

ECOMINING

ECOLOGICAL MINING INDUSTRY



LIFE 04 ENV/ES/000251



PRESENTATION

In 2004, the European Union approved through its Program: LIFE – Environment the financing of the “Eco – Mining” project, promoted by Hormisoria S.L., to create a “sustainable mining extraction and development of spaces of environmental and social interest” model in the municipal area of Garray (Soria, Spain). This project was the only one granted in Castile and Leon from the nine selected in this year’s official announcement by the European Community to be developed in Spain.

With the approval of this project, the interest for promoting innovative mining actions and their environmental surroundings was acknowledged by the European Commission’s Environment Directorate –General, granting the “excellence” label to the project due to the objectives to be achieved.

This performance carried out by the company Hormisoria S.L. intensified its strategy of commitment with the environment, which began some years before, by taking part in the Industrial and Environmental Technological Programs (PITMA) from the Ministry of Industry and Energy in 1994 and 1995, with Research Projects and Promotion Performances of Mining and Environmental Incentives of the Regional Government of Castile and Leon between 1996 a 2003, as well as the obtaining the certifications according to the ISO 14001 regulation on Environmental management and according to the ISO 9002 regulation on assurance and Quality Management.


The importance of the conclusions reached in this work make us think about the sustainability of mining and of the environment where it is introduced, where aggregates extraction activities and their future are included.

Mining has always been a basic industrial activity for towns’ development. The exploitation of mining resources has been and is a need linked to human beings’ evolution and to the degree of development of a society, so that our making good use of ores during certain periods have helped to make them know as “Stone Age”, “Copper Age” and “Iron Age”. Likewise, some ores have been key for the development of History: the appearance of gold and silver, the coal extraction and the exploitation of other energy products as oil and gas.

Nowadays, both industrial rocks and ores will be the mining resources of the XXI century and the future centuries, due to the supply needs in a global economy era, where they already represent more than the 40% of the raw materials world production.

A great part of the industrial rocks and ores’ value comes from the possibility of an integral exploitation of these resources – in its turn, it depends on the scientific, technological or industrial level of each country. Under these conditions, the exploitation and commercialization of industrial rocks and ores play a very important role in the economy of each country or given geographical area, as they are a very important source of wealth and incomes.

In the current industrial activities, however, the mere economic development cannot be considered as the sign of a society without taking into account the strong involvements with the environment. There, the quality of the production processes, as well as the products and safety, are carried out in performance scopes that need the highest attention and commitment.



The “sustainable development” expression was defined in the Report written by the Brundtland Commission of 1987 and published by the World Environment and Development Commission from the UN, under the name Our common future.

According to this report, sustainable development would be described as the “collection of economic, social and political development channels that meet the current needs without compromising the future generations’ ability to satisfy their own needs”.

In this sense, sustainable development acquires other nuances, being much more than just protecting the physical environment, as an integral policy that allows guaranteeing human beings a quality of life has already been planned. Due to this, it is conceived as the search for a balance between the supply needs and the environment conservation, both for us and for our successors, what adds a solidarity component, so as to distribute the goods in a balanced and sustainable way. It also needs the development of a technological efficiency to get the highest number of resources at the lowest social and economic cost.

The opinions voiced in several forums by the persons responsible for sustainability approaches, which doubt about the mining that involves the extraction of non-renewable resources and a sustainable activity, have a clear example here of the boost for the social and economic development of the area.

The mine of El Tomillar and the towns of Dombellas and Santervás de la Sierra in Garray (Soria) have been the objective of the search for compatibility solutions between the Environment and the mining activities, counting, for this purpose, on the application of the best extraction techniques available; paying special attention to those ones that should be applied in critical areas for biodiversity. For this, it has been essential to work with all the agents involved, joining efforts to establish the more suitable performances and practices. This has been possible thanks to the attitude shown since the beginning by the company El Carrascal Tomillar Llanos Cuesta y otros, a company that has shared the environmental and social objectives aimed, turning them into their own ones so as to promote performances that are set within their associative framework.

The need for an open social dialogue where we have had the opportunity to transmit that the benefits generated by a mine will not only be for the company, but they will also benefit the local communities, in the regional and national economy, and these benefits are sometimes more than for the company itself. It is essential to have an objective environmental conscience of the dimension and relevance of the extraction activities, which can be achieved by recovering lands and reusing them.

The objective of the project “Innovation model in gravels and aggregates extraction mining sector, based on clean technologies, that generates positive environmental scenes” has been to answer the concept of sustainability in the mining management in the extraction area and its surroundings and social environments, with the application of a real example developed in the Gravel Pit El Tomillar, that belongs to the company Hormisoria S.L.

Within this context, I consider it essential to launch a plea to encourage all those main agents taking part in these activities, to carry out an exercise for and on behalf of the “subjectivity culture and lack of information and formation”, with regard to the good practices in the mining activities and their social consideration, a thing that worries and disturbs me.

The correct vision of the works carried out shall encourage other businessmen and businesswomen to pledge their firm commitment to this sustainability and balance approach that favours the correct distribution of the territory, the creation of employment and increases the environmental and social welfare of both people and the local communities.

Lastly, just congratulate Mr. Alberto Soto Orte, the President of the Company Hormisoria S.L., due to the high level of the environmental commitment that his company has been carrying out during these years, as well as in the whole collective work. I would also like to congratulate the institutions and people that have taken part in order to achieve the objectives aimed with this project, with a special mention to the partners of El Carrascal Tomillar Llanos Cuesta y otros, as well as Eco 4 Ward



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EUROPEAN INNOVATION AND SUSTAINABLE DEVELOPMENT MODEL IN THE AGGREGATE EXTRACTION MINING SECTOR

INDEX

1. Introduction.....	219
2. Project Description.....	229
2.1. Main Objective.....	231
2.2. Specific objectives.....	232
2.2.1. Conditions to prevent and minimize the negative environment impacts.....	232
2.2.2. Field oriented to generate positive environment balances.....	234
3. Experimentation and outcomes.....	237
3.1. General view.....	239
3.2. By action lines.....	240
3.2.1. "Clean technologies" field.....	240
3.2.2. "Sustainable mining" field.....	245
3.2.3. "Positive environmental balance through the planned improvement" field.....	258
3.2.4. Field: "Conciliation of interests".....	283
4. Transfer and reproducibility.....	297
5. Conclusion and summary of the results achieved.....	303
6. Appendixes.....	309



PROJECT LIFE-ECOMINING



1 INTRODUCTION

This publication gathers the approach, methodology and outcomes of the European “EcoMining” project that has achieved the international definition and validation of a “sustainable mining” model where the aspects of technological innovation, environment enhancement and Corporate Social Responsibility (CSR) converge; developed in the excellent framework of the European Union LIFE Program.

The origins of this project must be located within the framework of reconciling between those that carry out the mining activity and those that own the lands.

The “EcoMining” project has managed to choose the environment as key conciliation element and meeting point of conflict interests, by designing the pioneer international models committed to generate sustainability demonstrations beyond the legal requirements of environment enhancement, searching, in parallel, to foster the endogenous development within the active territory.

In order to show the model excellence and goodness, the sphere of action of the project was not aiming to be delimited just to the local level; but on the contrary: It was committed to hire an Austrian partner as international expert in the environment area, as well as to present the project to the European Union turning out to be the only approved “LIFE show” project in Castile and Leon in the year 2004 and one of the 10 selected project in Spain to be funded under the LIFE program excellence label supporting the European innovation applied to environment.

As a result of the global project, it could be anticipated the validation of a European reference model of the barrel extraction mining sector, as well as the proof with exemplary goals that **all quality mining activity must not be unaware of the innovation, that can and must keep the commitment with the environment and based on it, to lead high interest models and strategies to the endogenous development of depressed areas.**

Nowadays, the visible outcome of the aforementioned is represented by the mine “El Tomillar” owned by Hormisoria S.L. and the villages of Dombellas and Santervás de la Sierra in Garray (Soria) where the project has been developed; that based on both sustainability and mining activity, has managed to generate the additional synergies to build a reference and international interest demonstration, both to the mining sector and to the population in general, and it is advised to be visited and known on-site, due to the great beauty and scenery interest of the area as well as due to the not so positive fact of being one of the lower population density area of the European Union.

The partnership structure has been one of the key project elements to achieve the initially forecasted outcomes and successfully validate the different proposed models.

PROJECT SPONSOR AND BENEFICIARY:



Hormisoria, S.L.: Firm devoted to the aggregates extraction activity (gravel and sands) endorsed by more than 20 years of experience in the field with accredited technical-professional reliability and the commitment of continuous improvement via applied research, the innovation and the environment through the permanent collaboration with universities and European and Spanish engineering firms. ISO 9000 certified and one of the first Spanish companies in the sector with ISO14000 certification, nowadays the company is committed at the highest level with the introduction of a graded approach to the EMAS register under the 761/2001 European Union Regulation.

LOCAL PROJECT PARTNER:



Sociedad El Carrascal, Tomillar, Llanos, Cuesta y Otros: was founded at the end of XIX century (year 1878) by the last neighbours of Dombellas and Satervás de la Sierra municipalities, that contributed with their lands to establish a communal regime oriented to share the forest and livestock as an alternative to fix the population in the rural area and to put a stop to the continuous rural exodus to the city.

Even though the initial objective was not achieved due to the generalized area depopulation that led to the closure of houses, city houses and schools, this Society has been keeping alive by observing their objective and now it is an open society to all descendents of both municipalities with more than 500 co-partners spread all over the European Union, as consequence of the rural exodus that aimed to unsuccessfully avoid and that, two centuries later, with such a kind of interventions, has finally achieved the change of tendency by fixing the population and offering employment in the area.

As partner and owner of part of the lands where the mining activity is being developed, the entity is responsible to model along with the beneficiary the final scenes with a great environmental importance and reinforce the endogenous development potential.

Additionally as partner and company specialized in the selection of the Best Available Techniques (BATs) and Best Environmental Practices (BPs); it has participated as:

INTERNATIONAL PROJECT PARTNER:



Eco4ward: environment expert company with head office in Graz (Austria) that advises numerous companies and different economic sector by using eco-efficiency principles and collaborates directly with the Austrian Science and Environment Ministry in the definition and implementation of environment management models and systems.

It has a large and accredited experience in applied environment innovation projects, in different areas and European programs.

Additionally as partner in the Eco-Mining project, it has participated in European-wide selection of the Best Available Techniques (BATs) and Best Environmental Practices (BPs).

At a European level, the aggregate is the second most used natural resource by human being after the water, with 6,5 tons per inhabitant and year, and a census of more than 27.000 aggregates extraction mines and direct and indirect economic representatives exceeding 20% of EC GDP.

AN ESSENTIAL SECTOR IN EUROPE

The aggregate mining industry has nearly 27.000 mines around Europe.

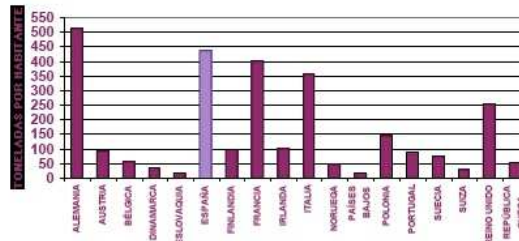
The annual aggregate production is about 1.840 millions of tons, what means an annual consumption per inhabitant of 6,6 tons.

The number of companies in this sector is around 15.000.

These data show the great importance of this industry within the European context as a provider of essential materials for the society.



PRODUCCIÓN DE ÁRIDOS PARA LA CONSTRUCCIÓN 2004



	EMPRESAS	EXPLOTACIONES	PRODUCCIÓN MILLONES DE TONELADAS				TOTAL	%	TONELADAS POR HABITANTE	PRODUCCIÓN POR EXPLOTACIÓN MILES DE TONELADAS
			ARENA Y GRAVA	ROCA TRITURADA	ÁRIDOS RECICLADOS					
ALEMANIA	1878	5640	297	165,7	50	513	18,0	6,3	91	
AUSTRIA	900	1250	65	27	3	95	3,3	11,7	76	
BÉLGICA	87	72	9,2	47,7	1,8	59	2,1	5,8	815	
DINAMARCA	400	410	38	0,3		38	1,3	7,2	93	
ESLOVAQUIA	128	181	4	16		20	0,7	3,7	110	
ESPAÑA	1650	2250	155	282	1	438	15,4	10,0	195	
FINLANDIA	400	3600	55	43		98	3,4	19,2	27	
FRANCIA	1800		168	225	9	402	14,1	6,7		
IRLANDA	350	360	50	50	1	101	3,6	27,3	281	
ITALIA	1796	2460	220	135	3	358	12,6	6,2	146	
NORUEGA	793	4500	14,7	35,7	0,9	51	1,8	11,7	11	
PAÍSES BAJOS			12	4	0,5	17	0,6	1,0		
POLONIA	3450	1745	105	40	2,5	148	5,2	3,8	85	
PORTUGAL	331	357	6,3	82		88	3,1	8,2	247	
SUECIA	170	1940	26	41	8,2	75	2,6	8,4	39	
SUIZA	338	500	26	3	3	32	1,1	4,6	64	
REINO UNIDO	350	1280	79	124	54	257	9,0	4,4	201	
REPÚBLICA CHECA	300	520	24	25,5	2,5	52	1,8	5,0	100	
TOTAL	15121	27065	1354,2	1346,9	140,4	2841,5	100	6,5	105	
%			47,7	47,4	4,9					

This kind of wrong focused activity is generally linked to the idea that in the intrusion environments:

- It is a potential source of pollution (suspended dust particles, water consumption, landfill leachate, wastes, acoustical pollution, biodiversity impact, visual impacts, etc).
- It generates a significant "ecological footprint", at the sight of its capacity to modify the relief of the territory.
- Appearance of problems, when the "land ownership" where the resource is located at and the "mining right ownership" are not held by the same hands.

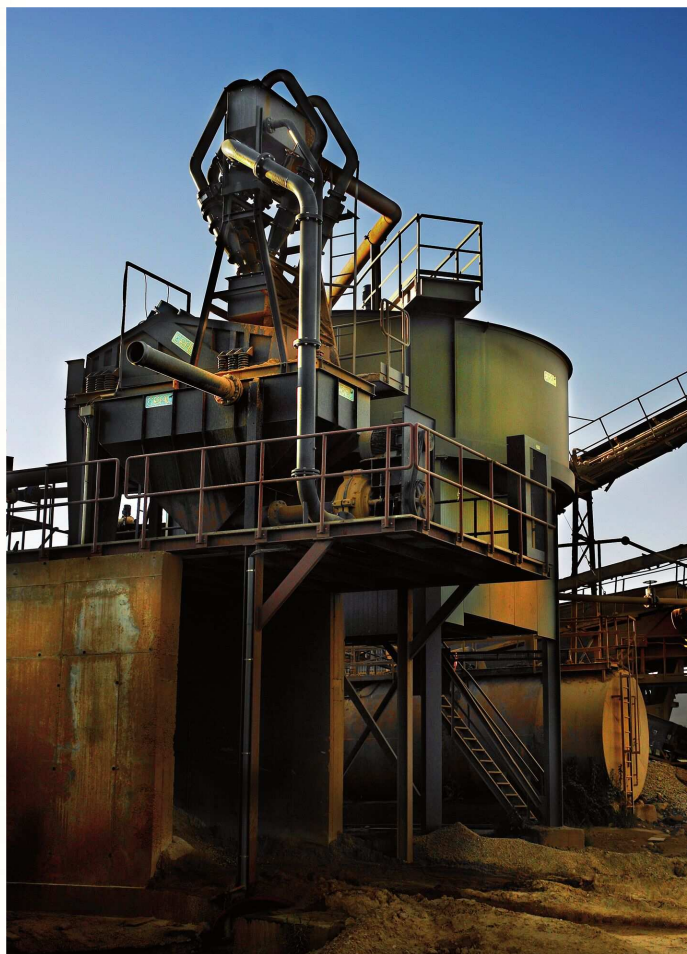
Starting with the aforementioned precedents and the expounded conceptual framework, the project defined a series of high transfer potential and replicable capacities models at European level, which allowed:

- To minimize to the maximum extent the negative environment impacts.
- To model the high environment value final scenes in benefit of the biodiversity via the “improving instead of restoring” principles.
- To favour the endogenous development in the implementation areas by applying the Corporate Social Responsibility (CSR) via the “cooperating instead of arguing” principle.

With this aim different actions started to run in June 2004 in four perfectly defined action lines; two of them oriented to minimize the negative environment impacts and two of them devoted to generate positive environment impacts, based on the mining activity potential to influence on its area and environment as an element for the conciliation of interests in conflict.



- Field of prevention and minimization of the negative environment impacts:
 - Validation of a prototype that, combining different “clean technologies”, would show significant water saving in the material cleaning process, it would reduce the settling ponds and the related issues.



- Validation of a “sustainable mining” model that, via the application of at least 15 best environmental practices (BPs), would reduce the potentially activity-generated negative impacts.

- Conditions to generate positive environment impacts:

- Implementation of a model oriented to show in the mine itself, the potential of a “planned enhancement and restoration” to define a high ecological value final scene, that would involve an improvement with respect to the starting point and the creation of spaces in favour to the biodiversity.

- Development of other models that taking the environment as “conciliation of interest in conflict” element and applying the CSR principles to favour the endogenous development of the implementation areas; ◦ would

allow with demonstration goals, the soil management and enrichment with agro-forest goals and the creation of leisure natural spaces towards the environment and intergeneration coexistence eco-awareness.

Completed the project in June of the year 2007, the outcomes support the achievement of the initial goals, being able as a summary to underline the following outcomes in each field or action model:

- Prevention and minimization of the negative environment impacts field:
 - A process has been validated which, combining a “hydro-cyclone battery” and a “forced natural settling” system, has shown water saving figures higher than 80% and has allowed cutting out the total number of settling ponds that initially occupied 5 hectares as well as their related issues.
 - With the collaboration of the Austrian partner, several engineering, an R&D+I consultant firm and the University of Valladolid, up to 118 Best Environmental Practices (BPs) and Best Available Techniques (BATs) eco-related and appropriate for the sector have been gathered at European level; as well as the effective implementation of more than 30 of the aforementioned in the pilot aggregates mining, achieving among other, the following outcomes:
 - Reduction of atmospheric emissions: in more than 4 tons per year by the implementation of renewal energies and lower use of hydrocarbon fuels.
 - Reduction of acoustical and suspension dust pollution: in more than 25%; by creating the green barriers and re-organization of material stocks and compacting of more than 45.000 m² of tracks.
 - Reutilization of dries sludge: 100% in the composting and direct filling of mining holes in a “transfer mining” context.
 - Use of rain water: more than 90% of used irrigation waters come from rains and the rest are devoted to feed back the close circuit of material cleaning and spaces created in favour of biodiversity.



- Generation of positive environment impacts (Model A in the mine field):
 - 25.000 m² of green screens.
 - 123.000 m² of total modelled surface.
 - 44.000 m² of enhanced surface with autochthon plants.
 - 86.000 m² of enhanced soils with more than 100 tons of composted biogenic resources.
 - 80.000 m² of compacted clay base surface to use the rain water.
 - Achievement of an additional potential of carbon fixing over 30 tons per year.
 - Implementation of drip irrigation systems powered by renewable energies (wind and solar power) and wind pump system to recover the water coming from the dry-out of sludge.
 - Improvement of several biotopes under compatibility and complementary criteria, according to the relief, fauna and autochthon vegetal species, requirements of lake areas, etc... having been increased the number and survival rate of species.





- Generation of positive environment impacts (Model A in the conciliation of interests' field):
 - Creation of a demonstration area about the erosion restraint and carbon capture of 3.5 hectares.
 - 13.000 m² of surface created as eco-awareness, renewable energies and intergeneration coexistence area.
 - Increment of a potential of carbon fixation over 15 tons per year.
 - Implementation of a 5Kw PV (Photovoltaic) solar system associated to the "intergeneration leisure environment meeting point", with a potential of atmospheric emission reduction of 4,9 tons per year.
 - Increase of the number of built/restored houses in Dombelas and Santervás de la Sierra areas.
 - Start of three new sustainable rural tourism bind activities.
 - Generation of a new employment stable offer in the area.
 - Rise of 15% of censed population in both places.
 - Wide diffusion of the project with more than 46.000 eco-awareness achieved impacts in the closest villages to "The Society".



Additionally to the significant direct outcomes achieved in the illustrative action, it has to be pointed out the important synergies generated by the project in the physical and social environment of the intervention area, and among them, the following are highlighted:

- The institutional agreement between the Environment Ministry of the Regional Government of Castile and Leon Government (Environment Education Service) and Garray city council in a complementary and additional support to the different programmed actions of the project.
- The investments run by the Provincial Council of Soria and the City Council of Garray are:
 - The improvement of the accesses to the villages of Dombellas and Santervás de la Sierra and the creation of routes of environment interest and spaces to biodiversity observation.
 - The creation of a LIFE Program information point via the restoration of the municipal washhouse and the enhancement of the environment to generate other green spaces to support the coexistence.
 - The implementation of a municipal land as bus and car parking for visitors that want to access the “leisure inter-

generation environment area” reducing the impact of road traffic in a scenery, ethnographic and environment municipality.


- The recent collaboration of the financial institution Ibercaja through its social subsidiary supporting the “post-LIFE” activities involved to the eco-awareness via generated models.

Finally and aiming to reinforce the transfer potential and the outcomes of the project, a region, national and even European-wide diffusion strategy has been run that in its expert aspect, has addressed the European Sector Association (UEPG) through the Spanish National Association of aggregates Manufacturers (ANEFA as Spanish acronym), having also being involved the Spanish and Austrian Government Offices with competences in the fields of mining, environment and territory, the Chamber of Commerce of Austria and the different Spanish and European universities.

In a diffusion approach addressed to the public, the strategy has been structured through national, regional and local TV channels with a favourable echo of the project in the citizenship, highlighting the notable character as high interest environment model awarded by the Spanish RTV (TVE as Spanish acronym) in the highest audience news spaces.

In the section of other communication media, the presence of the project in radio and press media is also highlighted as well as the essential contribution of its <http://www.life-ecomining.org>; website in the diffusion field; assuming that the project partnership commits the “post-LIFE” objectives of keeping and update the aforementioned website with further interventions and actions and reflecting the contributions of companies, universities and particulars as an “European sustainability observatory on the mining field”.





Finally, the success of the project is not only attributable to the beneficiary, even not the partnership as a whole. A project of these characteristics, ambitious in their foundations and with objectives to become an international model, only can be successful when the collaboration among the partners and with other entities and companies, or “multi-agent participation” converges in a common ground.

At the sight of the above, Hormisora S.L. as sponsor wants to make an express gratitude mention to the following entities, companies and institutions:

- **Castile and Leon Autonomous Government**
 - ◆ **Environment and Agricultural Regional Ministries**
 - ◆ **Ministry of Industry, Commerce and Tourism, Mines of the Soria Section**
- **Provincial Council of Soria.**
- **Garray City Council.**
- **University Agricultural Engineering Schools of University of Valladolid.**
- **Ibercaja.**
- **Austrian Federal Environment, Transport, Innovation and Technology Ministries, and Economy Ministry.**
- **Chamber of Commerce of Austria and Regional Chamber of Commerce of Stiermarck.**
- **Eco 4 Ward**
- **Europa Innovación y Desarrollo, S.L.**
- **Spanish National Association of aggregates Manufacturers (ANEFA).**
- **UEPG.**
- **Spanish Radio and Television Entity (RTVE).**

The previous list is not exhaustive and consequently can be extended to many other companies and private individuals that have contributed, to a greater or lesser extent, with their products, works, and ideas in the benefit of the project.

Special mention is deserved the help received from the European Commission Environment General Secretariat of LIFE Program, as well as the significant labour performed by the External Assistance to favour the reinforcement of the outcomes of this demonstrative performance, performed in the framework of European LIFE Program supporting the innovation and excellence projects called to be the international reference in sustainability fields to contribute with its outcomes to adapt the legal framework and the environment policy of the European Union.

THANKS EVERYONE.





2

PROJECT DESCRIPTION

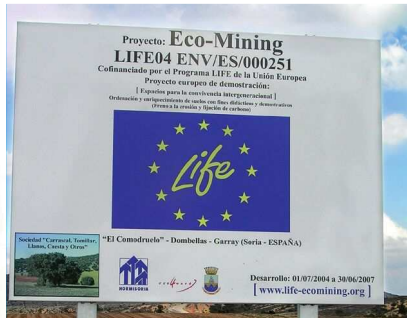
Seeing the European statistical demand and aggregates production data; the economic importance of the Sector in the European Union as a whole is quite evident since it is the second most used resource after the water.



2.1 MAIN OBJECTIVE:

The extraction activity in general, and particularly the aggregates', has a related environment and social problematic tackled by the project since the first phase of the proposal, that aims to show that the environment and population impacts might be minimized; through the implementation of different models, which:

- Show that the negative environment impacts on water, environment and biodiversity can be minimized; through the implementation of clean innovation technologies that allow the reduction of water waste, settling ponds and the requirement of sludge transportation to fill the mine holes.
- Experiment the viability of an innovative model of “sustainable extraction” with transfer aims; that will combine the clean technologies with other measures of environment impact prevention and minimization (Best Environmental Practices – BPs – and Best Available Techniques –BATs –).
- Promote the introduction of innovative concepts oriented to generate favourable environment on-site impacts (improving instead of restoring) taking advantage of the mining activity potential to intervene on the environment; by creating, after the resource extraction, enhanced spaces with respect to the starting point in the benefit of the environment and biodiversity.
- Favour the synergies towards the endogenous development of implementation areas:
 - By reducing the social problematic that in general accompanies the extractive activity (cooperating instead of arguing).
 - By improving the economic and social development potential of inhabitants and environment; based on the creation of eco-awareness and coexistence spaces.



Consequently, two large action lines were defined:

- The first one, addressed to minimize the negative environment impact derived from the activity.
- The second one, addressed to generate positive environment outcomes in the area after the resource mining.

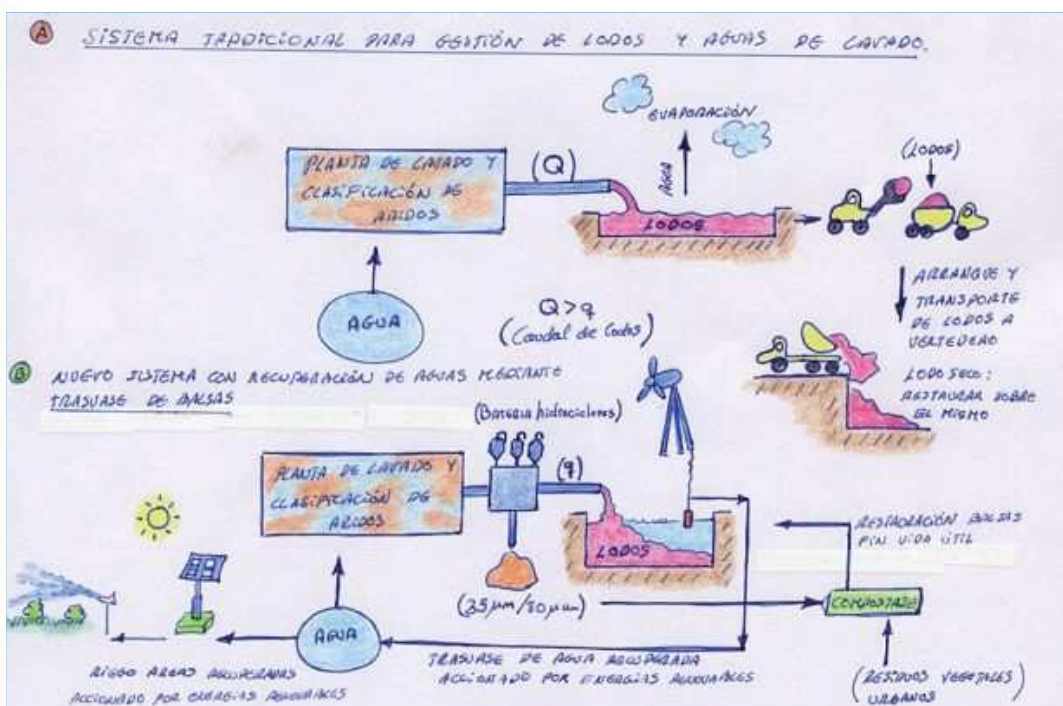
2.2 SPECIFIC OBJECTIVES:

To achieve these objectives within the framework of "Eco-Mining" project, the required actions have been carried out:

2.2.1. Conditions to prevent and minimize the negative environment impacts:

2.2.1.1. Clean technologies:

With this action line, the test and validation of an process based on combined clean technologies are tackled, that will show the high water savings in the processes of ore cleaning and the maximum recovery of water resource via the optimum sludge dry-out; reducing the requirement of additional resources and the related problematic of dry-out ponds.



- Water saving over 55%, through the recovery of cleaning process water and its reincorporation to the close circuit.
- Reduce diffuse pollution risks, reducing and even cutting out the settling ponds requirements.
- Reuse of 100% dries sludge in recovery tasks, in line with “mining of transfer” application”.
- Reduce up to 25% of used hydrocarbons; direct consequence of reducing the requirement for transportation of dried sludge from the settling ponds to other holes of the mine.

2.2.1.2. Sustainable mining:

The project considered the design and validation of a high potential transfer model, that will integrate 15 “Best Environmental Practices (BPs) and/or Best Available Techniques (BATs); addressed to show and quantify the minimization of negative impacts generated by the activity; establishing the environment indicators based on 532/2003 European Commission Recommendation.

It was consequently aimed to demonstrate that the application of these and other measures, depending on the type and problematic of each mine, can generate environment benefits; among others, the following:

- Reduction up to 120 tons per lead installation time of CO2 emissions to atmosphere; by clean energy generation.
- Reduction of impacts derived from acoustical and suspension dust pollution.
- Efficient use (cleaning and irrigation processes) up to 200m³/year of rain water gathered in the mine.





2.2.2. Field oriented to generate positive environment balances:

2.2.2.1. Positive environment balance through the planned improvement:

The efforts in this action line were addressed to transforming the “eco-footprint” generated by the mining activity, via the introduction of the “improving instead of restoring” concept”; generating, this way, the significant added environment value final scenes after the resource extraction and creating spaces in favour of biodiversity in the same land as the used by the mine.

The previously existing biotopes must be analyzed and the ideal plants and the structure of the spaces must be defined to effectively produce the aimed environment improvements after the resource mining and the creation of biodiversity favourable spaces.

In this area, as particular objectives, were envisaged:

- To progress in the landscape integration by lowering the visual impacts and creating green screens.
- To create “green islands” allowing to fix up to 340 tons carbon during the mining concession period.
- To progress in the environment improvement concepts vs. the impact restoration, in the benefit of the environment and the sector image.

2.2.2.2. Positive environment scenes within the framework of conciliation of interests:

The objective of this action line is the promotion of “conciliation of interests in conflict”, when the land ownerships and the mine rights are held by different hands.

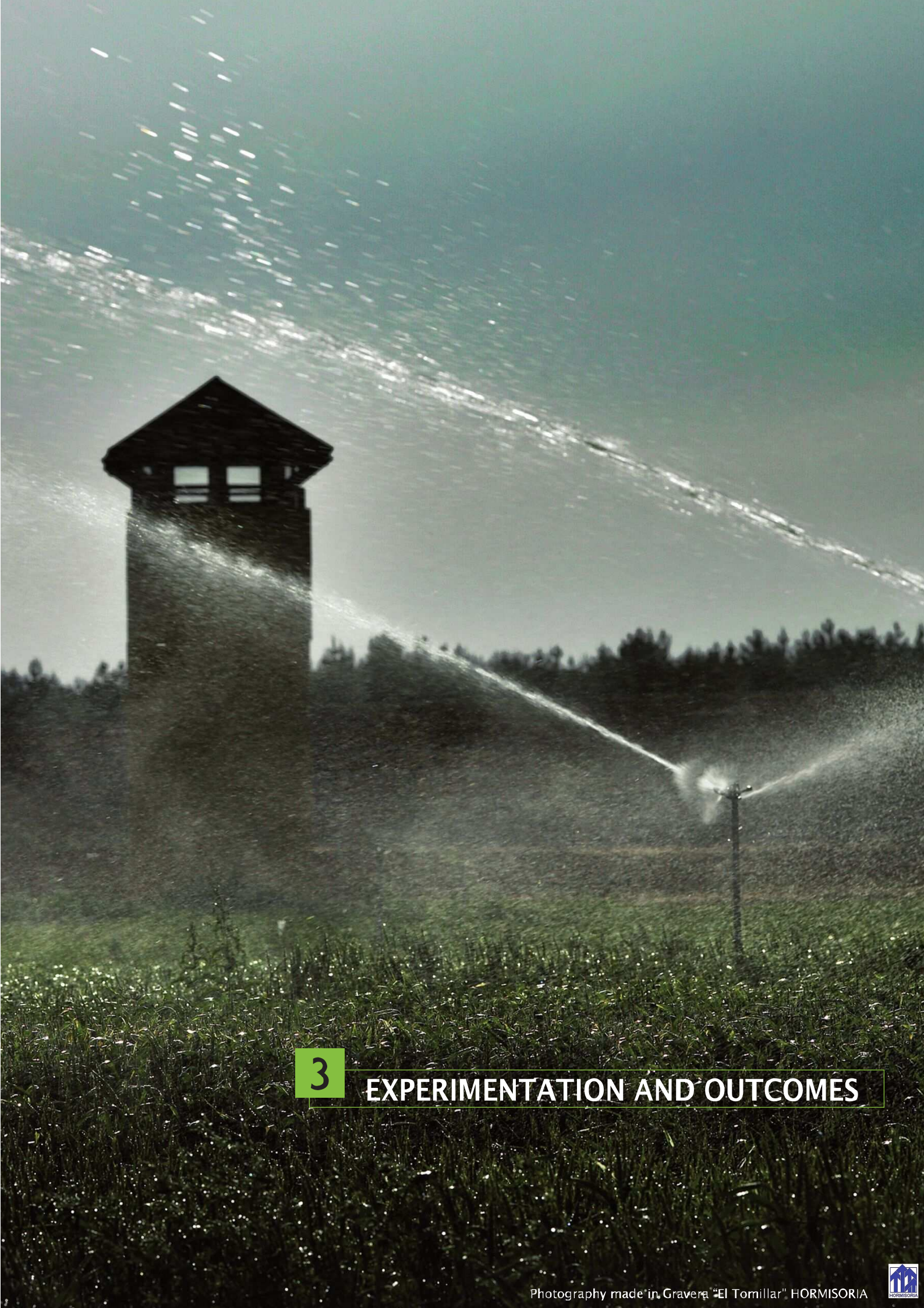
In this new approach of “cooperating instead of arguing” and taking the environment as conciliator agent, the project should boost the creation of high added environment value demonstration and awareness spaces, as well as to provoke in the area enough synergies derived from its endogenous development. This would favour that the population could see the mining activity as an “opportunity source” and not as a “threat” of their interests and with the potential to regenerate the high interest scenery and environment spaces.

In order to achieve this objective, the sponsor of the project had to apply Corporate Social Responsibility principles that based on an environment improvement would favour the endogenous development of the area by generating as a whole “positive eco-footprint” balance models.

In particular, the specific objective of the project was established as:

- Validation of two models with positive environment balance showing the environment potential as an economic interest conflict conciliator agent.





3

EXPERIMENTATION AND OUTCOMES

3

EXPERIMENTATION AND OUTCOMES

3.1 GENERAL VIEW:

One of the highest achievements of the projects has been to deal with the issues of extractive activity from an integral approach and to focus the developments on the environment without neglecting the population social aspects, awareness and endogenous development.

Indeed, any individual technological, environment or social improvement approach in a mine, that was based on the demonstrated models of this project, will involve, doubtless, a benefit to the concrete area addressed by the actions; however, the real added value of the model relays on its application with a global scope on the get-go issues analyzed as a whole.

It has to be highlighted the significant achievements and outcomes of “Eco-Mining” project in the concrete action lines that have allowed to defying the initially defined objectives in the fields of:

- Technological innovation.
- Application of best practices for a “sustainable mining”.
- Application of environment improvement criteria in the benefit of biodiversity to lower the “eco-footprint” generated by the mining activity.
- Conciliation of interests in conflict, taking as base the environment in the benefit of endogenous development of the area.

On the other hand, and, as it has been stated in the introduction, significant synergies generated by this European project in the benefit of Dombellas and Santervás de la Sierra villages are highlighted. The Local and Central Administrations in their different fields of competence have driven these synergies that were detailed in the introduction of this publication: Regional Government of Castile and Leon (Junta de Castilla y León), Provincial Council of Soria (Diputación Provincial de Soria) and City Council of Garray, and additionally other entities as Ibercaja through its social entity supporting the future actions of “post-LIFE” projects.



All the aforementioned has highlighted the interest that the innovative performance arises in the Public Administrations, entities and companies, as well as the significant drive of generating reference models to be applied in other environments and geographical areas of the European Union.



3.2 BY ACTION LINES:

3.2.1. "Clean technologies" field:

From the aggregates cleaning process, sieve classification and, in some cases, the material mill grinding process; an ultra-thin "waste" material (< 80 μm) in aquatic suspension outcomes. To segregate the solid fraction of the "sludge", air dehydration system is being used in settling ponds.

The sludge represent from 5% to 15% of initial product and they cannot be directly spilled out due to among other reasons the amount of solid suspended particles; they have been considered as waste material and, once dried, they are transported and usually placed in the mine holes.

With this system:

- A huge amount of water is wasted due to evaporation.
- The restoration time increases due to the high amount of spaces required by the activity.
- The diffuse pollution risks are increased and the real transfer mining activity is prevented.

With this action line, a combined technological system has been defined that accelerates the sludge dehydration in the ore processing plant; and according to the guidelines of the Water Framework Directive, it recovers almost the total amount of water in the sludge. Additionally the settling ponds have been eliminated and the resulting material is being used to restore and compensate soils.

After several trials, it was stated as conclusion that it would have to combine a "hydro-cyclone battery" to obtain in first place < 38 μm "sieve sludge" with an additional dehydration system allowing the transformation into a "solid-humid" spill-out, with maximum water recovery and apt to correct edaphic impair correction.

As a real scale, previous experiences combining different technologies were unknown; the implementation was sequenced with a prototype in first place that, according to the test and accurate characterization of the hydro-cyclone process effluent, determine the dehydration system that better fit with the objectives of the project.



Consequently, two phases were established:

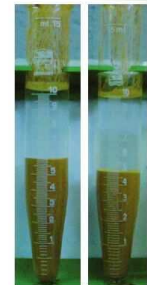
3.2.1.1. First Phase (Solid to solid segregation: hydrocyclonic precipitation):

In this phase, the “hydro-cyclone battery” was inserted in the initial cleaning process line that allows to recover > 38 um; sludge fractions and obtain a continuously < 38 um; sludge stream, reducing in this way the amount of sludge that require further dehydration process.



After several biochemical analyses and frequent samples of evacuated solids with the cleaning waters, it was come to the conclusion that the “> 38 um” particles content represents an average value about 50% of eliminated solids in the cleaning waters.

Even though the values were often about 50%, other mining areas provide highly different values with respect to expected ones which was not considered odd given both the quantitative and qualitative variability of this type of sedimentary fields, highly far from the homogeneity; aspect to have in to account in other mines, since each one will require its own analysis addressed to characterize exactly the material to treat.

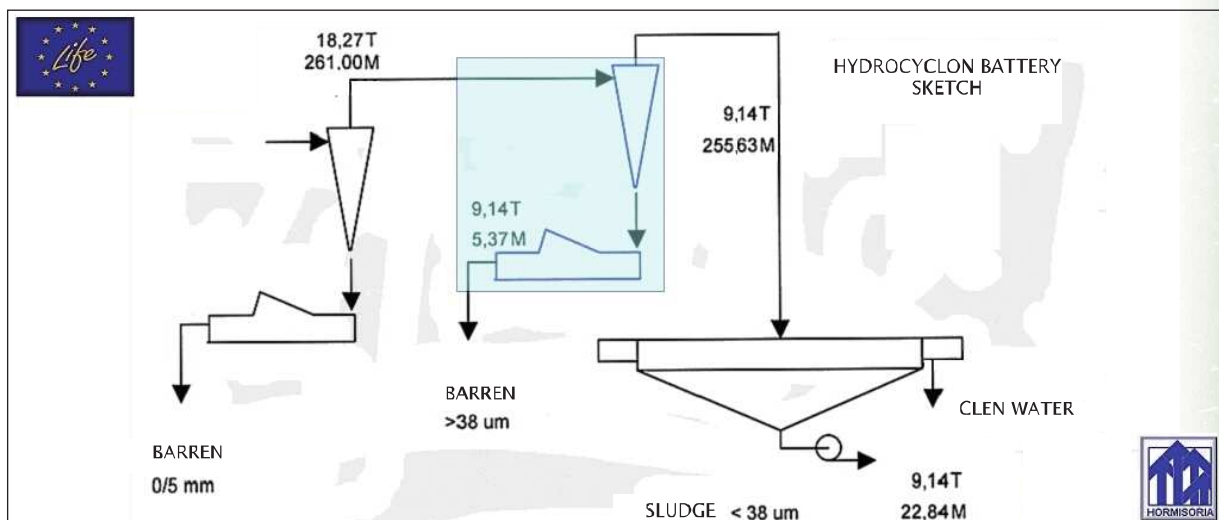


It has been determined the content of total solid and sands over 38 um in the overflow of the hydrocyclonic precipitation and the sludge settling concentration, by using a sieve of 38 um; additionally, the total content of solids and the concentration of particles of sizes lower than 38 um The concentration of sludge coming from the settling areas was calculated in based on the density of the pulp calculated by the weight and volume of the sample.

The installation to recover the ultra-thin particles were designed based on the maximum >38um fraction units to recover, as well as the flow of the measured treatment via appraisal wells in the installation of sands cleanings.

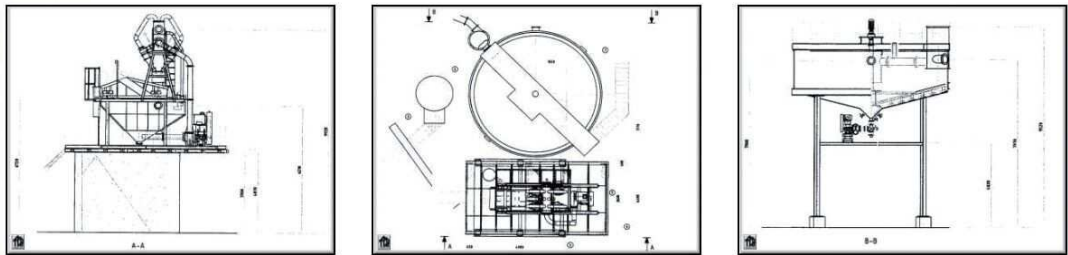
It was established that the solid concentrations in the initial cleaning waters of hydro-cyclonic precipitation overflow were about 70gr/l and it was checked that the pulp flow to treat was 300m3/h.

These values allowed to define the type of hydrocyclonic precipitations and appropriated vibrant dry-out aiming to recover between 30 to 50% of thin sands >38um ; so the spilled sludge amount will be reduced to an amount equivalent to 70/75% of the initial values transported to the “ponds”.



The installed hydrocyclonic precipitations show specific characteristics for the target application:

So, for instance, the geometry of the above belongs to one of the most efficient ones in terms of a better recovery of $>38\mu\text{m}$ fractions. At the same time an area has been included in their cylindrical section to have a larger retention solid time in the inner part, which allows enlarging the length of the vortex and getting the bigger recovery of thin particles of target size.



The final utility of ultra-thin recovery material is to be used as substratum of compost elaborated in the same mine with objectives of improvement and enrichment of the mine soils, and that, after they will form the different recreated spaces in the benefit of the bio-diversity.



COMPARED OUTCOMES

Indicators	Before the 1st phase	After the 1st phase	Improvement Quantification
Settling ponds surface	±5 Hes	±5 Hes	
Flow of overflow water	261,00 m ³ /h	255,63 m ³ /h	
Solid concentration	70,00 gr/l	52,68 gr/l	
Solid concentration in overflow	18,27 Tn/h	13,47 Tn/h	
Solid concentration in sludge	0,378 Tn/m ³	0,378 Tn/m ³	
Sludge to be pumped to the settling ponds	48,4 m ³ /h	35,6 m ³ /h	Recovered pump water: 26%
Rate of pond occupation to 1000m ³	20 h 39´	28 h	Ponds duration: 36%
Required pump energy	30*387=11.610 Kw*h	30*285=8.550 Kw*h	Emission reduction: 26%

The aggregates mines using just this technique, might recover about 26% of required sludge transportation water, a significant amount of ultra-thin material that might be addressed such as to composting; and the useful lifetime of the settling ponds in more than 30% as consequence of lowering of refilling rate (The outcomes may vary depending on the physical, chemical and structural characterization of the material, which is characteristic of every deposit).

3.2.1.2. Second phase (Segregation liquid- solid: dehydration):

Once successfully concluded the first phase of solid-to-solid segregation and characterized the resulting material, to determine the most appropriate technology or technique for "liquid-solid" segregation numerous "on-site", at "actual scale" trials with materials from different areas of mine were performed.

It has important to insist on this point and to point that in every aggregates beds and even in different parts of the same bed, mineral with a different characterization may arise; due to the former, when it has been decided to implement a technology aiming similar objectives to those stated in this project, it is mandatory to carry on-site tests at real scale and with materials from different areas of the mine.

The trials performed with "press filters" and "centrifugal system", even though they have been given positive outcomes at lab scale; they did not show the expected balances at "actual scale"; so they had to be discarded.

The fact that the tested technologies have not shown to be optimum in this particular case must not steer to the conclusion that the aforementioned are not usable in the dehydration process of other aggregates mines. On the contrary, the abovementioned technologies may be optimum in many other mines to generate significant water savings and reducing fines (32 microns) ones coming from the different sludge and clays compositions.

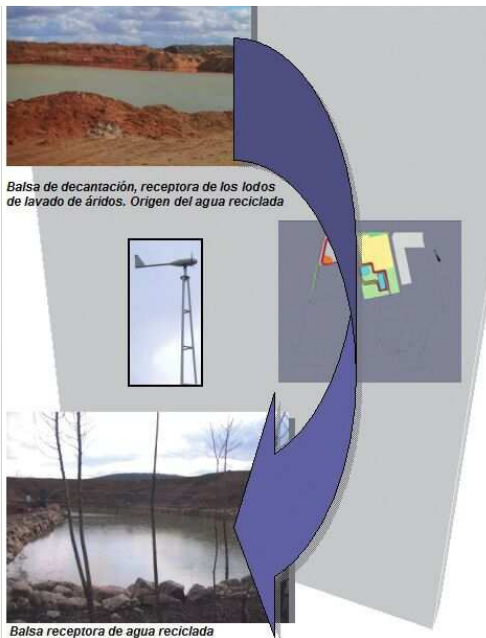
In the particular case of this project, the incapability of applying these technologies respond to the specific characterization of the sludge of this mine, with highly plastic sludge, that is, the water create a packaging around the laminar particles, producing a lubricant effect that makes easy the sliding of particles each other. The highly plasticity is due to extremely small sizes of particles, high surface area and swelling capability; what produces water absorption in the interlaminated area.



All the above produces two effects during the compression, on one hand they bulk the possible pores to transport water from the inside to the outside of the sludge cake achieving a bonbon-type sludge cake; and on the other hand their high specific surface produces solid-fluid interaction stress that block the dehydration process. Additionally, due to the sludge composition, some molecular water exists that becomes almost impossible to eliminate by mechanical processes (montmorillonite).

At the sight of this situation and aiming to reach the planned objectives, a second prototype integral component was finally devised that combined with the first phase one gets to:

- Recover almost all the sludge water to further uses.
- Eliminate the settling ponds.
- Refill directly the mine holes, avoiding the additional sludge transportation and the resulting CO2 emissions.



This new system of sludge treatment works as follows:

Through the piping system from the cleaning plant, the sludge arrive at the “forced natural settling deposits” (previously made large mining holes, with reduced length and highly deep).

The sludge directly spilled starts to settle and forms a delta, so that in the front part there is always an area with enough water depth to install the balling pump.

The water is released almost completely from the deposit front, where the water is clear and clean, to the second receptor pond, from which it is distributed either as cleaning water or to be used in the irrigation tasks of the restored areas or green barriers.

Once refilled the deposits, the holes are filled by the sludge and on top of them, the soil improvement and restoration labours start, being unnecessary the mechanical carryout of materials to other places of the mine.

The system is completed with a pump system powered by wind energy that reduces the energy costs and with the resulting saving of atmospheric emissions.



COMPARED OUTCOMES

Indicators	Before the 2nd phase	After the 2nd phase	Improvement Quantification
Settling ponds surface	±5 Hes	Removed	100% removed ponds
Sludge to be pumped to the forced natural settling deposits	35,6 m ³ /h	35,6 m ³ /h	
Rate of deposit occupation (1,000 m3)	28 h	28 h	
Renewable energy used to pump clean water from settling deposits to breakwater.	0 Kwh/year	1.231 Kwh/year	Emission reduction: 738,6 kg/year of CO2
Recovered water for further uses	120 m ³ /day (40%)	300 m ³ /day (80-90%)	
Time to transport the reduced sludge from the settling ponds to the filling holes, per 1,000 Ton of washed graded aggregate.	Average 350 hours/year	90h/year are estimated for the full elimination	Withdraw of shipping needs for this purpose. Nowadays, society is devoted to transportation of ultra thin particles to compost and treatment areas; this task is for environment benefit. Important: we have to consider that the reduction of sludge in a given year belongs to the generated sludge of the former years.

3.2.2. “Sustainable mining” field:

The development of this action line has shown that with complementary character of other action lines of major field, the application of “small” action lines is of the high environment benefit and in consequence in the benefit of a better image of the organization.

Hormisora S.L., company with accredited environment commitment, backed by the fact of being one of the first companies of the sector ISO14001 environment management certified and ISO9002 guarantee and quality management, adopted in based on the reinforcement commitment project and the application of additional measures in the environment benefit.



ISO 9001
ISO 14001

Within the framework of “Eco-mining” LIFE project, Hormisora in collaboration with the expert Austrian partner “econ4ward”, engineering, consulting firms and Spanish and European universities, has implemented in the mine more than 30 Best Practices (BPs) and Best Available environment related Techniques (BATs) applicable to the mining sector for illustrative purposes, in order to perform the monitoring of the environment indicators set in 532/2003 10 July CE Recommendation to implement EMAS in the Organizations.

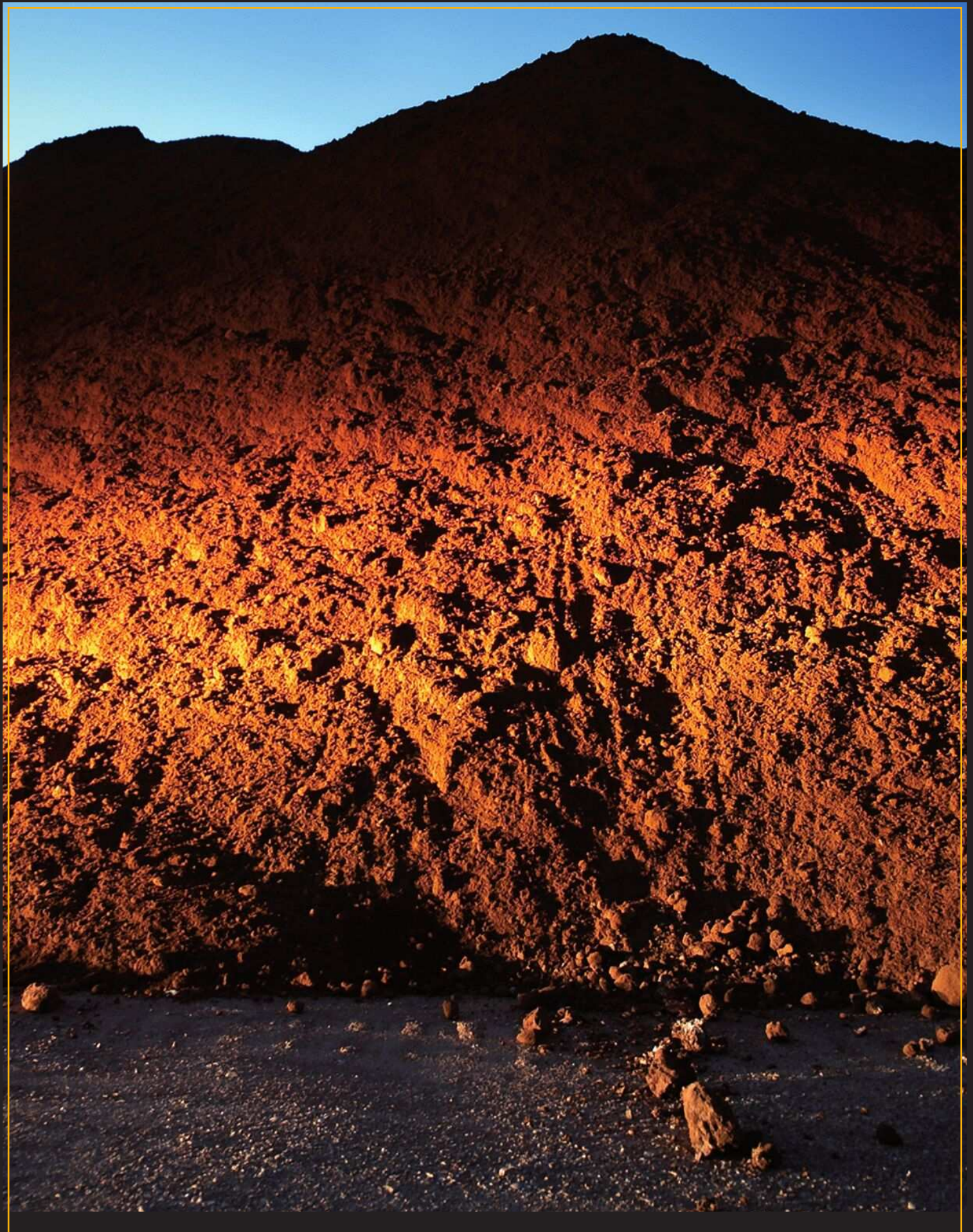
After gathering and systemize at international level up to 118 measures applicable to aggregates extraction sector in the environment benefit, the finally tested ones were selected (the complete measure list can be consulted at <http://www.life-ecomining.org>).

In the next pages the detailed evolution of the environment indicators is shown; based on the information gathered within the demonstration.

ENVIRONMENTAL INDICATORS

Meaning of the abbreviations

BP,s	Best environmental practices
BAT,s	Best Available Techniques
MBI	Management behaviour Indicators
ESI	Environment Status Indicators
OBI	Operational behaviour Indicators



SUSTAINABLE EXTRACTION MODEL ENVIRONMENTAL INDICATORS (BPs) Y (BATs) FOLLOW-UP TABLE

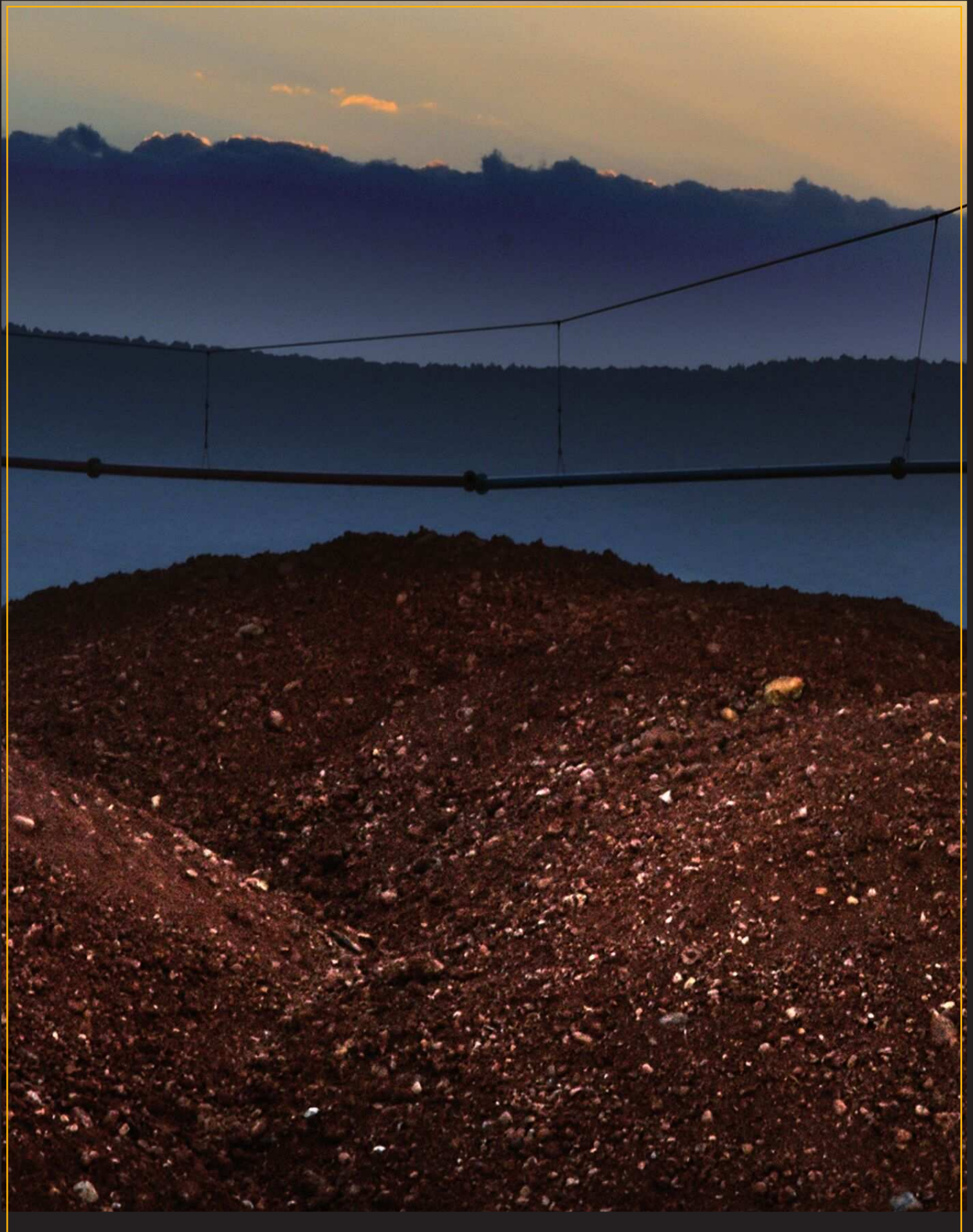
Recommendation 532/2003/CE

ORDER AND CATEGORY	DESCRIPTION OF THE [BP / BAT]	ENVIRONMENTAL INDICATORS	INDICATOR FOLLOW-UP			COMMENTS	
			2004	2005	2006		2007
1 (ICG)	Renewal of the ISO 14001 certification and auditing planning.	Annual audit	YES	YES	YES	YES	System previously implemented
	"Legal Compliance" with regard to the Environment: Environmental registry.	Annual revision	YES	YES	YES	YES	
	Compliance with the established legal regulations with regard to the mining.	Compliance with the annual work planning	YES	YES	YES	YES	

LINKED TO THE MANAGEMENT OF THE ENVIRONMENTAL BEHAVIOUR

LINKED TO THE INTRODUCTION OF CLEAN TECHNOLOGIES

2 (IEM)	Closed cycle system so as to get the best water recovery and reuse during the wash process.	M3 consumed water/ Tons of washed graded aggregate	3,5 m ³ /Tn	3 m ³ /Tn	1,95 m ³ /Tn	< 0,7m ³ /Tn	Between the 80 and the 90% of the water contained in the sludge is now recovered and returned to the closed circuit system. By the traditional settling ponds system now replaced, the water was evaporated.
		No of working hours of the sludge/settling machines /1.000 Tons washed graded aggregate		293 h/year	408 h/year	90 h/year (Planned)	Important: The sludge evacuation in a certain year belongs to those generated in previous years. Part of the saved time is destined to the ultrafine shipping works to the composting, turning, compost mixing and the soils improvement and compensation; that will be to the direct benefit of the environmental impact.
3 (IEM)	Forced settling deposits system in closed circuit for the recovery of the water during the wash and settling ponds suppression.	M2 ponds/ Tons washed graded aggregate	0,097 m ² /Tn	0,097 m ² /Tn	0,04 m ² /Tn	0 m ² /Tn	The settling ponds have been removed when taking on a new method based on "natural forced settling deposits".
		Recovered water volume (m3 and %)			120 m ³ /day (40%)	300 m ³ /day (89-90%)	Through the transfer system, nearly all the settled water is recovered. When "opening", we have to consider a deposit as no recoverable, the water added to the pond until creating an enough water column to be transferred through pumping.



SUSTAINABLE EXTRACTION MODEL ENVIRONMENTAL INDICATORS (BPs) Y (BATs) FOLLOW-UP TABLE Recommendation 532/2003/CE

ORDER AND CATEGORY	DESCRIPTION OF THE [BP / BAT]	ENVIRONMENTAL INDICATORS	INDICATOR FOLLOW-UP				COMMENTS
			2004	2005	2006	2007	
4 (ICO)	Planned storage of the material under environmental and safety criteria, avoiding detachment and sliding. Asphalting of accesses and crushing of roads for the heavy machinery traffic.	Grouped surface given over to the material arrangement Area of asphalted stretches. Area of crushed stretches.	9 Has	9 Has	9 Has	9 Has	It only represents the 15% of the mining area; product of a suitable area rationalization and distribution policy. The storing has been disposed so as to be also used as a natural barrier for the dispersion of suspended dust. It belongs to the access area to the mine, the one that withstands a greater intensity of heavy traffic 2007 includes main track plant screen.
			2.160 m ²	2.160 m ²	2.160 m ²	2.160 m ²	
			7.200 m ²	7.200 m ²	25.600 m ²	45.000 m ²	
5 (IEM)	Creation of sand cords, leveling, boundaries and "green screens", that can be used as visual and acoustic screens against dust, for the CO2 fixing and the soils enrichment. Revegetation with autochthonous species and others under sustainability criteria, taking advantage of the terrain's relief and the geoforms derived from the mining.	(1) Barriers and/or created green screens area Total area where improvement, reforestation and cultivation works have been carried out. Total area improved with autochthonous plants. Carbon Tons/ fixed year	0,14 Has. m ²	0,16 Has	5,6 Has	5,6 Has	From April 2006 the planting in the main plant screen will be carried out. From April 2006 most of the planting is carried out. Only considering the one improved with autochthonous species. Most of the planting is carried out from April 2006 and the outcomes are gathered in 2007. CO2 collection, including all the effective revegetated areas. In 2007 the collection has not taken place yet as the plantations are in the growing period; the forecast is realistic and careful.
			3,2 Has	6,18 Has	12,3 Has	12,3 Has	
				0,055 Has	0,055 Has	4,4 Has	
			9,20 Tn	30,69 Tn	56,4 Tn (Planned)		

(1) Note: The impact reduction will be noticed immediately.
Due to the exact measurement of the dust and noise reduction, it can be considered to be non-significant at this moment, as the plantations need a vegetative development to achieve their objective; the created barriers area is taken as direct indicator.



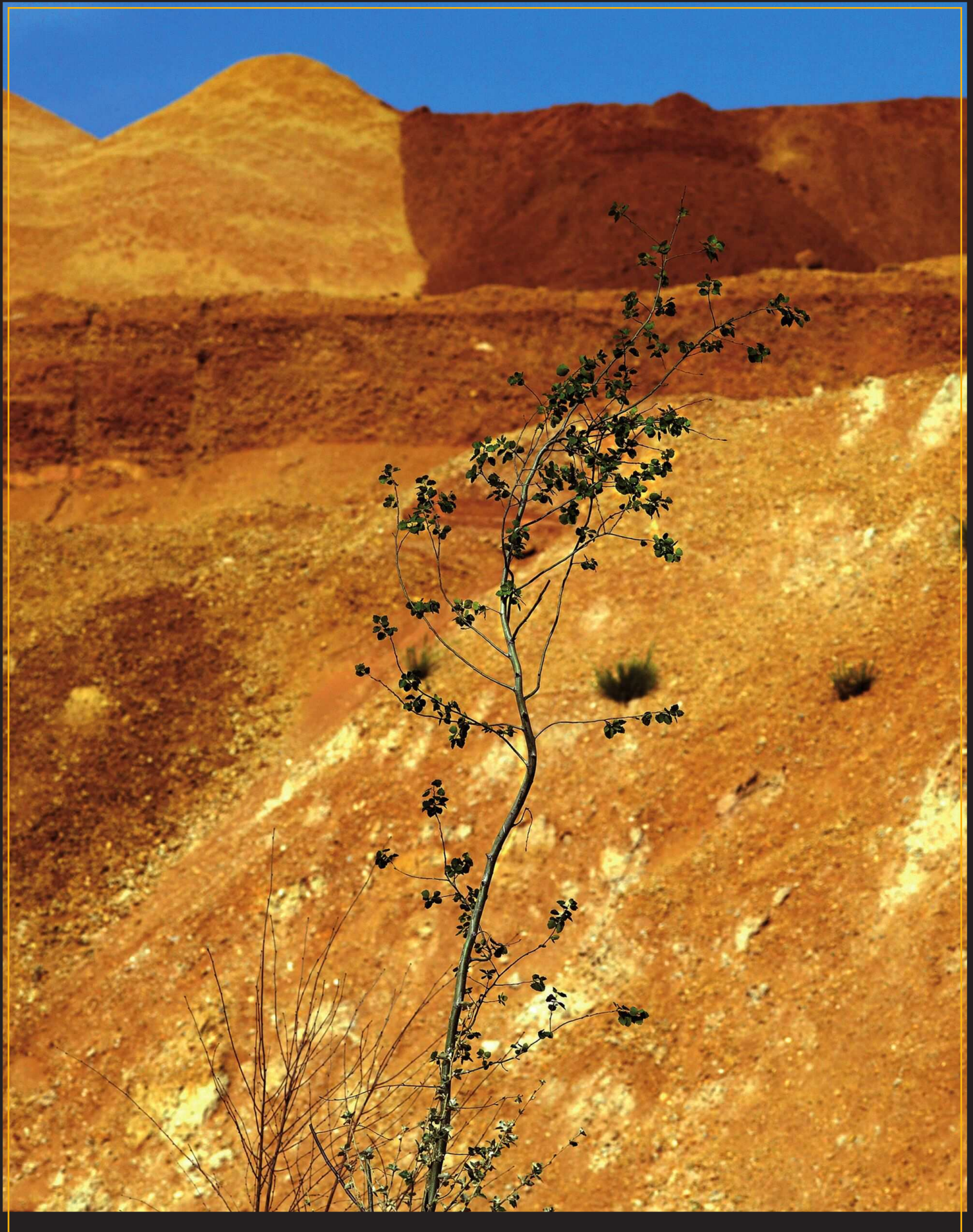
SUSTAINABLE EXTRACTION MODEL ENVIRONMENTAL INDICATORS (BPs) Y (BATs) FOLLOW-UP TABLE Recommendation 532/2003/CE

ORDER AND CATEGORY	DESCRIPTION OF THE [BP / BAT]	ENVIRONMENTAL INDICATORS	INDICATOR FOLLOW-UP				COMMENTS					
			2004		2005			2006		2007		
			Drip	Drip	Drip	Drip		Drip	Drip	Renewable energies	Renewable energies	
6 (IEM)	Implementation of efficient and localized irrigation systems based on the use of renewable energies	Efficient irrigation techniques.									The drip area has been extended and a new clean generation system through renewable energies (solar and eolian).	
		M3 of water/Ha (efficient and traditional).		795/15.1.195 m ³		2.982/16.884 m ³						It hasn't been irrigated since September 2006 approximately and it is predictable that it won't be irrigated again until May 2007, according to pluviometry.
7 (IEM)	Planning of "natural-forced runoff" systems, through a clayey base and the appropriate slope; forced settling deposits and a breakwater for the storing and distribution of clean water.	kWh/year of generated renewable energy				6.037 kWh/year					Generated by screen irrigation systems and equipment for the transferring between the ponds and consumed in the corresponding processes.	
		Tons avoided emissions / year (CO2)				3,6 Tn/year					4,4 Tn/year	Most common reference values: 0,60 Kg of CO2; 1,33 g of SO2 and 1,67 g of NOX per kWh generated.
8 (IEM)	Use of sludge and useless leveling material for the terrain restoration, the covering of dumps, the straightening of sides and as a base for the recultivating and restoring of soils for farming and forest purposes.	"Natural forced runoff" area		61.555 m ²		79.795 m ²					Up until April 2006, all the levelling was carried out, previous to the plantation's execution.	
		M3 of rain water collected in compacted surface		21.544 m ³		38.189 m ³					8.371 m ³ (Jan-March)	It is the total volume collected based on the period's pluviometry. Directly usable: breakwater and settling deposits. The remaining nourishes the spaces for biodiversity and retains the humidity of the soil; what results in a fewer irrigation need.
8 (IEM)		M3 of rain water collected in the breakwater and in the settling deposits.		974 m ³		2.967 m ³					973 m ³ (Jan-March)	
		M3 of earth and sludge for the soils restoration and recovery. (% of the available)		31.771 m ³ (100%)		42.868 m ³ (100%)						27.817 m ³ (100%)



SUSTAINABLE EXTRACTION MODEL ENVIRONMENTAL INDICATORS (BPs) Y (BATS) FOLLOW-UP TABLE Recommendation 532/2003/CE

ORDER AND CATEGORY	DESCRIPTION OF THE [BP / BAT]	ENVIRONMENTAL INDICATORS	INDICATOR FOLLOW-UP				COMMENTS
			2004	2005	2006	2007	
9 (IEM)	Collection and useful application of the pruning and scrub clearing for the recovery of the biogenetic wastes.	Tons of biogenetic wastes.	15 Tn	30 Tn	55 Tn	4 Tn (Jan-March)	Includes organic inputs acquired outside as main source. The solid used, as well as the one of the earth used for mixing, has not been considered. The collection of biogenetic products is seasonal and, therefore, it cannot be constant.
		Improved soils surface	32.500 m ²	46.255 m ²	85.615 m ²		Soil surface where organic soil conditioners and improved topsoil have been added. In 2007 no soil conditioners have been added to new surfaces.
10 (IEM)	Turning and aeration of the organic matter for the soils preparation (fertilizer for growing) and as a way to reduce the CO ₂ .	Tons/year of fixed carbon	6,75 Tn	12 Tn	22 Tn	1,8 Tn (Jan-March)	A 45% of the organic matter considered.
		Surface where the crop rotation is to be applied.	32.500 m ²	32.500 m ²	32.500 m ²	47.500 m ²	Though the potential area under cultivation has increased, no planting has been carried out.
		No of rotated varieties	3	3	3	4	Cereal (wheat and barley). Leguminous plant (alfalfa and sainfoin). Oleaginous plant (sun flower)
11 (IEM)	Creation of habitats and a small lake; reuse of water, tree planting, aquatic plants and attention to the autochthonous fauna (bioindicators); under sustainability criteria.	Tons/year of fixed carbon per considered variety.	1,6 Tn	2,7 Tn	2,7 Tn	2,7 Tn	Only the "pond" area is included; though the remaining spaces do also work as spaces for biodiversity. The area of the pond that was planted had to lie dormant (before April 2006)
		Improved surface as "spaces for biodiversity"			4.720 m ²	4.720 m ²	Two amphibious species taken into account (common frog and common tree frog) and some of their predators (lataste's viper, grey heron, white stork); as the most abundant ones. The number of individuals and their survival have been increased. In 2007 we have been able to see a greater number of specimens of white storks and a significant
		No of bioindicators and average survival period	4-6 species (> a year)	4-6 species (> a year)	4-6 species (> a year)	12-15 species (> a year)	



SUSTAINABLE EXTRACTION MODEL ENVIRONMENTAL INDICATORS (BPs) y (BATs) FOLLOW-UP TABLE Recommendation 532/2003/CE

ORDER AND CATEGORY	DESCRIPTION OF THE [BP / BAT]	ENVIRONMENTAL INDICATORS	INDICATOR FOLLOW-UP				COMMENTS
			2004	2005	2006	2007	
LINKED TO THE EMISSION REDUCTION AND THE WASTE MANAGEMENT							
12 (ICO)	Use of the latest machinery and vehicles that meet the latest techniques with regard to emissions (EURO II-III type).	Total number of vehicles	6	6	6	6	Only the heavy machinery and the vehicles used in the mine have been considered.
		Class number EURO III	4	4	4	4	Only the heavy machinery and the vehicles used in the mine have been considered.
		Tons/year of avoided emissions	Δ 52% 970 Tn/year	Δ 52% 970 Tn/year	Δ 52% 970 Tn/year	Δ 52% 970 Tn/year	
13 (ICO)	Use of silent machines (machines EU classified).	No of new machines marked with the CE conformity.		1			Only the heavy machinery and the vehicles used in the mine have been considered. In this case, the silent machinery where the indicator is to be applied coincides with the one of the indicator No 12; but is does not have to be always like that.
		Average time of executed / recommended maintenances	250/250 h.	500/500 h.	500/500 h.	500/500 h.	Through the periodic cleaning of the air filters (compressed air) and the use of air filters with a double maintenance interval.
14 (ICO)	Carry out repairs and the maintenance of the vehicles in the garage; observing the environmental and dumping regulations.	Maintenances in the garage or adapted area / total number of maintenances	1/8	1/4	1/4	1/1	We consider maintenances in the garage the ones that are carried out by the garages located inside the mine.
		No of collections per year	2-3	2-3	2-3	2-3	Though the number of collections is kept, the capacity of the deposits for oil has doubled, and the capacity of the containers for the recycling of several materials has increased.
15 (ICO)	Equip selective waste collection spaces. (metals, plastics, paper, oils, batteries, ...); and their suitable shipping through authorized companies if required.	No of collections per year	2-3	2-3	2-3	2-3	Though the number of collections is kept, the capacity of the deposits for oil has doubled, and the capacity of the containers for the recycling of several materials has increased.



INDICATORS FOLLOW-UP SUMMARY TABLE Recommendation 532/2003/CE “Sustainable Extraction” Model							
ORDER	CATEGORY OBJECTIVE	INDICATOR	MEASUREMENT UNIT	2004	2005	2006	2007
1	ORGANIZATION	ISO 14001 – EMAS – LIFE	No of generated or improved positive behaviours.	5	8	22	
2	WATER	Water consumption	M3 consumed water/Tons of washed graded aggregate	3,5	3	1,95	<0,7
3	SOIL	Reduction of settling ponds	M2 occupied/Tons of washed graded aggregate	0,097	0,097	0,040	0
4	EMISSIONS	Suspended air, generated noise and visual impacts.	Area of created plant screens (Hectares)	0.14	0.165	5.6	5.6
			Area of asphalted stretches (m2)	2.160	2.160	2.160	2.160
			Area of compacted stretches (m2)	7.200	7.200	25.600	45.000
5	SAFETY AND EMISSIONS	Suspended air and risk reduction	Grouped and reorganized material storing area.(Hectares)	9	9	9	9
6	WATER AND SOIL	Earth and sludge purpose	M3 of earth for regeneration and restoration/total M3 available	31.771 (100%)	42.868 (100%)	27.817 (100%)	
7	EMISSIONS	Greenhouse emission gases through clean generation.	Tons/year of avoided CO2			3,6	4,4
8	SHIPPING	Fuel consumption	No of working hours of sludge ponds-machines/1000 Tons of washed graded aggregate		293 h/year	408 h/year	90 h/year
9	ENERGY	Energy consumption	kw / Tons of product	79	121	122	119
10	WASTE	Recycled waste	No of collections / delivery	2-3	2-3	2-3	2-3
“Positive Environmental Balance that generates Spaces for Biodiversity” Model							
ORDER	CATEGORY OBJECTIVE	INDICATOR	MEASUREMENT UNIT	2004	2005	2006	2007
11	SOIL AND EMISSIONS	Carbon Catching-Fixing	Tons of fixed carbon per revegetated areas.		9,20	30,69	56,4
12	SOIL	Spaces for biodiversity	M2 created			4.720	4.720
13	SOIL	Revegetations, screens and terraces for the improvement, stopping of the erosion and the carbon fixing.	Hectares created		0,22	6,9	6,9
14	WATER	The exploitation of rain water	Hectares of natural forced runoff		6,15	7,98	7,98
			M3 of collected rain water		21.544	38.189	8.371
15	ENERGY	Renewable water for irrigating and pumping	M3 rain water for irrigation/M3 irrigation water		795/795	2.967/2.982	973/...
			Renewable kw / Consumed kw			6037/1820	7268/...
			Hectares. Created		3,5	3,5	3,5
16	SOIL	Demonstrative spaces to stop both erosion and carbon catching.	Tons of fixed carbon		6,57	15,62	23,4 prev.
17	SOIL	Spaces for awareness and coexistence	M2 generated		3.000	13.000	13.000
18	EMISSIONS	Greenhouse gases emission	Avoided Tons / year (clean generation)				4,90
19	AWARENESS	Applications, mechanisms and techniques bases on renewable energies	No of applications/mechanisms				12
20	AWARENESS	Behaviour development	No of impacts for awareness that have been achieved	30.000	42.000	44.000	46.000
			No of collaborations and meetings of the Society with Governments, companies or Institutions	4	14	18	42
21	ENDOGENOUS DEVELOPMENT	Construction/restoration of houses in the area	Performances derived from generated synergies			3	6
			No of restored or built houses	10	17	22	22
22	ENDOGENOUS DEVELOPMENT	Development of the No of inhabitants	No of inhabitants	44	47	50	53
23	ENDOGENOUS DEVELOPMENT	Direct employment created	No of hired workers		2	3	3

3.2.3. “Positive environmental balance through the planned improvement” field:

The law applicable to the mining activity considers a high degree of demand as regards the environment, as the high impact such activity can have on the environment.

This potential impact, together with other social and economic factors, has created the idea that a mine is synonymous to environmental degradation.

The LIFE “Eco-Mining” project starts from the premise that the mining environmental problems still exist, and they can be noticed even today in many areas of Europe, huge mining scars consequence of past performances, though the approach the performance



adopts is to demonstrate that mining itself can help to generate positive environmental balances. The environmental impact of this activity not only can be minimized with a suitable prevention, but the tendency can be inverted through improvement performances, over and above the required simple restoration; giving back the environment final scenes with a high environmental added

value that favour biodiversity and the sustainable development of exploitation within the framework of the “Eco-Mining” project, which has shown the validity of this principle about “improving instead of restoring” that, based on the mining activity itself, allows generating positive environmental balances.

The mining of gravel pits and, in general, every mining activity carried out outdoors, entails a drastic change of the original conditions of the territory where this mine is located and that can be divided into two great groups according to the physical place taken into account:

- A direct environmental impact on the mining area; can become apparent the following ways:
 - Elimination and/or degradation of the natural vegetation cover of the area.
 - Elimination of most of the fauna linked to such flora.
 - Change in the traditional use of the area (farming, ranching, etc..)
 - Drastic change of the terrain’s topography.
 - Change of the subsoil of the area.
 - Change in the water behaviour of the terrain.
- An indirect environmental impact on the joined territory that can become apparent with any of the following impacts:
 - Emission of noises from the mine’s machinery that can affect the behaviour, habits and composition of the fauna of this environment; and even have a negative effect on the human activity.
 - Dust emissions, with effects similar to the abovementioned.
 - Landscape alterations, breaking their monotony and, in many cases, “degrading the view” of places of interest due to their beauty.

When we talk about “restoration” in the mining context, this performance should not be understood as the fact of “giving back” to the terrain the initial aspect and conditions as they once were; as, if we consider that an important quantity of the original filling material has been extracted, there will be a material deficit after the mining that will have

necessarily changed the environment's shape.

Therefore, in the case we are dealing with, the "improvement" approach of the gravel pit of "El Tomillar" wants to make the most of the new geoforms, recreating a final scenario where the environment's environmental quality has improved significantly.

Apart from the environmental value, other consequences linked to the cost ratio / future environmental benefit of this kind of performances have been considered; as can be the possible agroforestry, recreational, tourist or mycological uses for the environmental awareness, ... This way, we have made a progress in the formation of an awareness for a sustainable environmental respect, and "alive instruments" about the education of the nature on the territory itself have been created.

New geoforms have been made good of in order to generate microclimates useful for the recreation of ecosystems that did not exist before. The appearance of river beds and holes where there were not any before, have allowed recreating lakeside ecosystems that have increased the biodiversity of the area and that can also be used for the irrigation during the initial periods of the establishment of the plantations and agroforestry growing in those areas that are far from the aquifer.

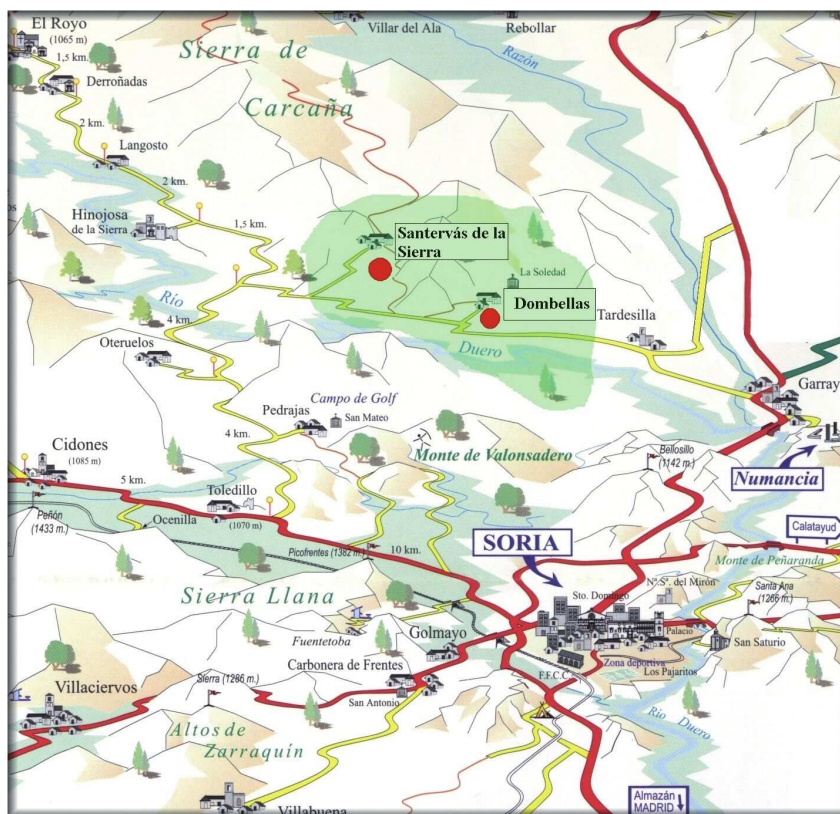
3.2.3.1. Characterization of the environment (situation, socio-economical aspects, flora and fauna):

In order to put the executed performances into context, we show some of the keys that characterize the natural and socioeconomic environment of the area.

The gravel pit of "El Tomillar" is located in the Dombellas (Soria) municipal area, in the road that links the towns of Garray and El Royo, only 15 kms far from the capital, Soria.

The socioeconomic environment belongs to the typical of the whole province of Soria: a small, aged and with a mostly farming economy rural population; though the closeness of the capital, Soria, gives the environment the condition of a periurban area characterized, in its turn, for one of the lowest population density rates of the EU.

The agriculture of the area is a dry cereal-producing type, though there is an irrigation network (The Buitrago field) badly used as the climate is what strongly limits the agricultural activity; though there are some irrigated plots of land of alfalfa that are being exploited.



The gravel pit is located in a key transition area between two types of landscape and the mining of the terrain: the cereal-producing plain is quite close to Garray and to the great mountains that extend from Valonsadero and El Royo to the Urbión and Cebollera Mountain Ranges.



The natural vegetation of the area matches the type of Mediterranean sclerophyllous holm (*Quercus ilex rotundifolia*), over limy substrata at the north of the mine.

In the South and in the North there are Pre-Atlantic Spanish oak forests (*Quercus pyrenaica*) on siliceous soils that belong to the Valonsadero mountain; and in the transition zones the gall-oak groves (*Quercus faginea*) come up.

To the South of the gravel pit the River Duero runs and, in the dammed stretch, has an example of galley forest full of birch (*Betula pubescens celtiberica*) and other species such as the lombardy poplar (*Populus nigra hispánica*), the ash tree (*Fraxinus angustifolia*), elm trees (*Ulmus minor*) in a shrub-like shape, willows (*Salix alba*) and osiers (*Salix caprea*).

What is really interesting is the understory from the gall-oak groves located next to the gravel pit, where we find shrub-like cuttings of spiraea (*Spiraea hypericifolia*), spindle trees (*Euonymus europaeus*), peony (*Paeonia broteri*), and honeysuckle (*Lonicera etrusca*), among others.

In the case of the cleared oak grove on the siliceous soil (there are olm oaks on siliceous and limy soil), we find the degradation stratum that the terrain had before its mining and that shows nitrification signs due to the cattle action: French lavender (*Lavandula stoechas pedunculata*) and marjoram (*Thymus mastichina*). There are also isolated cuttings of broom (*Genista florida*), *Halimium ocymoides* and the rock rose (*Cistus laurifolius*).

Given the closeness of the river environments, in the flooded areas or the gravel pit one can easily find *Salix caprea* and *Typha latifolia* cuttings.



The nitrophilous communities that appear on the ditches and in similar areas are represented by the typical and frequent thorny bushes, so interesting due to their fauna as they provide fruits and a thick shelter. We should highlight the Wild Rose (*Rosa canina*), the Blackberry bush (*Rubus ulmifolius*) and the Blackthorn (*Prunus spinosa*).

Regarding the presence of reforestations, we should highlight the existence of *Pinus pinaster* reforestation inside the mine that takes up a surface of some 30 hectares and is 15 years old. In this environment there are also other reforestations the same age populated with *Pinus pinaster* and *Quercus pyrenaica*.

The fauna is the typical of the center of the Iberian Peninsula; being the following the most abundant species:



MAMMALS: European Hedgehog (*Erinaceus europaeus*), Field vole (*Microtus arvalis*), Red fox (*Vulpes vulpes*), Badger (*Meles meles*), Wild boar (*Sus scrofa*), Deer (*Cervus elaphus*) and Roe Deer (*Capreolus capreolus*).

AMPHIBIANS: Common Salamander (*Salamandra salamandra*), Common Midwife toad (*Alytes obstetricans*), Common Toad (*Bufo bufo*), Common Tree Frog (*Hyla arborea*) and Common Frog (*Rana perezi*).

REPTILES: Green lizard (*Lacerta bilineata*), Large Psammodromus (*Psammodromus algirus*), Iberian wall lizard (*Podarcis hispanica*), snake (*Natrix natrix*) y Lataste's Viper (*Vipera latasti*).



BIRDS: Though the bird's catalogue of this area is really broad; we will only highlight some species that have a special interest as they come to the gravel pit due to its wetlands: Grey Heron (*Ardea cinerea*), White Stork (*Ciconia ciconia*), Marsh Harrier (*Circus aeruginosus*), Buzzard (*Buteo buteo*), Crane (*Grus grus*), Cuckoo (*Cuculus canorus*) and Bee-eater (*Merops apiaster*).

In order to define the biotopes, we have counted on the help of the University of Valladolid, taking into account both the fauna housing needs and the adaptive features and compatibilities of the plant species to be introduced.

3.2.3.2. Action types:





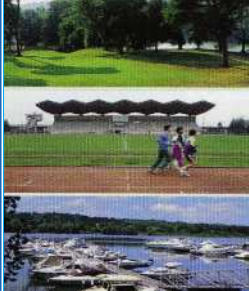


We can consider three well-differentiated geoforms originated by the process of removing the crude material from the terrain and the filling of the hole with barren material:

- A. Flat areas: the ones of the platform that is filled with barren in the upper level.
- B. Areas with a steep slope: formed with the previous filling in the front, once it has been finished.
- C. Flat areas that have not been filled: belong to the bottom of the mine's hole.

The works carried out for the correction of the topography and the improvement of the terrain for its later use have been the following:

TYPE OF AREA	PREVIOUS WORKS	PERFORMANCES AND USES
A	Levelling out and filling with topsoil	Agricultural crops; grasslands and copses. Agroforestry crops.
B	Bar formation and remodelling	Forest and autochthonous plantations. Recreation of natural habitats.
C	Softening of the terrain's irregularities	Forest and autochthonous plantations, including the creation of wetlands. Recreation of natural habitats.

Depending on the final shape of the terrain, there is a different aptitude in order to receive some kinds of performance or others that are summarized in the following table, generally speaking:

RESTORATION TYPES		
TYPES OF USE	CHARACTERISTICS	NECESSARY ASPECTS
AGRICULTURAL	 <ul style="list-style-type: none"> -Fruit tree plantations (citrus, olives...) -Cereals -Vines -Pasturelands -Fodders -Horticulture -Nurseries -Farms 	<ul style="list-style-type: none"> -Gentle slopes -Settling system -Fertile and reconstituted soil -Type of crop adapted to the water availability and to the soil conditions
FOREST	 <ul style="list-style-type: none"> -Tree planting for the wood exploitation 	<ul style="list-style-type: none"> -Moderate slopes -Fertile and reconstituted soil -Settling system -Species selection
NATURAL HABITAT	 <ul style="list-style-type: none"> -Recovery of the natural environment or creation of a new habitat. -Reserve (flora and fauna) 	<ul style="list-style-type: none"> -Fertile and reconstituted soil -Species selection
NATURAL HABITAT (wetland)	 <ul style="list-style-type: none"> -Shores and hole modeling -Fertile soil, we reconstituted in the shores -Species selection 	<ul style="list-style-type: none"> -Shores and hole modeling -Fertile soil, we reconstituted in the shores -Species selection
LEISURE ACTIVITIES	 <ul style="list-style-type: none"> -Hiking -Contact with nature/nature learning center -Observatory of species or areas of geological interest -Climbing -Hunting -Fishing -Aquatic sports -Fields to practice sports (athletics, football, golf, motocross, cyclo-cross, ...) -Aerodromes -Zoo -Botanical garden -Exploitation museum 	<ul style="list-style-type: none"> -Slope stability -Good geotechnical conditions of the restored soil -Accesses -In the vicinity of centers of population -Protection for the users -Good hole fitting-out (aquatic sports)
TOWN PLANNING	 <ul style="list-style-type: none"> -Housing developments -Parks and green areas -Auditoriums -Churches -Campsite -Cemetery 	<ul style="list-style-type: none"> -Gentle slopes -Good geotechnical conditions of the restored soil (foundations) -Accesses
INDUSTRIAL	 <ul style="list-style-type: none"> -Soil for the establishment of industrial areas -Parking lots -Dumping site for waste and composting plant -Water tank for human consumption or irrigation. -Fish farm -Sewage treatment plant 	<ul style="list-style-type: none"> -In the vicinity of centers of population -Protection for the users -Infrastructures (electric lines, sewer system, drinking water, access roads, etc.) -Good hole fitting-out and sealing (dump sites, deposits, fish farm)

3.2.3.3. Types of performance according to the functions:

In the context of modelling final scenes with a “positive environmental balance”, the various structures and interventions carried out have aimed to serve several functions, among which we should highlight the following ones:

- **Acoustic screens** that reduce noise emissions that come from the mine.
- **Screens that catch the suspended air** that comes from the mechanized extraction, material shipping and crushing works, and also from the leaks of exploited terrains that do not have a plant cover yet.
- **Plant islands so as to favour a biodiversity rise:** it is about recreating natural habitats that can be used as a shelter for the plant wild life and for the autochthonous animal one.

The diversity of plant formations entails the fauna diversity and its effect is the biodiversity rise regarding the starting point.

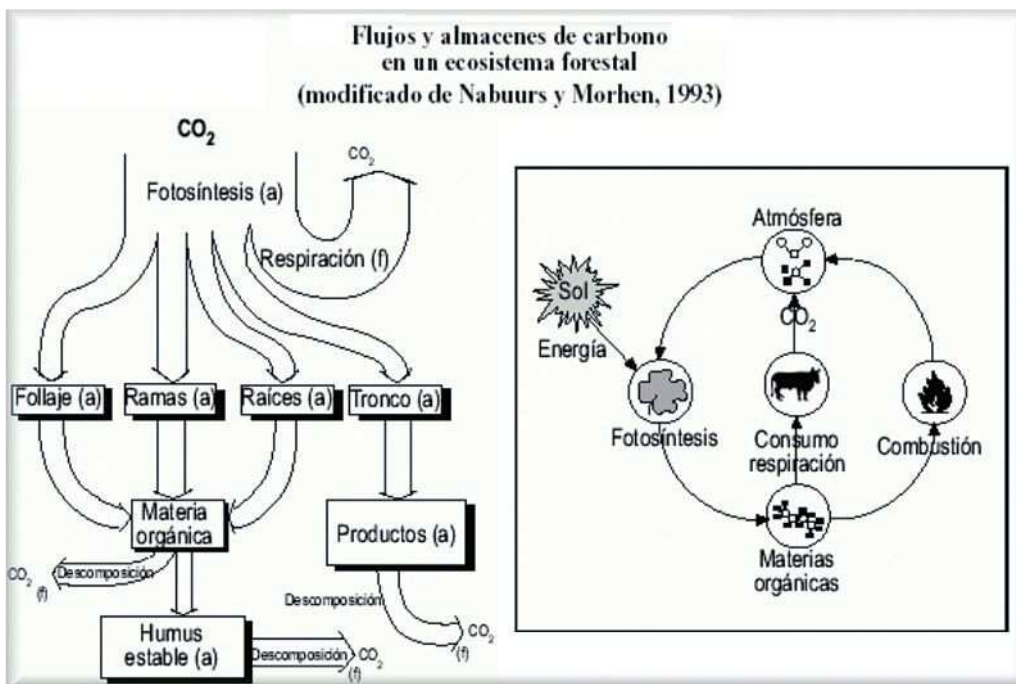
- **CO2 Drain:** Every living plant is a potential collector of atmospheric CO2 through the existing balance between the breathing and photosynthesis processes.

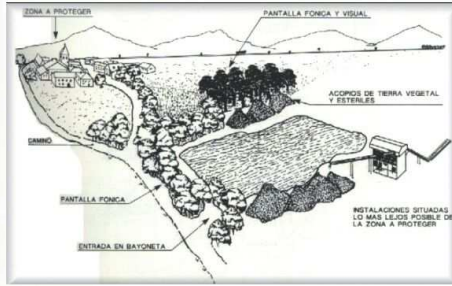
The introduction of this plant function is really important since several summits have been held about the climatic change and, specially, the established in the Kyoto Protocol.

Any plant surface has a CO2 fixing function, though in this project we have opted for introducing species that are specially effective, so we have resorted to woody and perennial plantations that block the CO2 in the wood at a very long term.

- **Soil stabilization and erosion stopping:** After the mining of terrains modified soils appear, whether they are natural or have been created after the dumping of sludge and barren; in many cases their geform shows steep slopes and their stability is endangered due to the act of more aggressive atmospheric agents (rain - runoffs; wind - pull up, shipping and barren storage; ice - land cracking).

The use of vegetation combining species with several types of system, radical regarding their shape and size, favours the land stabilization in its various levels. Likewise, the foliage slows down the energy with which several of the abovementioned meteors act on the terrain.



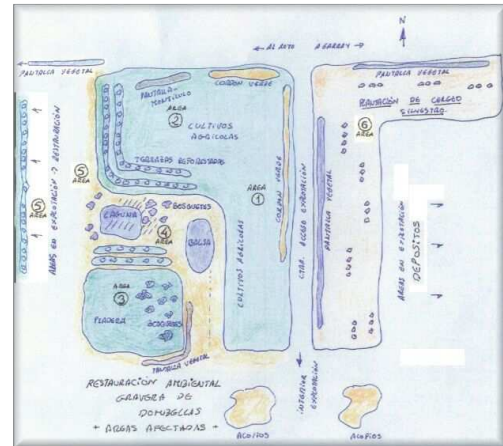


- Reduction of the visual impact: As a result of the change in the land's shape, the installation of several mechanical structures can really stand out in the appearance of the landscape where they are located.

Through the introduction of plant screens located strategically, it is possible to reduce or stop the visual effect from the most significant places of the environment.

3.2.3.4. Performed actions:

Once the generalities taken into consideration in the framework of the LIFE project have been depicted, the particular undertaken actions, as well as their location in the mine, have been briefly described immediately afterwards.



3.2.3.4.1. Areas 1 y 2: Agricultural crops:

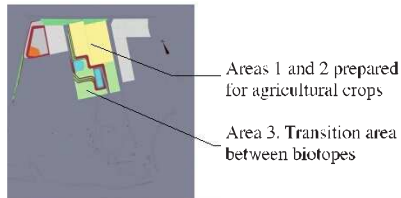
Agricultural crops are located on the top area of filling materials, taking advantage of the flat and horizontal geomorphologic shape of the land.

Previously, the slopes and levels of the platform were corrected in order to distribute the rain off water flows correctly (mainly to avoid floods); improving the “edaphic horizon” through organic and limestone soil amendments (removal of vegetal soil, stock and restoration after the mining activity) and establishing an automatic spray/sprinkle irrigation system.

Typical area and planned rotation crops are introduced in the area, however with improved quality soils and able to be irrigated: cereal (wheat, rye and barley), sunflower, sainfoin and alfalfa.

3.2.3.4.2. Area 3: Transition area between biotopes:

It belongs to a similar shape surface, related to areas 1 and 2; however, the treatment has been rather different and an integration model of diverse areas has been used, natural small forest alike woodland and agricultural crop flat areas.

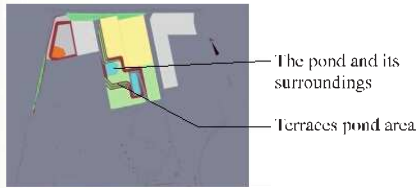


This area shares broad-leaved and coniferous cone irregular planted small forest areas, with perennial herbaceous crops such as the sainfoin (*Onobrychis viciaefolia*). The areas nearby are areas 1 and 2 of agricultural crops and the next one is the terrace area with arboreous and shrubby autochthonous vegetation.

In the case of woody and shrubby species, aiming to recreate a dynamic aspect forest mass, different sizes, and/or ages in the same species are used. These measure intents to “break” the artificial aspect of homogeneous same-age individual tree-plantations (In the natural forest young, mature and aged individual trees co-exist).

Additionally, the planned tree alignments, as well as the rectilinear tree demarcations are avoided. This way, a more natural appearance will be achieved





3.2.3.4.3. Area 4: Wetland (Pond and its surroundings):

In the pond, a lake environment along with a scrubland vegetation border has been recreated, altered with herbaceous areas; following a similar philosophy than the explained in the former section.

This area is located in the lower level of the dump. It has a flat and slighted undulated topography, with a special features since there is a steeply depression that is rather often fled by water, thanks to the rain water filtration favoured by the clay base compacting and slope level-out at the sight of the outline and the emergence, after the mining, of captive water pockets.

Herein, in this area, is where a higher level, if possible, of biodiversity will be located, both at the fauna and flora level, since the terrestrial and aquatic ecosystems emerge.

During the restoration process the following action lines were undertaken:

- Change of land´s topography.
- Correction of the shores of the pond, recreating the deep and shore or temporary flooded areas.
- Contributions and lay-off of 'edaphic horizon' previously stocked-up and 30cm thick enhanced.
- Installation of irrigation systems supporting the further plantation beyond the pond.
- Planting of selected species.
- Creation of shelters for the aquatic fauna.

The aquatic pond ecosystem has a huge potential to increase the biodiversity. Previously to the start of pond shores correction works, the presence of aquatic fauna was ascertained, mostly amphibious-type, with a significant frog population (*Rana perezi*), as well as Common Tree Frog (*Hyla arborea*) despite the existing scant vegetation at the moment. Additionally, the rather often presence of predatory species of the aforementioned was



ascertained as well: Viper (*Vipera latasti*), Grey Heron (*Ardea cinerea*) y White stork (*Ciconia ciconia*).

To consolidate the settlement of the aforementioned fauna, the vegetation and environment to shelter and breed them has been recreated.

The pond has been equipped with all type of structures and additionally certain level of water nutrients has been strengthened in order to ensure the presence of micro fauna and rotting-material invertebrates as first step, after the vegetation, of the trophic chain.

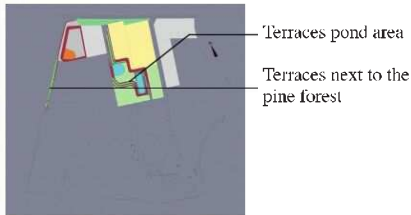
In order to achieve this, remains of wood vegetation have been included in at the bottom and on the shores, vegetation that was obtained in the collaboration framework with firm, company in charge of green areas maintenance of the city of Soria.

The branches of shallow water and shores have been slowly and progressively incorporated, monitoring their decomposition and performing the water analysis to avoid eutrophication processes.

In the areas beyond the pond and in those areas nearby the slope, the different species has been inserted to create barriers and graded and slightly defined transition areas.



VEGETATION AREA 4 - POND AND ITS ENVIRONMENT	
AREA	VIABLE SPECIES
SHALLOW WATER	BULLRUSH (<i>Thyfa latifolia</i>)
	GIANT REED (<i>Fragmites australis</i>)
	RUSH (<i>Juncus efussus</i>)
	PURPLE WILLOW (<i>Salix purpurea</i>)
	PURPLE WILLOW (<i>Salix atrocinerea</i>)
	CORNELIAN CHERRY TREE (<i>Cornus sanguinea</i>)
SHORE	WHITE WILLOW (<i>Salix alba</i>)
	POPLAR (<i>Populus alba</i>)
	POPLAR (<i>Betula pubescens</i>)
	WILD ROSE (<i>Rosa canina</i>)
	BLACKBERRY BUSH (<i>Rubus ulmifolius</i>)
	BLACKTHORN (<i>Prunus spinosa</i>)
MEADOW AREA (not flooded)	ASH TREE (<i>Fraxinus angustifolia</i>)
	ELM TREE (<i>Ulmus campestris/pumila</i>)
	COUNTRY MAPLE (<i>Acer campestris</i>)



3.2.3.4.4. Area 5: Terraces

This area belongs to the slope facing the dump and consequently consists of the material discarded in the aggregates cleaning processes and basically is clay-based.

The first remodelling works of this land strip consisted of the creation of a slop stability bars through 3m-high x 5m-wide in the platform or verge.

One problem of this soil was its high impermeability due to its clay composition and the sudden changes of volume in function of the humidity level. The impermeability was seized by creating a rain water circuit circulating along with the revegetated areas and in the benefit of vegetation and additionally reducing the speed and energy impacting with and flowing on the slope (forced natural rainfall systems).

Since clay is an undesired material to develop the vegetation, and at least 30m 'edaphic horizon', previously stocked and enhanced layer was placed.

The module of undertaken plantations in this area consists of either wood and shrub-type autochthonous species or allochthonous facultative, aiming to settle the land since they were already adapted to the initial conditions of the soil. They belong to the Mediterranean vegetation species, since despite they will have irrigation system the initial years, the area is a clearly rain water draining area.



The stratification of the vegetation in high elevations (trees and bushes or shrubs) intends to provide with a natural appearance the entire environment, taking advantage of the size of the trees to hide the existing slope between each verge, on top of which the vegetation or the topsoil would be impossible to be planted or be supported.

Species with powerful root systems able to drill the clay-layer have been chosen, in order to create natural elements to stabilize the slope.

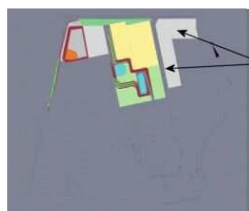


Within the bar formation work, it is worth pointing the area located ‘nearby the pine wood’; they are highly uneven or hilly areas as consequence of excavation areas in the border of gravel pit as consequence of different earthmovings fill and layer off through sludge spill-off and levelled ground works.

The lack of space in the area obliged them to create small verge on top of which different wood species were planted with the aforementioned indicated criteria and with the objective to provide stability to the soil.



VEGETATION AREA 5 - TERRACES	
AREA	VIABLE SPECIES
VERGE	PINE (<i>Pinus nigra</i> and <i>Pinus pinaster</i>)
	PHOENICIAN JUNIPER (<i>Juniperus thurifera</i>)
	GALL OAK (<i>Quercus faginea</i>) (northern exposure)
	HOLM OAK (<i>Quercus ilex rotundifolia</i>) (southern exposure)
	ROCK ROSE (<i>Cistus albidus</i>)
	ROCK ROSE (<i>Cistus laurifolius</i>)
	BROOMS (<i>Cytissus scoparius</i>)
	DORYCNIUM (<i>Dorycnium pentaphyllum</i>)
	WEGDORN (<i>Rhamnus alaternus</i>)



3.2.3.4.5. Area 6: Agroforestry crops.

A flat area along with the access to the gravel pit is assigned to experiment with autochthonous forest species that can be used as model of sustainable agroforestry system and consequently as an alternative to the typical agricultural model of the environment.

The selected species is the sweet cherry (*Prunus avium*) with a triple-fold asset; according to some studies carried out by the

School of Agricultural Engineering of the University of Valladolid in Soria:

- Adaptation already proven in the weather conditions of the area since it is an autochthonous species of Soria. This species thrives in a natural way in the mountain areas of Soria Iberian System, where the rainfall regime is higher, and even more; there are no xeric summer conditions. These constraints have been overcome by the application of irrigation systems powered by renewable energies and using localized and high efficiency emitters. The irrigation is mostly applied in the summer season to overcome its reduced water conditions.





- Suitable CO₂ fixing capability since it is a perennial and long-lived crop that keeps the CO₂ fixed in the wood and filtering it into the soil through the humid components derived from the leaf fall, remains of prunes and 'shedding' of roots.

- Capability as wood crop: The sweet or pink cherry is a wood of exceptional quality and in-demand in the European market.

This essay intends to establish as illustrative crop methods addressed to this production as a sustainable alternative model to the environment crops.

- Biodiversity: Sweet cherry plantations contribute to the increase of biodiversity in the area in which the demonstration is undertaken, since it introduces a new vegetal species with respect to the start of aggregates mining activity. Likewise all the signs point to the fact that as the plantation increases in age and size, the fauna will be increased as well as its presence, since it

offers settlement and food to birds, invertebrates and different predatory species.

The cherry plantation is located in the East side of the gravel pit, in the area adjacent to the large spaces devoted to agriculture and SO-801 road (Tardasillas - El Royo). Consequently the plantation serves as a biotopes barrier or transition area between the agricultural areas and the forestry areas at its West side; it will reduce the views over the mine from the road and will be used as a natural barrier so as to mitigate the suspended dust remains and noise; since NW wind is the predominant wind of the area.

The irrigation water contribution when required is performed by a irrigation system (high frequency located irrigation) and an application technique 'between plant stem' in order to create a humid strip along with the plantation rows that improve the common located irrigation system in each plant stem; and achieving, this way, a higher mining of the land by the root plant systems.

Graphic note of land preparation, plantation and development processes:





3.2.3.4.6. Plant screens:

This chapter takes into consideration the different types of introduced structures within the enhanced areas complying with the following conditions:

- **Reduction of undesirable views** that contrast negatively with the environment.
- **Reduction of wind incidence** and, consequently, of the dust suspension leak (capture capability).
- **Ambient noise muffle** generated by the extractive machinery, the aggregated processing plant and the transportation means to the outside area.
- **Biodiversity islands**, since they consist of different vegetal species with all typical sizes: herbaceous, sub-shrub, shrub and arboreous. 'Living fences' will be equipped, typical of some areas to delimit the agricultural parcels and important settler of wild life.
- **CO2 Fixing:** In their mature stage they will have a huge biomass amount per surface unit since they are planted in thick plantation schemes. For this reason, they are CO2 drain we should take into account. On the other hand, they will be located in the main areas of pollution emissions , such as traffic routes for heavy machinery.



Regarding the different types of structures that have been introduced, they are:

▫ **Linear barriers:**

They are row or linear plantations with a low height. They are one or two rows of plants combining several sizes of vegetation alternating the more or less pre-determined shape and with distances between plants about 2 to 4m in the case of arboreous species and 0,5 to 1m in the case of shrub-types.

They are used in areas where the width is not enough to perform wider bands as the propriety fences, borders or roads.

Their final appearance will be as a thick hedge however consisting of several species and sizes.

Prunes over different natural elements can be performed in order to restrain the size and growth, but never using square or artificial shapes to keep them always with a natural appearance.

These types of screens are located within the mine in the border with the wild cherry plantation with the access road to the inside of the mine and the border of the aforementioned and the SO-801 road (Tardesillas-El Royo).

One sole plantation row is used with distances between plants of 4m in case of trees and 0,5m in case of shrubs. Trees and shrubs are planted among the same row.

The thickness (width) of the screen in its mature stage will keep with the irrigation areas of the most voluminous tops (about 6m width).

The screen is provided with drip row irrigation system, using integrated and every-meter self-compensating drip pipe.

In the area of the screen bordering the SO-801 road, the *Salix atrocinera* is the only one used, since this species has been populating the gutters from Tardesillas village to adjacent environments to the area, fully achieving the landscape integration.





VEGETATION IN LINEAR BARRIERS	
AREA	VIABLE SPECIES
CHERRY TREES INTERIOR ACCESS ROAD	SIBERIAN ELM TREE (<i>Ulmus pumila</i>)
	CORNELIAN CHERRY TREE (<i>Cornus sanguinea</i>)
	PURPLE WILLOW (<i>Salix purpurea</i>) / (<i>Salix atrocinerea</i>)
CHERRY TREES SO-801 ROAD	PURPLE WILLOW (<i>Salix atrocinerea</i>)

▫ **Revegetated mounds:**

They are artificial elevations of land planted with vegetation.

They are structures rather appropriated to 'hide' undesirable views, since well constructed they seems to be natural risen in the ground.

They are constructed with sterile material coming from the mine, are covered with enhanced topsoil and identical or similar vegetation to the environment's is planted on it.

In our case a cordon line has been performed in the area bordering with SO-801 road; being its main mission to break the view over the mine from the road, hiding the far away views by hindering the line of sight.


Aiming to make it similar to a natural geographical feature, it has been mainly revegetated with fruit trees and shrub, including some few arboreous stems or trunks.



It is 250m-length with a 3m-width in its base and 1.5m-high.

The shrubs have been planted with 0.5 plants per m² density.

As far as the trees are concerned, once attended the plantation surface, its aim and aesthetics; two medium shrub-type size trunks have been planted (Kermes oak).

VEGETATION IN REVEGETATED MOUNDS	
AREA	VIABLE SPECIES
ON THE EDGES OF THE ROAD SO-801 	FRENCH LAVENDER (<i>Lavandula stoechas pedunculata</i>)
	MARJORAM (<i>Thymus mastichina</i>)
	ROCK ROSE (<i>Cistus laurifolius</i>)
	KERMES OAK (<i>Quercus ilex rotundifolia</i>)

□ **Green corridors:**

They are 'higher magnitude' screens since they use considerable wide and large planted surfaces; going along with SO-801 road.

One of the most important action lines under this category has been the planting of a plant screen in the adjacent areas of the current mine and the short-medium term mining areas.

It has an average width of 15m and about 1,200m length.

The philosophy of this type of screen is to imitate in the foreground (from the road) the type of existing vegetation (holm oak and pine tree in this case) in the area, so it has not to seem an artificial linear formation, but the front or natural section practiced by the road in the original mount.

This type of plant formation has as well an important function of CO₂ fixing, since it is close to the traffic ways of machinery and has a huge amount of vegetal biomass.

The premises of the construction of the main screen have been:

- Low maintenance
- Landscape coherence with the environment
- Functional with its objective
- Durable and self-regenerative.



The selected species has been chosen based on the following characteristics:

- Broad-leaves and stout high-growth species.
- Adaptable to environment (autochthonous or allochthonous facultative) and according to the environment existing species.
- In terms of the plantation schemes, it has been taken into account the use in the same species of different ages and sizes individuals aiming to provide with naturalness and dynamics the plantation.
- Keeping the levels, respecting those specimens that due to their special interest or protection have been kept in their original location.

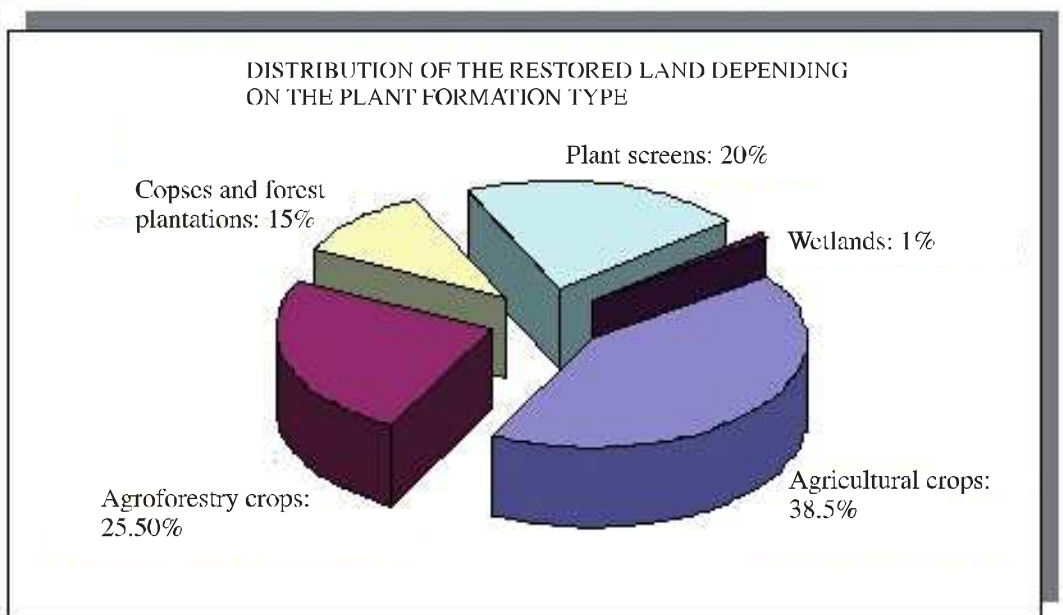
As in the case of agroforestry crops, the irrigation will be made using high frequency (micro) irrigation between the plant stems; so two deposits in elevation have been installed to improve the pumping by gravity effect and they are powered with renewable energy provided by a hydroelectric equipment (solar tracker plus wind device) also installed to the same purpose.



VEGETATION INTRODUCED IN THE GREEN CORRIDOR		
PLANT GROUP	VIABLE SPECIES	% of occupation
MAIN SPECIES	(trees)	75-80%
	Pinus pinaster	70%
	Pinus pinea	10%
	Pinus sylvestris	20%
OTHER SPECIES	(Trees and shrubs)	25-20 %
	Trees	20%
	Quercus faginea	25%
	Quercus pyrenaica	15%
	Quercus ilex rotundifolia	50%
	Acer campestre / monspessulanum	10%
	Shrubs	80%
	Cytissus scoparius	5%
	Cistus laurifolius	30%
	Lavandula stoechas pedunculata	50%
	Rosa canina	5%
	Prunus spinosa	5%
	Rubus ulmifolius	5%
PLANT TYPE	PLANT SIZE	% to be planted
TREES	Plants > 1,75 m.	10 %
	Plants 30-50 cm.	70 %
	Plants < 20 cm.	20%
SHRUBS	Plants > 0,4 m.	20%
	Plants < 0,4 m.	80%

3.2.3.5. Summary of improved areas, created biotopes and plant structures

PERFORMANCE	YEAR 2005	YEAR 2006	TOTAL (m ²)
	Works that have been carried out / development	Works that have been carried out / development	
AGRICULTURAL CROPS			47.500
Area 1: Agricultural	Finished and being cultivated	Finished and being cultivated	32.500
Area 2: Agricultural	Earthmoving Initiated irrigation system	The framework for future crops has been finished Efficient irrigation systems	15.000
AGROFORESTRY CROPS			31.470
Area 6: Cherry trees (A)	Finished and being cultivated	Finished and being cultivated	13.755
Area 6: Cherry trees (B)	Filling with improved topsoil Irrigation systems	Finished and being cultivated Efficient irrigation systems	17.715
COPSES AND AGROFORESTRY PLANTATIONS			18.721
Area 5: Terraces in the pond area	Earthmoving Planting started	Executed planting Replacement	825
Area 5: Terraces in the pine forest area	Earthmoving	Executed planting Efficient irrigation systems	1.500
Area 4: Wetland	Earthmoving Soil improvement	Executed planting Efficient irrigation systems	4.720
Area 3: Transition	Earthmoving Soil improvement Assembly of irrigation systems	Executed planting Efficient irrigation systems	11.676
SCREENS			24.600
Limits of the cherry trees- Interior road of the mine	Executed planting	Replacement	250
Limits of the cherry trees- SO-801 Road	Ditch streamlining	Executed planting	350
Green screen: Passes parallel to the SO-801 road	Setting out and earthmoving in the track	Earthmoving Efficient irrigation systems Renewable energies Executed planting	24.000
WETLANDS			1.100
Area 4: Pond	The streamlining of the pond has been finished	Finished planting	1.100
TOTAL MODELED AREA (Includes some preexisting "improvements" that are now integrated in the model)			123.391



3.2.3.6. Volume de captured CO2 by carbon fixing derived from the environment enhancement

Year 2.005							
Name	Crop type	Collecting area (Ha)	Average Index in CO2 Tons/ Hectares and year	Collecting level	Tons. Total CO2/year	M3 water Average requirements Hectares/year	Foreseen total volume
Cherry tree planting (phase I)	Arboreous	1,37	0,18	Wood and foliage	0,25	360,00	493,20
Cherry tree planting (phase I)	Arboreous	1,37	4,20	Soil	5,75		0,00
Other leafy trees (ash tree, poplar, etc...)	Arboreous	0,80	0,50	Soil+plant	0,40	360,00	288,00
Crops (grain cereal)	Herbaceous	1,60	0,70	Soil+plant	1,12	3.000,00	4.800,00
Crops (fodder leguminous plant)	Herbaceous	1,60	1,00	Soil+plant	1,60	6.000,00	9.600,00
Green islands (plain, terraces and plant screens)	Mixed	0,05	1,50	Soil+plant	0,08	288,00	14,40
TOTALS		6,74	1,35		9,20		15.195,60

Year 2.006							
Name	Crop type	Collecting area (Ha)	Average index in CO2 Tons/ Hectares and year	Collecting level	Tons. Total CO2/year	M3 water Average requirements Hectares/year	Foreseen total volume
Cherry tree planting (phase I)	Arboreous	1,37	0,91	Wood and foliage	1,25	360,00	493,20
Cherry tree planting (phase I)	Arboreous	1,37	9,50	Soil	13,02		
Cherry tree planting (phase II)	Arboreous	1,77	0,18	Wood and foliage	0,32	360,00	637,2
Cherry tree planting (phase II)	Arboreous	1,77	4,20	Soil	7,43		
Other leafy trees (ash tree, poplar, etc...)	Arboreous	0,80	0,50	Soil+plant	0,40	360,00	288
Crops (grain cereal)	Herbaceous	1,60	0,70	Soil+plant	1,12	3.000,00	4.800
Crops (fodder leguminous plant)	Herbaceous	1,60	1,00	Soil+plant	1,60	6.000,00	9.600
Green islands (plain, terraces, plant screens...)	Mixed	3,70	1,50	Soil+plant	5,55	288,00	1.065,6
TOTALS		13,98	2,31		30,69		16.884

3.2.3.7. Additional optimization measures:

This section includes other action lines undertaken to promote and enhance the plan objective of biodiversity spaces enhancements.

□ Protection and promotion of spontaneous self regenerated autochthonous vegetation:

It has been pointed that in the enhanced areas, due to the restore of vegetal stratum reserved at the start of the mining and the enhancement of soil; the propagation seeds of some autonomous species of the area (mainly seeds), start the colonization processes. It has been ascertained that the digging up of the previously stocked soil activates the seed germination coming from the pre-existing vegetal mass.

The most spectacular case is *Cistus laurifolius*' (in the verges of the terraces) and the *Salix atrocinerea* (in the pond shores).

As the restoration philosophy is to take as reference the starting point from the environment viewpoint, it has been considered as logical to take advantage of the spontaneous response of the nature at the sight of the new situation created by the mining; consequently, the natural flora has been protected taking the following measures:

- Perform selective weeding leaving the seedling of special interest, but keeping a logical order since some of them are invasive such as *Salix atrocinera*.
- Include the spontaneous seedling well located within the plantation distribution in the crops forecasted plans: irrigation, compost, etc...
- In the performed actions outside the non-exploited areas (green corridor) it has been intended to select the natural stems and trunks well located and of interest; leaving its adjacent areas without any earthwork required to prepared the land. In this area there are the *Quercus ilex rotundifolia* trunks.



□ Propagation of spontaneous reclaim:

Some species that are reclaim spontaneously in the areas exploited offer the possibility to get vegetation easy planting seedlings.

This material will be the best genetically adapted to the eco conditions of the areas due to its spontaneous and autochthonous characteristics. Using easy operations, seedlings have been obtained that have been replanted in other areas, aiming to increase the colonization speed of these species.



Table of current species and regular methods of vegetative propagation.

SPECIES	PROPAGATION METHOD
BULLRUSH (<i>Thyfa latifolia</i>)	Underground rhizomes
LOMBARDY POPLAR (<i>Populus nigra italica</i>)	Rooted basal shoots
BIRCH (<i>Betula pubescens celtiberica</i>)	Rooted basal shoots
WILLOWS (<i>Salix purpurea</i> / <i>Salix atrocinerea</i>)	Rooted basal shoots. Semi-woody nursery cutting



- **Nesting boxes installation:**

Nesting boxes have been installed in order to attract different birds while plantations acquire bearings enough to guarantee the refuge for this species. It is a measure to promote biodiversity which also tries to guarantee safe levels of fitohealth in plantations, since many of these insectivores are plague consumers.

□ **Experimentation with fertilizers and ecological preparations for the improvement of the introduction of forest plantations and restoration in general.**

It is a way of interconnection between two LIFE programs. In the Eco-Mining project the product TERRACOTEM, produced by the firm TERRAVIDA, specialized in the elaboration of products for the preparation of soil for agriculture, gardening and reforestations like compost and different kinds of corrections, has been tested with acceptable outcomes. This company participated in the project LIFE00 ENV/E/000543 "Processes of co-composting and application of its products in landscaping, reforestation, forest and agricultural cultivations in Andalusia".

The applied product (TERRACOTEM) is a mix of polymers and aggregates which, applied on the plantation holes, is used to improve the soil, as it provides air to the soil; ; nutrients, as it is enriched with mineral fertilizers; and, above all, produces a retainer effect of the soil humidity, thanks to the content of a hygroscopic polymer which absorbs the water of rains or irrigation and gives it progressively, reducing the losses because of percolation or evaporation.

This product favours the percentages of roots of new plantations and constitutes a factor for the saving of irrigation water, as it increases its permanence in the soil.

It has been applied in different plantations, doing sample plots without the product and plots with different amounts of it in the same conditions and with the same vegetable species.

└ Stores and processing for the preparation of natural compost:

Soil analyses provide as a result its low content in organic matter of the original soil.

The very objectives of the project (increase of biodiversity and improvement plans as reinforcement of the ones for restorations)" imply improving the soil conditions, favouring the adaptation of a higher number of species and increasing the load of potentially generable bio-mass.

By means of an agreement with the company in charge of the maintenance of gardens and green areas in Soria; Hormisoria receives in the gravel quarry the vegetable origin waste from these maintenance works:

- Grass collection waste
- Hedges and edges pruning waste
- Leaves from the autumn harvest
- Woody elements from the tree pruning and bases elimination.

All this bio-mass is treated in areas annex to the gravel quarry for the elaboration of "compost" and "mulch", in order to improve the composition of modified soils providing organic matter.



An area specially aimed for the store and elaboration of compost has been created.

Composting is a natural process of degradation of organic matter, in this case with vegetable origin, made by aerobic microbes. The process is quick in mild stations and needs humidity and air.

For this, you need distributing the waste in narrow and approximately one meter height cords, with the aim of achieving a balance between the pile humidity and its aeration.

The formation of compacting causing the appearance of non-aired areas in the pile must be avoided, as it results in the production of anaerobic fermentations in which metabolites generally toxic for plants are produced. This can be detected because of the bad smell from the pile, which must be turned over and aired. The well-elaborated product (compost) has a fibrous granular appearance and a pleasant aroma of "forest aroma".

In order to increase the handling of waste, favour its aeration, the contribution of humidity and value the "waste" obtained from the hydrocycloning battery (prototype - 1st phase); vegetable waste is mixed forming alternate layers, with the superfine sand obtained; thus achieving an alternate use for this subproduct





of the aggregate cleaning process and taking advantage to make up for the costs of this treatment, time reduced in “work machine” devoted previously to the transport of sludge from the settling ponds (prototype – 2nd phase).

In the first phase, the vegetable material cords are built with mechanical means (shovel), alternating layers with the aforementioned sand. (In volume, about 80% vegetable waste / 20% fine sand is used).

Later, in consecutive turns both materials are mixed and sand is used as a mean of triturating and homogenization of vegetable materials.

Experience has proofed that the composting process lasts, at least, one year; since there were no previous data in the weather conditions in the area.

Other extremes that must be taken into account during the elaboration process are the addition of water by external means and of microbe flora; by means of the addition of cured manure to the pile.

The final product (compost) is used as an organic correction within the very plantations of the mine within the framework of the LIFE project; and within the context of the model of “conciliation of interests” that the very project considers in collaboration with “Sociedad El Carrascal”.

= Elaboration of a botanical inventory.

The University of Valladolid, through its centre in Soria (Escuela Universitaria de Ingenierías Agrarias), works on the elaboration of a botanical inventory of the environment flora. This work is going to be published in a book or explanatory leaflet as a manner for the environmental divulgation and awareness in performances to be developed in a time frame “Post-LIFE”.

= Use of renewable energy for the irrigation of plantations.

In order to successfully achieve the establishment of some species which base their effectiveness in a quick generation of vegetable volume (bio-mass), additional irrigation contributions are needed, especially in the first years of plantation and in drought periods.

In coherence with the philosophy of the LIFE program and with base in the proposal approved from the Eco-Mining project, the introduction of renewable energy for the feeding of the systems of irrigation, recuperation and conduction of water from the “forced natural settling deposits” to the distribution pond has been promoted.

The irrigations systems that have been introduced:

- Reuse the effluent streams of the mine as main source of water.
- Use efficient techniques: high frequency localized systems (trickle irrigation, microsprinkling, etc...)
- Are driven by renewable energies.

The system consists of two underground deposits of 40 m³ capacity fed with waters recuperated from the mine.



As existing drops do not allow providing the irrigation system with an optimum operating pressure by gravity (2 Kg/cm²), a pumping system driven by a solar and wind hybrid installation; consisting of the following elements:

- Stationary accumulator 1500Ah-24V.
- Reverser / loader MS5.000/220 V.
- Wind-solar regulator 150+30 Amp.
- Inclined aerogenerator 3.000 neo 24V, on a tower of 9 m height.
- Monocrystalline solar panels of 165 w/24 volts, on a follower support.

The pumping group consists of a pressure group composed of a double turbine pump and incorporated 4 CV manoeuvre; 500 l steel hydrosphere; 40 m³ control levels in both deposits and electrovalves for irrigation sectoring.

Basically, the system stores in accumulators the electric power generated by the solar panels and the aerogenerator, using the source of energy most efficient in every moment (day - night - no sun - absence / presence of winds, etc...); this energy is used to drive the pump impelling the irrigation water.

□ **“In-situ” justifying identification of the different biotope recreated.**

For didactic and awareness purposes of schoolchildren and university students of different engineering branches who yearly visit this mine and reinforcing the very exemplifying diffusion of project in benefit of the transfer of the model internationally, in every generated biotope specific signals have been designed and introduced, which internalize the LIFE logotype and explain the basic elements conforming each area, its environmental interest, its aim and the justification which has lead to its creation as environmental improvement.





3.2.4. Field: “Conciliation of interests”:

The project in this area of performance has also achieved proving the utility of environment as element for the endogenous development of depressed areas and for the conciliation of interests in conflict when the “ownership of the land” and the one of the “mining right” are held by different hands.

The conflict situation arises in a natural way and is almost generalized in the European Union when the right provided by law for the mining industry to exploit a resource declared as of “public utility” and the right of ownership of the soil collide when they are not in the same hand.

The “Eco-Mining” project has introduced the basis of a new informer principle for the mining activity: “Cooperating instead of arguing”, proving that it is possible, in some cases, changing the “lawsuit” for the “cooperation and agreement” with its basis in the very improvement of environment.

For this purpose, different elements that have been proven to be useful to establish a collaboration framework and beneficial for both companies have been maintained, which were based on the environment:



- The ability of the Beneficiary (Hormisoria) to intervene over the terrain (this capacity of intervention can be considered, at the same time, as an opportunity or as a threat).

- The desire of a community, in this case grouped around the “Sociedad Civil El Carrascal, Tomillar, Llanos, Cuesta y Otros”, for favouring the resurgence of two localities victim of the rural exodus (Dombellas and Santervás de la Sierra, in the province of Soria).
- The commitment with the environment by both parties, as a key element for conciliation: A company certified in ISO 14000 and a “communal” Company who has developed sustainable management tasks since its constitution in XIX century.



In the framework of this modelling, the following performances have been made:

- Restoration and improvement of degraded soils in collaboration with the Beneficiary.
- Creation of a “demonstrative area of the curb to erosion y for the capture and fixation of carbon”, in the State “El Comodruelo”, where previously existed an “uncontrolled tip” which has been timely closed and restored in the locality of Dombellas.
- Creation of an “area for the environmental awareness and the intergenerational life together”; in “Prado de San Sebastián”, in the locality of Santervás de la Sierra.
- Furthermore, and fruit of the synergies that the project has generated, both in public administrations and institutions and companies, different spaces have been promoted and adapted which mean an important added value for both localities in order to favour their endogenous development:
 - Improvement of the roads of access to Dombellas and Santervás de la Sierra.
 - Recovery of the municipal wash house in Santervás, where the information point of the LIFE project is located.
 - Building of a parking at the entrance of Santervás in order to minimize the impact of vehicles of the visitors of the different spaced of environmental interest created.
 - Improvement of environments and enlargement of the green areas of the church and fronton of Santervás de la Sierra.
 - Different improvements in roads of the locality of Dombellas.

The localities of Dombellas and Santervás de la Sierra, both belonging to the municipal district of Garray (SORIA), are located about 20 km far from the capital of Soria, at 1.100 meters altitude and in a picturesque place in the surrounding area of Monte de Valonsadero and on the slope of the mountain of La Carcaña.

In an area of 2.554 hectares (34% of the surface of the municipal district of Garray), at the start of the project there were 44 inhabitants (over 337 inhabitants of the total census of the municipality of Garray including both localities). Even the proximity to the capital, Soria, has not protected these localities of the scourge of depopulation and of rural exodus forming, thus, one of the periurban nucleuses with less population of Spanish.



On the other hand, and in spite of the unquestionable natural and landscape value of their environment (Carcaña Mountain Range, Valonsadero Mountain, the Duero bank...), both localities had become depressed areas with scarce development, with unproductive soils in which the effect of erosion and, in some case, also of territory degradation, could be clearly seen.

The vegetation of the area is the one typical of the low mountain in this geographical area formed, mainly, by holm oaks, pine wood, thyme and rosemary and a large part of the terrain qualified as “unproductive wasteland”. The geological composition of the terrain and its proximity to Duero River results in the abundance of gravels and sands as a mining resource likely to be classified as of “public utility”.



3.2.4.1. Demonstrative area of the curb to erosion – Recovery of the estate “El Comodruelo”:

In this performance, for territory awareness and dynamizing purposes, a “Demonstrative area of the curb to erosion and capture and fixation of carbon” has been created in an unproductive soil degraded because of conducts against the environment.

In the framework of collaboration defined in the project, the company Hormisoria S.L. supplied 3.800 tones of earth and substrate to retrieve the interest of an area of the Company located in the right border of the SO-801 road which, over the years, had become an uncontrolled tip.

DATOS IDENTIFICATIVOS		Zona de actuación del Proyecto LIFE: "Eco-Mining"	
Alto	19 Km.	Coordenada X	542740
Ancho	19 Km.	Coordenada Y	4629727
		Huso en S. G.	30

Espacio demostrativo del freno a la erosión y captura de carbono Finca "El Comodruelo"		ESCALA
Fuente de la imagen: http://www.sispac.jccyl.es/		1:108500

< Espacio Demostrativo >
 "El Comodruelo"
 - Recuperación del suelo.
 - Ordenación - Roturación.
 - Definición del espacio.
 - Plantaciones:
 - Freno a la erosión (Vid).
 - Fijación de carbono (Cerezo).

[Comodruelo] Zona restaurada

[Comodruelo] Detalle del vertedero

[Comodruelo] Hormisoria, S.L. aporta tierra y nutrientes para restauración

[Comodruelo] Zona restaurada

[Comodruelo] Se retiró los escombros y se restauró la zona

[Comodruelo] Zona restaurada

[Comodruelo] Zona restaurada

Once the degraded soil had been recovered, it was ploughed up and the plan designed by a Forestry Engineer was executed in an area of 3 hectares of the estate “El Comodruelo”, doing the following actions:



- **VINEYARD plantation:**

For demonstrative and divulgation purposes of the curb to erosion, of analysis of the capacity of adaptation of Mediterranean cultivation to arid environment and extreme conditions (height, cold, wind, ...) and as dynamizer element of the area, for its cultural appeal and of distinguished challenge as experimental vineyard plantation pioneer in Spain in an elevation higher than 1.000 meters high

The area where this cultivation is located is the highest and flattest area of the estate and its plantation was done with three varietals, by manual means y with the style of “four wind plantation”.



- **CHERRY TREE plantation:**

Also for divulgation purposes, 1.270 cherry trees were planted to make schoolchildren and adults aware of the potential the tree species have to capture and fix carbon, collaborating to reduce the quantity of CO2 existing in the atmosphere.

Furthermore, a trickle irrigation system has also been installed in the cherry trees area, which takes advantage of the drop existing to make a gravity irrigation; and a part of the trickle irrigation has been directed to the area between saplings in order to favour its rooting, based on outcomes obtained by Hormisoria in its performances.



- **Forestry treatment:**

A series of forestry treatments has also been done which have consisted of the pruning and clearing of a holm oak wood which previously was a brave mountain



- **Perimeter protection:**

In order to protect the area for the animals in the forest (roe deer, deer, wild boars ...) and for livestock this area has been fenced in its perimeter respecting its correct integration in landscape.

- **Performance identification:**

Divulgation of this area and its environmental interest is reflected through the placement, at the entrance of the area, of an informative poster showing the LIFE logotype and the aim of the demonstrative action.



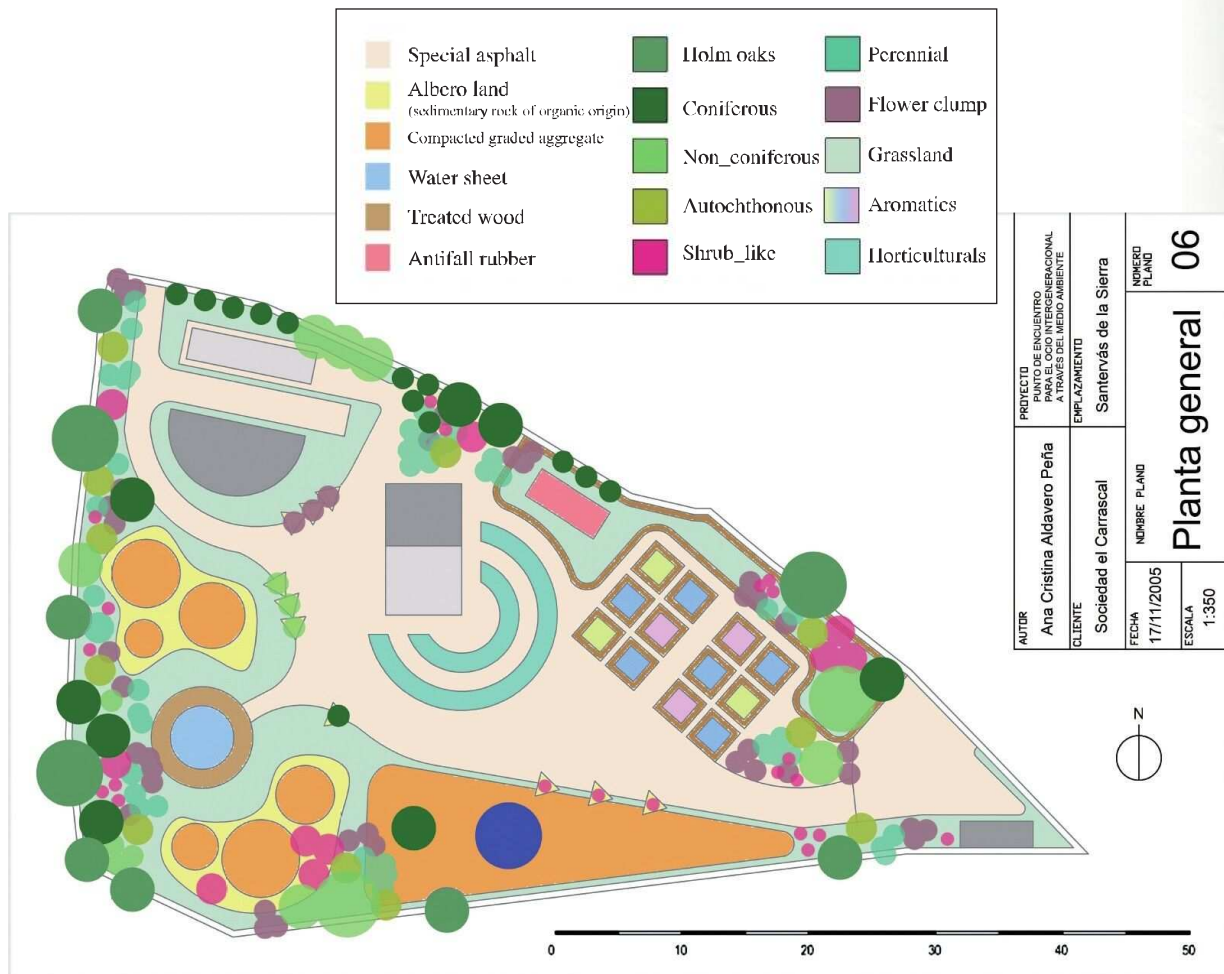
Furthermore, in the inside of this area and accessible for visitors, a divulgation panel has been placed which explains with more details the aim of this model, its environmental interest and its benefit for the endogenous development of the area.

3.2.4.2. area for environmental awareness and intergenerational life together:

- Performance (definition and aim):

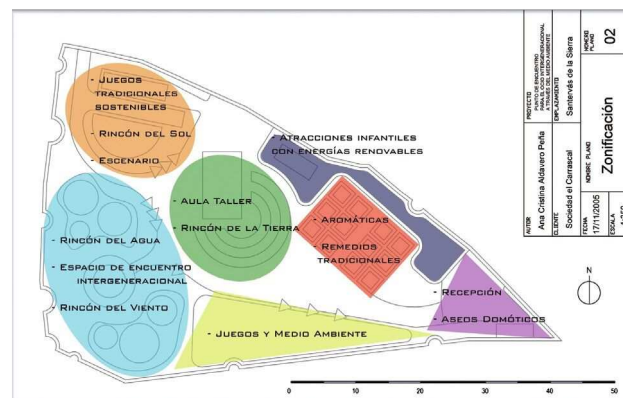
This performance has been done in the place known as “Prado de San Sebastián”, in the locality of Santervás de la Sierra, and shows, at “small scale” a global vision of the usefulness of renewable energies and the function of environment as driving force for the endogenous development in what constitutes a real meeting area for intergenerational life together.

This area is also used to lead visits to natural spots of the environment where different natural elements in which small cleaning and environmental value works are monographically highlighted at a higher scale.



Through game and participation, the visit of this place allows knowing the characteristics, potentials and interrelationships of the different nature elements:

- soil spot: socioeconomic significance of sustainable mining industry and agriculture as development alternatives
- Water spot: its use in the different phases of its integral cycle, its rational use, need for maintaining its quality, etc.
- Sun spot: clean energy source, its different uses, benefits, combination with other renewable technologies...
- Air spot: climate driving force, its quality, its potential as renewable energy source.



Furthermore:

- To make aware of the environmental repercussion of our daily acts: contamination and recycling.
- To show and experience the operation of renewable energies and their potential cycles of transformation and storing.
- To promote the enjoyment of nature, respecting the environment.
- To favor the intergenerational contact in spaces specifically devoted to children and adults and placed in the same precincts.
- To promote the endogenous development of the performance area.



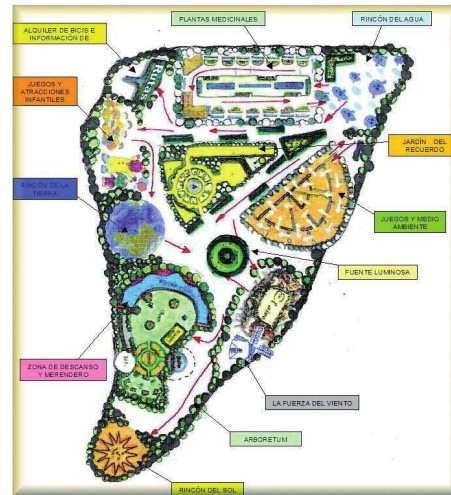
• Ideas contest:

For the definition of this place, a contest of ideas was called which was open to companies and general public since a double approach:

- One, at a “micro level”, in which the awareness action concentrates by means of “spots”, favouring, at the same time, and under the link of environment, the life together in an “intergenerational area”. This place is nowadays located in Prado de San Sebastián, in Santervás de la Sierra.
- Another one, at a “macro level” allowing the real contact with nature and environment and encouraging visitors to enjoy the outstanding beauty and important environmental value of the surroundings.

Both approaches complement to fulfil the function of awareness, dynamization and intergenerational life together aimed by the project.

The call turned around the aforementioned approaches and had a good reception among administrations, institutions, companies, teaching centres and general population and a very important repercussion in the media (For further details on the call, proposals and developments please go to <http://www.life-ecomining.org>):



- **Summary of the selected proposals:**

Presented by: Ana Cristina Aldavero Peña:

It is a proposal that gathered the “call for ideas” approach, giving it a specific content. The descriptive developments each of the spaces contained have allowed making a progress in the definition of the model and have been very helpful for the execution phase.

This proposal did also contain several activities designed to the participative environmental education in its various aspects: environmental values, current problems, sustainability, renewable energies, urban ecosystems, etc.

Presented by: Grupo ESOLTEF.

This company, devoted to the design and installation of renewable energy, made an approach with potential applications based on such generation forms.

The one about installing a photovoltaic solar installation whose effective area was located on the scene of the designed building and allowed the environmental awareness in the solar energy as a renewable source was considered.

Presented by: ARIEMA, Energía y Medio Ambiente.

A company devoted to the hydrogen technology and the fuel cells; presented a very elaborate integral proposal in which they make known the hydrogen’s potential as the future technology.

With a demonstrative purpose, some educational applications based on this renewable energy supply and storage system are exhibited in this area; with which the visitors will be able to know and experience their possible uses and operation.

Presented by: Mr José Manuel Marín (inhabitant of this locality).

Included several proposals linked to the own history and culture of the area, among which we should highlight:

The cleaning and recovery of some “lost sources” in the area and the subsequent uses of water for demonstrative purposes.

The recovery of former “handmade bridges” that had been nearly lost in order to incorporate them into the hiking and bicycle touring routes that have been designed.

- Spots for the environmental awareness:

From Prado de San Sebastián and the Estate “El Comodruelo”, the routes that lead to several spots that will be useful for raising the public awareness of the need to look after the environment have been identified. For this reason, a specific signage that marks the routes to the places of interest has been installed, where the logotype of the LIFE Program is internalized.

“LAS CORDACHUELAS” SPOT: located high over the town of Santervás de la Sierra, is a privileged place where the project places the “Wind spot” at a macro level, as there is a lot of wind for children and young people to play with kites, hear its sound or just carry out educational or play activities related to this element of nature.



Mirador de Las Cordachuelas

Estás en la solana de sierra de Carcaña, al resguardo de los vientos fríos procedentes de las sierras del norte provincial. Esta sierra junto con los relieves grisáceos que se dibujan en las proximidades del río Duero constituyen las Sierras Ibéricas o sierras de altitud media que contornean los mayores macizos del Sistema Ibérico soriano septentrional (Urbión y Cebollera).

- 1 Águila real
- 2 Búho real
- 3 Búho leonado
- 4 Cuervo
- 5 Cornejo
- 6 Búho real
- 7 Colapso lizo
- 8 Escribano montesino
- 9 Alcaudón dorsiniego
- 10 Perdiz

El Caseruco

Monte Vidueyro

El Comestizo

Sierra de S. Marcos

Pico Fresco

Río Duero

Las Vegas

Santervás

Rebollar

Alameda

El Páramo de Plancho

Rebollar

Malvarrosa

Escorial

Quigro y anador

Rebollar

Pico

Sierra de Carcaña

Encina o cornoque
(Quercus ilex subsp. hibernica)

Quejigo
(Quercus agrifolia)

Rebollo
(Quercus pyrenaica)

Pino silvestre
(Pinus sylvestris)

Enebro
(Juniperus communis)

Pino albar
(Pinus galeatica)

Financian:

Colaboran:

THE SPRINGS OF DOMBELLAS: Located in the town of Dombellas, where one can enjoy the “Water spot” in a spot where some natural springs rise, in contrast with the aridity of the environment during the summer season, in order to form a true natural area of interest to biodiversity. In this thematic spot, the awareness work for the environment conservation through the arousing of the senses relating them to water as the basic element for life continues.



- **Synergies generated in favour of the area, within the framework of performances of “Sociedad El Carrascal...”:**

The various performances carried out by the authorities of the Regional Government of Castile and Leon, the Provincial Council of Soria and the City Council of Garray have made known the importance of the performances that were being developed within the framework of the LIFE Eco-Mining project at an institutional level.

The abovementioned interest has been increased by the fact that the own regional and local Governments have planned to bring the “Environment City” project into fruition in the area around the performance area and in the town of Garray itself.

This has generated a series of additional synergies that, taking the focal point of intervention of the LIFE project as a starting point, has allowed to boost and carry out additional performances that have been taken on by such Public Administrations, and among which we should highlight:

Restoration of the former municipal washhouse of Santervás de la Sierra:

A building owned by the town council where the “LIFE Program information point” has been placed and that has been restored and converted to place the performances that have been carried out and some suggestions about the activities that can be carried out, the places and spots of interest, and the routes of environmental interest of the area.



Improvement of the roads of access to Dombellas and Santervás de la Sierra:

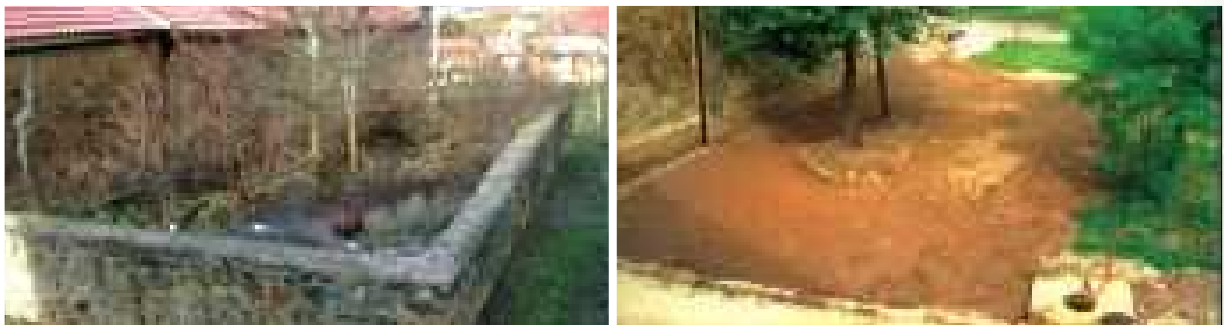
The width of the road of access to the towns of Dombellas and Santervás de la Sierra has been extended; in order to facilitate the passage of buses and vehicles that gain access to the spaces created within the framework of the LIFE Program.

Likewise, a car park for buses has been built in this last access road, seeing the foreseeable influx of schoolchildren to the intergenerational meeting point that is being built in Santervás and in order to avoid the road traffic inside the abovementioned town.



Recovery of the abandoned area and enlargement of green spaces.

The recovery of several urban spaces and their fitting as green spaces has been carried out, as well as the improvement of the neighbouring spaces that have allowed creating natural leisure and resting areas for everyone to make good use of them.



Adaptation of the area that surrounds the pelota court of Santervás de la Sierra.

The local, provincial and autonomous governments have also carried out the restoration of the town's pelota court, as well as the cleaning and adaptation of the area that surrounds it, what has allowed to harmonize the set where we can find the LIFE performances information point and the "Eco-awareness and coexistence area", which is located in Santervás de la Sierra itself.



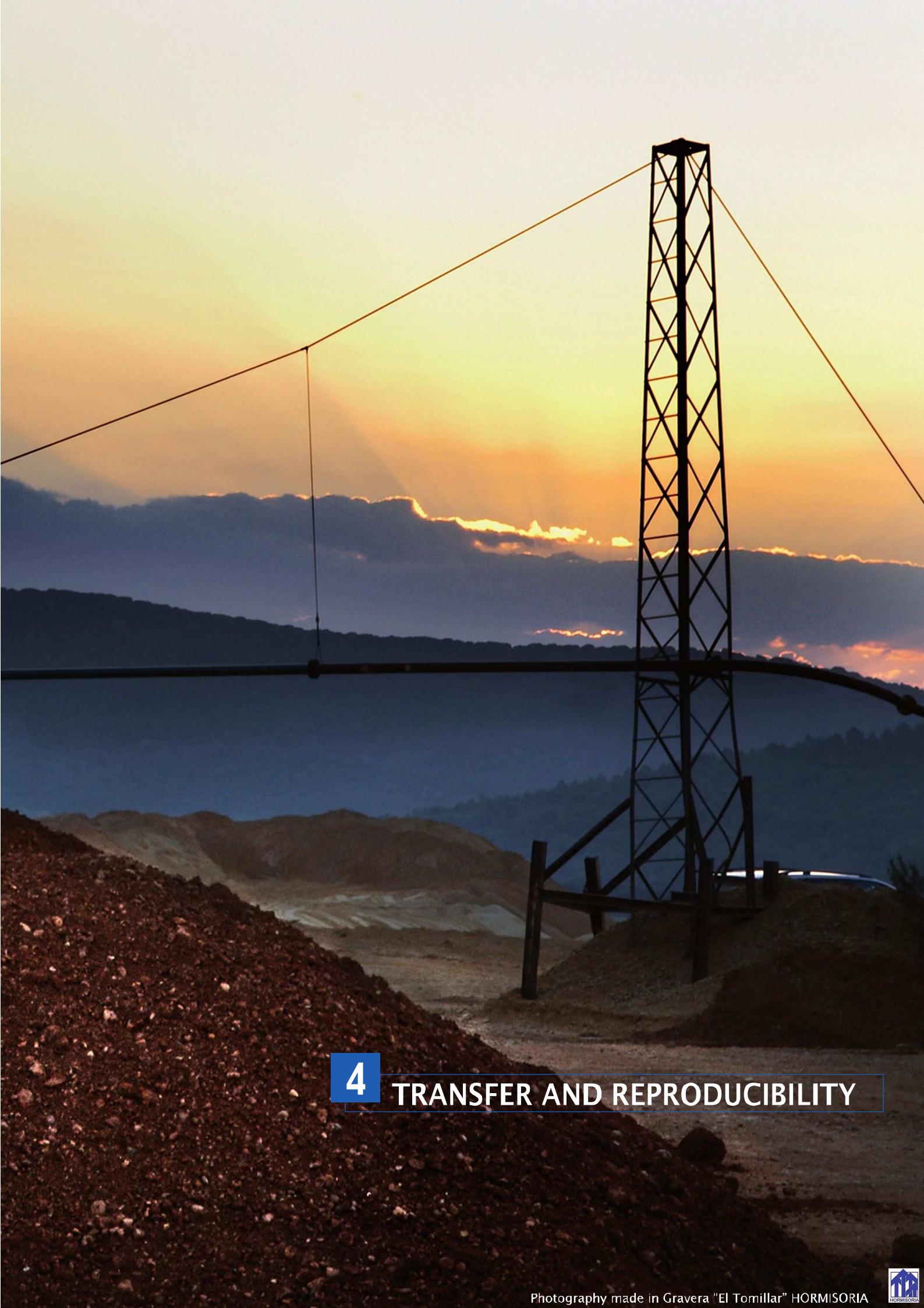
3.2.4.3. Development of indicators within the field of “Sociedad Carrascal...”:

Based on the environmental indicators designed by Hormisoria and eco4ward for the models linked to the mining activity; “Sociedad El Carrascal” has defined its own ones, which are included in the following table:

INDICATORS FOLLOW-UP SUMMARY TABLE							
Recommendation 532/2003/CE							
“Interest reconciliation” Model							
ORDER	CATEGORY	INDICATOR	MEASUREMENT UNIT	2004	2005	2006	2007
16	SOIL	Demonstrative spaces to stop both erosion and carbon catching	Hectares. Created		3,5	3,5	3,5
			Tons of fixed carbon		6,57	15,62	23,4 (prev.)
17	SOIL	Spaces for awareness and coexistence	M ² generated		3.000		13.000
18	EMISSIONS	Greenhouse gases emission	Avoided Tons / year (clean generation)				4,90
19	AWARENESS	Applications, mechanisms and techniques bases on renewable energies	No of applications/ mechanisms				8
20	AWARENESS	Behaviour development	No of impacts for awareness that have been achieved		42.000		46.000
			No of collaborations and meetings of the Society with Governments, companies or Institutions	4	14	18	42
			Performances derived from generated synergies			3	
21	ENDOGENOUS DEVELOPMENT	Construction/ restoration of houses in the area	No of restored or built houses	10	17	22	22
22	ENDOGENOUS DEVELOPMENT	Development of the No of inhabitants	No of inhabitants	44	47	50	53
23	ENDOGENOUS DEVELOPMENT	Direct employment created	No of hired workers		2	3	3







4 TRANSFER AND REPRODUCIBILITY

4

TRANSFER AND REPRODUCIBILITY

Starting from the premise of the important environmental impacts that the mining activity can generate and the presence of several conflicts linked to the mining activity itself within the EU field the experience developed by the LIFE Eco-Mining project is interesting and potentially applicable, to a certain or lesser extent, in more than 15.000 companies and 27.000 mines in every EU country.

If we combine the abovementioned with the need that the aggregates mining resource (the second natural resource most demanded, after water) follows an increasing progression tendency, especially in those countries that have just joined the EU, the transfer potential of this project is really high, until becoming an international reference model.

This aspect of promoting the transfer was one of the project's specific objectives since the planning phase as it set out the modelling of several scenes that meet the environmental and social problems jointly, trying not to omit any aspect that could cause the improvement of the sector for those potentially affected towns: technological innovations, the application of best environmental practices, criteria for the improvement of exploited mining spaces and formulas to reconcile interests in conflict.

As a reinforcement measure for the high reproducibility potential of the outcomes, the final spreading strategy has been channelled mainly through the sectorial European federation (UEPG) and through the various public administrations that have power regarding the mining, the environment and the land planning fields.

The obtained outcomes and the proven environmental benefits (water saving, a fewer degree of occupation of the land given over to settling, emission reduction, ...); cause that the technology and techniques that have been proven be of special interest form most of the European aggregate mines, in accordance with the technologies similarity and the techniques used in the sector.



The great interest that this experience has aroused in the sector, in the Public Administrations themselves, and in the population in general, has been verified, highlighting the newsworthy nature some spaces with a large audience broadcast by TVE have provided it with.

As main added values of this project, in accordance with the different public, we should highlight:

FOR THE AGGREGATE SECTORIAL:

The demonstrative action is really interesting due to the “image renovation” and the qualitative step that it is for the mining industry to make known the commitment of the sector with the innovation, the environment and the corporate social responsibility as the ways to meet the recourse demand in a balanced way, as well as the minimizing of the environmental impacts and the development opportunities for those areas where a different mining industry be introduced due to its sustainable nature.



FOR THE PUBLIC ADMINISTRATIONS:

The mining does also cover the social need of an essential good and favours the development in those areas where it is introduced.. For this reason, the objectives of the Public Administrations involved in ensuring the application of the specific legal framework, shall, within the abovementioned framework, try to reconcile the potential interests in conflict among all the agents involved and shall also combine the protection of the mining resource of public utility, the soil ownership and the land planning in a balanced way. This project can also contribute to this due to its exemplifying nature.

FOR THE POPULATION:

The project has succeeded in the mining industry to be seen as a “chance source” and not as a “threat” through this model. As the best objective indicator, we should highlight the fact that the population of the area has pledged its firm commitment to the environment improvement and maintenance as the way to achieve an endogenous sustainable development and due to the fact that in only three year’s time of validity the exodus tendency has been inverted.





5

**CONCLUSION AND SUMMARY
OF THE RESULTS ACHIEVED**

CONCLUSION AND SUMMARY OF THE RESULTS ACHIEVED

As it is described in the “achieved objectives summary table”, we should highlight that the LIFE Eco-Mining project has easily gone beyond the objectives planned initially, what has allowed to achieve these outcomes and validate an international reference model that is specially interesting to:

The mining sector:

- Important water savings in the ore cleaning process.
- A fewer degree of land occupation in the sludge drainage works, as the settling ponds have been removed.
- The efficiency of transfer mining increases.
- The reduction of emissions into the atmosphere.
- New sources of use of the ore in order to enrich the soils
- Speed up the environmental improving process of the exploited area.
- Improve the image of the sector in the society..
- Obtain a pacific environment where the activity can be carried out.
- The generation of areas of interest for biodiversity once the mining resource has been obtained.

From the technical point of view, the introduction of a hydro-cycloned system at the end of the ore cleaning line is a technical innovation that allows, on one hand, recovering between a 25 and a 50% of ultrafine barren ($< 50 \mu\text{m} > 38 \mu\text{m}$) for subsequent uses and, on the other hand, reusing between a 25 and a 50% of the water needed to ship that part of the recovered sludge to the settling ponds.

The “sludge dehydration by natural forced decanting” with “clean pumping” based on renewable energies allows reusing nearly all the water contained in the generated sludge (80 – 90%) and the direct filling of the mine holes, what means a reduction of the emissions derived from the shipping that is now avoided.

The Public Administrations:

The advantages of the validated model and the outcomes obtained do also have a great interest for the various public administrations with different authorities, but that concur on the mining activity field. The project has contrasted elements and models so as to provide forms to support the rural policies, where the principles included in the following community regulations have been applied:

- IPPC Directive (96/61/CE about pollution integrated prevention and control).
- Environmental management systems with the high disseminating potential (ISO 14000 and EMAS Regulations).
- Eligibility and use criteria of the environmental indicators, following the 2003/532/CE Recommendation on guidelines for the application of the 2001/761 Regulation from the European Parliament and the Council.
- Guiding Principles of the Water Framework Directive (2000/60/CE by which a community action framework in the water policies field is established).

For the population:

As the benefits derived from making good use of the mining activity, as “chance source” for the endogenous and sustainable development of the towns, have been proven. This is more important when this activity is introduced in rural areas where the endogenous development potential is fewer that in the urban field, or where the population density does not guarantee the offer of the minimum services to the visitor. .

We shall not forget that the mining activity itself needs labour, which, due to its cost and effectiveness, is recruited in the neighbouring areas. On the other hand, and seeing the development synergies that the project has shown, it is clear that the image of the “mining industry” as a “chance source”, favours the creation of new ways of activity and development (construction, tourism, agroforestry mines, ...).

Along this line, the project has generated several jobs and the derived synergies have introduced numerous sources of activity in the area, what speeds up the house restoration speed, the improvement of infrastructures and accesses, and the important increase of visitors in the area which, in its turn, is bearing on the creation of new tourist infrastructures.

But this “European sustainable mining model”, apart from the importance of the abovementioned, has an extra added value we should highlight due to the degree of difficulty that often entails collaborating with those that are closer. This great added value lies, above all, in having achieved to group all the agents around the project, agents that, one way or another, had an interest on such game, taking as cohesion flag the environment applied with conciliation criteria.

The merit of this project, promoted by Hormisoria S.L, and developed for three years of intense work in collaboration with “Sociedad Civil El Carrascal” and “Eco4Ward” from Austria, belongs to many people. We hope that its outcomes, given its international reference nature, benefit the environment and the development of depressed rural areas what, all in all, is just like saying that these outcomes benefit everyone.



SUMMARY CHART OF ACCOMPLISHED OUTCOMES

SUMMARY CHART OF ACCOMPLISHED OUTCOMES	
Aimed outcomes	Accomplished outcomes
55% water saving in ore cleaning processes	By means of combination of the systems that have been introduced, a percentage between 80 and 90 % of used water is recovered for its introduction in the system.
Diffuse contamination risk reduction	Total reduction of this risk by means of removal of all "Settling ponds" and its substitution by smaller "deposits for forced natural settling" which take profit from the very holes of mine.
Emission reduction (CO2): 120 Tons/useful life of the installation	Foreseeing a useful life of renewable energy installations that have been introduced for 25 years; It will avoid the emission of 232 CO2 tones to the atmosphere.
Validation of "sustainable extraction" model	118 BPs and BATs for the application to sector have been compiled and the evaluation and monitoring of more than 30 ones of those that have been introduced have shown excellent outcomes. Criteria provided by Recommendation 532/2003 EC, defining 15 environmental indicators have been fulfilled.
Acoustic contamination 15% reduction	* 5,6 H vegetable barriers have been created which block the trajectory of domineering winds and, in its vegetable maturity, will reduce the acoustic impact in a higher level than the one foreseen. They reduce visual impact and, moreover, minimize the spreading of suspending dust, purpose for which 45.000 m2 soils have been compacted. * Material storing line, although it maintains its area, has been designed in order to act as a natural additional barrier in the same line of domineering winds.
Fixation of 340 T of carbon in mining concession period (30 years)	In only 2 years of agroforestry cultivations evolution more than 45 T have been fixed. We must take into account that the progression of carbon fixation increases particularly in the first years ; and that the chosen cultivation has a "felling turn" of 40 years, a fact which multiplies by 2 the outcomes of this aim.
100% reuse of dried sludge for restoration.	Between 25 and 50% of steriles are assigned to composting (soil improvement). The remaining, up to 00%, to direct filling of holes (restoration).
25% emissions reduction because of lower use of hydrocarbons	Reduction of more than 70% of transport in ponds works due to elimination of need to transport dried sludge to other areas. Although this reduction causes a sterile transport to the composting area and its mechanical treatment, this hydrocarbons consumption is to the advantage of environmental benefit and is worthwhile through carbon fixed in compost, reaching also the aimed purpose.
Include clean energies.	A hybrid system of generation (solar – wind) for irrigation system and another one wind for bombing between settling deposits and clean waters pond have been introduced. A 5 kW photovoltaic solar system has been introduced in the Prado de San Sebastián by Sociedad El Carrascal. Total generation power is 15.492 kW/year. → 9,3 Tons/year avoided CO2.
Efficient use of 200 m3 rain water.	Only having into account water directly profitable taken from clean water breakwaters and "natural forced settling deposits" during the period of project execution to 2007 more than 4.000 m3 have been reused.
To validate to models with positive environmental balance.	In the mining field, 6 hectares of spaces for biodiversity have been modeled by means of the creation of different biotopes. In the field of Sociedad Carrascal, an area of 3,5 hectares has been created; which is a demonstrative area of carbon fixation and curb to erosion in the state "El Comodruelo". Also 1,3 hectare of demonstrative spaces have been created for awareness of renewable energies use, environment and as a meeting place for intergeneration leisure.
Specific spreading products.	Permanent project spreading at a European scale, through sectors, Institutions, press, radio, TV and specific spreading products; with an impact higher that 4.000.000 people, 27.000 mines and more than 40 Administrations and Public Institutions with authority on the matter. Specific spreading products: Final publication in several languages in paper and DVD format. Web of the project with accesses in four languages, leaflets, brochures and papers, specific video in Betacam SP Standard format, routes and spaces signage, specific point of information about the project, report dossier and impacts on the media.



6 APPENDIXES

6

APPENDIXES

The following are the appendixes of this publication:

- Project's Homepage (<http://www.life-ecomining.org>) in four languages.
- Innovation and research performances and projects, applied to the environment by Hormisoria.
- DVD: with the final publication and a video of the project.

Project's Homepage (<http://www.life-ecomining.org>) in four languages

PROYECTO ACTUACIONES Y RESULTADOS DIFUSIÓN ÁREA DE PARTICIPACIÓN ENLACES

[Prototipo combinado] [Exploración sostenible] [Restauración planificada] [Conciliación de intereses]

ECOMINING Proyecto cofinanciado por la Unión Europea

Noticias

Última actualización:
Febrero 2007

[Hormisoria-eco4ward]
Concurso europeo de ideas
[Convocado "curso europeo permanente de ideas para la sostenibilidad, en el ámbito de la minería"](#)

Modelo innovador de extracción de áridos (gravas y arenas) basado en tecnologías limpias, generador de escenarios medioambientales positivos.

El Proyecto pretende demostrar la viabilidad de modelos innovadores a escala europea basados en tecnologías limpias y en la obtención de escenarios finales con saldo medioambiental positivo en la actividad de extracción de áridos (gravas y arenas).

Objetivos:

1º.- Demostrar el potencial de minimización de impactos ambientales negativos en el sector, sobre el agua, aire, tierra, entorno y biodiversidad; mediante la implantación de tecnologías limpias innovadoras.
2º.- Experimentar la viabilidad de un modelo innovador de "extracción sostenible" con fines de transferencia que combine tecnologías limpias con otras medidas de prevención y minimización de impactos ambientales (buenas prácticas).
3º.- Fomentar la introducción de conceptos innovadores orientados a generar impactos medioambientales favorables (mejorar frente a

An innovative model based on clean technologies for the extraction of arids (gravel and barren), and the generation of positive environmental scenes.

The project pursues to demonstrate the feasibility of innovative models on a European scale based on clean technologies and the obtaining of final scenes with a positive environmental balance for the activity of extraction of arids (gravel and barren).

Objetives:

1º.- Demonstrate the high minimization potential of negative environmental impacts on the sector; water, air, ground, environment and biodiversity; through the implementation of innovative clean technologies.
2º.- Experiment the feasibility of an innovative sustainable extraction model for transference purposes that combines the clean technologies with other prevention and minimization measures of environmental impacts (best practices).
3º.- Promote the introduction of innovative concepts aimed at generating favourable environmental impacts (improving instead of

Un modèle innovateur basé sur les technologies propres pour l'extraction d'arides (gravier et sable) et la génération de cadres environnementaux positifs.

Le projet recherche démontrer la faisabilité de modèles innovateurs sur une échelle européenne basés sur les technologies propres et sur l'obtention de cadres derniers avec un dénouement environnemental positif pour l'activité d'extraction d'arides (gravier et sable).

Les objectifs:

1º.- Démontrez la minimisation d'impacts environnementaux négatifs sur le secteur; sur l'eau, l'air, la terre, l'environnement et la biodiversité, à travers la mise en oeuvre de technologies propres innovatrices.
2º.- Eprouver la faisabilité d'un modèle innovateur d'extraction soutenable dans le but de le transfert qui combine les technologies propres avec autres mesures préventives et pour la minimisation d'impacts environnementaux (meilleurs pratiques/best practices).
3º.- Encouragez l'introduction de concepts innovateurs pour générer impacts environnementaux favorables (améliorer au lieu de

Ein innovatives modell über saubere technologien für den schotterabbau (Grobkies und Sand) und die möglichkeit positiver einflussnahme auf die umwelt.

Das Projekt verfolgt folgende Ziele: die Durchführbarkeit eines innovativen Modells, saubere Technologien für den Schotterabbau zu demonstrieren - gemessen an europäischen Ansprüchen - und die Erzielung eines Szenariums mit einer positiven Umweltbilanz für das Abbaugbiet nach der Schotterentnahme (Grobkies und Sand).

Maßnahmen:

1º.- Die Demonstration des hohen Potenziales der Minimierung negativer Umweltauswirkungen für die Bereiche; Wasser, Luft, Boden, Landschaft und Biodiversität durch die Implementierung innovativer sauberer Technologien.
2º.- Die Erprobung der Durchführbarkeit eines innovativen nachhaltigen Modells für den Schotterabbau, das saubere Technologien mit anderer Vermeidungs- und Minimierungsmaßnahmen für Umweltauswirkungen kombiniert - best practices für Transfer-Zwecke.
3º.- Förderung der Einführung innovativer Konzepte, die positive Umweltauswirkungen bewirken, (Verbessern statt Reparieren und

ECOMINING

Proyecto Eco-Mining [General] Hormisoria Soc.Carrascal eco4ward

PERFORMANCES AND INNOVATION AND RESEARCH PROJECTS APPLIED TO THE ENVIRONMENT BY HORMISORIA

DATE	PERFORMANCE FRAMEWORK	NAME / SUBJECT MATTER	CALLING ORGANISM OR ADMINISTRATIVE UNIT
1994	ENVIRONMENTAL TECHNOLOGICAL AND INDUSTRIAL PROGRAM (PITMA)	WATER TREATMENT IN AGGREGATES CLEANING	MINISTRY OF INDUSTRY AND ENERGY
1995	ENVIRONMENTAL TECHNOLOGICAL AND INDUSTRIAL PROGRAM (PITMA)	WATER TREATMENT IN AGGREGATES CLEANING II	MINISTRY OF INDUSTRY AND ENERGY
1996	RESEARCH PROJECTS	PILAR PROJECT	
1996	RESEARCH PROJECTS	ALEXANDRA PROJECT	
1997	RESEARCH PROJECTS	ENMIENDA CALIZA PROJECT	
1998	AGREEMENT WITH THE UNIVERSITY OF VALLADOLID	EVALUATION OF CHEMICAL PARAMETERS IN THE SOILS OF SORIA (FIELD: 90.000 HECTARES.)	
1999	RESEARCH PROJECTS	STUDY ABOUT THE EVALUATION OF RESERVES	
2000	MINING INCENTIVES- ENVIRONMENT INFRASTRUCTURE, PREPARATION AND EQUIPMENT	RESOURCE RESEARCH AND WATER COLLECTION FOR THE AGGREGATE PLANT	REGIONAL GOVERNMENT OF CASTILE AND LEON. DEPARTMENT OF INDUSTRY, COMMERCE AND TOURISM
2001	QUALITY ASSURANCE CERTIFICATION ISO14001	MANAGEMENT SYSTEM APPLIED TO THE EXTRACTION, TREATMENT AND CLASSIFICATION OF THE AGGREGATES OF THE GRAVEL PIT.	BVQI ESPAÑA, S.A.U.
2002	MINING INCENTIVES- ENVIRONMENT	RECOVERY OF DUMPS FOR AGRICULTURAL OR FOREST USES	REGIONAL GOVERNMENT OF CASTILE AND LEON. DEPARTMENT OF INDUSTRY, COMMERCE AND TOURISM



PERFORMANCES AND INNOVATION AND RESEARCH PROJECTS APPLIED TO THE ENVIRONMENT BY HORMISORIA

DATE	PERFORMANCE FRAMEWORK	NAME / SUBJECT MATTER	CALLING ORGANISM OR ADMINISTRATIVE UNIT
2003	MINING INCENTIVES- ENVIRONMENT	MINIMIZATION OF THE ENVIRONMENTAL IMPACTS LINKED TO THE AGGREGATE CLEANING PROCESS	REGIONAL GOVERNMENT OF CASTILE AND LEON. DEPARTMENT OF INDUSTRY, COMMERCE AND TOURISM
2004	AGREEMENT WITH THE UNIVERSITY OF VALLADOLID	RESEARCH WORK DEPARTMENT OF PLANT PRODUCTION AND FOREST RESOURCES	
2004	LIFE ENVIRONMENT PROGRAM, EU "ECO MINING" DEMONSTRATION PROJECT LIFE04 ENV/ES/000251	DEMONSTRATION OF INNOVATIVE MODELS AT A EUROPEAN SCALE BASED ON CLEAN TECHNOLOGIES AND ON THE ACHIEVEMENT OF FINAL SCENES WITH A POSITIVE ENVIRONMENTAL BALANCE WITH REGARD TO GRAVEL AND BARREN	EUROPEAN COMMISSION DIRECTORATE-GENERAL FOR ENVIRONMENT
2005	AGREEMENT WITH THE UNIVERSITY OF VALLADOLID	ASOIL ADVICE FOR FOREST PURPOSES, ARBOREOUS SPECIES AND CROPS OF INTEREST TO THE ENVIRONMENT AGAINST EROSION	

