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SCHEDULE II

CARTOGRAPHY STUDY OF THE WORKS PROPOSAL

This section contains the step-by-step description of the methodology used for the design of the dunes, the abrasion craters and the slacks, which have been restored with the Life Enebro works proposal.

ANALYSIS OF THE CARTOGRAPHY

To get to know the current situation of the area of action, as well as the situation prior to the great alterations that occurred at the end of the 1960s, cartographic information was gathered from the Devesa-Albufera Service of Valencia City Council.

The following cartographic material was used in the drafting of this proposal:

- ✓ Vectorial map at a scale of 1:2000, from 2001 and with a contour interval of 0.5m
- ✓ Orthophotographs at a scale of 1:2000 from 2001
- ✓ Vectorial map at a scale of 1:2000, from 1965 and with a contour interval of 1m
- ✓ Orthophotographs at a scale of 1:2000 from 1965
- ✓ Geo-referenced orthophotos realised by Cartogesa for TYPSA (flight February 2003) provided by the El Jucar Hydrographic Confederation (study for the sustainable development of l'Albufera 2004).

Both maps were realised by the company CARTYTOP, using two photogrammetric reconstructions using aerial photogrammes at a scale of 1:5000 for the 2001 map whilst the scale for the 1965 photogrammes was 1:20,000.

The comparison of the maps to detect the changes that have taken place during that period requires a coincidence in the reference system used as well as the altimetric data. The planimetric analysis of the maps was done by superimposing one over the other and comparing the spatial situation of the objects that had remained unaltered during the analysed period. From this analysis it was deduced that the two maps fit and reliably coincide in the representation of the terrain; the existing discrepancies being minor and in neither case is there a systematic difference between the maps that could be due to a difference in the reference system used, but these small discrepancies are within the tolerance limits established for these scales.

The altimetric verification was done locating a series of control points distributed throughout the area of action in those areas, mainly roads, where there was certainty that no significant change had occurred between the two dates. Two digital elevation models were generated, one for each date, in TIN format, of the whole area of action using the available 3D map. Using these models the altitude of each of the control points on the two dates was interpolated. The difference between the two calculated values provides a measurement of the altimetric difference existing between both restitutions. The average difference between the elevations obtained for 2001 and those from 1965 is -33cm, while the typical deviation of the differences is 50cm. Analysing the data, it is noted that the plane of reference in the 2001 map is located some 30cm below that used in the previous map. On the other hand, the value of the typical deviation indicates that there is an important dispersion regarding the average that is not only caused by a discrepancy in the election of the plane of reference, but that there are also accidental errors in the altimetric information.

Analysing the most significant altimetric discrepancies between both maps, the conclusion was reached that the 1965 map had altimetric data of lesser

quality and, therefore, had greater influence in the total altimetric error. This conclusion is supported by the fact that the scale of the photogrammes used to make the 1965 map is 1:20,000. This scale is lower than the value indicated by photogrammetric theory, which indicates that for large scale reconstructions, as is the case (1:2000), the scale of the photogramme must be a maximum of 4 times lower than that of the map to be made. On the other hand, the authors of the map by indication of the Devesa-Albufera Service set a contour interval of 1 metre in the 1965 maps, thus increasing the value of the altimetric tolerance with which the map must comply.

The 2001 map accurately reflects the current status of the area of action and is that used in the drafting of this project. While the 1965 map is an extremely valuable picture of the previous situation and is used as a reference for the definition of the forms that are to be recovered.

GENERATION OF DIGITAL ELEVATION MODELS

Using the two available maps, the corresponding digital elevation models (MDE) are generated in TIN format (triangulated irregular network), which provide altimetric information for the entire area of action. The digital cartographic data that provides the altimetric information needed to generate the model are the contour lines, the marked points, and the existing roads, lanes and highways in the area.

From each of the TIN models a raster digital model was generated, also known as a grid, comprising a mesh of square cells (pixels) measuring 1m x 1m, where the value stored in each cell corresponds to the altitude above sea level of the central point of the cell or pixel. This data model allows data from different periods to be compared in a simpler way, as well as carrying out arithmetic between different models.

Plans Nº 2 “Digital elevation model 1965” and Nº 3 “Digital elevation model 2001” represent the raster digital models for 1965 and 2001.

OBTAINING THE MAP OF CHANGES OCCURRING DURING THE PERIOD 1965-2001

Carrying out the subtraction, cell by cell, of the 2001 raster model minus the 1965 model, a model of changes is generated where the numerical value stored in each cell represents the difference in the height at that point between the two analysed dates.

Plan Nº 4 “Map of changes 1965-2001” represents the variations in altitude occurring during this period of time. Reductions in height (negative values) are shown in blue tones, mainly corresponding to old dunes that no longer exist. While the increases in height corresponding to old abrasion craters that have been artificially filled in are shown in orangey-yellow tones.

To define the dunes and abrasion craters that must be recovered with the execution of this project, the following has be borne in mind:

1. The map of change: analysis of the map of changes determines that there is not enough sand to recover the dunes as they were in 1965, therefore, the decision is taken to reduce the elevation of the dunes by one metre, in other words, the area represented on the map of changes in light blue, symbolising a reduction in height between -1 and 0.3, is considered as if there had not been an altimetric variation. Regarding the abrasion craters, it is decided to recover all those existing in 1965, represented in the map of changes in orangey-yellow tones.
2. Fieldwork: Allows verification of whether the form of the dunes and abrasion craters, previously established with the map of changes, can be recovered. Obviously, a series of modifications to the initial design is made, as there are roads crossing through dunes and abrasion craters that cannot be eliminated and areas that currently have a very natural and recovered landscape, due to which it is decided that action is not to be taken, as occurs with the section between the Casal d’Esplai and the National Parador.
3. The design of each of the units of action: Once the shape of the dunes, abrasion craters and malladas that are to be recovered has been decided,

we continue with the design of each of the units of action, which process is described below.

DESIGN OF ACTIONS

To design each of the units of action, whether dunes, abrasion craters or malladas (slacks), the following process has been carried out always using the map of changes as the basis and reference.

1. Delimitation of the area of the unit of action. In Plan Nº 5 “Digital model of the final situation”, the location and limits of the different units of action are shown.
2. Assignment of height to the points that define the perimeter of each element. The altimetric information obtained from the 2001 model.
3. Design of the morphology of the new element, defining its maximum/minimum heights, slopes and fracture lines.
4. Generation of a representative MDE of the element, informing on the height of the different points of the terrain that form part of the unit of action.
5. Calculation of the volume of earthworks needed to realise the action.

Having realised the model for each unit of action, Plans Nº 6 and 7 are generated “General floor plan of the final situation (contour lines) north and south", which show details of the resulting situation after the execution of this project throughout the area of action. For this purpose the information corresponding to the surface area of each unit of action was removed from the 2001 model and replaced by the information contained in each of the created models.

The “Redesigned floor plan” represents the variations in the altitude that must be made to each point within the units of action for their correct execution. This map is obtained by deducting from Plans Nº 6 and 7 “General floor plan of the final situation (contour lines)”, the map representing the current situation (2001 model). The contour lines existing on this map do not represent altitudes in relation to sea level, but the increases (for positive values) that must be made to the terrain represented in the 2001 map, to obtain the forms of the terrain

represented in Plans Nº 6 and 7 "General floor plan of the final situation (contour lines)". Similarly, the negative values represent the decrease in the elevation of the terrain needed to reach the project elevation.