

IMTO – Italian Mission to Oman

University of Pisa

SUMHURAM

Preliminary Report

April – May 2012



**RESTORATION WORKS AT SUMHURAM
(ARCHAEOLOGICAL PARK OF KHOR RORI)
(Sultanate of Oman)
CAMPAIGN APRIL-MAY 2012**

IMTO

Diary of activities

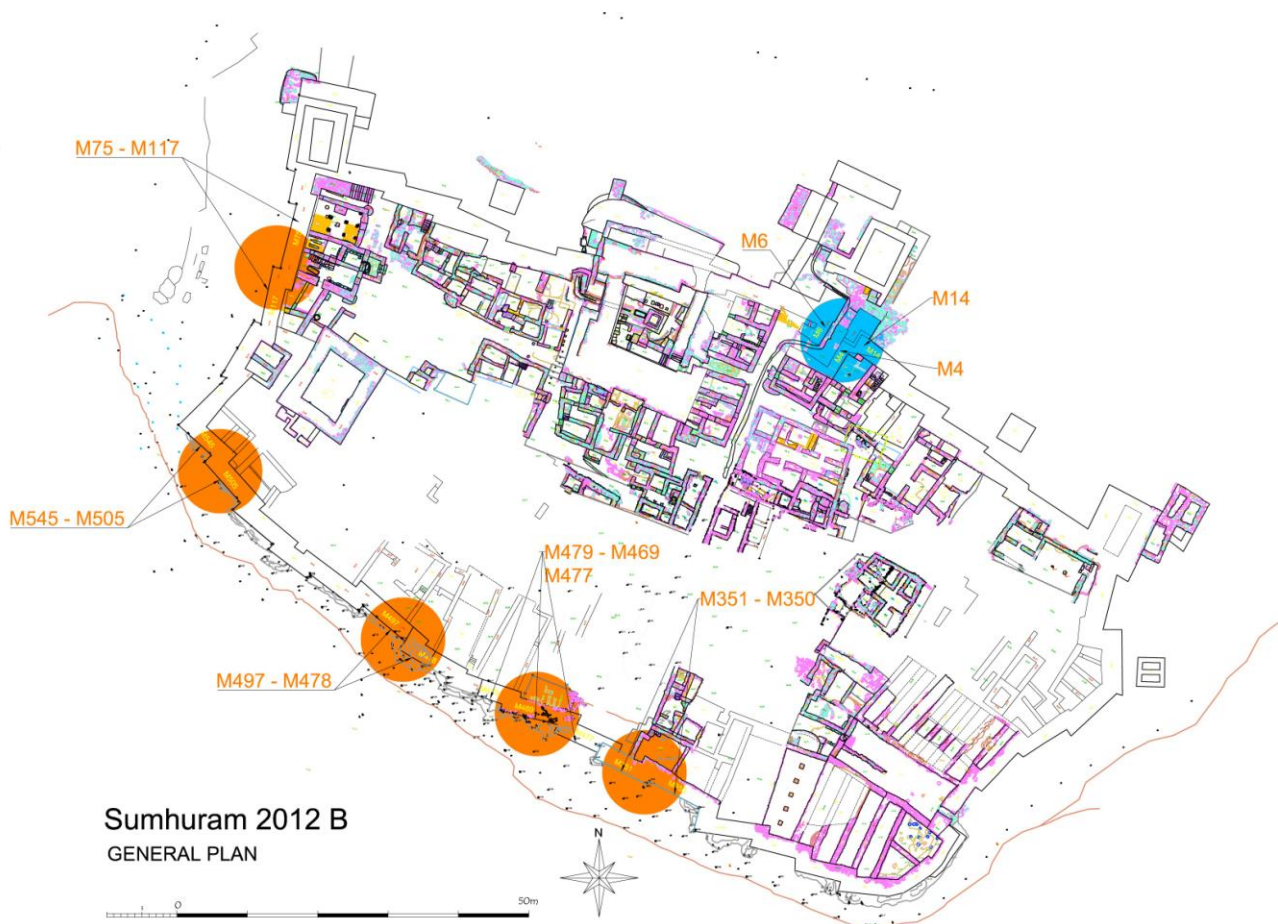
14th April - 17th May

(Arch. Valter Filatondi, Surveyor Marco Monti)

Introduction

This campaign started on Saturday 14th April 2012 and will finish on Friday 18th May 2012. We had already all the needed information regarding the locations we had to restore in Khor Rori. In order to simplify the sequence of the operations and to identify the position of each activity, every area of restoration has been named with an abbreviation (i.e. M4 means the wall number 4), as reported below.

The different locations are as follows:



1. M75 – M117 city wall - rising up the city wall - western side
2. M545 – M505 city wall – south-western side
3. M350 and M351 city wall – south eastern side
4. M497 – M478 city wall – integration of missing masonry
5. M479 – M469 – M477 city wall – integration of missing masonry
6. M4 – M6 – M14 rising up the monumental gate and postern gate (planning)
(marked on picture with blue colour)

Five teams of workers, each of about twelve members, have been engaged for all the needed operations to complete the restoration of the above mentioned walls and areas. One more team of ten people was engaged to prepare the sieved sand and the mortar used by the other teams.

The first day on site we noted a condensation among several parts of the original walls. We took some pictures to show the phenomenon:



We tried to understand this phenomenon never seen during the previous campaign and at last we assumed the following:

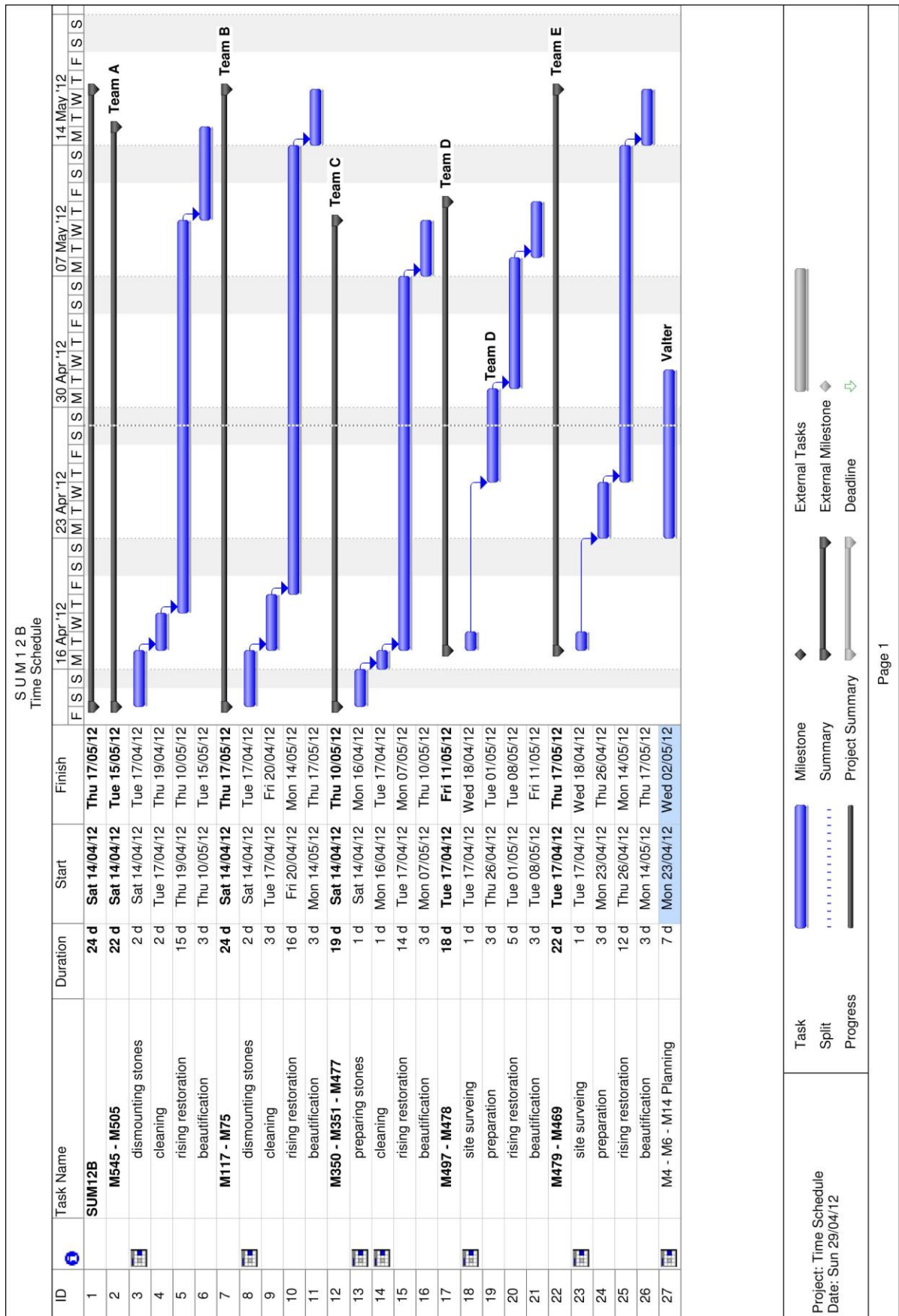
- a) The condensation is due to the delta between the inside and outside temperature and to the humidity of the incoming raining season;
- b) The detachment of the ground from the external surface of the ground among the stones is due to the sun that dries the external film of ground and to the wind that dusts the ground in deep between the stones.

This fact day after day will leave a gap between the stones and will determine the collapse of the wall itself.

Our suggestion is to clean the gap between the stones and to put some mortar in deep between the stones in order to avoid the detachment of the superficial ground. This solution don't avoid the internal condensation but can block the erosion of the inner filling of the walls.

To better control the advancing of the works and the use of the resources on site, a simple time schedule has been prepared at the beginning of the campaign to help us in checking the timing during the sequences of the job.

Time Schedule at the beginning



Working progress status

In order to check the advancement of the works, we daily took a significant number of pictures of all the areas in which we had to make the restoration.

The number of the pictures and the position from which they are taken from, are hereby reported in order to have a weekly update about the working progress status. From every reference point, two or three pictures have been taken, depending on the significance of the point of view.

The procedure of the reconstruction of the walls

The reconstruction of the walls has been done as follows:

- a) in a first phase, the dismounting of the collapsed or braked stones has been done by hands removing the inner filling by the means of pick and shovel;
- b) the second phase has been the reconstruction of the walls, row by row, replacing the stones at the external faces of the wall and providing the inner filling as soon as any row became finished. Of course before starting a new wall, a layer of geotextile was previously positioned keeping at least 10 centimetres outside of the wall face to easily recognise the beginning of the restoration.

For the mortar we follow the same criteria used during our previous campaign.

Sand and lime were always four buckets of sand mixed with eight scoops (600grams/each) of lime.

Therefore the final composition for 10 kg. of mortar was the following:

- Sand 9182 grams
- Lime 765 grams
- Yellow colour 40 grams
- Brown colour 13 grams

To fix the stones each other, we used two different kinds of mortar as it has been done before:

- **stone mortar**, for the external stones, obtained by the mix of sieved sand, hydrated lime, brown and yellow oxides for the chromatic tone.
- **filling mortar**, used for the back filling of the structure, made with the same components, except the use of raw sand instead of sieved sand.

As we said in the final report of the previous campaign SUM12A, we still have a different opinion about the use of the stone mortar. We think that the use of raw sand to fix the stones each other is better as a binder, for the presence of inert in the mix. However, we followed the received instructions.

Rising up of the walls M75 – M117

The situation of the existing walls M75 – M117 were as you can see in the picture below, took on 14th April 2012.



Sequence of photos on the walls M75 – M117 – up to 20th April 2012



Sequence of photos on the walls M75 – M117 – up to 27th April 2012



After the cleaning of the above wall that faces to the temple, we decided to stop the works due to the fact that we have been asked to concentrate our efforts in finishing all the works at the southern side of the city walls because they want to construct the new paved path before the raining season. Therefore we moved the team to the wall M479 – M469 and M477. We will restart the works on these two walls, after the finishing of the above mentioned integration of missing walls.

Sequence of photos on the walls M75 – M117 – up to 11th May 2012



*Restoration works at the Archaeological Park of Khor Rori (Sultanate of Oman)
Campaign SUM12B - Diary of activities (14th April – 17th May)*



Sequence of photos on the walls M75 – M117 – up to 16th May 2012



This walls have been finished on 16th May 2012

Restoration of the walls M545 – M505

The situation of the existing walls M545 – M505 were as you can see in the picture below, took on 15th April 2012. After the dismounting of the modern staircase, happened during last campaign SUM12A, the state of preservation was as shown below.



Sequence of photos on the walls M545 – M505 – up to 20th April 2012



Sequence of photos on the walls M545 – M505 – up to 27th April 2012



These two city walls have been finished on 03rd May 2012.

Rising up of the walls M350 – M351 – M477

The situation of the existing walls were as you can see in the following picture below, took on 15th April 2012.



Sequence of photos on the walls M350 – M351 – M477 – up to 27th April 2012

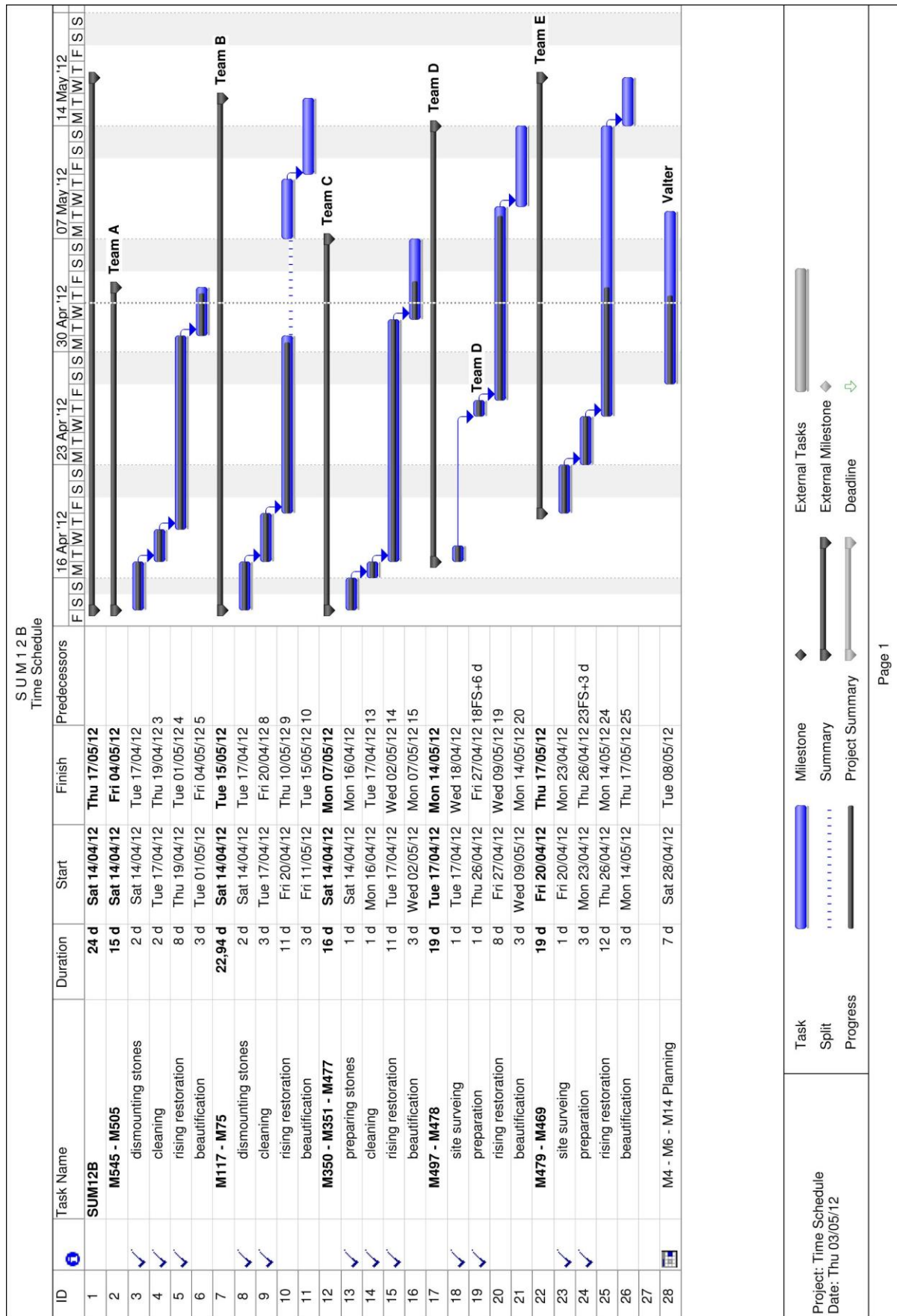


Sequence of photos on the walls M350 – M351 – M477 – up to 04th May 2012

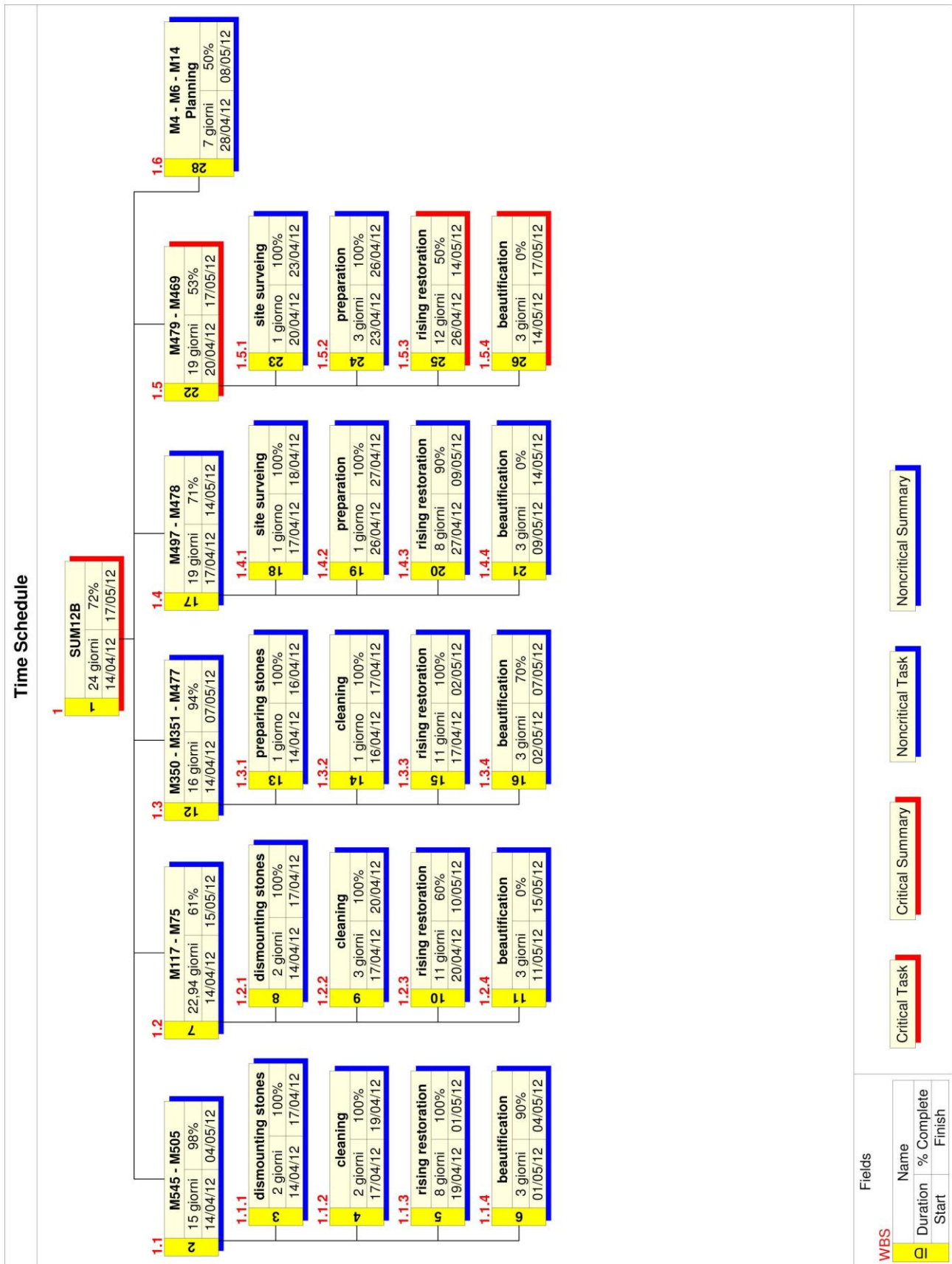


The M350 – M351 and integration of M477 have been finished on 08th May 2012.

Time Schedule on 04th May 2012



Works Breakdown Structure on 04th May 2012



Integration of missing masonry of the walls M497 – M478

The situation of the existing walls were as you can see in the following picture below, took on 15th April 2012.



Sequence of photos on the walls M497 – M478 – up to 27th April 2012



Sequence of photos on the walls M497 – M478 – up to 04th May 2012



These city walls have been finished on 08th May 2012.

Integration of missing masonry of the walls M479 – M469

The situation of the existing walls were as you can see in the following picture below, took on 15th April 2012.



Sequence of photos on the walls M479 – M469 – up to 27th April 2012



Sequence of photos on the walls M479 – M469 – up to 04th May 2012



Sequence of photos on the walls M479 – M469 – up to 11th May 2012



Sequence of photos on the walls M479 – M469 – up to 17th May 2012



This walls have been finished on 17th May 2012

Rising up of the city wall M206

On the 14th May 2012, after the completion of the required works, we took a picture from the other side of the lagoon at the southern side of the city.

As you can see on the picture below, the right side of the city walls appear too horizontal:



Therefore we decided to rise up the wall M206 located in the middle part of that right side. We started the works keeping in mind that we had to finish before leaving on 18th May 2012. So only 3 days left, but enough to rise the wall with two rows of stones as shown on the pictures below.

photo on the walls M206 – up to 14th May 2012



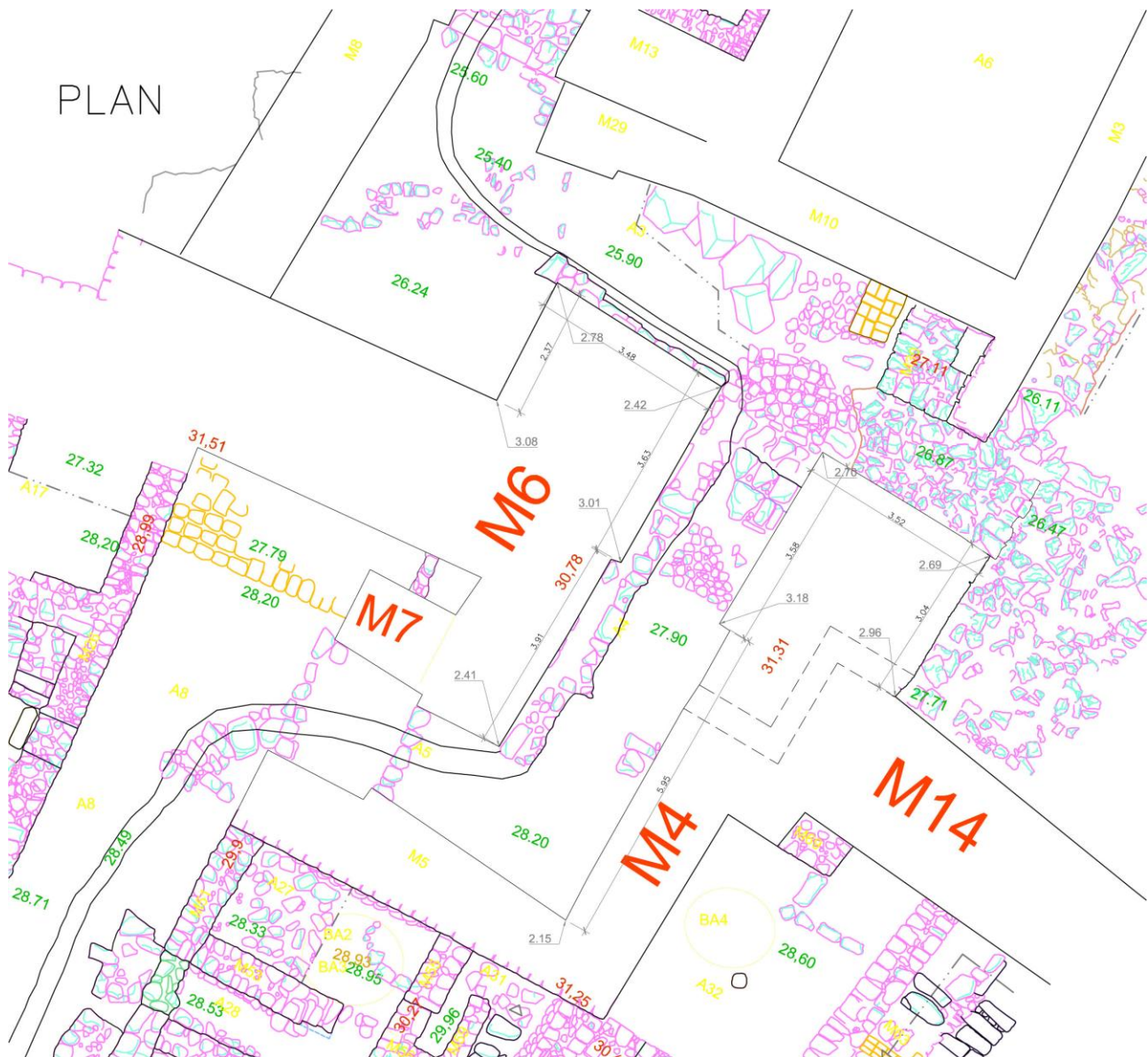
Sequence of photos on the walls M206 – up to 17th May 2012



This work has been finished on 17th May 2012.

Rising up the monumental gate and postern gate

Feasibility Study



The above picture is a plan of the situation of the area we are going to study for its monumental improvement. We took a site survey on all the involved walls indicated as M4 – M6 - M14. More in detail, the wall M6 represent the right side of the main entry. For this wall the requirement was the increasing of its high to give the wall the proper monumentality for the entrance of the city.

As you can see on the pictures below, the original portion of the wall, the lower part of the wall, is in bad state due to the erosion of the inner filling caused by the sun and the wind actions, as the other part of the walls we were talked about at

the beginning of this report. Due to this fact, some of the big stones, close to the corner, are broken but still in place.

Considering the reconstruction of this wall, it means that we need of an auto crane having 20 meter in wing and 1 ton at the end of the wing standing for all the time in front of the main entry. We need this auto crane for dismounting and replacing all the stones. The other problem is the dimension of the stones that we have to replace. These stones must have the same big dimension as those broken to replace. Therefore we suggest to keep the wall as it is, consolidating the lower part of the original stones by the means of mortar injection. We suggest to do the same for the wall M4, at the corner below the stone with the epigraph, and for the wall M14 on both sides of the entrance of the postern gate. You can have more details of what we are talking if you look on the below plan:



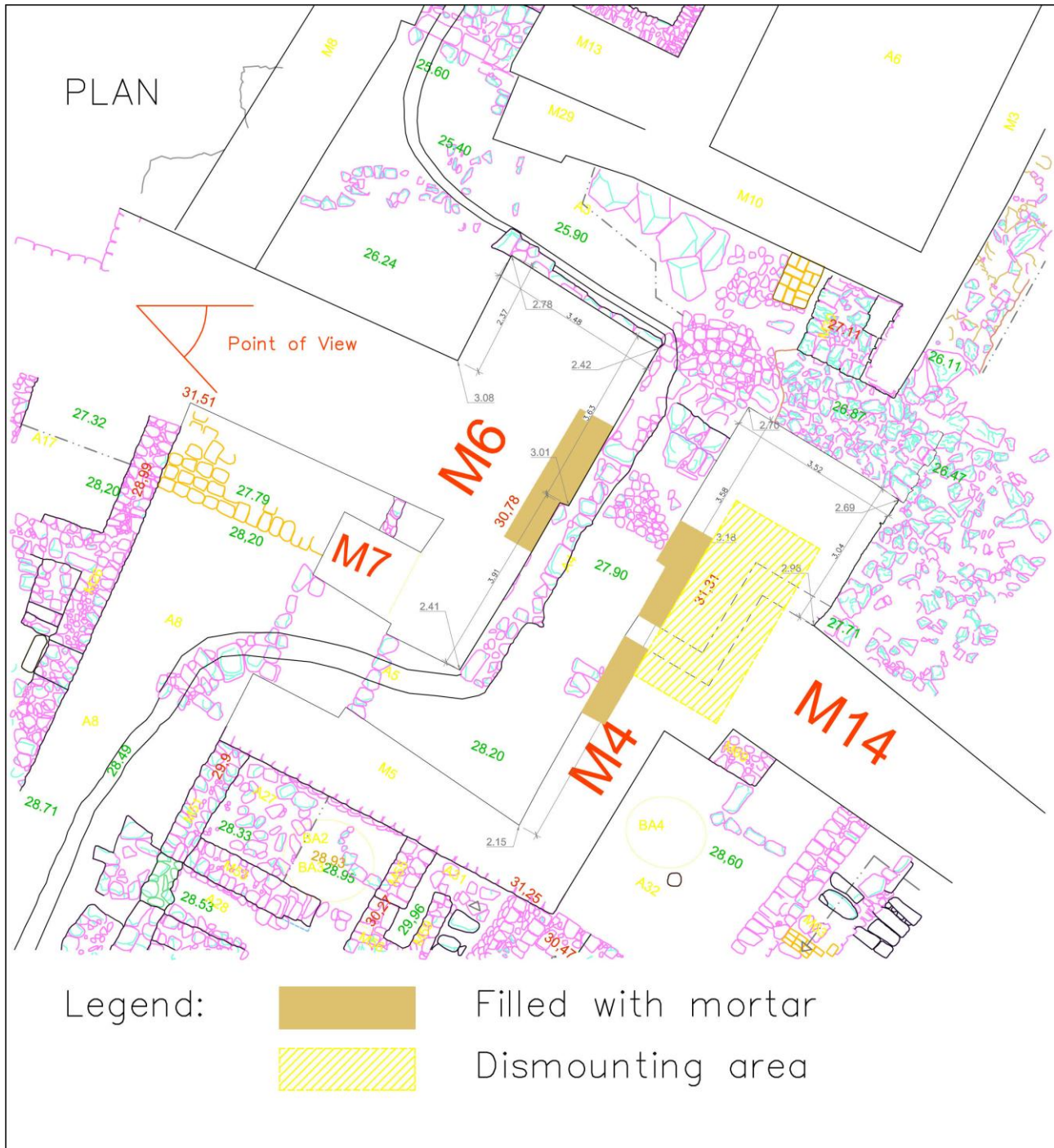
M4

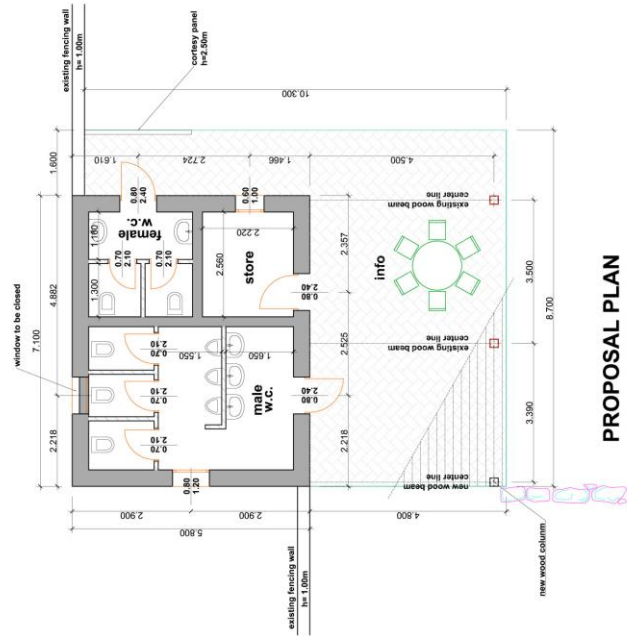


M6

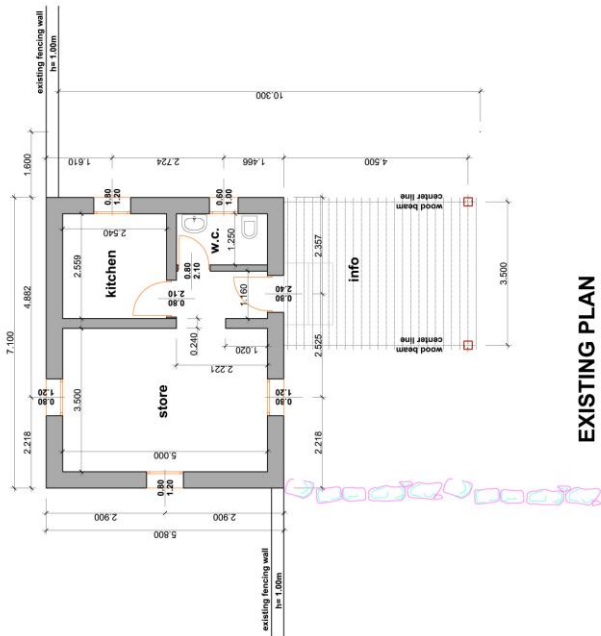


*Restoration works at the Archaeological Park of Khor Rori (Sultanate of Oman)
Campaign SUM12B - Diary of activities (14th April – 17th May)*



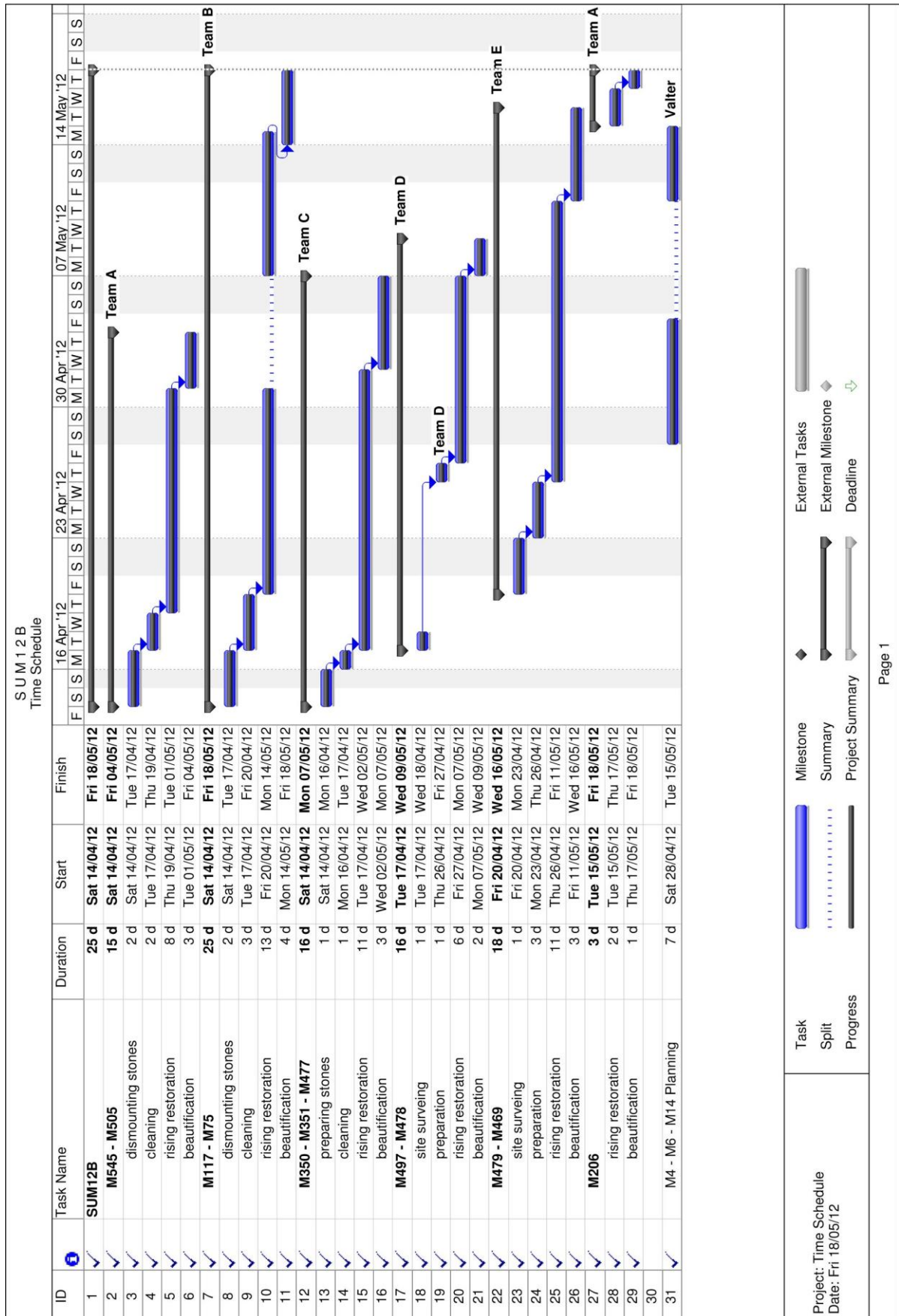


EXISTING VIEW

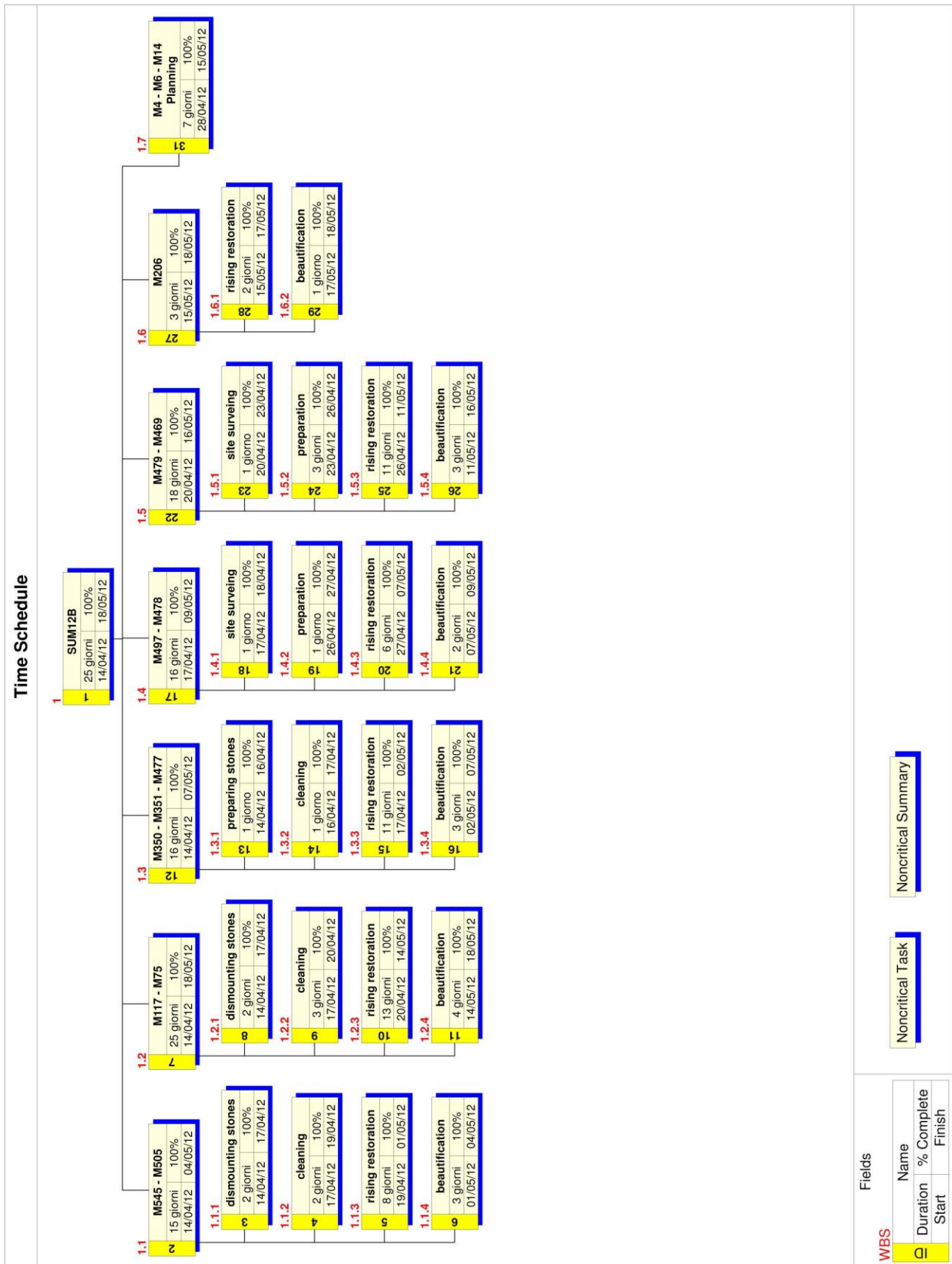


Restoration works at the Archaeological Park of Khor Rori (Sultanate of Oman)
Campaign SUM12B - Diary of activities (14th April – 17th May)

Time Schedule on 18th May 2012



Works Breakdown Structure on 18th May 2012



**RESTORATION WORKS AT SUMHURAM
(ARCHAEOLOGICAL PARK OF KHOR RORI)
(Sultanate of Oman)
CAMPAIGN APRIL-MAY 2012**

IMTO

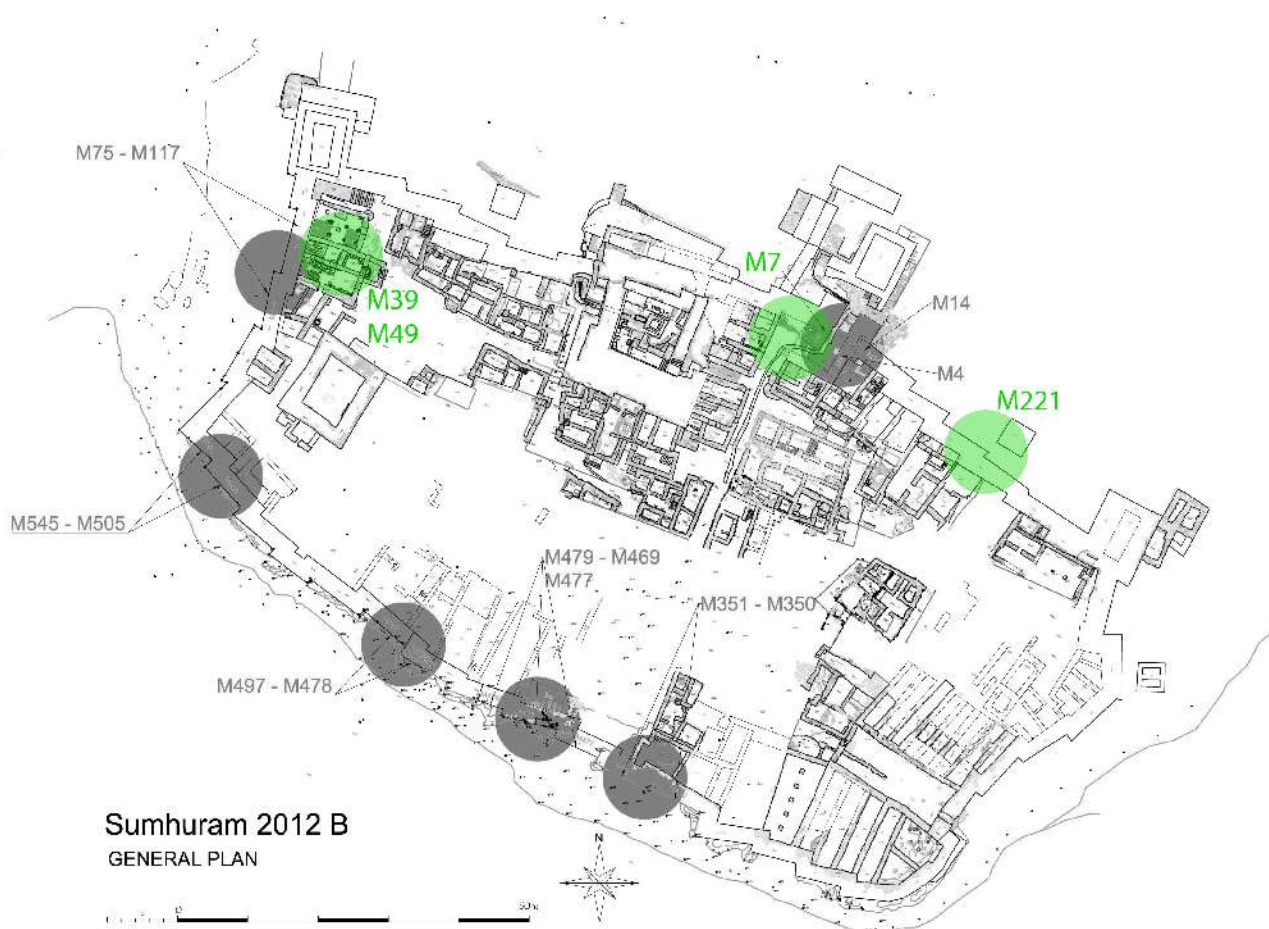
Diary of activities

5th May - 17th May

(Arch. Stefano Bizzarri)

Introduction

During the SUM12B I worked in collaboration with the Italian Mission To Oman in Sumhura site (Khor Rori). From 5th to 17th of May I have mostly worked for the preservation, restoration and rebuilding of M7, M39 and M49 walls. Moreover, I have fixed the collapse of the corner on the left side of M221 wall. The work is shown in the general plan as follow (green colour).



M7

The restoration of M7 wall started the 5th of May with the check of the stones and the fractures. As usual I tried to keep in place more stones I can, in order to preserve the original shape and materials. The side of the wall close to the main entrance needed to be dismantled and reinforced. The removed stones were stored close to the area. To make the wall stable it was necessary to rebuild it on the existing solid lower row which is built on the original level and covered with geotex. The other side of the wall was in better state of preservation: only few stones needed to be replaced. The criteria for the composition of the mortar was the same of the last SUM12A campaign.

The 9th of May the wall M7 was completed.













M221

The corner on the left side on M221 wall, at the junction with M223, was in a poor state of preservation and the lower part was collapsed. I needed to remove the stones from that side up to the foundation, spreading then a layer of geotex following from the rebuild of a new part of wall using same stones from the collapsed area kept in place by mortar. At the beginning of the second week the part of the corner was entirely rebuilt.









M39/M49

These walls belong to the Monumental Building area and needed to be preserved and reinforced putting in place two or three rows of new stones with mortar on a new geotex layer. I didn't find any problems with this couple of walls and in few days they are completely rebuilt and covered with a little quantity of mortar and finished with dry-stones.

M39 and M49 walls were restored and partially rebuilt at the end of the second week.







