Zorrotzaurre Ecological Centre

Preliminary proposal

based on a workshop organized by the
Forum for a Sustainable Zorrotzaurre
www.zorrotzaurre.org

Document prepared by
Robert Alcock

Ecological design consultant
John-Paul Frazer

Participants and contributors to the workshop
Robert Alcock, Ecologist, Forum for a Sustainable Zorrotzaurre
Xabier Arana, Urdaibai Biosphere Reserve
Javi Belza, Paiaundi Natural Park
Patricia de Santiago, Forum Vauban
John-Paul Frazer, Ecological Designer, Exergy Design
Almudena Garrido, "Euskaldunako Zubia" Residents' Association
Jose Maria Gorostiaga, University of the Basque Country / Getxo Aquarium
Mercedes Kobeaga, Basque Government
Paul Otaola, Managing Commission of Zorrotzaurre
Daniel Reiser, Landscape Designer, Gross Max
Javi Torcal, Architect
Jose Ucar, Architect
Idoya Zuloaga, H@cería Cultural Centre
1. Introduction

The idea of creating an ecological centre at the north end of the Zorrotzaurre Peninsula, Bilbao, Basque Country, Spain, was first proposed in March, 2004 at the "Forum for a Sustainable Zorrotzaurre " conference (www.zorrotzaurre.org). This Forum was an initiative by residents of Zorrotzaurre, with the aim of promoting the development of the peninsula as an exemplary sustainable urban area. The ecological centre idea gained further momentum with the presentation in October of the Master Plan for Zorrotzaurre, including an aquarium and study centre located at the point of the peninsula. This is an exceptional site, almost surrounded by the tidal waters of the Bilbao river estuary and the Deusto Canal; pointing out to sea, towards the future.

On 9 December 2004, a workshop was held to prepare an initial proposal for the Zorrotzaurre Ecological Centre. This workshop was organized by the Forum and funded by the Bilbao Town Hall (Area of Urban Planning and Environment.) This document is based on the results of the workshop.

I would like to express my thanks to the Town Hall for their support, to all those who took part in the workshop for their creativity and hard work, and to those who couldn't be present but who provided ideas, suggestions and information. A large number of ideas arose from the workshop, and I have tried to represent them in this document in the most appropriate fashion. Following the workshop, the section on the initial design of the centre was developed in greater detail with the help of John-Paul Frazer, to whom I owe special thanks. However, it should be stressed that the design presented here is merely an initial idea, intended to stimulate debate. To facilitate this debate, an Open Forum has been set up on the website www.zorrotzaurre.org: a space open to all to share information, knowledge, and ideas about the Ecological Centre and the future of Zorrotzaurre. This document is also available for download in the publications section of the same website.

This is a preliminary and open document. If it attracts the attention of the public to sustainability and the future of Zorrotzaurre, it will have achieved something.

Robert Alcock, Zorrotzaurre, 13 December, 2004
2. Philosophy and Objectives of the Centre

The philosophy of the centre can be expressed by five essential ideas, each of which implies several objectives:

**Promote and demonstrate sustainability**
- Be self-sufficient in energy. Have a positive impact on the environment (not just less negative impact.)
- Demonstrate energy efficiency and bio-climatic architecture.
- Use the waste and surpluses of the area in the creation of the centre and for conversion into products and services of value.
- Promote the use of sustainable technologies and environmental improvement in the area, including changes in citizens' behaviour.
- Promote, support and advise sustainable projects.

**Centre of ecological knowledge**
- Collect, organize and disseminate knowledge about a range of subjects (environment, biodiversity, sustainability, local history, etc.)
- Carry out ecological research, education and training at all levels from primary to postgraduate.
- Attract people, allow them to ask questions and learn about the environment, and raise public awareness.
- Be a source of inspiration.

**Open source philosophy**
- All the information and knowledge accumulated during the project should be free for all to access.
- Be a space that is free and open to all; not merely a tourist attraction.

**Human beings are part of nature**
- Demonstrate the dynamic relation between human beings and nature, especially in an urban context.
- Use nature as model to create a sustainable society. Mimic a natural system: respond, evolve, grow, learn...

**Scales from local to regional**
- Focus the activities of the centre on a series of scales, from local to regional:
  - The building and its external spaces
  - Zorrotzaurre
  - Metropolitan Bilbao; the river estuary and its watershed
  - Bizkaia and beyond
3. Activities and Functions, Products and Services

To achieve the above objectives, the centre will carry out various activities and functions that will create a range of products and services. Below is a partial list of possible activities, functions, products and services that arose from the workshop. They can be divided into five general areas: sustainable building, knowledge, economy, society, and leisure and enjoyment.

**Sustainable building**
- Bioconstruction, bioclimatic architecture, energy, recycling and treatment of wastewater.
- Clean the air (biofilters), river sediment and contaminated soil.
- Generate energy for export.
- Produce plants and fish.

**Knowledge**
- An open network of ecological knowledge: all can contribute and all have access to the repository of knowledge.
- Centre for environmental / ecological studies (service of the Town Hall): carry out practical work and host visiting students and researchers. A focus for knowledge (from universities, companies, institutions).
- A didactic building: Demonstration, education, dissemination of topics related to environment, planning, biology, construction, waste.
- Outdoor areas that show natural ecosystems during recovery and recreation.
- Environmental indicators: make the environment visible - sundial, tide indicator...
- Demonstrate the urban and industrial reality of the area.
- Observatory of sustainability for Bilbao and the river estuary.
- A worldwide bank of examples of good practice for application.
- Establish links with other centres.
- Laboratories, classrooms, library, thematic spaces, video conferencing.
- Publications, exhibitions.

**Economy**
- Ecological companies: workshops for companies, spaces to rent.
- Offer environmental control management.
- Measure and enhance flows: identify niches in resource flow for SMEs.
- Create industrial ecologies.
- Offer a system of labels for local products.
- Advise project planners and residents.
- To create economic benefits and jobs.
Society

- Guided tours showing the values of sustainability.
- Coordinating volunteers.
- Seminars and dialogues, round tables, networks of cooperation with associations.
- Meeting point between environmental agencies.
- Serve citizens and respond to those who want to know, to propose, to denounce, or to work for the environment.
- Trips to carry out environmental projects.

Leisure and Enjoyment

- Attract people.
- A thing of beauty in itself: A living sculpture, the prow of the city, a green beacon.
- Ecological restaurant / cafe / hotel.
- Bookshop / shops selling ecological products (wine, coffee ...)
- Boat tours, hire of bicycles and boats.
- Space for meetings, auditorium, concerts, theatre, cinema.

Participants during the workshop (l.) and on a walking tour to the point of Zorrotzaurre (r).

4. Initial design

Based on the philosophy and objectives and the list of activities, functions, products and services, here we present an initial design for the Zorrotzaurre Ecological Centre and its outdoor areas.

At this phase of the process, the intention is not to define the form of the Centre but to suggest possibilities. Thus, this design must not be considered as channelling or limiting in any way the future shape of the Centre.
Spaces and Uses (see Figure 1)
The Centre is located on the northernmost part of the Zorrotzaurre peninsula, away from high buildings so as to receive full solar access. A waterside path (for pedestrians and bicycles) follows the river and the canal from the city centre, to the plaza at the point. A few metres north of the point plaza, two ramps (one on each side of the peninsula) climb to the raised plaza that forms the nucleus of the Ecological Centre.

In the centre of this plaza is the environmental indicator: a tower topped by various displays that show the state of the environment: wind strength and direction, tide level, current and mean temperature, air pollution, etc.

To the north of the plaza is a small building that contains an organic cafe and restaurant, and the environmental observatory. The observatory's aim is to house, organise and analyse all the available data on the state of the environment and the environmental performance of the Centre itself, Zorrotzaurre and metropolitan Bilbao, the river estuary and its watershed.

Note: The observatory - restaurant represents the first phase of the Centre. The observatory will study the design and construction of the main building. During this first phase, the restaurant will be an important source of income for the centre. Before construction of the main building, the area will house a recycling business. Construction materials will be collected from factories that are demolished in Zorrotzaurre, and part of these materials will be used in the construction of the Centre.

North of the observatory, a path leads north to the prow, a light structure cantilevered out over the water, with spectacular views.

To the south of the raised plaza there is the study and interpretation centre, the main building of the Centre. Here is the main information booth of the Centre and the start of several tours. The north side of the building has a gentle slope to allow the raised plaza to receive sun throughout the year. The building has two wings separated by a central atrium with a transparent roof. The rest of the building exterior and the interior of the atrium are densely planted. The building contains a wide range of spaces for the different functions of the centre.

The main visitors' tour passes through the atrium, descending gradually, towards the theatre plaza, to the south of the main building, embraced by the two wings. This plaza is an area for theatrical performances, concerts, cinema, etc. To the south of the plaza is the gnomon, a tower crowned by a solar disc or lens, which converts the whole south facade of the main building into a great sundial, marking the position of the sun for each hour and month.

Descending alongside the plaza, visitors come to a wood containing a lake or wetland, with paths and interpretation signs. Arriving at the canal, they see the marine centre and aquarium on the water, connected with the main building by a bridge. Along the canal bank, the existing intertidal marsh has been restored as a nature reserve.
Figure 1: General Plan. Above: Elevation and plan of the Centre and its external spaces. Below: Public space and uses.
Figure 2: Water and ecosystems. Above: Water flows. Below: Ecosystems.
Waters Flows and Ecosystems (See Figure 2)

One of the key elements of the Centre will be a series of small ecosystems, representing the ecological diversity that exists or existed in the Bilbao river estuary and its watershed, and in comparable, more pristine areas (e.g. Urdaibai). Its functions will include:

- Exhibition and education
- Cleaning the air, water (rain, grey water, black water) and sediments (from the Canal)
- Research, both basic (diversity, networks, flows...) and applied (restoration, uses in treatment, products and services ...)
- Cultivation of species of economic value to sell and for restoration of other areas of the river estuary and its watershed

These ecosystems will be connected by water flows of three types: water low in nutrients such as organic carbon, nitrogen and phosphorus (rain and grey water), water high in nutrients (black and grey water), and saline water (water of the river and canal).

**Water low in nutrients**

The ecosystems of this cycle represent the watershed of the river estuary, from the mountain and streams to the woods and cultivated lands.

The main source of water for these ecosystems is rain. The roof of the main building collects rain, which passes through ecosystems representing the upper watershed (including plants such as shrubs, grasses, mosses...) on the less sunny north side of the building. The water then passes through the interior of the atrium in a series of streams, ponds, and waterfalls, with fresh water and bank ecosystems. Part of the water, by now clean, is recycled for toilet flushing, cleaning, etc. At the end of this cycle are the ecosystems of the lower watershed, that is, native woodlands and cultivated lands; the latter are represented by a collection of threatened local varieties of fruit trees (pears, apples).

**Water high in nutrients**

One of the functions of this cycle of ecosystems is to demonstrate that the ecological treatment of wastewater (black and grey water) is effective, economic, and practical. This aim could be fulfilled by a small demonstration-scale system. Nevertheless, it is quite feasible to combine medium-scale ecological treatment with an education and research centre. In this case, then, we assume that the centre will treat not only its own waste but also the wastewater from one of the three future districts of Zorrotzaurre (approx. 4 000 people, that is to say, 1 000 m$^3$ a day of wastewater, without separation of black and grey water.)

This water enters via underground pipes into the basement of the main building, where primary treatment is carried out using micro-organisms in a series of tanks (approximately 2 500 m$^3$, to retain the water for two and a half days). From here the treated water is pumped up to two tanks. The smaller tank carries out additional treatment with micro-organisms at demonstration scale; from here the water flows through a series of tanks in the atrium with aquatic systems (rivers, wetlands...) for intensive production of plants and fish.
The common egret *Egretta garzetta* (l.) and the kingfisher *Alcedo attis* (r.), two species protected under European law with habitat in Zorrotzaurre.

From another tank, the water flows into the wetland located to the south of the theatre plaza, where secondary treatment takes place. From here, the waters are released into the existing intertidal marsh on the canal bank, for tertiary treatment. This is done at low tide so that the water is not released directly into the canal. Part of the water is diverted through pipes to platforms with plants, floating in the canal. Here the waste water is combined with water and sediments from the bottom of the canal (highly polluted) that are then digested and cleaned.

**Saline water**

To include salt water ecosystems in the centre, saline water is pumped from the bottom of the estuary (the salinity fluctuates according to the state of the tide). This water, which contains highly contaminated sediment, is treated in a series of sea grass, rocky shore and rock pool ecosystems in the marine centre / aquarium. It then flows to the intertidal marsh to regulate the salinity level.

Figure 3: Climate. Psychrometric graphs of temperature and humidity data from the Zorrotzaurre meteorological station from 2004: (a) By frequency; the black line includes two-thirds of the observations. (b) By comfort zones, based on ideal conditions of 19°C and 70% RH.
**Climate and Energy**

**Climate of the site**
On the proposed site for the Centre there now exists a meteorological station of the Basque Government that allows us to study the climate of the site. With respect to bio-climatic design, the temperature and humidity are key (see Figure 3). Habitually, the temperature is between 5 and 22°C and the relative humidity between 65% and 90% (the black line in Figure 3a includes 65% of the observations). If this graph is compared with the ideal conditions for comfort in a building of this type (Figure 3b) we see that, 30% of the time, conditions are in a comfort zone fairly close to these ideal conditions. During another 30% of the time, it is necessary to warm or cool slightly (no more than 3°C) to reach this comfort zone; this is easily achieved with simple bio-climatic techniques. Beyond this zone is where it is necessary to apply more advanced techniques. Only 5% of the time it is necessary to cool more than 3°C; on the other hand, 35% of the time there is a strong need for heating. That is to say, in the bio-climatic design, more ingenuity is necessary to heat than to cool the Centre.

**Energy design**
To achieve the objectives of being self-sufficient in energy, practicing sustainability, and demonstrating bio-climatic architecture, applied a wide scale of techniques and products of bio-climatic architecture and construction will be used in the buildings of the Ecological Centre. Without going into quantitative studies, the following table compares the available sources and stores of renewable energy with the energy needs of the Centre to illustrate some of the possible techniques to be applied.

<table>
<thead>
<tr>
<th>Application</th>
<th>Solar</th>
<th>Wind</th>
<th>Tide and currents</th>
<th>Thermal mass and insulation</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat</td>
<td>Windows, atrium, greenhouses, Trombe walls, reflectors</td>
<td></td>
<td>Massive, externally insulated envelope Earth and river as heat / cool stores</td>
<td>Heat pumps</td>
<td>Persons, devices, grey water (insulated pipe)</td>
</tr>
<tr>
<td>Cool</td>
<td>Solar chimneys, Albedo control, insulated blinds</td>
<td>Passive ventilation, evaporation</td>
<td></td>
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<tr>
<td>Light</td>
<td>Windows, reflectors, light pipes</td>
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<tr>
<td>Electricity</td>
<td>Panels PV</td>
<td>Turbines</td>
<td>Turbines</td>
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<tr>
<td>Pumping</td>
<td></td>
<td>Wind pumps</td>
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5. Funding sources and possible investors

During the workshop the following funding sources and possible investors for the centre were proposed:

**Institutions**
- *Basque Government*: As a demonstration centre for bio-climatic architecture.
- *Bizkaia Provincial Government*: The current owner of the site.
- *Bilbao Town Hall*: Creating the centre as a public service would have benefits for the citizens (quality of life, environment, etc.) The centre might include a bureau of the Town Hall. In the case of the Vitoria Environmental Studies Centre, the Town Hall funded the construction.
- *Bilbao Bizkaia Water Consortium*: Might take part in constructing the wastewater and sediment treatment system.
- *Zorrotzaurre Managing Commission*: The site is already dedicated for public use within the current master plan, which implies that this project would fit into the plan.

**Other sources**
- Banks and foundations with environmental criteria: e.g. Triodos Bank, Foundation La Caixa, BBVA …
- Franchises and collaboration with companies: restaurant, rental of bicycles and boats, sale of products (plants, etc.)
- Ecological construction companies or producers

6. Conclusions

This document seeks to promote public debate and to stimulate interest in the idea of creating an Ecological Centre in Zorrotzaurre. But the creation of this Centre, however outstanding, would achieve little if it did not go hand in hand with a more sustainable form of development in the whole of Bilbao.

The redevelopment of the Zorrotzaurre peninsula represents a great opportunity to redefine the future of the city: it will be the biggest real-estate operation in metropolitan Bilbao. If Zorrotzaurre were to be developed according to purely economic criteria, with mobility based on the use of the private car, with little green space and little attention to energy efficiency, it would truly be a wasted opportunity. Conversely, if the creation of an ecological centre as proposed in this document really did serve to awaken public interest and to stimulate a more sustainable form of development, there could be no better place for it than Zorrotzaurre; because it is there, more than anywhere else, that the Bilbao of the 21st Century will be built.