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## Study of reformation and re-establishment of vegetation during alternative management of quarries in the municipality of eastern Mani

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### ABSTRACT

The present paper studies a) the restoration of the landscape in a quarry site and b) the establishment of vegetation and its incorporation into the natural landscape without affecting the aesthetics of the area. The aim of this study was the re-establishment of the landscape which is overloaded as a result of quarry activities and construction of streets for heavy equipment. The study focuses on the organisation and reformation of countryside for the accommodation of several events.

### 1. INTRODUCTION

The installation and operation of several industrial units in the natural landscape increases rapidly and causes changes in the landscape and the microclimate due to the operation of equipment that release pollutants which contribute to microclimate changes. The high cost of installation combined with the high cost of land purchase lead the owners to establish the units in areas outside of cities or close to the natural landscape where the costs are lower (Sakellakis, 2006; Eleftheriadis, 2008)

In other countries restoration of the landscape in similar areas is accomplished from the start of the construction phase having as result the immediate absorption of the impacts and the harmonization of the unit with the landscape.

The aim of this study was the re-establishment of the landscape which is overloaded as a result of quarry activities and construction of streets for heavy equipment. The study focuses on the organisation and reformation of countryside for the accommodation of several events.

### 2. METHODS AND MATERIALS

The case study area is a private area located in Loukadika of Messinia, Greece, which belongs to the municipality of Eastern Mani. It is an isolated partly rocky area of 16.186,88 m<sup>2</sup> (4 acres) where no other activities are carried out except breeding of livestock.

The area is characterized by:

1. sloping terrain
2. particular forestry value (*Quercus pubescens*, *Olea europaea*.)

#### 2.1 Research and Study Methodology

In order to shape the environment in such an area proper investigation and successful design are required. Proper design improves substantially the quality of life. The science that contributes to development, enhancement, conservation and restoration completing thus composition and configuration of the landscape is Landscape Architecture. The landscape architect as a leader in science is the person who through his successful design offers qualitative use of the landscape in harmony with human needs and activities (Arbogast et al., 2000; Rokos, 2001; Dimitriou and Georgi, 2008).

The research methodology is based on the principles of landscape architecture and aims to achieve the following:

1. Search similar cases in Greece and abroad
2. Analyze the area of interest
3. Design the proposal

## 2.2 Similar Cases - Examples

Our search on similar cases in Greece and abroad was not successful and gave no results. For this reason the study group investigated similar areas, in terms of conditions and characteristics.

The examples given below are mainly from quarries which have similar restoration needs as the study area examined in this work.

### *Darlton Quarry*

In this case the restoration is classified in the "Optical Hide (Rehabilitation) Option", Fig.1.

There are cases where the extraction of raw materials requires the development and operation of large fronts for long periods. In these cases the boundaries of the mining/quarry sites are particularly noteworthy and the establishment of vegetation should be combined with the modification of soil characteristics (landform transformation).

The vegetation that is going to be used must be compatible with the character of the area and the existing vegetation in the quarry. The time period for the establishment of plantations is very important so that the visual coverage is achieved at the right time.

In Darlton quarry several uneven slopes in terms of height were created. The slopes were developed in such a way as to act as a link with the boundaries of the quarry. The elements of the area outside the quarry were extended to the inner part of the restoration area to enable better interaction. The type, colour and layout of the area play a very important role especially when the site is visible from long distances.



Figure 1: Darlton Quarry.

### *Restoration in Butchart Gardens in British Columbia in Canada*

Mining areas and quarries have a long tradition of after use as botanical gardens. One such case is the mining area in the Butchart Gardens in British Columbia in Canada.

In 1904 began the restoration of the abandoned limestone quarry with a total area of 500 acres as presented in Figs 2a and b.

The botanical garden opened in 1940 and receives annually over one million visitors. This is one of many similar examples. A more recent example is the approval given by the Memorial University of Newfoundland in Canada to establish a botanical garden in an abandoned quarry.

The role of the Landscape Architect is very important for the rehabilitation of such areas. The involvement of a landscape architect from the early stages of the work is very important as the study and understanding of the actual land-



Figure 2a and b: The Butchart Gardens in British Columbia in Canada.

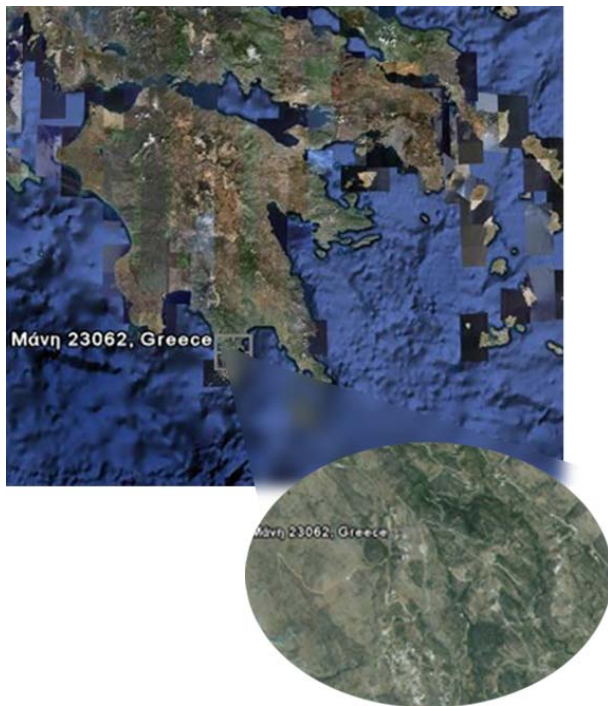


Figure 3: Aerial Photograph of the wider area of Mani and Loukadika.

scape becomes apparent from the first stage where information on the design and planning of site restoration should be obtained. The information obtained needs to be summarized in the following categories:

- Ecology and Development
- Research and Technology
- Culture
- Nature
- Science and
- Art

In the natural environment beyond the ecological consciousness and awareness, the materials as well as the ways used for constructions are also considered important. Materials with light colours friendly to the environment have to



Figure 4: The existing situation of the area.

be used so that they will not increase the temperature in the area by absorbing solar radiation. Another issue that has to be considered by the Landscape Architect is the technology that exists concerning the study area. The cultural and natural characteristics should be combined and mixed with the scientific knowledge to achieve a successful result.

Another issue that designers should consider is the safety measures required for proper planning. The safety standards during construction and proper use should be inspected by a specialist in order to achieve an effective use of the restored area.

### 3. ANALYSIS OF THE STUDY AREA

The study area (Fig. 3) of approximately 16186.88 m<sup>2</sup> is located at a distance of approximately 1 km from the settlement of Loukadika, in Messinia, Greece; since it is isolated and inclined it is ideal for the installation of such a unit. The provincial road which connects the settlement with the area crosses its upper part. The vegetation in the surrounding area is of particular value and forestry for the proposed configuration (Fig. 4); the aim is to link the unit with the larger area of the region which is visible from the road without affecting the Mediterranean landscape which is typical in the region.

The interventions made by the study group aimed at preserving the naturalness of the landscape while seeking to make the space as much safe as possible and functional for users. Also, through vegetation, designed to enable continuity and connection to the wider landscape, to establish an air filter for microparticles released during processing of plant material and thus improve the microclimate of the restored area. Generally, the regeneration of this area is necessary in order to connect the unit with the natural landscape and transmit through this the environmentally friendly nature that distinguishes this facility.

The surrounding study area is characterized by naturalness and Mediterranean character. Due to the rocky surface, no other activities, except breeding livestock, are carried out around the site. The characteristics of the site make the study of the configuration particular since the aim should be achieved through a physical view connecting the region with the

unit.

The proposed actions should be considered so as to contribute substantially to the dual use of region; emphasis should be placed on the fact that the restored area should be user friendly and provide space that will accommodate various activities.

During the design and in order to implement a complete study for the rehabilitation of the area issues that were taken into consideration included the present and anticipated use of the site as well as processing of the parameters and constraints.

### *3.1 The Proposal*

The proposed design aims through appropriate manipulation of vegetation and the landscape to unify the various operations carried out on the perimeter and the area of study and to achieve the physical integration of this region within the rest of the mountainous - Mediterranean landscape (Gómez-Aparicio et al., 2004).

For the better planning and exploitation of the site, due to the presence of steep slopes, the formation of levels throughout the area was proposed, which according to the purpose that will serve they will have similar dimensions.

The basic idea behind the proposed formulation is to maintain the initial naturalness of the landscape. This can be achieved by maintaining and enhancing the existing vegetation and by creating a large hedge of plants and trees to hide the area and maintain the vulnerability of the aesthetic landscape which is achieved largely by the creation of steps at which trees, mainly broadleaf (deciduous and evergreen), will be planted. This approach apart from the visual improvement will contribute to changing the microclimate of the area, will absorb as filter large percentage of pollutants produced by the activities carried out and will act as natural acoustic screen which will greatly reduce any noise generated by the operations.

In order to achieve this it is important to take into account the needs of plants required for their growth. For this reason, since the soil is rocky it is proposed that 1 m<sup>3</sup>/m<sup>2</sup> of soil is placed at all levels.

The selection of species proposed for the establishment of vegetation was made on the basis of climatic and soil conditions in the region. More specifically selected species are resistant

to drought in arid and rocky soils, low temperatures and strong winds. These species include: *Ostrya vulgaris*, *Quercus pubescens*, *Aria Quercus ilex*, *Punica granatum*, *Olive Olea europaea*, *Juniperus oxycedrus*, *Ceratonia siliqua*.

Finally, for aesthetic reasons and in order to avoid monotony various resistant to drought shrubs and especially lavender, levantine, thyme, oregano and other brushwood were installed (Castro et al., 2002; 2004).

The dominant idea has similar characteristics with the rest of the region. The simple lines and nature form complex designs. The nature of physical space is maintained and is not converted into a human construction in the natural landscape. There were used colours of wood, natural flooring materials and equipment and generally plain and simple intervention will follow the natural character of the area.

The configurations including roads for vehicles, pedestrian zones, green spaces, fences and constructions will be considered so as to contribute substantially to the dual use of the area and to highlight the role of space as environmentally friendly and able to host various activities (Fig. 5).

During the design of the portal, marking of the entrance of the facility was considered an aspect of great importance; therefore the construction of two stone columns with a spacing of 5.5 m was proposed to enable vehicles to cross. Outside the entrance a synthesis of stone and tree was considered.

### *3.2 Additional Constructions*

Next to the office building the construction of a 15 m<sup>2</sup> chalet which will function as a kiosk providing information on the operation of the unit as well as serving as environmental education pavilion is proposed.

At the lowest point of the unit it is proposed that the recovered steep slopes of soil and terrain will form the basis for the construction of an outdoor amphitheatre, using iron and wood, which is expected to host several events and constitute a place for gathering of visitors during summer and when the weather permits. The proposed shape is suggested to be triangular, with the scene at the lowest point. It consists of 9 rows of seats in order to accommodate approximately 90 people (Fig. 6).

The amphitheatre is proposed to be constructed as an elevated small-scale construction, based on a metal skeleton of which only the vertical lines will be placed in the ground. The construction is proposed to have this shape for the following reasons:

- It doesn't require special configuration of the excavation of soil only for the installation of piles that will form the central skeleton of the structure.
- No cement or other materials will be used since it is a lightweight construction which in future can be easily removed if required.
- It is placed in an inclined area and at low level so that rain water can easily drain under the construction without causing any problems.

#### 4. CONCLUSIONS

The design, in terms of functionality of the site is summarized below. A traffic clear network of footpaths will connect the various parts. Alternative forms of operations so that different areas can be used both ways, through individual and organized activities, will be developed includ-



Figure 5: 3D Model of the proposed Configuration in the Unit.



Figure 6: Photograph of the model with the proposed configuration.

ing: Aesthetical organization that reflects the character of the area, Use of vegetation as a main element, Flexibility of the space with the possibility of carrying out social open air activities (exhibitions, performances, rallies), Visual and functional complexity of each area to provide the necessary wealth. Finally, all provisions in the light of the Environmental Planning and Principles of Landscape Architecture to protect and enhance the cultural and natural landscape of the region will be considered.

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