

# Environmental Engineering and Management for EXPO 98

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# EXPO 98

- Last World Fair of the XX Century
  - Major environmental reclamation project
  - Development of a new town for 60.000



# EXPO 98

Aerial view (1993)



# EXPO 98

Aerial view (1998)



# EXPO 98

- Environmental problems and solutions
  - Reclamation projects
  - Urban development projects
- Environmental management tools
  - Actual practice
  - Research
- Lessons learned

# Reclamation Projects

- Sanitary Landfill
- Soil decontamination
- Demolitions
- Transplanting trees
- Wastewater treatment plant upgrade
- Cleaning-up of Trancoa River

# Reclamation Projects

- Lisbon's sanitary landfill was converted in a 50 acres park
  - Major contractor: Geosyntec (USA)





# Reclamation Projects

- Decontamination of soils at oil refinery sites, slaughterhouse and dock
  - Major contractor: Heidmeij (Netherlands)





# Reclamation Projects

- Demolitions: 810.000 tons of concrete, 190.000 tons of stone, 60.000 tons of road pavement and 5.000 tons of steel
  - Recycled for use in development of new town



# Reclamation Projects

- 500 trees were transplanted, 30.000 trees were planted



# Reclamation Projects

- Major Lisbon wastewater treatment upgrade
  - Tertiary treatment was introduced
  - Major contractor: Degremont (France)



# Reclamation Projects

- Cleaning-up Trancoa River
  - Mini-dams and wastewater treatment plants were built upstream
  - River banks were cleaned before EXPO 98



# Urban Development Projects

- Solid waste removal
- Technical gallery
- Energy management
- Environmental impact statement
- Monitoring

# Urban Development Projects

- Automatic solid waste removal





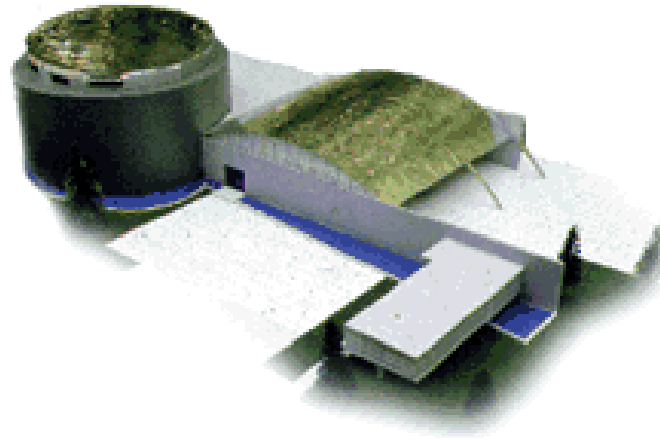
# Urban Development Projects

- Technical gallery was designed to facilitate maintenance



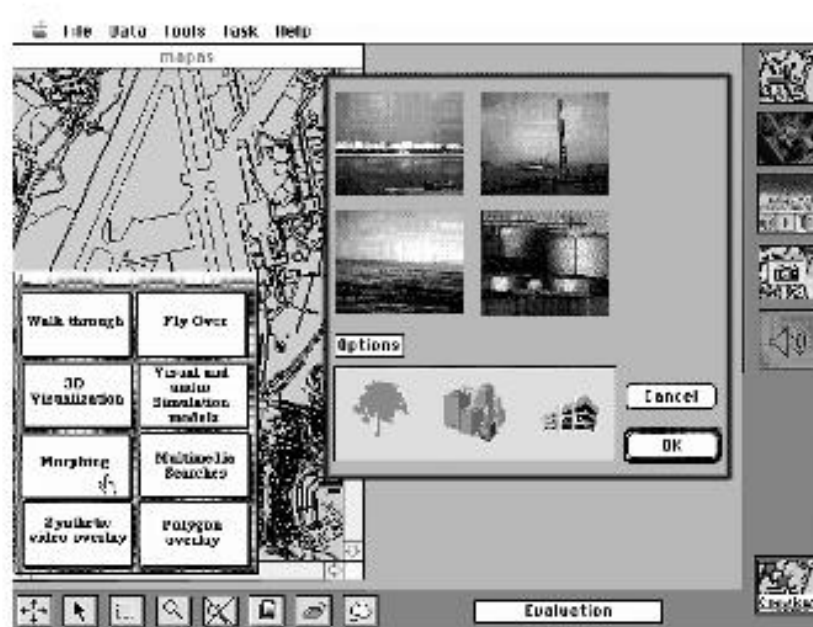
# Urban Development Projects

- Energy management
  - Central facility for air conditioning
  - Buildings were designed to minimize energy consumption



# Urban Development Projects

- Environmental impact statement
  - Media and investors oriented



# Urban Development Projects

- Monitoring
  - Ground water quality



# Urban Development Projects

- Monitoring
  - Air quality



# Urban Development Projects

- Monitoring
  - Noise





# Urban Development Projects

- Monitoring
  - Meteorological station



# Management Tools

- Project management
- Environmental information system
- Exploratory system
- Virtual Tejo

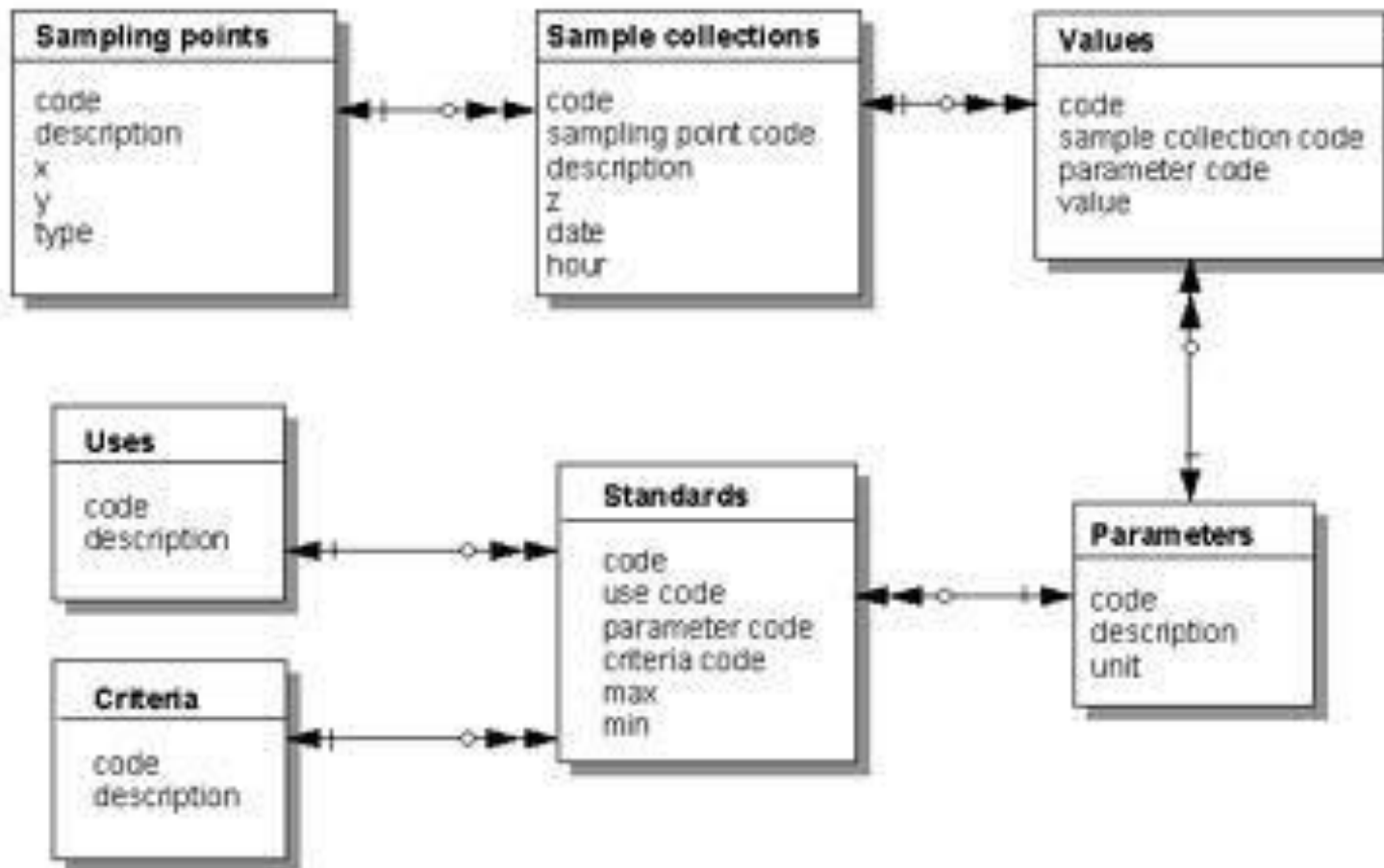
# Project Management

- PERT/CPMs were developed in 1993. They were revised every quarter until 1997
- Planning in 1997 and 1998 (until the opening in May) used the day unit
- Web based working sites with planned activities, weekly status reports, project documents, and providing access to conferencing were tested successfully in 1997-98

# Environmental Information System

- A comprehensive environmental information system was developed in early 1994. It has been updated since that date.
- It was implemented in Oracle

# Environmental Information System



# Environmental Information System

**Expo '98 - Base de Dados Ambiental Versão 2**

Ficheiro Editar Ver Introduzir Operações Procurar Opções Ajuda

? ? FN A? N? VAL

Água Terra Ar Ruído Clima Redes Edific.

DXF

Seleccione o Pretendido

**353** **cadmio**

Código	Descrição
353	Cadmio
354	Cromio (+6)
355	Cromio (total)
356	Cobalto
357	Cobre
358	Cianeto (livre)
359	Cianeto (total)
360	Fluoreto (total)
361	Chumbo
362	Mercurio (Hg)
363	Molibdenio (Mo)

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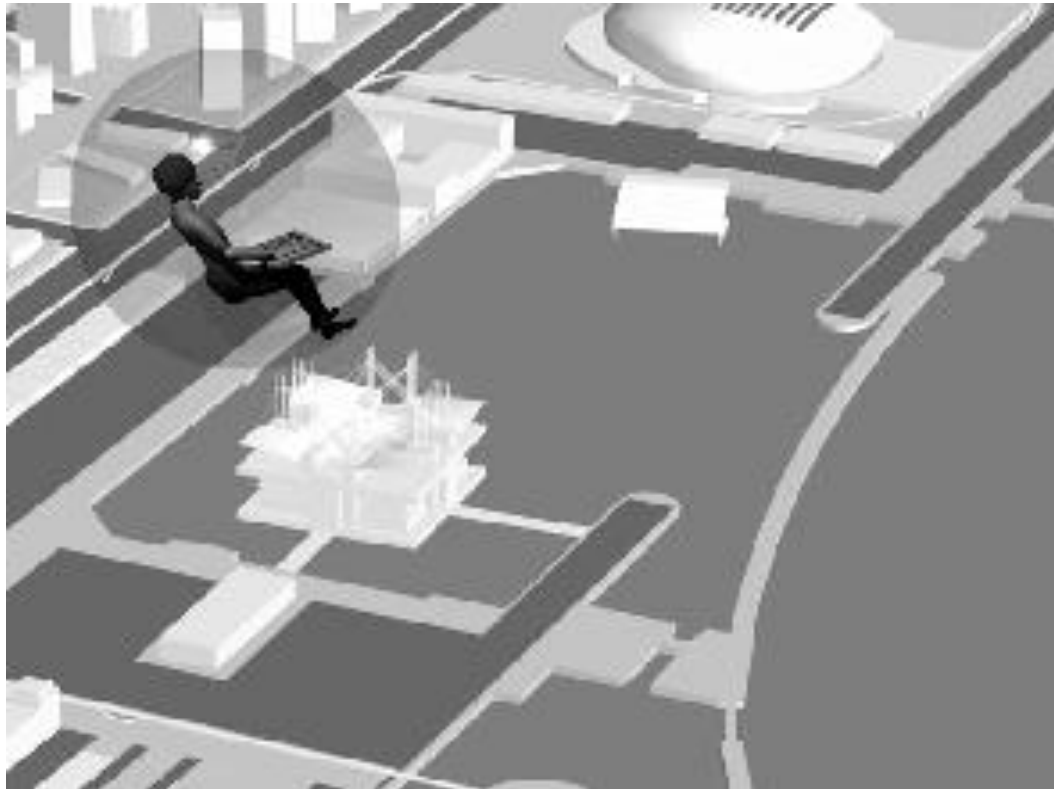


# Exploratory System

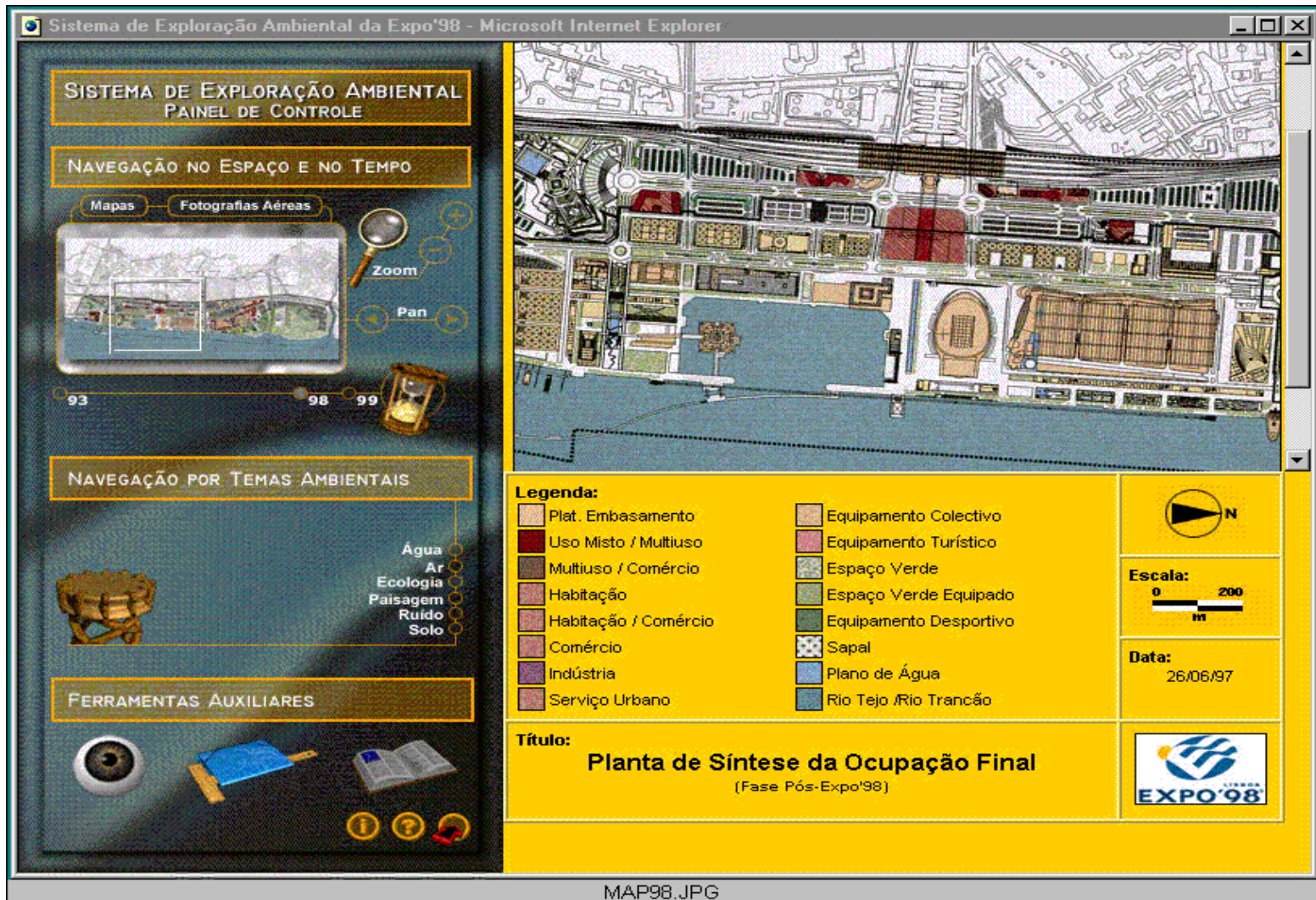
- Open Web site with synthesis of all studies  
([www.expo98.pt/ambiente](http://www.expo98.pt/ambiente))
- Internal Web site with all the reports and projects and access to information system, models and visualization tools  
([http://sig.cnig.pt/sea\\_www](http://sig.cnig.pt/sea_www))

# Exploratory System

Initial interface

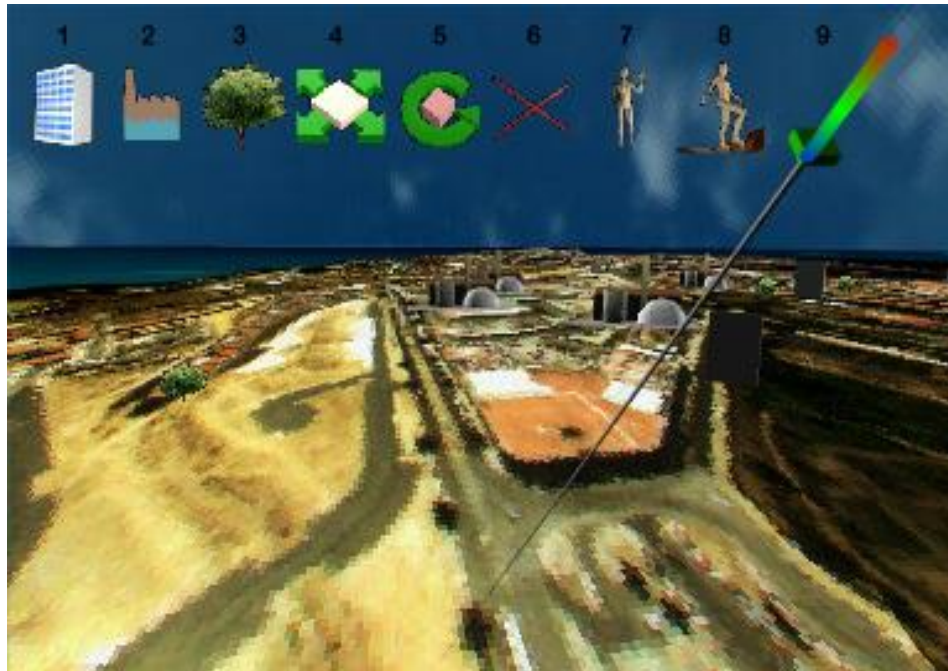


# Exploratory System



# Virtual Tejo

## Virtual Tejo user interface



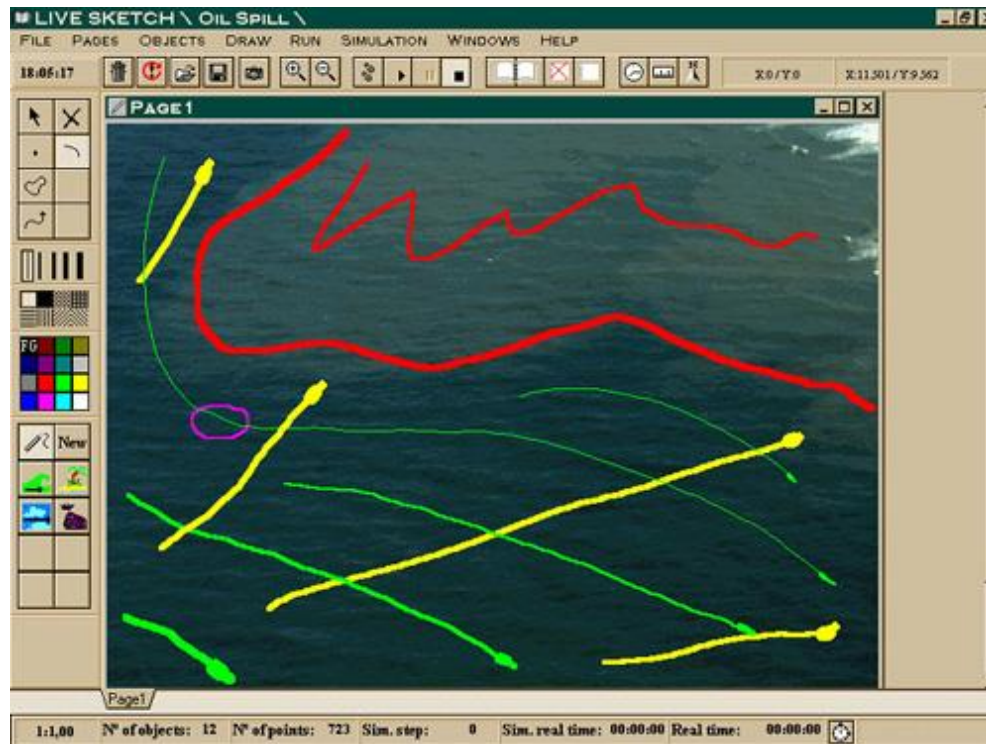
### Tool Legend

1. Create Building
2. Create Factory
3. Create Tree
4. Translate Object
5. Rotate Object
6. Delete Object
7. Move/Stop Toggle
8. Fly/Walk Toggle
9. Virtual pointer



# Virtual Tejo

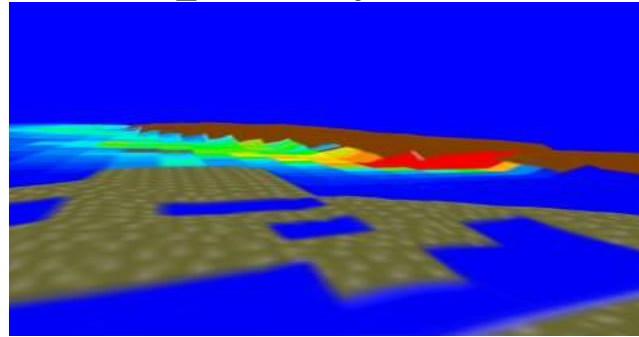
- Modeling by sketching



# Virtual Tejo

- Visualization of water quality models

- Aerial views



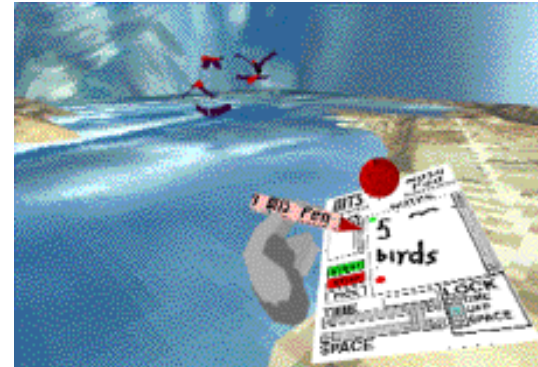
- Aquatic ecosystem





# Virtual Tejo

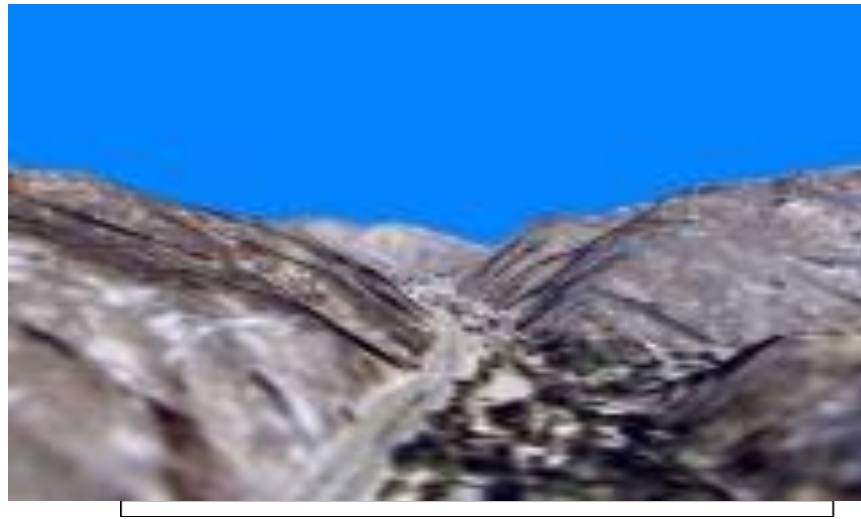
- Browsing in Time and Space (BITS)
  - Take notes
  - Pick up objects
  - Space and time travel
  - All in a virtual environment



# Virtual Tejo

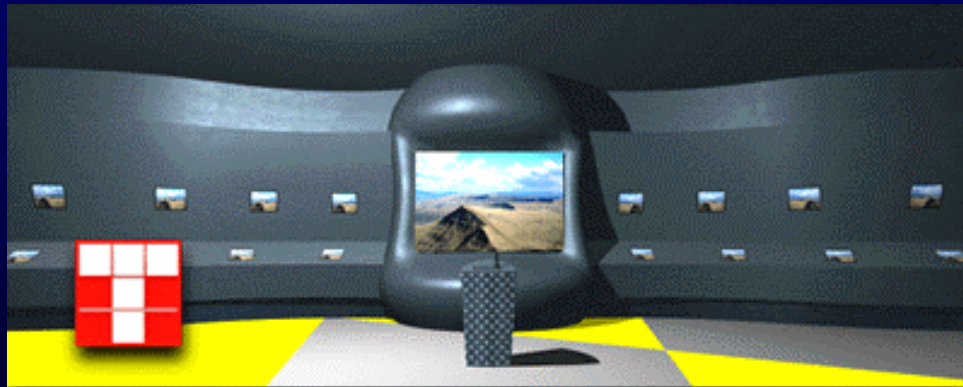
- Virtual Tejo became Digital Portugal, a virtual fly-over of an aerial photograph mosaic of the whole country displayed at Expo98 (1 million users)
- Lisbon and Porto, the two major cities, were shown at 1 meter resolution
- To download demo see [www.imersiva.ch](http://www.imersiva.ch)

# Digital Portugal



# Digital Portugal

## Scenario



# Lessons Learned

- Saving costs in sampling is dangerous
- Dealing with citizen and the media should be taught in environmental engineering
- The Web facilitates project management with the Working Site concept
- The time lag between research results and actual practice is being reduced

# References

- Fonseca, A., Gouveia, C., Camara, A.S. and Silva, J.P. (1995). “Environmental Impact Assessment Using Multimedia Spatial Information Systems”, Environment and Planning B, 22: 637-648.
- Camara, A.S. et al. (1998). “Virtual Environments and Water Quality Management”, J. Inf. Systems, ASCE, 4/1: 28-36.

# References

- Camara, A.S. Environmental Systems: A Multidimensional Approach. Oxford, U.K.: Oxford University Press, 2002
- Web site with all papers, videos and demos:  
<http://gasa.dcea.fct.unl.pt/gasa/gasa98.htm>