

SUSTAINABLE BROWNFIELD RESTORATION IN PARC DE L'ALBA-BARCELONA SYNCHROTRON PARK

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This paper shows an example of how the development of an extensive degraded area can be done using urban planning tools in a sustainable way with the objective of balancing economic viability, nature conservation and improvement of ecological systems and biodiversity, and the enhancement of the quality of life in surrounding communities.



Figure 1. Parc de l'Alba-BSP is a sector undergoing urban development, located between the municipalities of Cerdanyola del Vallès and Sant Cugat del Vallès, at the center of the Barcelona Metropolitan Region

General overview of Parc de l'Alba-BSP

Parc de l'Alba-BSP (Barcelona Synchrotron Park- BSP is the Parc de l'Alba's business area) is a 340-hectare public park, located 20 Km North of Barcelona (Catalonia, Spain), projected as 3 areas with 3 main missions (Figure 2):

- **Attracting** innovative companies around the BSP (100 plots, 64 hectares)
- **Creating** a new residential neighborhood (4,000 apartments)
- **Preserving** biodiversity in the green areas (56% of the *Parc de l'Alba-BSP's* surface)

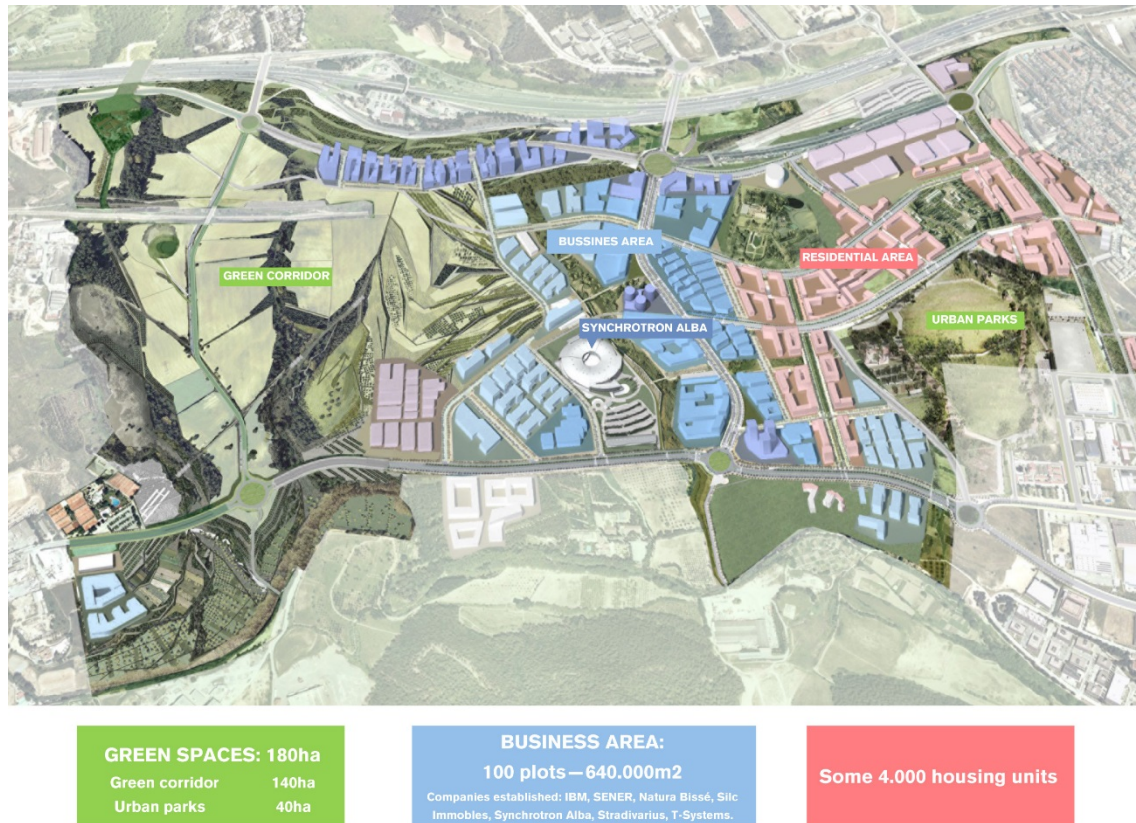


Figure 2. Extensive spaces are maintained at Parc de l'Alba-BSP dedicated to the conservation of biodiversity and ecological restoration, which coexist with the sectors dedicated to business and residential uses

The area was historically occupied by different types of industrial (asphalt, ceramic) and mining activities (clay pit extractions) that impacted the soil transforming an important part into old landfills. 39 hectares of the total surface of the Parc were occupied by industrial complexes that provoked affection to the soils. Nowadays, 18% of the area has already been restored, which include, two old tile works industries, a contaminated site by a dismantled asphalt factory and an uncontrolled landfill of demolition materials with asbestos. All actions carried out to date costed € 3.3 M and created approximately 15 direct temporary jobs and 80 indirect jobs.

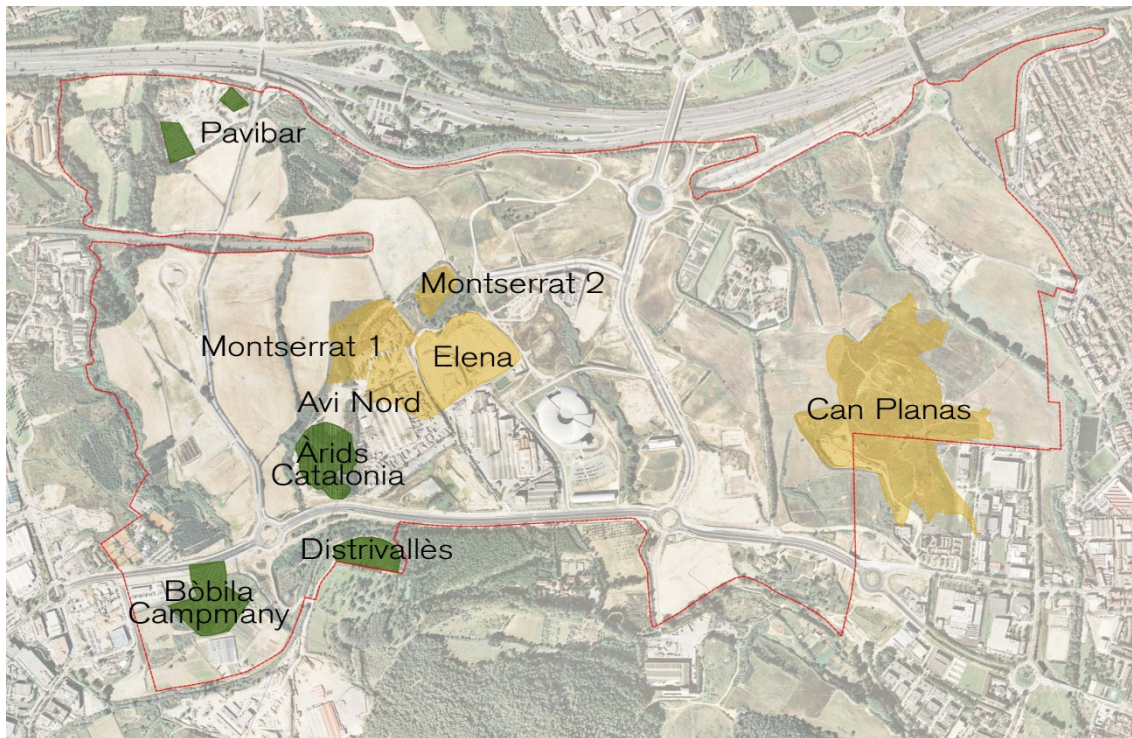


Figure 3. Degraded soils by former activities at Parc de l'Alba-BSP: old tile works (Bòbila Campmany and Distrivallès), uncontrolled landfills (Montserrat 1 and 2, Avi Nord, and Àrids Catalonia), controlled landfills (Elena and Can Planas) and contaminated soil (Pavibar). Sites already restored are shown in green and those pending restoration are shown in yellow

An urban plan was developed for this area, where new businesses (including the Synchrotron) and residential areas will share common spaces with rain feed crops, watercourses and woods. Recreational areas will include a large preserved ecological connector with 140 hectares assigned to natural areas connected to Collserola Natural Park, the main green lung of the Barcelona metropolitan area. All these actions were incorporated in the Urban Plan by means of accurate development measures and management regulations, and the specific actions to implement the restoration of brownfields in order to make them compatible with the new suitable uses.

The Parc de l'Alba-BSP action program, designed to support its Green Infrastructure, is structured in 5 strategic axes (Figure 4) including Ecological restoration (which integrates the restoration of contaminated sites by former activities), Application of "nature-based solutions", Ecological management of green spaces and pending building areas or Supporting agriculture. This commitment was awarded in 2016 by the European Commission "[Business & Biodiversity](#)" label.

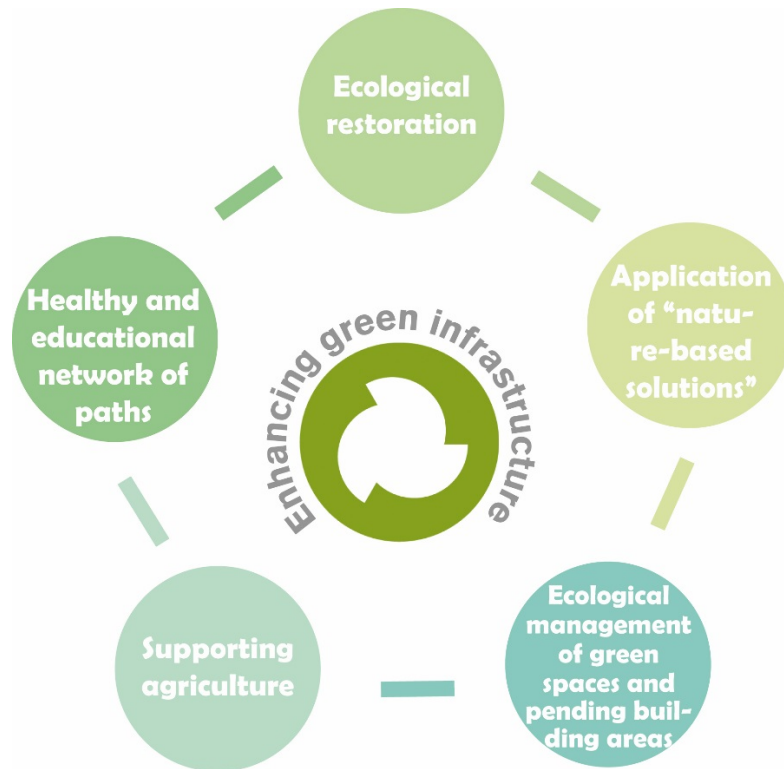


Figure 4: The programme to support the green infrastructure of the Parc de l'Alba-BSP is broken down into five core areas, with different objectives, which promote the conservation of biodiversity and contribute to people enjoying the space and the development of production activities

Working methodology

Firstly, an historical study was performed to identify all potential contaminated areas. This approach consisted on a study of historical aerial photographs, a review of the administrative documentation available and preliminary soil investigation studies.

Afterwards, different studies were carried out in these areas in order to delimit and characterize the quality of the soil and groundwater and in order to know if they were compatible with the initial Urban Plan.

After that, studies of gas emission from the subsoil and air immission in the contaminated area close to urban/nearby receptors were performed. Using a methodology for Human Health Risk Assessment (HHRA) [1] it was calculated the present risk for the identified existing receptors in the area and for future planned uses in order to safely develop the future urban planning of the area. With these results a proposal of sites restoration and future uses of the land was done making it compatible with the urban developing plan.

Specific records were designed to compile the necessary information of each degraded location which were incorporated in the urban plan regulations: including specific technical conditions of site restoration tasks and implications in urban development (Figure 5).

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CONDICIONS DE L'ACTUACIÓ

Aquests sòls han de ser objecte de Restauració ambiental, per poder adquirir les condicions d'ús a que estan destinats. Malgrat el risc calculat dona admissible, es recomanen les següents actuacions de millora:

- 1) Millorar el confinament per a minimitzar l'entrada d'aigua de pluja i sortida de gasos, consistent en un segellat superficial de triple capa a sobre de l'abocador.
- 2) Un bombeta algües amunt de l'abocador per minimitzar l'entrada d'aigua subterrània (Veure esquema barrera hidràulica i ubicació de pous d'aquesta fixa)
- 3) Sota el sistema d'impermeabilització s'hauria de posar un sistema d'extracció de gasos que garanteixi que el dipòsit es trobi permanentment a una pressió lleugerament per sota de l'atmosfera
- 4) Establir un monitoratge de l'abocador en els vectors algües subterrànies i aire.

(*) L'ESTUDI D'OBRES BÀSIQUES INCORPORA AQUESTES DETERMINACIONS

IMPLICACIONS AL PLANEJAMENT URBANÍSTIC

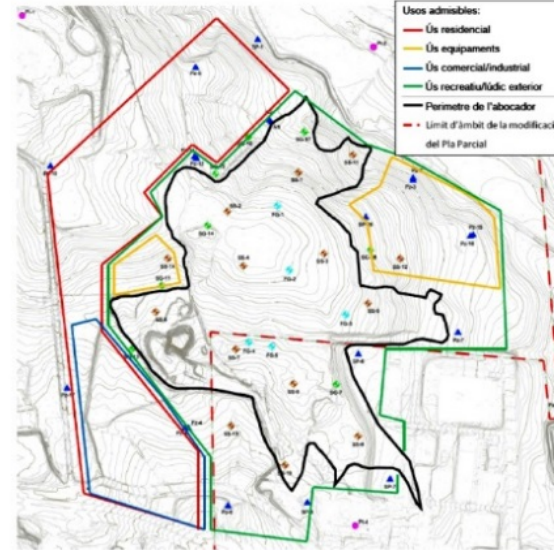
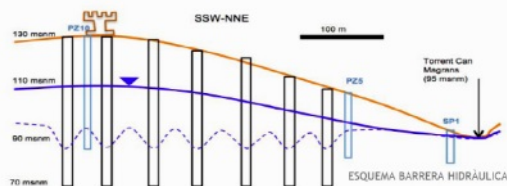
Usos admissibles:

- 1) A l'àrea de l'abocador, només estan permesos els usos recreatius a l'exterior i sense cap tipus d'edificació per tal d'evitar espais poc aprofitats on es puguin acumular gasos, i per tal de protegir la integritat del nou segellat.
- 2) Evitar la construcció de soterranis a les zones on el nivell freàtic es troba molt proper (<5 m) a la superfície del terreny (sona est, sudest i sud) per tal d'evitar l'afectació a les algües subterrànies (Veure figura de piezometria)
- 3) Els usos estan definits seguint les directrius dels usos admissibles a sobre i al voltant de l'abocador. (Veure figura dels usos admissibles)

Altres consideracions:

- 4) Garantir l'estanqueïtat de les xarxes soterrànies (abastament, clavegueram, pluvials, ...) tant a sobre l'abocador com al voltant.

RESTAURACIÓ: A càrrec i mitjançant conveni interadministratiu de ARC, AMB i Ajuntament de Cerdanyola del Vallès, condicionada al sector del parc Tecnològic.



01. CAN PLANAS. 1b
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FIG.

LA PROPOSTA DE PLANEJAMENT S'HA PORTAT A TERME AMB LES DIRECTRIUS I ZONIFICACIÓ DEFINIDA, INCORPORANT USOS ADMISSIBLES EN L'ÀMBIT DE L'ABOCADOR (ESPAIS LLIURES I EQUIPAMENTS A L'ÀMBIT URBÀ)

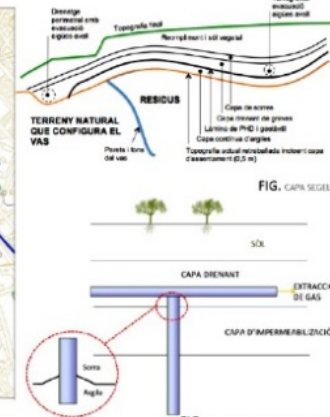


Figure 5. Example of specific record of Can Planas site

Can Planas: a former landfill

Can Planas was an old clay quarry of 18 hectares, which was later filled with different materials (land, construction debris and hazardous waste) without authorization or control until the 80's, when the quarry was used as an authorized legal landfill which was finally closed in 1995.

In a preliminary urban plan developed before site investigations, a residential area was designed for the landfill area. After different site investigations (including hydrogeological modelling and soil-gas immission and emission studies of volatiles in the urban/nearby receptors) the initial urban plan was changed removing buildings from the site.

A new approach was taken based on HHRA in which acceptable present and future risks in the surroundings of the landfill were obtained [2]. With this approach, the corrective activities will basically consist in minimizing the income of rain water to the landfill in order to minimize the discharge of leachate. That will be done from the surface with the installation of a cover layer, and from the subsoil with the installation of an upstream hydraulic barrier. Passive gas extraction is planned for reducing the impact of gas emissions.

These corrective activities will allow to develop the area as urban recreational park in the new Urban Plan (Figure 6).

The uses on-site the landfill will be also limited avoiding any construction on top of the new capping layer. There are also prescriptions and limitations for the urbanization of the surroundings.



Figure 6. The future Can Planas urban recreational park

Arids Catalonia: a site with asbestos

Arids Catalonia was a former uncontrolled landfill of demolition materials including asbestos exploited in the 70's. Based on HHRA, the solution was to confine the asbestos in situ by means of a clay and soil cover to prevent the inhalation pathway, and include regulations in the Urban Plan for the allowed uses and management conditions of this plot. Nowadays, the site is already restored and reforested and new paths have been equipped with signposting for its public use, incorporating the area to the Parc de l'Alba green corridor in 2012 (Figure 7).



Figure 7. Current state of Airds Catalonia site

Pavibar: a former asphalt factory

Pavibar was a former asphalt factory that contaminated the soil with fuel and metals. The owners abandoned the site in early 2.000s, leaving the factory without dismantling (see the first picture in figure 8). Different soil investigations were carried on, and based on the results of the HHRA, the local administration officially declared the soil as contaminated. The remediation consisted in the excavation and subsequent management of the soil. Most of it was sent to a cement factory for mineral valorization, whereas a small fraction was rejected to a landfill. Furthermore, inert materials and soils stored in the abandoned plot are being reused in the restoration of this and other degraded areas.



Figure 8. Former and current state of Pavibar site

Elena landfill

Elena is a controlled landfill filled since 2007 with the selection of packed municipal waste, still being shut down/closed. Verification of its compatibility for future use as a recreational area will need to be done.



Figure 9. The filling and the current state of Elena landfill

Concluding thoughts

The Parc de l'Alba-BSP action program, designed to support the Green Infrastructure and biodiversity, is broken down into five core areas, with different objectives, to promote the conservation of biodiversity and also to contribute to people enjoying the space and the development of productive activities. This program incorporates the restoration of the contaminated sites degraded by former activities in order to make them healthy and useful for the community. The overall project management was changed to take into account HHRA results on the contaminated areas to make compatible the decontamination plans, the urban development and business development of the site.

The weaknesses of the overall process are:

- The different authority bodies structure with shared competences (groundwater, contaminated soils, urban planning) makes the technical validation of the action plans hard to achieve, which can put the credibility of the project at risk.
- The involvement of stakeholders is an unresolved issue. It is known that they have to be included in the decision-making process, but that is hard to achieve.
- Although the urban plan integrates the remediation cost and associated liability, the burden falls mainly on the public administration.

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[2] Martí, V.; Jubany, I.; Perez, C.; Rubio, X.; Pablo, J.; Gimenez, F. (2014) [Human Health Risk Assessment of a landfill based on volatile organic compounds emission, immission and soil gas concentration measurements](#) Applied geochemistry 49, p. 218-224