition could also serve to introduce the cultural exchanges and openness of the Nabataean culture at its zenith.

- **Slide 18**: Burning incense in a confined space may be problematic, as some people with breathing problems or allergies could be affected. Also the fumes may go through the ventilation system and thus the smell would spread throughout the museum rather than be confined to the "caravanserai".

As for the "Tools for caravanning", sorry I do not understand this one (tools like what?), but sounds very interesting.

Also interesting are the "musical instruments", are they supposed to be replicas of Nabataean instruments? Or traditional??

"Ancient music gently resounds around the caravansary", if this means Nabataean music, I doubt that we have evidence for what it sounded like although it may be conjectured from available data (for the sake of authenticity, it should not be presented as real Nabataean music though).

- **Slide 20**: Like the music, we do not have evidence of the exact pronunciation although here conjecture is easier.

Dr. Khairieh Amr
Deputy Director for Technical Affairs
The Jordan Museum, Amman
9 October 2013

COMMENT ON A-7 TEST EXCAVATION

The closing sentence of the report cannot be stressed enough:

"Nevertheless it is recommended to keep a close eye on the area during the actual construction of the museum."

There is a high probability that rock-cut features may be found, as indicated by the surrounding areas that were not recently covered with agricultural soil.

I recommend that archaeologists be present on site AT LEAST while excavating for the foundations of the museum building.

Dr. Khairieh Amr
Deputy Director for Technical Affairs
The Jordan Museum, Amman
9 October 2013

Appendix 6: Environmental and Social Consideration

Summary

1. General Information

1.1 Study area

The target area for the analysis of current environmental condition is Petra Region, Wadi Musa and PAP in particular.

The target area for the environmental impact evaluation is the Project site and the Project itself.

1.2 Methodology of the Study

The study method follows JICA Environmental and Social Consideration Guideline (April 2010).

The Jordanian Environmental Impact Assessment (EIA) Bylaw of 2005 is also referred.

According to the JICA Guideline, this study is at the Initial Environmental Examination (IEE) level. It means that the study will be conducted by using existing data/information mainly with minimum site survey (i.e. HIA and Traffic Flow Survey), and will evaluate the potential impact and prepare mitigation measures and a monitoring plan.

1.3 Schedule of the Study

At present, almost all-necessaryinformation can be collected in cooperation with PDTRA.

Brief analysis of current condition and identification of potential impacts/scoping has been finished. (See the following Particulars)

Detail evaluation will be conducted based on the condition of future prediction. (e.g. future tourist population, capacity of the museum, and traffic demand forecast, etc…)

The report of Environmental and Social Consideration will be completed by the end of October 2013.

2. Analysis of Current Condition

2.1 Collected data

Analysis of current condition is conducted by using the following documents:

- ✓ Strategic Master Plan for Petra Region (June 2011)
- ✓ State of Conservation Report - Petra Archaeological Park (January 2013)
- ✓ Wadi Musa Tourist Zone - Urban Design and Landscaping (Preparatory Works Phase Report - July 2013)
- ✓ Other environmental monitoring data and survey reports provided by PDTRA

These data include not only the Project Area but also all over Petra Region. To understand the condition of Project Area, Buffer Zone Study Report (Phase 1) will help

the JICA study team a lot. Moreover, the ESIA study report of the Back Road Project is very useful in order to understand the process and contents of ESIA in Jordan.

2.2 Luck of data

There is no data on air pollutant in the area covered with the Project Area and Wadi Musa down town. However, air pollutant is one of the key issues for this project, because local and tourist transportation causes traffic congestion in Wadi Musa down town and it leads to generate air pollutants.

There is no data on drinking water qualities. These data shall be received from the Ministry of Water.

There are data on an ecosystem, but it is not enough information on endangered species. There are several lists prepared by the Petra National Trust and theMaster Plan study team.

3. Evaluation of the Environmental Impact

Brief identification of potential impacts/scoping has been finished.

Identified negative impacts are; air quality, water quality, waste, noise, ecosystem, water usage, existing social infrastructures (traffic jam), landscape, etc.

However, these negative impacts are temporary or limited, and they can be minimized by implementing mitigation measures. Detail evaluation will be conducted for the negative impact mainly.

Particulars

(1) Objectives

This document was prepared in compliance with the Jordanian Environmental Impact Assessment (EIA) Bylaw of 2005, and JICA Environmental and Social ConsiderationGuideline (April 2010). The primary objectives of this study are:

· Ensure that environmental and social issues are taken into consideration in the design phase.
· Identify and assess the potential environmental and social impacts of the project alternatives.
· Propose mitigation measures to minimize the potential impacts of the project on the environment and assign appropriate entities to measure implementation and monitoring.

(2) Environmental Impact Assessment System in Jordan

1) Outline of the Environmental Impact Assessment System in Jordan

The Environmental Impact Assessment (EIA) Bylaw No.37 was issued in 2005 to ensure that the anticipated impacts any development project may have on the social, economic, and natural environment in Jordan are identified. Its aim is to limit these impacts in order to achieve sustainable development in the country. The bylaw applies to all industrial, agricultural, commercial, construction, residential, and tourism projects.

The project shall be classified in any of the following categories by decision of the Secretary General on the basis of the recommendations of the competent party at the Ministry:

1. Category 1: includes the projects which require a comprehensive environmental impact assessment.
2. Category 2: includes the projects which require a preliminary environmental impact assessment, based on which the need to conduct a comprehensive environmental impact assessment will be determined.
3. Category 3: includes the projects that require neither a preliminary nor a comprehensive environmental impact assessment.

General information about the project, which requires a thorough environmental assessment or apreliminary environmental impact assessment are shown in below;

1. Description of the Project
2. List of Major Alternatives to the Proposed Project
3. Identification of the Most Important Environmental Aspects

2) Laws and Regulation on Environmental Impact Assessment in Jordan

Laws and regulation on Environmental Impact Assessment in Jordan are shown below.

- Laws

• Environment Protection Law No. 52 for the year 2006

· Protection of Cultural Heritage and Site No. 5 for the year 2005

• Antiquities Law No. 21 for the year 1988

· Petra Development and Tourism Region Authority Law No.15 for the year 2009

• Ministry of Agriculture Law No. 44 for the year 2002

• Renewable Energy & Energy Efficiency Law No. 3 of the year 2010

• Public Heath Law No. 47 for the year 2008

• Traffic Law No. 49 for the year 2008

•Labor Law No. 8 for the year 1996

- Regulations

• ESIA Regulation No. 37 for the year 2005

• Air Quality Protection Regulation No. 28 of the year 2005

• Soil Protection Regulation No. 25 of the year 2005

• Regulation No. 24 of the year for the Management of Hazardous and Dangerous Materials

• Regulation No. 27 for the year 2005 for the Management of Solid Waste

• Regulation No. 66 for the year 1994 for the Sewage System

• Underground Water Regulation No. 85 of 2002

• Environment Protection from Pollution in Emergency Case No. 26 for the year 2005

• Natural resources and National Parks bylaw of 2005

• Protection of Birds and Wildlife bylaw No.113 of 1973

- Instructions

• Noise Level Control Instructions for the year 2003

• Instruction for the Limitation and Control of Noise for the year 2003 Standards

• Water – Reclaimed Domestic Wastewater (JS 893:2006)

• Environment – Air Quality – Ambient Air Quality Standards (1140:2006)

(3) Current Status of Environmental and Social Condition in the Project Area

Based on the existing documents shown as below, current status of environmental and social condition of the project area was reviewed.

- Strategic Master Plan for Petra Region (June 2011)
- State of Conservation Report - Petra Archaeological Park (January 2013)
- Wadi Musa Tourist Zone - Urban Design and Landscaping (Preparatory works Phase Report July2013)
- Other environmental monitoring data and survey reports provided by PDTRA

Table 8-1Current Status of Environmental and Social Condition in the Project Area

	Item	Outline of current status
Pollutant Control	Air Quality	· National Environmental Standard for air quality is provided by Ambient Air Quality Standards (1140:2006), however there is no Ambient Air Quality monitoring station located near the project area. · According to the report provided by PDTRA, the present traffic and transportation situation in the Petra Region and particularly in Wadi Musa is considered by all parties concerned as one of the most critical issues in the region. One of the main reasons is the fact that most of the traffic for tourists visiting the PAP currently needs to go through the narrow and often quite steep streets of downtown Wadi Musa; this not only consumes time but also causes considerable traffic jams and pollution.
	Water Quality	· Water supply within Jordan is regulated by the national government. The per-capita water allotment in Maan Governorate for the year 2007 was 214 liter per day. Due to water scarcity in Jordan this rate may well be lowered.The water is currently supplied using ground water from the well fields in the region. · The quality of thesesources is variable: The principal groundwater sources are in good condition and show little evidence of any surface originating pollution, with the major settlements sited well away from the ground water recharge area. · The spring sources are however showing evidence of stress from a mix of urban pollutants.
	Waste	· Regarding solid waste disposal, the PDTRA has started to undertake initial measures by creating a dedicated unit for this issue. By using six vehicles, PDTRA operates collection of solid waste. Six communities generate appoloximately 45t solid waste per day, however, it becomes twice or three times in tourist high season (April and October). · PDTRA promotes waste separation and re-cycle. There are two types of trash boxes located in the area. (Blue color: Papers and carton, Green color; metal and grasses)

	Item	Outline of current status
Natural Environment	Climate	· The climate of Petra is influenced mainly by the southern mountains agro-climatic zone, which is characterized by arid climate condition with average annual precipitation over the catchment area of approximately 180 mm. Temperatures are influenced by elevation, with a maximum temperature of 29.6°C in July, and a minimum temperature of 4°C in February, as recorded by Wadi Mousa weather station. · Winds are predominantly from the west and Southwest and light.
Natural Environment	Protected Area	· Project area is located by Petra Archaeological Park (PAP). · Petra Buffer Zone Study has been conducted and the Project area will be defined as “Special area for enhancement and management of PAP”.
	Ecosystem	· The Petra region is a unique place for plant geographers and of great interest to botanists for its diversity. However, no comprehensive studies on the flora have been undertaken until now. The fauna of Petra is of equally great diversity: 332 species (PNT 1996) have been identified within the region, of which the majority is insects and birds. However, also in this case a proper mapping of the wildlife in the region is currently lacking. · The project area had already been developed and there are the secondary forests such as pine trees.
	Hydrology	· The natural rainwater streams in the project area are the downstream of catchments that extend 60 km2 to the north and south of WadiMusa. The Water streams discharge to the main Wadi course located to the right of the tourist’s street, a maximum street length of 12 km. The challenge of this Wadi is that the Wadi lays in a dry region and regarding the extent or the catchment a flash flood is probable in this Wadi.
	Topography and Geology	· The project area is dominated by sandstone sedimentary rocks. Quaternary and recent deposits are also present in the area. The general geology along Petra back exit road shows that the rock outcrops are of sedimentary origin. They consist of beds of sandstone, which belong to the Umm Ishrin Sandstone and Disi Sandstone Geologic Formations of Rum Group of Cambrian to Ordovician Age of Paleozoic.
Social Environment	Land use	· A significant amount of land in the Petra region is owned by the government and, by law, must not to be transferred to private ownership. Therefore the total amount of private land for development and agriculture is limited. · Five existing forms of land use currently exist within the Petra Region: 1) urban development, 2) agriculture, 3) forestry, 4) protected areas and 5) tourism zones as represented by the Petra Archaeological Park. · The project area is located by Petra Archaeological Park (PAP), and will be defined as “Special area for enhancement and management of PAP”. · This area is highly tourism zone in the region with commercial sector such as hotels and souvenir shops, while there are few residential buildings, no schools and health facilities.
	Resettlement	· Several buildings (i.e. Tourist police and Crowne hotel’s facilities) exist in the project area, but there are no households which are needed resettlement by the proposed project. · Tourist police will move to underground of the Visitor Center. On the other hand, agreement on land exchange will be singed between PDTRA and the owner of the hotel’s facilities.

	Item	Outline of current status
	Living and Livelihood	· Petra mainly depends on the tourism sector. In the last decade, tourism has greatly improved in the region, while the traditional sector of agriculture has increasingly declined due to the growing water shortage and the comparatively easy income opportunities in tourism. The entire region has a population of 30,710 people (DOS 2012), and increased pressures on housing and social-welfare services are expected, which are already inadequate in some of the communities.
Social Environment	Living and Livelihood	· The social structure of the population is characterized by a variety of tribes, subdivided by clans, which have a tendency to favor members of the same clan when it comes to hiring employees. This explains to some extent why members of one tribe and/or one community are often dominating some businesses (e.g. tour operators). As a result, benefits from tourism are not shared equally among all the tribes and communities of the region. · Overall, the workforce in the Petra Region is well educated and includes many academics, especially in Wadi Musa where the College of Archaeology, Tourism and Hotel Management is located. The regional unemployment rate is at 9% lower than the Jordanian average of 12% (Al-Hasanat, 2009). Unemployment in the Petra Region mostly affects women as well as the population group aged between 21to25.
	Infrastructure and public services	· Water shortage due to the drying out of natural springs is one of the major issues threatening the future of the Petra region. The 214 liters per capita per day that were available in 2007 are predicted to drop to 145 liters by 2030 if the population keeps growing at the present rate. Critical to addressing the water needs of the region would be the increased inclusion of intensive water harvesting and water re-use efforts. · Besides the crucial water issue, the ability of the region to support urban development is also directly related to the availability of infrastructure – roadways and transportation systems, sewer, waste disposal, electricity and telecommunications. Much of the existing urbanized areas require an improved and adequate infrastructure. · The main roads of the region are in good condition but smaller roads that lead to less touristic places are in poorer condition. The town of Wadi Musa is suffering from serious traffic congestions during peak business hours, which is accentuated by the tourism traffic passing through town. · Available public services such as schools, hospitals and leisure facilities (e.g. youth or sports centers) are unevenly and insufficiently distributed across the region.
	Heritage	· Heritage Impact Assessment(HIA) was conducted by JICA study team, and confirmed that there is no possibilities that the project will affect archaeological remains in the area.

	Item	Outline of current status
	Landscape	· Characteristics of landscape were confirmed through the preparatory survey of Wadi Musa Tourist Zone - Urban Design and Landscaping. The following observations could be made based on the views experienced in the Site: ➢ While descending to Wadi Musa, the visitor can see the scenic mountains of Petra, with the hotels in the foreground. The mountains provide a unique color scheme and interesting texture. The trees in the Dara, and among the houses, add to the brownish color scheme of mountains different shades of green. ➢ Khirbet Al Falahat also provides interesting views as the traditional architecture and the stairs integrated with rock formation and the terraces planted with olive trees. Furthermore, views from the Khreibt al Falahat into the Ravine (al Dara) are unique. ➢ - In general, there is clutter that could add an adverse effect on some of the remarkable view.

(4) Scoping

Based on the result of review of the environmental and social condition of the project area, potential impacts of the project were identified. (Scoping)

The potential impacts were evaluated by the project phase (Before/ during construction, Operation) and by environmental items, taking into consideration of the activities in each project phase.

The types of the impact are shown as the following legend;

A +/- : Significant positive/ negative impact is expected.

B +/- : Positive/ negative impact is expected to some extent.

C +/- : Extent of positive/ negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses.

D : No impact is expected.

The result of the scoping is shown in the table below.

Table 8-2 scoping of the potential impact of the Project

Item			Before/ During Construction	Operation	Evaluation
Pollutant Control	1	Air Quality	B-	B-	**Construction :** The use of heavy machinery and vehicles carrying staffs and supplies, could cause an increase in the concentration of gases and particulate matter. However, it would be limited and temporary. The calm conditions of the winds in the Project Area would not lead to spread air pollutants. **Operation :** Based on the estimation of future traffic demand, traffic plan will be proposed and implemented for the surrounding area of PAP. Countermeasures for current traffic situation had been proposed in the Master Plan for Wadi Musa down town. If these countermeasures will not be realized, trafficcongestion which causes air pollutantswill continue to occur by local traffic and tourist buses.
	2	Water Quality	B-	D	**Construction :** Construction activities such as washing heavy machinery and vehicles will cause effluent. **Operation :** Sewage generated from the museum will be connected to the existing waste water line and will be treated at Al Baida Waste Water Treatment Plant. (If tourist will increase in the future, expansion of waste water treatment system will be needed.)

Item			Before/ During Construction	Operation	Evaluation
	3	Waste	B-	D	**Construction :** Construction waste (waste soil, concrete) will be generated from reconstruction of the existing buildings. **Operation :** Museum cafeteria will use re-useable bottle to serve beverages. Solid waste generated from tourist will be separated, collected and re-cycled.
	5	Noise and vibrations	B-	D	**Construction :** The use of heavy machinery and vehicles carrying staffs and supplies, could cause noise and vibrations. **Operation :** The museum will not cause noise and vibrations. Even if the museum will operate in night time, the noise generated from tourist is limited and there are no residences in surrounding area.
Natural Environment	9	Protected Area	D	D	The project Area will be defined as “Special area for enhancement and management of PAP”, the Project will follow its rule.
	10	Ecosystem	B-	B+	**Construction :** A few pine trees will be cut off for the construction, but most existing secondary forests can exist. The project area had been developed and constructed the buildings, so that impact of the project will be limited. **Operation :** Surrounding area of the museum will be replanted, taking into account local flora, so it will contribute to conserve local ecosystem.
	11	Hydrology	D	D	The project will not affect current hydrology.
	12	Topography and Geology	D	D	**Construction :** Excavation works will be limited, so that the project will not affect current topography and geology.
Social Environment	13	Resettlement	D	D	There is no involuntary resettlement for the Project. Existing tourist police will move to the underground of new visitor center, and hotel facilities will move out of the surrounding area of PAP.
	14	Poor, indigenous, or ethnic people	D	A+	**Construction :** There is no involuntary resettlement for the Project. **Operation :** In the museum, handicrafts and other local products will be introduced and sold as culture in Petra. It will contribute to promote local economies and increase incomes of households.

Item			Before/ During Construction	Operation	Evaluation
	15	Local economies, such as employment, livelihood, etc.	B+	A+	**Construction:** Employment and procurement for the museum construction will be expected. New construction technique also will introduce this area. **Operation :** In the museum, handicrafts and other local products will be introduced and sold as culture in Petra. It will contribute to promote local economies and increase incomes of households.
	16	Land use and utilization of local resources	D	D	The project will not affect current land use and utilization of local resources.
	17	Water usage	B-	B-	**Construction :** Construction activities will use water for preparation of materials and washing the heavy machinery, etc. **Operation :** The museum will use water for its exhibitions and toilets.
Social Environment	18	Existing social infrastructures and services	B-	B-	**Construction :** Countermeasures for current traffic situation had been proposed in the Master Plan for Wadi Musa down town. If these countermeasures will not realize, traffic congestion will continues to occur by local traffic, tourist buses and vehicles for construction. **Operation :** Based on the estimation of future traffic demand, traffic plan will be proposed and implemented for the surrounding area of PAP. Countermeasures for current traffic situation had been proposed in the Master Plan for Wadi Musa down town. If these countermeasures will not be realized, traffic congestion will continue to occur.
	19	Heritage	C	A+	**Construction:** Heritage Impact Assessment was conducted by JICA study team and archaeological remains (water way) was founded near the project area. So archaeological monitoring should be implemented before construction works such as reconstruction of existing buildings and land cleaning. **Operation:** Heritage and archaeological remains will be managed appropriately, and they will be introduced to Jordanian and foreign tourist. It will help to conserve these cultural heritages.
	20	Landscape	B-	D	**Construction :** Construction works and temporary facilities will affect current landscape of the project area. **Operation :** In order to harmonize surrounding landscape, the height of the museum is limited and local materials whose color will be natural color such as white, beige or gray will used for its exterior.

Item			Before/ During Construction	Operation	Evaluation
	21	Infectious diseases such as HIV/AIDS	C	C	**Construction :** There is possibilities that temporary workers from outside of the area will bring infectious diseases. If, the workers will take the health and safety education program, the risk can be reduced. **Operation :** Petra is one of the most famous world heritage site and tourist will come from all over the world. So there is possibilities that tourist will bring infectious diseases.
	22	Working conditions	B-	D	**Construction :** Project proponent will follow any laws and ordinances associated with the working conditions in Jordan.
Other	23	Accidents	B-	B-	**Construction :** There is possibilities traffic accidents and other accidents will occur during construction. If, the workers will take the health and safety education program, the risk can be reduced. **Operation :** There is possibilities traffic accidents of tourist buses will occur, so traffic plan of the PAP should be considered to avoid these accidents.
	24	The impacts to transboundary or global issues	D	B+	The Project will not cause the impacts to transboundary or global issues. By using high energy efficiency technologies such as XXXXX, energy consumption can be reduced and it will contribute to prevent global warming.

(5) Comparison of alternatives

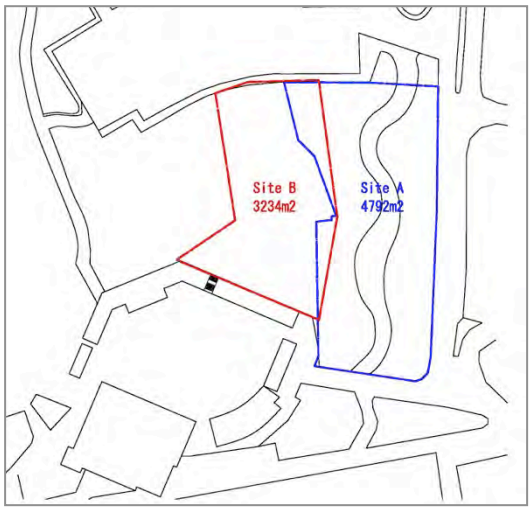
The location of the museum had been selected from several candidates, taking into account indicators such as current land use, the relation of traffic condition and tourist flow, available area for the museum, and cost, etc… Based on this evaluation, the area where north part of visitor center is was selected for the final candidate.

Based on the result of scoping, two alternatives were compared for that area.

Table 8-3 Comparison of alternatives

	Site A	Site B
Area	4792 m2	3234m2
Current land use	There is an approach linking parking to the gate of PAP. The land owner is PDTRA.	Tourist police building and Crowne plaza hotel's facilities exist. The land ownership will be transferred to PDTRA
Access from	New approach will be needed or	The tourist can use existing

Parking to the PAP	the side way can be used as new approach.	approach.
Vegetation	Secondary forests (e.g. pine trees) locate between site A and B.	
Heritage Impact Assessment	The archeological remains (water way) were found.	There are no archeological remains.
Advantage	The area is bigger than site B.	The tourist can use existing approach and get to the PAP gate smoothly. Open area of site-A can be used for temporary stock yard during the construction. Open area of site-A can be used for green area with the museum exhibitions
Challenges	Archeological survey has to be conducted, and it will take time. If the side way can be used as new approach for the PAP gate, the risk of traffic accidents will increase.	A few pine trees will need to cut off for the construction.
Conclusion		***Selected***



(6) Mitigation measures

Mitigation measures to minimize negative impacts of the Project are shown in the table below.

Table 8-4 Mitigation measures (Construction phase)

Items	Causes of Impact	Mitigation measures
Air pollution	Construction works (land cleaning, reconstruction of existing building) and the use of heavy machinery and vehicles	· Regular maintenance of heavy machinery and vehicles · Sprinkle water for prevention of dust spread (Dry season) · Identify and report to the responsible authorities on use of hazard materials · Safety drive and operation · Prohibitatation of combustion of solid waste
Water Quality	The use of heavy machinery and vehicles	· Prohibitatation of leakage of effluent to natural wate way
Noise and vibrations	Construction works and the use of heavy machinery and vehicles	· Regular maintenance of heavy machinery and vehicles · Prevention walls or curtains
Waste	Construction waste generation	· Preparation of dumps for the waste soil · Separation of solid waste and appropriate treatment · Identify and report to the responsible authorities on use of hazard materials
Ecosystems	Deforestation of the secondary forest	· Avoid deforestation of existing trees · Replant the local species
Living and Live hood	Gas and noise from the use of heavy machinery and vehicles Traffic congestion in Wadi Musa down town	· Avoid to affect the social infrastructures which are used by local communities · Respect culture in this area and avoid to interruptor interfere · Implement communication activities to local communities (Explanation of the project, education, etc…) · Implement the countermeasure (e.g. Development of car parking in the Wadi Musa down town.)
Cultural heritage	Construction works (land cleaning, reconstruction of existing building)	· Monitor and report to the responsible authorities on the existence of archaeological remains before the construction · Avoid to build the structures, land cleaning near the site of archaeological remains
Landscape	Deforestation Construction activities, Stock yard of the materials, equipment	· Avoid deforestation of existing trees · Prevention walls or curtains
Working Conditions	Accidents and Infectious diseases during the construction	· Conduct the health and safety education program for the workers

Table 8-5 Mitigation measures (Operation phase)

Items	Causes of Impact	Mitigation measures
Air pollution	Traffic congestion in Wadi Musa down town	· Implement the traffic plan proposed in the Master plan and in this study
Waste	Waste generated from the cafeteria and toilets	· Use reusable bottle for beverages · Separation of solid waste and appropriate treatment
Water and energy usage	Water use for exhibitions and toilets	· Introduce energy- saving design and technologies (e.g. natural ventilation system, high efficiency lighting system, etc…)
Living and live hood	Conflict between culture difference Night time operation of the museum Traffic congestion in Wadi Musa down town	· Respect culture in this area and avoid to interrupt or interfere them · Promote involvement of local communities to the Museum (Education for children and promotion of local products, etc.) · Implement the countermeasure
Landscape	Existing of the Museum	· Local materials whose color will be natural color such as white, beige or gray will use for the exterior of the museum.

(7) Conclusion and Suggestion

Based on the result of this study, potential environmental and social impacts from proposed project are identified. It is evaluated that identified negative impacts are temporary or limited, and they could be minimized by implementation of mitigation measures.

On the other hand, this project could expect to obtain the following positive impacts.

- The Petra museum will contribute to introducing unique and valuable culture in Petra to the world
- The Petra museum will contribute to increase a tourist attraction of Petra Region. It leads to increase the length of stay of tourists.
- The Petra museum will contribute to promoting the local product (e.g. Handicraft, medicinal herbs, other agriculture product, etc) to the tourist who comes from all over the world.
- The Petra museum will contribute to promoting cultural and ecological education for children. It leads to keep culture and living environment of their own.

To obetain understading and interest to the Project from local communities, it is very important that PDTRA will explain these positive impacts to the local communities.

In order to develop the Petra Museum Project, the next step PDTRA needs to perfom for EIA are the followings;

- To complete the Project basic design and the initial environmental and social consideration report (including HIA, Traffic survay) in cooperation with JICA
- To submit above information to the Ministry of Environment and confirm the EIA category and conduct necessary survey. (e.g. Air quality monitoring requires to set baseline.)

- To explain the Project basic design and the initial environmental and social consideration to the stakeholders such as the advisory committees, UNESCO, and other related authorities to this Project. PDTRA should explain the evaluation process of the selection of the museum location in detail.

Attachment 7: Test Excavation

1. Introduction

The overall objective of the project is to create a state-of-the-art museum in the World Heritage Site of Petra as part of the visitors' management plan with the aims of enhancing the visitors' experience and better understanding of Petra mainly focusing on the Nabataean culture and civilization that flourished in Southern Syria, Jordan, Palestine and North Arabia starting from the 4th century BCE and reaching its peak during the 1st century BCE and 1st century AD.

The proposed area for the museum is located within the boundaries of the buffer zone of the PAP (Petra Archaeological Park) (Pic 1 and Fig 1). The size of the proposed area is app. 6,000 m^2. It is recently being occupied by the tourism street in its eastern part, two housing buildings that belong to the SSC (Social Security Corporation) and the Tourism Police building in its central part while the western part is covered by pine, pepper and eucalyptus trees. The area is bordered by the bus terminal from the northwestern side and Petra Visitors' Centre Plaza from the southeast (Pic 2, 39 and Fig 2).

The general local name of the area is Zurrabah which has many meanings in Arabic including the entry way or the gate, the hiding place of a hunter who is waiting for the pray, the combination of colours yellow, red and green, and finally the water way among many others. Some other name is attributed, specifically to the area where the museum will be located. The name is al Quf which means in Arabic the elevated terraces. Till the 60s of the last century the area was used for processing agricultural products, especially wheat using old traditional methods. To the west of Quf, a place called al-Ramdhah, is situated (the place with hot sands used for curing joints' diseases). All these physical properties fit well with the nature of the studied area and indicate a specific use of it that includes industrial (Zurrabah), agricultural (Quf), or hunting activities.

2. Objectives

As a preparation for this project a series of subprojects were conducted including the Heritage Impact Assessment Project. The main objective of this subproject that was conducted between 9th and 24th of September 2013 was to survey the area around the proposed location for the museum and to document any archaeological remains in the proposed area and then to evaluate them and assess the impact of the project on these remains and finally to suggest mitigation measures to ensure the preservation of any archaeological remains if any.

3. Methodology

To achieve the above-mentioned goals it was decided to use different approaches for assessing the area for any heritage/archaeological remains. These approaches include:

a) Desk research for any available information of the area in special publications;
b) Surface examination and documentation of the area not only of the proposed for the museum plot of land but also to the surrounding area in a radius of not less than 200 metres to contextualize the results of the research;
c) And finally to select 5 locations for test pits that would be excavated down to the bedrock or to the virgin soil to document any human activities in the area.

4. Fieldwork Survey

The fieldwork was started with two day survey of the adjacent to the site area to the north, east and west. Various archaeological remains had been revisited. That include:

- Az-Zurrabah pottery kilns: (Pics 46,47,49,50, and 51). Az-Zurrabah is the largest industrial complex known in Petra area. Pottery pots including fine wares, kitchenware, oil pottery lamps, pottery water pipes and roof tiles were being produced at the site from the 1st century through the 6th century. 12 pottery kilns and several underground pottery workshops were uncovered.

- Az-Zurrabah water reservoir: (Pics7,52,53). Water was always an issue in the rocky area of Petra and that is why the Nabataean were harvesting literally every drop of water. They constructed sophisticated water harvesting and storage installations including reservoirs and cisterns, water aqueducts. The remnants of water canals to bring water to the reservoir and then to bring it to the town is still visible in the area of Az-Zurrabah to the left and the right of the paved road. Some later 12-13 century AD reuse of the area is documented at the reservoir itself and in the area adjacent to the Mövenpick Hotel (Pics 8,9, 10, 45).

- Rock cut tombs to the south west of the proposed for the museum area: (Pics 41,42,43).

- Al-Khan, caravanserai (Pics40,48). This monument is utilized now as a cave bar. It consists of a chamber and a plaza in front of it formed by two side porticos with pillars and Doric columns. In the funerary chamber, in its southern wall 6 niches are curved. Two square chambers and a recess located at the back of the chamber.

- A short segment of a water channel (Pic 35) is identified in the area to northwest of the bus park. Most probably this channel was running in the area of the bus park and continued to the area of the Visitor Centre. Unfortunately a small segment in the above-mentioned area is the only preserved part of it.

Within the surveying work the surface of the proposed museum site was closely examined for any archaeological remains. Almost the whole surface of the site was covered by agricultural red soil that was brought to the area in the 70s of the last century and later by PDTRA (Pics 3,4). On the less covered red soil and more intact area, pottery sherds had been found in a few surfaces (Pics 5,44). Obviously these pottery sherds were brought from outside, most probably by rainwater.

Excavations:

The excavations took place between 14th and 24th of September 2013. They were supervised by: Hani Falahat (DOA), Mohammad Marahlah, Samia Falahat and Harun Amarat (PAP: Petra Archaeological Park). The surveying works of plotting the trenches were done by Mahmud al-Hasanat (PDTRA). To all of them I want to express my sincere thanks for doing a good job. The workers were provided by the PAP and PDTRA. 12 of workers were involved in the excavations.

5. Results

Test trenches were chosen and plotted to cover both proposed the museum areas A and B. 5 test trenches were excavated: (Figs 2,3)

Test Trench 1 (TT1) (Fig 4 and Pics 11,12,13,14,15,20)

4 loci were identified in this trench:
Locus 1 is the loose red soil (5-10 cm thick),locus 2 is a compacted sandy soil (app.50 cm), locus 3 (h.60xw.15xl.50 cm) is probably a remnants of a corner of a water channel and finally locus 4 (50 cm.) is a compacted sandy soil, the same as locus 2. The compacted sandy soil is homogeneous in loci 2 and 4 and these loci were separated arbitrary after having 50 cm of homogeneous fill. The deepest point reached in the trench is 120 cm, and we decided to stop because no cultural materials were found in the fill.

Test Trench 2 (TT2) (Fig 5 and Pics 16,17,18,19,21)

5 loci had been identified in this trench:
Locus 1 (2-5 cm) red agricultural soil, locus 2 (50 cm) compacted sandy soil, locus 3 (50cm) compacted sandy soil, the same as the one above and the one beneath, locus 4 (35 cm) of the same compacted sandy soil, locus 5 (60-70 cm) of the same compacted sandy sterile soil with no cultural material. The depth of the trench is app. 200 cm.

Test Trench 3 (TT3) (Fig 6 andPics 25,26,27,28)

5 loci were also identified in this trench:
Locus 1 (10-15 cm) of whitish gravel mixed with red soil, locus 2 (30-40 cm) of loose sandy soil, locus 3 (15 cm) of 10 cement bricks covering an electric cable trench, locus 4 (28-35 cm) of compacted sandy soil, locus 5 (80 cm) of compacted sandy soil, the same as the one above. Three metallic water pipes are running within locus 2.

Test Trench 4 (TT4) (Fig 7,8 and Pics 22,23,24,34)

7 loci had been identified in this trench:
Locus 1 (14-16 cm) of dark gray soil with grass roots covering the northwestern part of it, locus 2 (16-30 cm) of gravel and loose building material, locus 3 (10cm) of concrete extending to a distance of 50 cm from the foundation of the Tourism Police building, locus 4 (40x50 cm channel of electric cable), locus 5 (25-60 cm) of compacted sandy soil, locus 6 (5-10 cm) of concrete under the foundation of the Tourism Police building, locus 7 (55-60 cm) of compacted sandy soil like the one above it.

Test Trench 5 (TT5) (Fig 9 and Pics 29,30,31,32,33)

2 loci had been identified:
Locus 1 (40-45 cm) of red agricultural soil, and locus 2 (60 cm) of compacted sandy soil with extremely hard surface. The trench lacks any cultural material.

5. Conclusions and Recommendations

The proposed area lacks any kind of cultural material that might indicate any human activities in the ancient periods. The only exception is that small segment of what could be interpreted as a corner of a water channel. The area demonstrated a homogeneous compacted sandy layer that covered the whole proposed museum area and had been revealed virtually in all the excavated test trenches.

It can be said with a big margin of certainty that the heritage impact will be minimal. Nevertheless it is recommended to keep a close eye on the area during the actual construction of the museum.

Fig 1 Site location	Fig 2 Distribution of test trenches

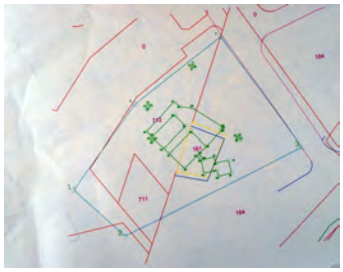
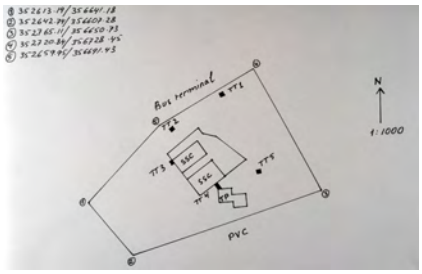

	

Fig 3 Coordinates of the test trenches	Fig 4 Test trench 1 plan and section

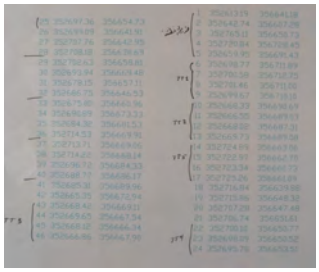
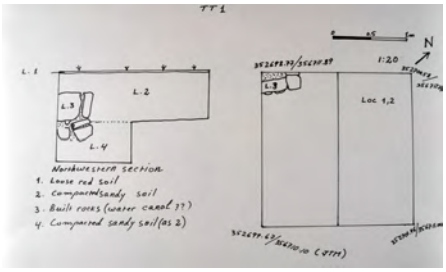

	

Fig 5 Test trench 2 plan and section	Fig 6 Test trench 3 plan and section

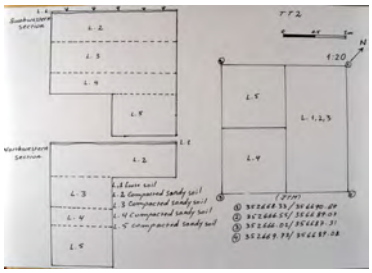
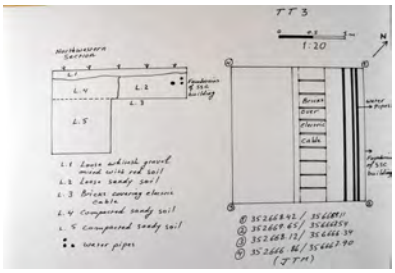

	

Fig 7 Test trench 4 plan	Fig 8 Test trench 4 section

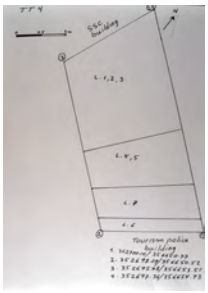
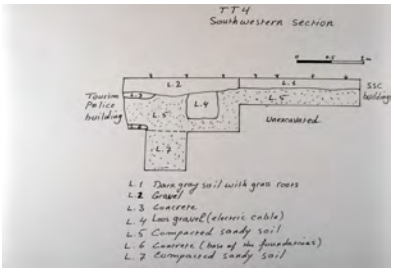
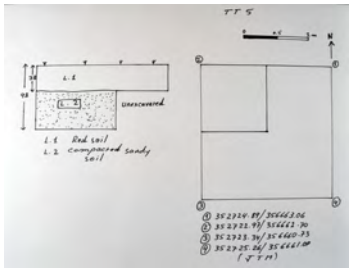
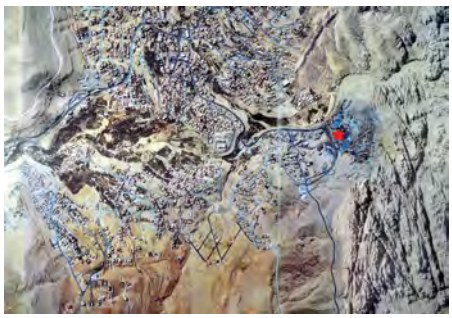
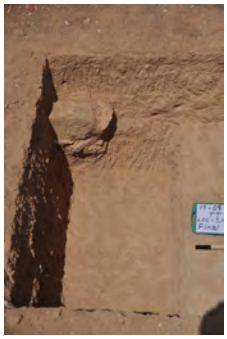
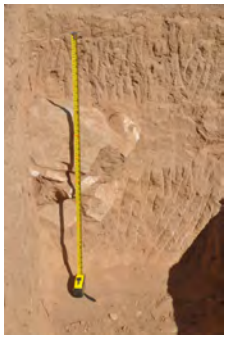

	

Fig 9 Test trench 5 plan and section	
	

Pic 1 Wadi Musa and project site location	Pic 2 Project site location (SSC houses and tourism police building
	
Pic 3 Project site location looking west. Red agricutural soil covering the surface	Pic 4 Project site location looking west. Red agricutural soil covering the surface
	
Pic 5 The area in front of the SSC buildings	Pic 6 Project site location. In the background Zurabah water reservoir and PAP building
	
Pic 7 Zurabah water reservoir	Pic 8 Water systern/tomb at Zurabah
	
Pic 9 Water channel across the paved road from Zurabah water reservoir	Pic 10 Medieval pottery sherds collected from the surface of the site
	

Pic 11 Test trench 1. General view looking northwest	Pic 12 Test trench 1. General view looking southwest
	
Pic 13 Test trench 1. Locus 1,2,3	Pic 14 Test trench 1. Locus 2
	
Pic 15 Test trench 1. Locus 2. Details	Pic 16 Test trench 2. General view looking northwest
	
Pic 17 Test trench 2. Locus 5	Pic 18 Test trench 2. Deatails
	
Pic 19 Test trench 2. Details	Pic 20 Test trench 1. Locus 1 and 2
	

Pic 21 Test trench 2. Locus 5	Pic 22 Test trench 4 before the excavations. Looking northeast
	
Pic 23 Test trench 4. General view	Pic 24 Test trench 4
	
Pic 25 Test trench 3. Details	Pic 26 Test trench 3. General view
	
Pic 27 Test trench 3. Electric cable trench	Pic 28 Test trench 3
	
Pic 29 Test trench 5. Looking east	Pic 30 Test trench 5. Looking east. General view
	

Pic 31 Test trench 5. Details	Pic 32 Test trench 5. Details
	
Pic 33 Test trench 5. Locus 2	Pic 34 Test trench 4. General view
	
Pic 35 Water channel across the paved road from Zurabah water reservoir	Pic 36 Backfilling TT 2
	
Pic 37 Backfilling TT 5	Pic 38 Backfilling TT 4
	
Pic 39 Site location in relation to Zurrabah water reservoir	Pic 40 Al-Khan (caravansarai). Tower tomb 4
	

Pic 41	Rock cut tomb	Pic 42	Rock cut tomb. Details
			
Pic 43	Rock cut tomb. Details	Pic 44	Collected on the surface pottery sherds
			
Pic 45	Tower tomb	Pic 46	Zurrabah pottery kilns
			
Pic 47	Zurrabah potteryworkshops	Pic 48	Al-Khan (caravansarai). Tower tomb 4
			
Pic 49	Zurrabah pottery kilns	Pic 50	Pottery production waste
			

Pic 51 Pottery production waste	Pic 52 Water channel
	
Pic 53 Zurrabah water reservoir	Pic 54 Project's site location. General view
	

Appendix 8: Traffic Management Plan

8.1 General

Non-smooth traffic flow at morning arrival and afternoon dismissal times has been an increasing issue particularly at two locations in the vicinity of Petra Archaeological Park (PAP), namely around the corner of Mövenpick Hotel and at the junction in Wadi Musa, from which one way section begins.

It is pointed out by UNESCO that the establishment of the Petra Museum (PM), to be located at the opposite side of Mövenpick Hotel, may even worsen the traffic flow (including pedestrian environment) and generate additional air pollution.

Therefore, the Project must ensure that its adverse effects to traffic are clearly understood, properly mitigated, and effectively managed through an introduction of traffic management schemes.

8.2 Existing Traffic Issues

Existing traffic issues in the vicinity of PAP include:

- Some locals park their vehicles (taxis, delivery vehicles, and family cars) in the main road causing congestion problems (illegal parking).
- Designated taxi bays are not provided, allowing taxi drivers to park anytime, anywhere without any regulatory control.
- Alternative routes to the designated public parking are underused and resultantly traffic is concentrated on the main road due to low awareness and relatively steep gradients.
- Some sections of roads are unreasonably narrowed due to encroachment of the establishments along such roads.
- The existing parking lots are not marked or divided by medians to arrange the cars/buses parking spaces, or the circulation in and out the parking lot.
- Some sidewalks aren’t properly designed to provide good pedestrian environment.

These issues can be addressed through enhanced traffic management schemes and small adjustments of facilities without causing major investments on physical infrastructure.

8.3 Traffic Survey

In the course of this study, a traffic flow survey was carried out at four locations in the vicinity of PAP with the aim to:

- Understand the present traffic volume at the road around the Mövenpick Hotel and present parking demand on the tourist bus parking lot,
- Estimate future traffic volume, pedestrian passage and parking space requirements after the full commissioning of PM,
- Assess if the current capacity of the concerned sections of roads/pedestrian and the existing parking lots can meet the future traffic demand after the commissioning of PM,
- Estimate the future exhaust gas emission (e.g. NOX, CO, SOX, SPM and CO_2) and assess if the projected emission is within the permissive level.

For this purpose, the Classified Vehicle Count Survey and the Parking Survey were performed in a total of 4 days (3rd, 4th, 5th and 6th October 2013) from 6am to 8pm. The subsequent reports by JICA Survey Team shall incorporate the assessment of the collected data, future traffic volume in comparison with the existing capacity, and future exhaust gas emission in comparison with the permissive level.

8.4 Traffic Management Plan

The data obtained from the Traffic Flow Survey will be used to prepare a Traffic Management Plan around the parking lot, the PM and the visitor centre, as well as recommending, as appropriate, necessary additional infrastructure development in the area.

The Traffic Management Plan shall help address the above-mentioned traffic issues and have a positive impact on traffic congestion at arrival and dismissal times. These changes shall be made with the cooperation of the Tourist Police, and PDTRA herein agrees to provide police support as the entity to implement the Traffic Management Plan.

Obviously, the most important factor in the success of this Plan will be the cooperation of locals, hotels, restaurants, business establishments, and others who drop off and pick

up tourists. Therefore, PDTRA will play as the focal entity to make the Plan functional.

The measures to be taken will include, but not limited to, the following:

- The roads around the Mövenpick Hotel may be changed to one way going north till the start of the divided road in order to decrease the congestion near the median dividing the touristic main road and the secondary road heading north towards the bus stop and the Crown Plaza Hotel.
- Some traffic signage or traffic regulator personnel, whichever appropriate, will be provided at the intersections to promote the use of alternative roads to reach the public parking lot.
- Designated taxi bays will be provided, as appropriate, with an effective enforcement by the traffic police.
- The on-road parking will be restricted within a few hundreds meters near the PAP entrance and/or specific peak hours of a day, perhaps with imposing fines to the violators.
- The open space above the bus parking will be used as extra parking lots. Other sites for additional parking lots, as necessary, will be identified to meet the future demand.
- The access to the main road near PAP entrance may be restricted to the guests and workers of Guest House Hotel.

Appendix 9. List of Collected Data

Information Provider	Date (2013)	Title	
PDTRA (Tahani Al-Salhi)	9.16	List of Basel Exhibition	Exhibition
	9.19	Visitor Centre Project Phase I and Phase II CAD data	Construction
	9.29	List of Existing Equipment (Part of Equipment provided by GTZ)	Facilities
	10.2	Amount of Rainfall in Wadi Musa	Environmental Impact Assessment Natural Conditions
	10.3	ESIA Study and Engineering Works for the Petra Archaeological Park Back Road	
		Strategic Master Plan (Annex and Maps)	
	10.6	PAP Buffer Zone Plan -Phase1-Assessment Report	
PDTRA (Yahya Hasanat)	9.26	Wadi Musa Tourist Zone - Urban Design and Landscaping Preparatory works Phase Report - July 2013	Traffic Constructions
PDTRA (Environment Director/ Majed)	10.4	Natural Resources and Environment	Environmental Impact Assessment Natural Conditions
		Air quality / Water quality etc.	
Jordan Standard Organization	10.8	JS 1052-1998, JS 1053-1998 (Motor Vehicle- emissions)	Environmental Impact Assessment Natural Conditions
PDTRA	10.13	Monthly Visitors to PAP (2008, 2010, 2011)	Traffic
		Daily Visitors to PAP (2011)	
Consolidated Consultants	9.24	Traffic Flow Survey Sheets used by CC	Traffic
Ministry of Public Works & Housing, Government Tender Department. (Eng. Moh'd Khaled Al-Hazaimeh)	9.29	Yearbook 2012 (Construction Works Unit Costs List in 2012)	Construction Unit Costs
ACES (Geographic Survey Company)	10.2	Jordan Engineering Association/ Regulation List of Site Area and Drilling Number	Geographical Survey
Habash-Deir Contracting Co. （Eng. Mechael Deir）	10.7	Internal Cost Data and List of Unit Cost Change (in Arabic)	Construction Unit Costs

Information Provider	Date (2013)	Title	
Cheif of traffic police in Wadi Musa	10.8	Number of Traffic Accident Casualties in Wadi Musa (2011, 2012)	Traffic
		Number of Casualties in Wadi Musa (2011, 2012)	
		Number of Cars related with Traffic Accidents occured in Wadi Musa (2011, 2012)	
Tourism police at PAP	10.9	Number of Registered Cars in Jordan (as of 8/Oct/2013)	Traffic

Appendix 10. Equipment Plan

Equipment Name	Main Specifications	Q'ty	Usage
Projector for Spherical Screen	Projector for ceiling Type: Laser light source projector Brightness: 3000 lm or more Resolution: WUXGA(1920x1200 dpi) HDMI connector: Equipped Frame synchronizer Usage: quartering play of image Projector for floor projection Type: Laser light source projector Brightness: 3000 lm or more Resolution: WUXGA(1920x1200dpi) HDMI connector: Equipped Projector mirror mount: Equipped Lens supporter: Equipped Fish-eye conversion lens Usage: Alleviation of projection to spherical screen Digital signage player Type: To be able to do digital signage playing with above projector SD card Capacity: 32GB HDMI distributor Type: To be able to do digital signage playing with above projector	1 set	For projection inside the museum
Touch Panel	Touch Panel Screen size: 32 inch or more(in case of longitudinally-halved using 1 panel), or 21 inch or more(in case putting in 2panels one above the other) Aspect rate: 16:9 Resolution: 1920x1060dpi or more Mount bracket: Equipped Digital signage player Type: To be able to do digital signage schedule playing on above panel SD card Capacity: 32GB Switching hub Port: 16ports or more	1 set	For explanation of exhibition contents
Acting Lighting Set	Type: Laser light source projector Brightness: 3000 lm or more Resolution: WUXGA(1920x1200 dpi) HDMI connector: Equipped Mount bracket: Equipped Digital signage player Type: To be able to do digital signage schedule playing with above projector	1 set	For acting lighting inside a museum
Equipment Set for Control Room	Digital signage player Usage: For playing check of audio and soft contents Playing check software function: To be able to check the playing of all signage players Default setting software for player	1 set	For control of soft contents in the control room

Equipment Name	Main Specifications	Q'ty	Usage
	Function: To be able to do default setting of all signage player SD card Capacity: 32GB Touch panel Screen size: 18 inch or more Mount bracket: Equipped Usage: For checking the playing soft contents Multi-media speaker Max. output: approx. 6W Rated impedance: approx. 4ohm Frequency range: 100 - 20,000Hz LCD monitor Screen size: 21 inch or more Usage: For playing control		
Electric Reach Forklift	Rated capacity: 2000kg or more Type: Electric reach forklift Reach: 2,700mm or higher Max. gredeability: 10% or more(loaded 3min.) Battery voltage: 48V or more Battery capacity: 320Ah/5 hours or more Recharger: Equipped	1 unit	For transporting the museum collections