

# NON-ENERGY MINERAL EXTRACTION IN RELATION TO NATURA 2000

## CASE STUDIES



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## INTRODUCTION

### Purpose of this document

The EU Action Plan for nature, people and the economy requires the Commission<sup>1</sup>, under Action 8, to “identify with Member States and other stakeholders best practices on investment for extractive operations and for land rehabilitation and restoration by non-energy mineral extractive industry, in order to complement the existing guidance on non-energy mineral extractive industry in Natura 2000”.

The aim is to communicate best practices in order to enhance the planning, design and implementation of non-energy extractive industry (NEEI) activities taking into account the provisions of the nature directives (Birds and Habitats directives<sup>2</sup>) and contributing to improving biodiversity, while, at the same time, meeting the demand for raw materials and ensuring the sustainable development of extractive activities.

Moreover, as confirmed in the European long-term strategic vision for a prosperous, modern, competitive and climate neutral economy<sup>3</sup>, sustainable and responsible mining and sourcing of raw materials approaches are needed to decouple climate objectives from negative environmental impacts associated with necessary technology materials. This is fundamental in the context of the sustainable development goals.

With this in mind, this booklet presents a collection of practical examples covering various types of mineral extraction and different stages of the mine life-cycle, including planning and design of operations, impact assessment and mitigation during the extraction phase, rehabilitation and after-care once the extractive activity is completed.

The selected case studies are grouped according to the following main types of best practice that they aim to illustrate:

- Partnerships, stakeholder cooperation.
- Impact assessment and mitigation.
- Rehabilitation: habitat restoration and improving species conservation.

The focus is on Natura 2000 sites and habitats and species covered under the nature directives, both in terrestrial and marine areas.

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<sup>1</sup> COM(2017) 198 final,  
[https://ec.europa.eu/environment/nature/legislation/fitness\\_check/action\\_plan/index\\_en.htm](https://ec.europa.eu/environment/nature/legislation/fitness_check/action_plan/index_en.htm)

<sup>2</sup> Directive 2009/147/EC on the conservation of wild birds, Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora

<sup>3</sup> COM/2018/773 final,  
[https://ec.europa.eu/clima/sites/clima/files/docs/pages/com\\_2018\\_733\\_analysis\\_in\\_support\\_en\\_0.pdf](https://ec.europa.eu/clima/sites/clima/files/docs/pages/com_2018_733_analysis_in_support_en_0.pdf)

The case studies should be read as a complement to the guidance document on “non-energy mineral extraction and Natura 2000”<sup>4</sup>. They are based on information provided by the stakeholders and do not necessarily imply any endorsement by the European Commission of the projects/activities in question.

**Natura 2000** is a network of core areas for the conservation of rare and threatened species, and some rare natural habitat types that are protected in their own right. The network stretches across all EU countries, both on land and at sea. Its aim is to ensure the long-term survival of Europe's most valuable and threatened species and habitats, listed under the Birds and Habitats directives. It consists of **Special Protection Areas (SPAs)** classified under the Birds Directive and **Sites of Community Importance (SCIs)** and **Special Areas of Conservation (SACs)** designated under the Habitats Directive.

[http://ec.europa.eu/environment/nature/natura2000/index\\_en.htm](http://ec.europa.eu/environment/nature/natura2000/index_en.htm)

### Selection of best practice examples

The identification of best practice examples has been carried out in consultation and with the contribution of NEEI associations at EU level, as well as of nature conservation NGOs. A significant number of examples were provided, which were then analysed to identify best practices that could be used to improve the implementation of non-energy extractive activities and their contribution to nature protection.

#### **Best practice**

*A best practice is a relevant intervention implemented and which is considered favourable in terms of adequacy, effectiveness and efficiency related to process and outcomes. Other criteria are important for a successful transferability of the practice such as a clear definition of the context, sustainability, intersectoral collaboration and participation of stakeholders.*

The following criteria were considered during the assessment of the examples provided.

- **Relevance** of the practice or intervention in relation to Natura 2000 and the nature directives. This considers how the practice supports the conservation of habitats or species of EU interest, the protection, management and restoration of Natura 2000 sites, appropriate assessments and mitigation measures, species protection, improving ecological connectivity and green infrastructure.
- **Design and implementation**. This criterion assesses the quality of the intervention, in particular the solutions that were found to avoid negative impacts or to contribute to conservation objectives in Natura 2000 sites, or to the conservation of habitats and species of EU interest (e.g. through site restoration).
- **Effectiveness and efficiency**. This criterion considers the degree to which the intervention was successful in producing a desired result and the relevance of the results in relation to Natura 2000, habitats and species conservation.

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<sup>4</sup> [http://ec.europa.eu/environment/nature/natura2000/management/docs/nee\\_i\\_n2000\\_guidance.pdf](http://ec.europa.eu/environment/nature/natura2000/management/docs/nee_i_n2000_guidance.pdf)

- **Transferability.** This criterion assesses whether the practice has used or produced tools (e.g. a manual or a protocol with a detailed activity description) that can be or have been reused or transferred to other contexts.
- **Sustainability.** This criterion assesses whether the practice has achieved self-sustainable results, and whether the continuation of the practice has been ensured through institutional support and/or ownership by the relevant stakeholders, or whether a sustainability strategy has been developed to maintain or continue promoting the results.
- **Intersectoral collaboration and stakeholder participation.** This criterion assesses the ability of the example to foster collaboration among the different sectors involved (e.g. environment and raw materials, authorities, NEEI, etc.) and ensure the participation of relevant stakeholders throughout the whole life cycle of the process, for instance, if appropriate tools were used to ensure cooperation and communication with relevant stakeholders (e.g. steering groups, platforms, web tools, etc.).

In the light of these criteria the selected examples are highly relevant for nature. In addition, they can be considered best practice for other particular aspects, such as stakeholder cooperation, impact assessment and mitigation, etc.

Many of the selected examples concern land rehabilitation and restoration that contribute to improving biodiversity and Natura 2000 features, as the Action Plan on Nature puts a special focus on this issue.

## KEY FINDINGS AND LESSONS LEARNT

A number of key elements of best practice and lessons learnt can be drawn from the case studies. These are summarised below.

### Partnerships and stakeholders cooperation

Non-energy extractive industries are constantly improving their performance in relation to nature conservation and biodiversity, thanks to the adoption of some form of corporate strategic planning which enables them to integrate biodiversity aspects into all levels of business activity, and this at an early stage in the planning process. Common tools include implementing Biodiversity Action Plans, adopting standards, codes of conduct or guidelines, and working closely with organisations dedicated to nature protection.

The adoption of a **Biodiversity Action Plan (BAP)** for an extractive activity can help in the design and implementation of mitigation and restoration measures that address the particular needs of species and habitats for which a site has been designated, e.g. as a Natura 2000 site. The BAP, supported by baseline surveys, is often carried out through cooperation with nature conservation experts. It provides guidance to NEEI operations, for instance on how to gather essential information about the biodiversity features of the site, or gain an understanding of potential impacts on wildlife in the site through consultation with stakeholders and other sources, or by identifying priorities for setting conservation objectives and actions.

During the operation phase, extraction sites can provide valuable biotopes for threatened species. Existing and new extraction sites can provide an opportunity for creating **habitat networks** in some countries or regions, for instance by securing favourable habitats for plant and animal species found in quarry and mining sites or by creating important stepping stones that can be managed accordingly.

Once the extractive activity has been completed, former mineral extraction sites have also offered a valuable opportunity to **recreate habitats identified as a priority in national Biodiversity Action Plans** through partnership programmes involving nature conservation agencies, NGOs and NEEI associations. Working with planners, industry, statutory bodies, conservation organisations and local communities, these partnership programmes can make substantial contributions to habitat creation and boost species populations, while providing nature-rich places for people to enjoy.

**Dialogue and cooperation among NEEI, competent authorities, NGOs and other stakeholders** is a key factor of success highlighted in many of the case studies included in this document. For instance, BirdLife Austria and the Mineral Resources Forum in Austria work together to promote the preservation of endangered species and their habitats in mineral extraction sites in Lower Austria. The German Nature and Biodiversity Conservation Union (NABU) and the Industrial Association of Stones and Soils of Baden-Württemberg (ISTE) are working together to promote biodiversity during mining and in the rehabilitation of extractive areas. A Cooperation Agreement recently signed between the Bavarian Union for the Protection of Birds (LBV), the Bavarian Building Materials, Stone and Earth Industry Association (BIV) and the Ministry of Environment, aims to contribute to improving the conservation status of amphibian populations on mineral extraction sites across Bavaria. A Network for Sustainable Mining was established in Finland to strengthen cooperation between the mining industry and relevant stakeholders to minimise any negative impacts of their operations on the environment, biodiversity and local communities. In UK, the Nature after Minerals Programme works with mineral planners, industry, statutory bodies, conservation organisations and local communities to contribute to habitat creation and boost species populations, creating areas that may qualify for later designation as Natura 2000 sites.

In some of these cooperation initiatives, the parties have signed a contract for cooperation which aims to implement exemplary measures in a significant number of extraction sites across the country. Usually this form of cooperation starts with the definition of a **set of target habitats and endangered species typically associated with mineral extraction sites**, based on the Birds and Habitats Directive annexes and national priorities. This is often followed up by the **production of conservation manuals for each target habitat and species**, which lay down general guidelines for suitable conservation measures to be implemented before, during and after extraction. Creating a **discussion forum** can be a useful tool to increase communication and cooperation among stakeholders.

## Impact assessment and mitigation

Extractive activities operating in or close to Natura 2000 areas need to consider their potential effects on habitats and species present in the site and may require an appropriate assessment according to article 6.3 of the Habitats Directive, and an Environmental Impact Assessment (EIA) or a Strategic Environmental Assessment (SEA) according to the respective directives<sup>5</sup>. Properly designed mitigation measures can help avoid negative impacts or reduce them to an acceptable level and thus allow the extractive activity to be carried out.

Assessment of non-energy extractive activities requires a good knowledge of the habitats and species of EU interest present in the site and surrounding areas and proper consideration of their ecological requirements. **Baseline studies**, including surveys and mapping where required, make possible the identification of impacts and necessary measures to protect the species and habitats present on the site.

Involving **ecology experts** in the design of mitigation measures and a monitoring programme to verify the results after their implementation are key success factors in some best practices presented in this booklet.

The examples included in this document address issues in relation to impact assessment and mitigation in case of extractive activities **within or around Natura 2000 sites**. For instance, in the extension of a limestone quarry in Sweden, mitigation measures were undertaken to avoid any possible negative effects on riparian habitats in a Natura 2000 site located downstream of the quarry. Another case study concerns one of the EU's largest underground copper mines, located near Natura 2000 sites in Portugal, which addressed potential risks on habitats and species on the sites with the implementation of an Environmental Management System that involves permanent soil and water monitoring.

**Species protection measures** are often implemented in the mineral extraction sites. For instance, at the beginning of each breeding season, the sites are surveyed in order to locate possible breeding areas of protected species and to define operational changes that might need to be eventually applied to safeguard these species. It may be necessary to protect nesting areas but in many cases it is enough to delimit and signal these areas in order to prevent disturbance during the breeding season. Such measures are applied in gravel pits located in a Special Protection Area (SPA) for birds in Spain (Soto Pajares). Mitigation measures are also implemented to protect and avoid disturbance to bat populations in an old gypsum quarry located in a Natura 2000 site in Italy (Monte Tondo), which hosts 15 bat species thanks to the large number of caves present in the site.

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<sup>5</sup> Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, as amended by Directive 2014/52/EU (EIA Directive)  
Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment (SEA Directive)



In some cases, **extractive activities started in a site before it was included in Natura 2000**, and appropriate assessment and mitigation were then required to prevent adverse effects on habitats and species present in the site. For example, sand extraction carried out in a site in Flanders (Belgium) before its designation as Natura 2000 was allowed to continue under a special plan agreed with the Flemish Government, which included measures to avoid and mitigate impacts, such as the closure and renaturation of a quarry, relocation of industrial facilities and complete removal of lorry transport thanks to the construction of an underground pipeline. The extractive activities are also managed to favour the conservation objectives of the Natura 2000 site by re-establishing typical vegetation communities that host protected species.

### Enhancing biodiversity through restoration and rehabilitation of extraction areas

Well planned rehabilitation and restoration of closed extraction areas can **contribute to nature conservation objectives at the national and EU level**, in particular when carried out in accordance with national or regional biodiversity plans and strategies. Restoration after mine closure can **create valuable biotopes, stepping stones along migration routes, ecological corridors and improve habitat networks** available for protected species. This is illustrated, for instance, in the ecological rehabilitation of an old lignite open cast mine in France (Arjuzanx) with recreation of suitable biotopes to support common crane (*Grus grus*) migration along one of its main routes. Although this example relates to energy minerals extraction, it is a good example of long-term rehabilitation to support biodiversity and ecological functions (bird migration).

Many extraction areas that were successfully rehabilitated with the aim of enhancing biodiversity were **subsequently designated as Natura 2000 sites** and are contributing to the conservation of habitat types and species of EU interest. For example, the creation of wetland habitat at one of the largest sand and gravel extraction sites in the UK (Needingworth Quarry) is making a substantial contribution to achieving the national targets for reedbeds and the bittern (*Botaurus stellaris*), a Birds Directive Annex I species that had undergone major declines in the UK. As another example, after the restoration of sand and gravel pits, which had been exploited in the “Île-de-France” since 1973, the Grand-Voyeux site was classified as an SPA and currently hosts breeding populations of four bird species included in Annex 1 of the Birds Directive.

**Active dialogue among all interested stakeholders**, as well as a **long-term vision in the restoration plan** is usually at the core of the successful examples presented in this document. The rehabilitation of the extraction sites is often discussed in advance with nature conservation authorities and local authorities. The success of these initiatives is also ensured by close collaboration between the NEEI and nature conservation NGOs.

In some of the examples included in this booklet, **restoration objectives were agreed with nature conservation authorities** with the aim to achieve national biodiversity targets. For instance, the restoration of the Mašovice quarry in the Czech Republic was implemented with the aim of creating suitable habitats for rare and threatened amphibian and aquatic species, in particular the Italian crested newt (*Triturus carnifex*), which was critically endangered in the country.

A **monitoring programme** to evaluate the effectiveness of implemented actions is essential to assess the results achieved. Scientific studies and monitoring are carried out as part of the restoration process often through partnerships with the scientific institutions, allowing **restoration actions and techniques to be adjusted and improved when needed**. The restoration techniques can be also integrated in the exploitation phase and be adapted and improved based on monitoring of the success of restoration process, in terms of fauna and flora communities and ecosystem functioning.

**After care** of the rehabilitated extraction areas is very important to ensure long-lasting results. Securing sufficient human and financial resources from private and public institutions, setting clear responsibilities and the engagement of local communities in the conservation and appropriate management of the site, are crucial elements to maintain and improve the results in the rehabilitated areas.

**Cooperation with relevant conservation agencies and NGOs** can contribute to the long-term management and monitoring, which is usually undertaken according to a detailed site management plan.

Appropriate after care can also be secured by the **creation of a public or private body with representatives of regional and local authorities and relevant stakeholders**, which remains in charge of the long-term site management and conservation. For instance, after the restoration of the open-cast mine of Arjuzanx, in the “Landes” (France), the site is managed by a public body, the “*Syndicat Mixte de Gestion des Milieux Naturels*”, which includes representatives of the Aquitaine Region, the Landes Department and several local councils.

# CASE STUDIES

# PARTNERSHIPS

## SPECIES AND HABITATS PROTECTION in mineral extraction sites in Lower Austria

**Minerals:** rock, gravel, sand.

**Location:** Austria.

**Natura 2000, habitats and species:** quarries and gravel sand pits provide habitats for birds, reptiles and amphibians, insects and drought-resistant grasses and flowers. Measures are to be implemented on 40 to 50 sites, including SPAs and/or SACs.

Bee eater (*Merops apiaster*). Petri Ahlroth



### Summary

Cooperation between BirdLife Austria and the Mineral Resources Forum in Austria is achieving successful results in the preservation of endangered species and their habitats in mineral extraction sites in Lower Austria. The Mineral Resources Forum is a voluntary platform in the Austrian Federal Economic Chamber that represents the interests of currently 125 mining companies.

Through a pilot conservation project in mineral extraction sites, they are securing favourable habitats for plant and animal species that are currently mostly found in quarry and mining sites, as their original habitats have been lost due to different developments and land uses.

The companies implement agreed measures voluntarily and at their own cost, supported by an ecologist hired by Birdlife and paid for by the project, which is in turn supported by the Regional Development Fund.

### Cooperation to secure biodiversity and habitats for species

Since the summer 2016, BirdLife Austria has been co-operating with the Austrian Mineral Resources Section of the Chamber of Commerce (member of UEPG) in a pilot project “Species and Habitats Protection in mineral extraction sites in Lower Austria”, funded by the Lower Austria Province and the European Regional Development Fund.

Together with a number of mining companies (rock, gravel, sand), BirdLife Austria tries to find, secure and enhance typical quarry / gravel / sand pit habitats for characteristic plant and animal species including: birds like the little ringed plover (*Charadrius dubius*), stone-curlew (*Burhinus oedipnemus*), sand

martin (*Riparia riparia*) and bee-eater (*Merops apiaster*); as well as reptiles; amphibians and insects like grasshoppers and dragonflies; and drought-resistant grasses and flowers.

Some of the target species are nowadays limited to quarry and mining sites, as their original habitats (free running rivers, dunes, etc.) have been destroyed by hydro-power plants, flood control, intensive agriculture etc. The initiative has provided many interesting results that include various elements of good practice, which are summarised below.

### Results and best practice elements

- Definition of a set of habitats and endangered target species typically

associated with mineral extraction sites, considering the Birds and Habitats Directive annexes and national priorities and focusing on their protection in mining sites.

- Production of short field manuals for each target habitat and species, including general guidelines for suitable conservation measures to be implemented before, during and after extraction (target group: nature conservationists, responsible officers in mining companies).
- Engaging and motivating voluntary participation of the mining companies through sector specific communication activities (led by the Chamber of Commerce).
- Visiting and mapping biodiversity in quarries and pits by expert and amateur conservationists organized by the NGO (with help of field manuals for comparability).
- Proposing and discussing relevant conservation measures together with the companies, agreeing on certain measures by consensus.
- The companies implement consented measures voluntarily and at their own costs, supported by a nature conservation expert hired by the NGO and paid for by the Regional Development Fund.
- The nature conservation expert compiles reports about the implemented measures (indicator: delivered habitat quality – not taking into account if the target species have settled the habitat already or not, as settlement may take quite a few years and also depends on further factors that cannot be controlled by the company).
- BirdLife Austria and field workers discuss any difficulties that may arise before or during implementation, e.g. regarding the companies' permits (e.g. specific re-cultivation requirements etc.) jointly with the relevant authorities.

- Helping outdoor nature educators to transfer knowledge about the typical habitats and species to pupils and the local population, especially inside quarries / mines (as far as the companies agree to allow field trips on their sites and the visitors' safety can be ensured).
- Assisting motivated companies in producing folders or information boards about their efforts and protected habitats (printing costs not included), and writing articles in relevant magazines.
- Reporting to the province's nature conservation authority.

By winter 2017/2018, the project team worked on over 20 sites, with the aim of implementing measures on 40 to 50 sites all over Lower Austria by spring 2019. A number of companies actively participate and take responsibility for endangered species (some of the sites are inside SPAs and / or SACs), and trust between nature conservationists and companies is growing.

Without ERFD funding, the project would probably not have been possible as there is no other financial mechanism to cover the cost of the professional nature conservation expert.

In the future, BirdLife Austria will try to expand the process all over Austria, subject to availability of appropriate financing. In Lower Austria, considerable amounts of Regional Development-based nature conservation co-funding is covered by a local fund on "gravel fees".

### References

The Mineral Resources Forum:  
<http://www.forumrohstoffe.at>

### Authorship

Prepared by Boris Barov for the N2K Group. Information and comments were provided by BirdLife Austria, Dirk Fincke (UEPG) and Petra Gradischnig (WKO-Fachverband Steine und Keramik).

## NETWORK FOR SUSTAINABLE MINING Finland

**Minerals:** 12 metallic ores, 27 industrial minerals and 7 other minerals.

**Location:** Finland.

**Mining in Finland:** Ca. 20 exploration companies. Ca. 4,500 direct jobs. Turnover: €1.5 billion. Investments: €200 million and €52.8 million in exploration. Mainly in Northern and Eastern Finland.

Source: Kaivosvastuu, 2016.



### Summary

The Network for Sustainable Mining was established in 2014 as a platform to strengthen cooperation between the mining industry and its stakeholders and to develop together concrete tools for more sustainable mining in Finland. The Network focuses on the self-regulation of the mining sector.

Eleven organisations have signed the Statement of Intent for the Network: the Finnish Mining Association (FinnMin), the Association of Finnish Local and Regional Authorities, the Regional Council of Lapland, the Finnish Metalworkers' Union, the Association of Finnish Steel and Metal Producers, the Finnish Sámi Parliament, Sitra, the Finnish Association for Nature Conservation, Finnish Industry Investment Ltd, the Central Union of Agricultural Producers and Forest Owners (MTK) and WWF Finland. These organisations are also members of the board of the Network.

Protection and maintenance of biodiversity is listed as one of the principles in the Statement of Intent to which the Network is committed. The Network has developed a Standard for Sustainable Mining in Finland which provides practical advice to the mining companies on sustainable mining. In addition, the Network has prepared a Standard for Sustainable Exploration, which includes guiding principles and assessment tools that cover the entire lifecycle of exploration activities.

### Mining in Finland and potential conflicts with Natura 2000

Mining is an important and growing industry in Finland. During the past ten years the interest for metal ore mining has grown rapidly and currently there are ten metal ore mines and over 20 exploration areas (October 2017).

In addition, there are many other industrial mineral and rock mines. Growing interest in mining increases also the importance of sustainability of mining activities.

The Finnish Mining Act<sup>6</sup> lays down the provisions for the exploration and exploitation of mining minerals, including the obligation of exploration and mining permits. Extraction of construction minerals, such as gravel, is regulated by the Land Extraction Act.

<sup>6</sup> Currently under revision

Several other Acts or Decrees such as the Nature Conservation Act, the Water Act, and the Act on Environmental Impact Assessment Procedure are also relevant in the planning and implementation of mining activities.

To date no mines/quarries in Finland are located within Natura 2000 sites although there are exploratory works underway to establish an underground mine for mineral extraction in one Natura 2000 site in Lapland.

The interest to extract minerals in some Natura 2000 sites is however ever-present, especially in the northern part of Finland. Potential impacts of mineral extraction on e.g. the hydrology of Natura 2000 sites with wetland habitats and the associated species is a typical concern.

The exploration of minerals outside Natura 2000 sites may also give rise to conflicts with the strictly protected species under the Habitats Directive.

### **Network for Sustainable Mining**

The Network for Sustainable Mining was established in 2014 as a platform to strengthen cooperation between the mining industry and its stakeholders and to develop

joint concrete tools for more sustainable mining in Finland.

The Network focuses on the self-regulation of the mining sector. The Network's general vision is to pave the way for making Finland the leader in sustainable mining.

The mining industry in Finland involves a wide range of stakeholders: local residents, industry workers, environmentalists, the Sámi people, other industries (such as tourism, reindeer herding, forestry and agriculture, and metal refinery), investors, and local decision-makers (municipalities and regions). Each of these groups are represented in the Network. Currently the permanent secretary of the Ministry of Environment is chairing the Network.

In the initial phase, Sitra (the Finnish Innovation Fund) hosted the Network, supported its development, gathered research data and peer experiences, organised training and assisted the Network in developing tools for Finland. This gave a sound start to the Network. Currently the Finnish Mining Association is in charge of the Network and it receives funding from various sources including a private foundation.



The board of the network in a meeting in Toronto in March 2015, while participating to the annual PDAC conference (Source: <https://www.kaivosvastuu.fi/>)



### Standard for Sustainable Mining in Finland

The Network has developed a Standard for Sustainable Mining in Finland using the Canadian Towards Sustainable Mining (TSM) standard as a model.

The Finnish TSM standard includes nine guiding principles and eight assessment tools. One guiding principle refers to biodiversity: *The companies will minimise any negative impacts of their operations on local communities, the environment, and biodiversity.*

Mining companies can assess, monitor and improve their performance using eight assessment tools which cover all stages of the mining life cycle. These tools can also be used for external auditing. It is the Network's board who decides which companies are accepted into the Finnish system. So far, 7 mining companies are following this standard.



One assessment tool involve assessing the performance level of activities aiming to

maintain biodiversity per production plant. The explanatory part of the tool (under the principles of No Net Loss/Net Positive Impact) refers to Natura 2000 sites and to the EC guidance document on “non-energy mineral extraction and Natura 2000”.

The checklist for the assessment does not refer explicitly to Natura 2000 sites nor to species covered by the Nature Directives; this may reflect the fact that tool is based on the Canadian system. However, the following relevant statements are included as part of the principles that companies following the Finnish TSM should commit to concerning biodiversity:

- *Recognising that Natura areas, legally-designated nature reserves and other areas and sites that are valuable in terms of nature conservation can contribute to biodiversity conservation, the companies will comply with the relevant conditions and requirements set in national legislation. The companies are committed to working with key communities of interest to develop transparent, inclusive, informed and equitable decision-making processes to promote nature conservation.*
- *No mining can be carried out in Natura areas, neighbouring areas affecting them, or other legally-designated nature reserves unless legal obligations are met and any negative impacts on biodiversity are compensated for in full, in accordance with the No Net Loss/Net Positive Impact principle.*

The ambition is that eventually all mining companies in Finland would follow, on a voluntary basis, the Finnish TSM standard.

### Standard for Sustainable Exploration in Finland

In addition, the Network has prepared a Standard for Sustainable Exploration. It includes guiding principles and four assessment tools, which cover the entire

lifecycle of exploration activities (preparation, enquiry, exploration, exit).

The exploration standard follows the same logic as the standard for sustainable mining: each tool is divided into performance indicators and their corresponding assessment criteria. The tools cover stakeholder involvement, biodiversity conservation, safety and health, and crisis management.

The tool for assessing biodiversity conservation management performance highlights the need to consider “Directive” species in the tool’s checklist. However, Natura 2000 sites are embedded under the term nature reserves in the tool’s checklist and explained only in the explanatory part of the tool.

The assessment tools include performance ranking with five levels where “C” represents lowest ranking (activities are at the level required by the Finnish legislation) and “AAA” the highest ranking (level of excellence according to an independent international auditing). The goal of each company is to achieve, at a minimum, an “A” ranking and to work towards continuous improvement. The Finnish Sustainable Mining Network is also updating the above-mentioned assessment tools.

The Network organises seminars and workshops. Also, training for mining companies in Finland on both the Finnish TSM standard and the sustainable exploration standard have been organised in 2016-2018. One training session took place in Estonia. Training material is available in Network’s website. The annual report of 2018 on the Network’s activities and an action plan for 2019 are publicly available. In addition, the Network produces a regular newsletter (in Finnish).

Based on the practices and experience elsewhere, including outside Finland, the

Finnish Sustainable Mining Network has also prepared a toolbox for helping companies with local stakeholder engagement before starting activities in the field. As many foreign mining and exploration companies are active in Finland, the toolbox has also been made available in English.

## References

Website of the Finnish Sustainable Mining Network <https://www.kaivosvastuu.fi/in-english/> (in English) and <https://www.kaivosvastuu.fi/> (in Finnish)

Active Mines and Current Projects in Finland: [http://en.gtk.fi/information/services/exploration/active\\_mines.html](http://en.gtk.fi/information/services/exploration/active_mines.html)

Finnish Mining Act (unofficial translation): <https://www.finlex.fi/en/laki/kaannokset/2011/en20110621.pdf>

Land Extraction Act (unofficial translation): [https://www.finlex.fi/fi/laki/kaannokset/1981/en19810555\\_19970463.pdf](https://www.finlex.fi/fi/laki/kaannokset/1981/en19810555_19970463.pdf)

Finnish toward sustainable mining Standard: [https://www.kaivosvastuu.fi/app/uploads/2017/03/Kaivosvastuujarjestelma\\_EN\\_13-03-17.pdf](https://www.kaivosvastuu.fi/app/uploads/2017/03/Kaivosvastuujarjestelma_EN_13-03-17.pdf)

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## Authorship

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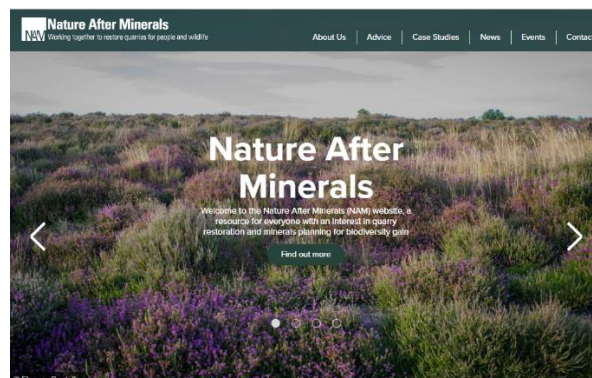
## NATURE AFTER MINERALS

Partnership programme to promote strategic biodiversity benefits from mineral sites

**Minerals:** non-energy related minerals, e.g. sand and gravel, clay, chalk, limestone and other hard rocks.

**Location:** United Kingdom

**Habitats and species:** priority habitats and species identified in the UK Biodiversity Action Plan, many of which are protected under the EU Birds and Habitats Directives.



### Summary

A study undertaken in 2005 by the Royal Society for Protection of Birds (RSPB) indicated that former mineral extraction sites offered a valuable opportunity to recreate priority habitats identified in the UK Biodiversity Action Plan (e.g. 50,000 ha of native woodland or almost 25,000 ha of lowland meadow). To promote high quality habitat creation on mineral sites, the Nature After Minerals (NAM) partnership programme was established by the RSPB and supported by Natural England (the statutory nature conservation agency in England), the Mineral Products Association and the British Aggregates Association.

The programme works with mineral planners, industry, statutory bodies, conservation organisations and local communities to make substantial contributions to priority habitat creation and boost priority species populations, while providing nature rich places for people to enjoy. The NAM programme promotes strategic, landscape-scale re-creation to provide joined up, large resilient areas of habitat and mosaics of habitat types, with their associated species, creating areas that may qualify for later designation as Natura 2000 sites.

### Background

Natural and semi-natural habitats, and their associated species, have undergone substantial declines in the UK as a result of land-use changes and developments, and now often only occur in small and fragmented patches.

To address this, and in response to the Convention on Biological Diversity, the UK developed a Biodiversity Action Plan (UK BAP) in 1994, which identified priority BAP habitats and species (many of which are protected under the EU Birds and Habitats Directives)

and set targets for their conservation, restoration and re-creation/creation.

However, meeting these BAP targets is a challenge due to the ongoing demand for the use of land for other purposes than nature conservation.

It was identified that former mineral extraction sites offered a valuable opportunity to recreate BAP habitats and/or habitats for BAP species, rather than their typical rehabilitation to agriculture or amenity use.

A GIS study undertaken by the RSPB in 2005 looked at the most appropriate biodiversity-led end-use options for active mineral

extraction sites in England (by looking at nearby habitats, soil types and water availability etc).

This study indicated that the potential for recreating BAP habitats after operations finished was huge (e.g. 50,000 ha of native woodland or almost 25,000 ha of lowland meadow), and sufficient to achieve 9 out of 11 key BAP habitat expansion targets.

Furthermore, many of these mineral sites were in locations that provided the opportunity to recreate the BAP habitats close to, or alongside, existing areas of the habitat, helping to reduce habitat fragmentation.

Therefore, restoration can also contribute to another important nature conservation objective, which is to increase the extent, coherence and connectivity of the protected area network and other sites of importance for wildlife.

However, despite these opportunities to contribute to important biodiversity policy goals, and provide related social and economic benefits (e.g. recreational, educational and employment opportunities, flood storage and water quality improvements), at the time few mineral sites were being used for such purposes.

As part of this project the RSPB consulted with mineral planners, operating companies and nature conservation organisations on the reasons for this.

The consultation revealed that there were a number of barriers to using mineral sites for the re-creation of BAP habitats, or other biodiversity focused objectives, the most important of which were a lack of support from the landowner, inadequate financial returns from the conservation end-use, difficulties in securing long term conservation management of the site, and in some localities, their proximity to airfields and the consequent risks of increasing bird strikes.

## The Nature After Minerals partnership programme

To help overcome these barriers, and to promote the strategic opportunities for delivering biodiversity through high quality habitat creation on mineral sites, the Nature After Minerals (NAM) partnership programme was established by the RSPB and supported by Natural England (the statutory nature conservation agency in England), the Mineral Products Association and the British Aggregates Association.

The programme works with mineral planners, industry, statutory bodies, conservation organisations and local communities to make substantial contributions to priority habitat creation and boost priority species populations, while providing nature rich places for people to enjoy.



In particular, the partnership has three main aims.

1. To advise on the delivery of priority habitat and enhance endangered species populations on mineral sites.
2. To work with conservation, local authority and industry interests to achieve a strategic approach to restoration of priority habitats at a landscape scale.
3. To raise awareness of the benefits that high-quality restoration on mineral sites can offer people and wildlife.

NAM provides advice on its website in relation to important topics to consider when undertaking biodiversity-led quarry restorations. This includes aspects of the mineral planning system, such as how to get the creation of BAP habitats and other priority biodiversity objectives incorporated into Mineral Plans (Box 1).

Advice is also given on practical considerations relating to the creation of biodiversity rich habitats on post mineral extraction sites, covering the safeguarding of soils (the causes of damage to soil and its mitigation measures, including site preparation, soil handling and soil storage), using natural regeneration to restore habitats, achieving landscape scale restoration, and specific advice on each main type of BAP habitat and some species.

Box 1. Some of the most important concepts that a visionary, innovative Mineral Plan should include.

**Be strategic** - Include biodiversity delivery on mineral sites as part of the strategic vision and objectives of the Mineral Plan.

**Protect what you already have** - The starting point for the Mineral Plan should be to allow no adverse effect on designated sites and existing priority habitat.

**Ensure a net gain in biodiversity** - All mineral proposals should result in a 'net gain' in biodiversity.

**Contribute to national and local biodiversity targets for habitat creation** - All mineral proposals should make clear their contribution to the achievement of national and local targets for priority habitats. This should include identifying the specific type and area of priority habitat that will be created through mineral site restoration.

**Promote a landscape-scale approach** - Mineral Plans should offer a steer towards preferred habitats within the Plan area. At the site allocations stage, the Plan should identify how the mineral sites – both individually and collectively – can best contribute to establishing a coherent and resilient ecological network.

**Give habitat creation due prominence** - Recognise and promote habitat creation as an appropriate 'stand-alone' objective for mineral site restoration. Plans that treat habitat creation as one possible outcome within generic categories like "amenity use" or "green infrastructure" are less likely to succeed in delivering priority habitats.

**Encourage a simpler approach to habitat creation** - Larger blocks of a smaller range of habitats on any one site tend to perform better ecologically and are often simpler and less expensive (per hectare) to manage in the long term, than an over-complex mosaic of many different habitats.

**Press for restoration to more "difficult" habitats where a choice exists** - Physical, geological and hydrological conditions may mean opportunities to create some habitats (e.g. magnesian limestone grassland or heathland) will be rare compared to others (e.g. broadleaf woodland). Strive to recognise and exploit such opportunities wherever they arise.

**Consider high-quality biodiversity-led restoration of best and most versatile (BMV) agricultural land<sup>7</sup>** - This is an appropriate after-use which can safeguard the long term potential and conserve the soil resource, and be delivered such that the land would still be capable of supporting agriculture in the future if required.

**Encourage early discussion** - Encourage applicants to discuss proposals with the planning authority prior to application. Involve conservation bodies (e.g. the RSPB, Wildlife Trusts, etc), Local Nature Partnerships and statutory agencies in discussions to ensure delivery of significant biodiversity gains.

**Press for extended after-care periods** - Five years is often not long enough to guarantee successful establishment of priority habitat. Mineral Plans should increase after-care to 25 years, using planning obligations as appropriate.

Numerous case examples are referred to in the advice sheets, and a webpage also provides individual examples of good practice in minerals restoration that benefit the natural environment and people, covering the following themes: habitat creation, species conservation, ecosystem services, stakeholder engagement, planning and resource management.

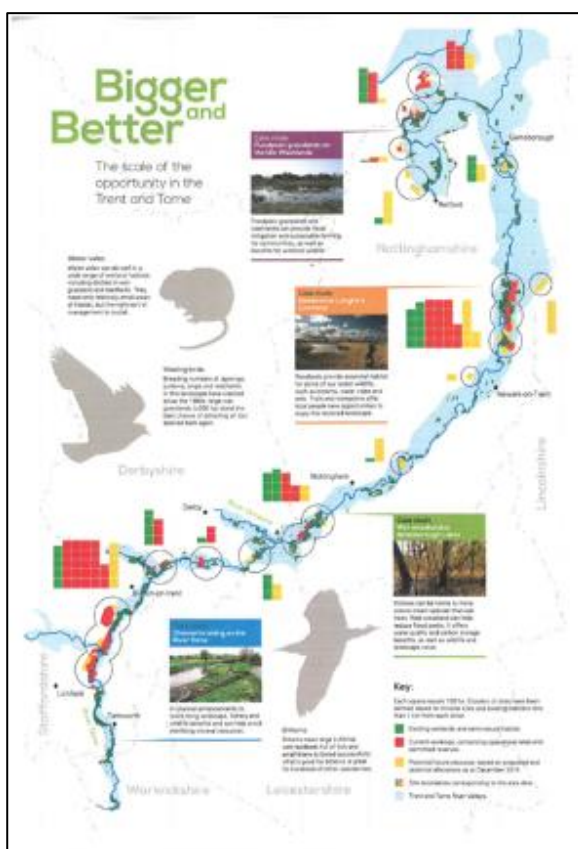


<sup>7</sup> This is considered to be land that is best used for agriculture, and therefore policies aim to protect it from significant, inappropriate or unsustainable development.

<https://www.gov.uk/government/publications/agricultural-land-assess-proposals-for-development/guide-to-assessing-development-proposals-on-agricultural-land>

Figure 1 shows a case example for the Trent and Tame River Valleys of how master plans can be used to provide a strategic and coordinated approach (across several Mineral Local Plan areas) to the restoration of clusters of mineral extraction sites to create large scale wetlands with large blocks of a smaller variety of wetland habitats on individual sites, whilst still providing the full suite of wetland habitats across the cluster.

Figure 1. Master plan for landscape scale wetland restoration on mineral sites in the Trent and Tame River Valleys (Source: RSPB)



In addition to the online guidance and case examples, the NAM staff work with mineral operating companies and individuals to promote and advise on biodiversity restoration projects.

Since 2010, the programme has engaged with over 40 mineral sites, giving over 3,600 ha worth of priority habitat restoration advice to the industry and other key stakeholders; influenced over 15,000 ha of minerals site restorations through responses to Mineral

Local Plans; and run a programme of events and training courses for stakeholders from across the industry.

The NAM has demonstrated good practice in the promotion of strategic, landscape-scale re-creation / creation to provide joined up, large resilient areas of habitat and mosaics of habitat types, with their associated species, creating areas that may qualify for later designation as Natura 2000 sites.

## References

Nature After Minerals (NAM) partnership programme <https://afterminerals.com>

The UK Biodiversity Action Plan <http://jncc.defra.gov.uk/ukbap>

Davies, A M (2006) Nature after minerals: how mineral site restoration can benefit people and wildlife. RSPB.

Lawton, J H, Brotherton, P N M, Brown, V K, Elphick, C, Fitter, A H, Forshaw, J, Haddow, R W, Hilborne, S, Leafe, R N, Mace, G M, Southgate, M P, Sutherland, W J, Tew, T E, Varley, J and Wynne, G R (2010) *Making Space for Nature: a Review of England's Wildlife Sites and Ecological Network*. Defra, UK.

Bigger and Better. How Minerals Local Plans can help give nature a home on a landscape scale in the Trent and Tame river valleys.

<https://service-rspb.boldlight.co.uk/app/uploads/sites/3/2016/03/Bigger-Better-Trent-and-Tame-doc.pdf>

For further information on the approach used in the Trent and Tame River Valleys see <https://service-rspb.boldlight.co.uk/app/uploads/sites/3/2016/06/TrentTameMineralsPlanningCaseStudy.pdf>

## Authorship

Prepared by Graham Tucker, Institute for European Environmental Policy, with information and comments provide by Helen Barnard, RSPB.

## SUSTAINABLE USE OF RAW MATERIALS in Baden-Württemberg

**Minerals:** rock, gravel, sand, clay.

**Location:** Germany.

**Natura 2000, habitats and species:** many protected species, such as the eagle owl (*Bubo bubo*), the peregrine falcon (*Falco peregrinus*) or the yellow-bellied toad (*Bombina variegata*) can use extraction areas that are properly managed during their operation and (incl. the toad *Pelobates fuscus*) after their rehabilitation.

*Bubo bubo*. Petri Ahlroth



### Summary

The German Nature and Biodiversity Conservation Union (NABU) and the Industrial Association of Stones and Soils of Baden-Württemberg (ISTE) are working together to promote the sustainable extraction and use of raw materials in the framework of the Baden-Württemberg's raw materials strategy. In particular, they aim to promote biodiversity during mining and the rehabilitation of extraction areas.

Extraction of raw materials offers opportunities for biodiversity, as extraction sites often provide valuable biotopes for threatened species. NABU and ISTE suggest that existing and new extraction sites should be seen as an opportunity for the habitats network of Baden-Württemberg, for instance as important stepping stones that need to be managed accordingly. Particular importance should be given to ensuring that the sites contribute to strengthen the habitats network in the long-term, **both during** their operational and after-use phases.

### Background

Mineral resources such as natural stone, sand and gravel make up the largest volume of raw materials extracted in Baden-Württemberg, with about 100 million tons per year, i.e. 10 tons per inhabitant. These raw materials are mined in about 500 extraction sites in Baden-Württemberg, spread over the whole federal state, where they occupy 0.18 % of the land area.

At the same time, around 10 million tonnes of construction and demolition waste is turned into recycled building materials every year.

In recent decades, there has been a strong concentration of extraction sites: instead of thousands of smaller outposts, there are now only around 500. This trend is due, on the one hand, to economic reasons (economy of scales, fixed costs for Infrastructure), but is also reinforced by the planning and approval practice.

Extraction of raw materials can cause conflicts with nature conservation depending on the value and sensitivity of the affected areas. However it also offers opportunities for biodiversity, as extraction sites often provide valuable biotopes for threatened species.

### Promoting sustainable development of raw material extraction sites

In 2018, the German Nature and Biodiversity Conservation Union (NABU) and the Industrial Association Stones and Soils (ISTE) of Baden-Württemberg published a joint paper of policy and action proposals for sustainable extraction and use of raw materials, in the framework of the Baden-Württemberg's raw materials strategy. In particular, they aim to:

- promote biodiversity during mining and re-cultivation;
- limit traffic and emissions by maintaining a decentralized supply of raw materials;
- maximise the recycling of building materials;
- improve the supply of raw materials in line with the sustainability goals;
- optimise the recovery and disposal of excavated soil in an ecologically friendly manner.

The two organisations acknowledge that as long as societal needs require that more buildings and infrastructure are built than demolished and recycled, it will be impossible to forego the extraction of raw materials in quarries, gravel pits and dredging lakes. Therefore, long-term planning is necessary to use quarrying sites in a way that can satisfy both the interests of nature conservation and of the extractive industry.

From a nature conservation perspective, mineral extraction sites should be integrated into the national habitat network as important stepping stones and managed accordingly. Particular importance should be given to their rehabilitation; when a new extraction site is planned, it should be ensured that the site will contribute to strengthen the habitats network, both during its operational and after-use phases.

In their joint paper NABU and ISTE suggest that existing and new extraction sites should not be seen as a barrier but as an opportunity

for habitat networking in the Biotope Network of Baden-Württemberg.

A widespread challenge to extraction operators is the occurrence of strictly protected species such as the eagle owl (*Bubo bubo*), the peregrine falcon (*Falco peregrinus*) or the yellow-bellied toad (*Bombina variegata*) in active quarries. Once a protected species settles on a site, a strict legal protection regime applies, including prohibition of killing and removal of breeding grounds and resting places. The strict protection of species can lead to operators avoiding the creation of suitable habitats as part of "avoidance care". This situation needs to be resolved through appropriate procedures.

Specific management measures should be implemented to promote the settlement of valuable species routinely, e.g. optimizing biotopes within the extraction site or marginal areas, increasing wildlife permeability and designing the after-use concept in the direction of the habitat network. These measures must be taken on a case-by-case basis. A solution has to be found for the described conflict with species protection law, so that the settlement of rare species can be allowed or actively promoted, without blocking the operation.

**Reference:** Naturschutzbund Deutschland (NABU), Landesverband Baden-Württemberg e.V. und Industrieverband Steine und Erden Baden-Württemberg e.V. (ISTE). 2018. Vorschläge für eine Nachhaltige Nutzung und Entwicklung von Rohstoffgewinnungsstätten im Rahmen der Rohstoffstrategie des Landes Baden-Württemberg.

[https://www.iste.de/source/Der\\_ISTE\\_informiert/2018-Inhalte\\_Nachrichten/2018-03-20\\_NABU-ISTE-Erklärung\\_Nachhaltigkeit.pdf](https://www.iste.de/source/Der_ISTE_informiert/2018-Inhalte_Nachrichten/2018-03-20_NABU-ISTE-Erklärung_Nachhaltigkeit.pdf)

### Authorship

Prepared by Boris Barov for the N2K Group.



## TOGETHER FOR AMPHIBIAN PROTECTION Cooperation Agreement

**Minerals:** rock, gravel, sand, clay.

**Location:** Germany.

**Natura 2000, habitats and species:** the cooperation agreement aims to improve the conservation status of threatened amphibian species : midwife toad, yellow-bellied toad, crested newt, spadefoot toad and tree frog.

*Alytes obstetricans*. José Alves Teixeira



### Summary

A Cooperation Agreement was signed in 2017 between the Bavarian Union for the Protection of Birds (LBV), the Bavarian Building Materials, Stone and Earth Industry Association (BIV) and the Ministry of Environment. It aims to map, conserve and contribute to achieving favourable conservation status of amphibian populations on mineral extraction sites across Bavaria.

Aware of the unfavourable status of several amphibian species in Germany and of the special potential of gravel and sand pits for these species, the LBV and the raw material extraction companies have launched a joint project to implement suitable measures to enhance their conservation through mutual information and cooperation.

Through this agreement, they will implement exemplary measures in more than 100 raw material extraction sites involving all types of raw materials.

### Cooperation to improve conservation status of amphibian species in Germany

A recent report of the Federal Government has shown that six threatened amphibian species have unfavourable conservation status due to loss of natural habitats, such as free flowing rivers, and near-natural habitats, such as wet meadows. These habitats have largely disappeared through river regulation and agriculture and are nowadays less abundant in the landscape than they used to be in the past.

It is also acknowledged that loam, sand, gravel and rock extraction sites have become important substitute habitats for the midwife

toad (*Alytes obstetricans*), yellow-bellied toad (*Bombina variegata*), crested newt (*Triturus cristatus*), spadefoot toad (*Pelobates fuscus*) and tree frog (*Hyla arborea*).

The companies are aware of the special role of gravel and sand pits for these species and intend to use this cooperation to promote opportunities for biodiversity conservation through exchange of information and practical collaboration.

When the emergence of valuable secondary habitats occur in their operations, the settlement of rare species is promoted during the extraction phase and in the rehabilitation phase.

The novelty and best practice element of this business & biodiversity cooperation is that the parties have signed a contract for cooperation which aims to implement exemplary measures until the end of 2021 in more than 100 raw material extraction sites in Bavaria, involving all types of raw materials.

The implementation of the agreement will be financially supported by the Bavarian Nature Conservation Fund, which will cover the additional costs of research and monitoring.

### **References**

Conservation & raw materials industry together for amphibians:

<https://www.lbv.de/news/details/naturschutz-und-rohstoffindustrie-gemeinsam-fuer-den-amphibienschutz/>

### **Authorship and acknowledgements**

Prepared by Boris Barov, with materials from LBV and Andreas von Lindeiner.

# IMPACT ASSESSMENT AND MITIGATION

## SKÖVDE LIMESTONE QUARRY

### Measures for the protection of alluvial forests

**Minerals:** Limestone quarry.

**Location:** Skövde, Sweden.

**Natura 2000, habitats and species:** the quarry is located close to a Natura 2000 site (Klasborgs and Våmb's ängar, SE0540093, 89 ha), which hosts grasslands and a priority habitat type: alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*.



#### Summary

The extension of a limestone quarry in Sweden required avoidance of any possible negative effects on a Natura 2000 site located downstream of the quarry, in particular on alluvial forests that are partly dependent on the flow of a small stream crossing the quarry site. This was ensured through the implementation of a project to re-route a section of the stream away from the planned excavation area, ensuring the continuous flow of water and sediments to the alluvial forest.

A new section of the stream was thus created, which fulfilled all the technical requirements but also provided as much biodiversity as possible. The project has turned out to be very successful so far. The appearance of the new stream corresponds very well to the set objectives and ensures the flows and sedimentation regime required for the preservation of the alluvial forests in the site.

#### Background

The Skövde quarry has been supplying limestone to Cementa's plant for almost a century. An application for a quarry extension of around 20 ha was submitted to the Land and Environment Court. Since early 2016 the permit approval is subject to an appropriate assessment under the Habitats Directive, the focus being on the hydrological impact of the proposed quarry extension on the adjacent Natura 2000 site Klasborgs and Våmb's ängar (SE0540093).

As part of the assessment, an investigation of the baseline condition of the habitats in the Natura 2000 site was undertaken. It considered the presence of a priority habitat type (*Alno-Padion*, *Alnion incanae*, *Salicion alba*, 91E0\*) and concluded that a sufficient seasonal flow of two surface streams was

needed to maintain the habitat in good condition.

The smaller stream, Hållsdammsbäcken, crosses Cementa's property and the planned quarry extension area. Therefore, to avoid causing significant impact to the alluvial forests located downstream, Cementa had to design and implement a project to re-route a section of the stream away from the planned excavation area, ensuring the continuous flow of water and sediments to the alluvial forest. Just before entering the Natura 2000 site, the stream merges into its original bed.

After having proven to the Court the feasibility of the designed stream diversion project, Cementa was granted the quarry extension permit on the basis of no expected significant impact on the Natura 2000 site. The works were carried out in 2017 and monitoring of

the habitat's condition started in 2015 and is scheduled every two years.

### Likely impacts on a Natura 2000 site near the quarry

The Natura 2000 site Klasborgs and Våmbs ängar (SAC SE0540093) is located south of the Skövde limestone quarry. The closest distance between the rim of the quarry and the Natura 2000 site is less than 100 m.

The Natura 2000 site covers 82.9 ha of forests and meadows with cattle grazing. In its northern part closest to the quarry, at the confluence of the streams Våmbsbäcken and Hållsdammsbäcken there is a stand of a few hectares of alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*, a priority habitat 91E0\*. The smaller of the two streams, Hållsdammsbäcken, follows the southern slope of Nordbillingen and has until 2017 formed the western border of the limestone quarry.

In order to continue operations, Cementa needed to extend its limestone quarry in Western direction. That would have required the removal of the Hållsdammsbäcken stream, which contributes about 20% of the surface water to the alluvial forest. Together with Våmbsbäcken, the two streams play an essential role for the hydrological regime of the alluvial forest, which requires regular spring flooding during discharge peaks and transport of alluvial sediments to the forest.

The removal of the stream could bring two risks: 1) significant reduction of the water flow and 2) alteration of the sediment deposition, both of which would have resulted in a negative impact on the protected area and its habitats.

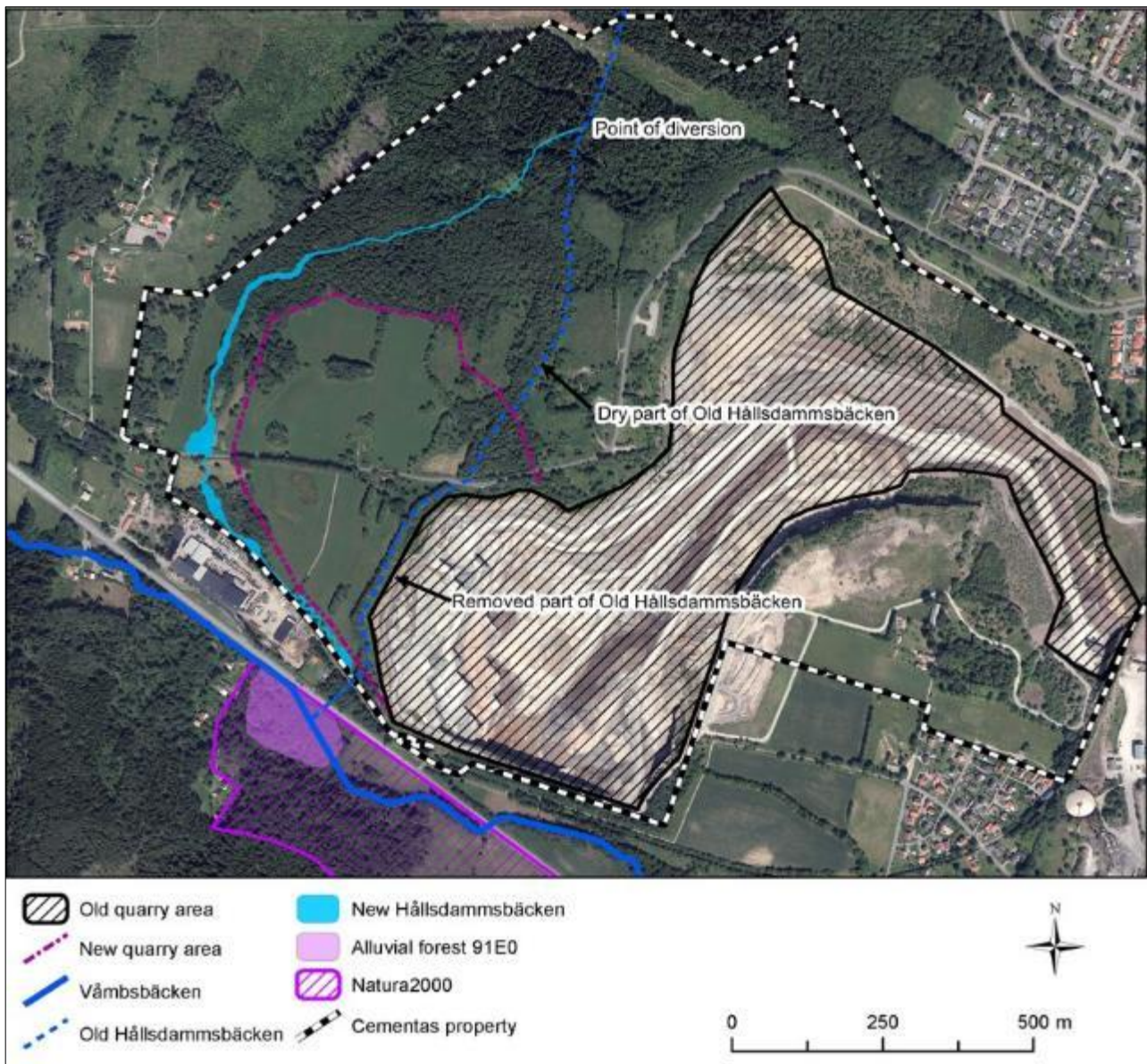
### Designing a solution that allows avoiding the negative impact

The avoidance of a negative impact on the Natura 2000 site was the main point examined by the Land and Environment Court

on which the quarry permit depended. Cementa had to provide the Court with a well justified, detailed and compelling case for a designed solution, which involved the diversion of a section of the Hållsdammsbäcken stream in Western direction.

The required baseline studies and field work, including hydrological probes and models were elaborated with the help of a specialized environmental consultants (Ecogain and WSP). To meet the challenge, the key requirements for the project were:

- To precisely identify the habitat types, present on the Natura 2000 site and their hydrological requirements.
- To sustain the required average annual water flow of the stream, including the seasonal peaks in spring.
- To ensure that no water will be lost through infiltration into the ground along the new stream, more specifically:
  - Identify which sections are prone to higher risk of infiltration.
  - Select appropriate construction material for the bottom layer of the new stream bed in these sections.
- To manage the expected large amounts of sediments transported downstream during the first years of the new stream section, more specifically:
  - Plan the dimensions and numbers of sedimentation dams needed.
  - Ensure that the “right” amount of sediments could reach the alluvial forest. Too much would negatively affect stream biodiversity, too little would in the long term deprive the alluvial forest from vital sediment load.
- To create a stream which fulfilled all the technical requirements but also provided as much biodiversity as possible.



Project area and key landscape features surrounding the Skövde limestone quarry.

A monitoring plan for the Natura 2000 site was established prior to the stream construction. The monitoring objectives include following the state of the vegetation in the alluvial forest on 18 permanent plots every two years (2015 was the base year). Continuous monitoring of water flows and levels in the New Hållsdammsbäcken and in Våmbsbäcken is also part of the programme.

#### Implementation of mitigation measures

Based on the detailed assessments, the proposed project was accepted by the Land and Environment Court as feasible and was

considered to bring no risk of significant negative impact on the priority habitat 91E0.

Cemeta was granted the quarry extension permit on the basis of a favourable decision on its investment proposal and mitigation measures to avoid negative impact on the Natura 2000 site.

To be able to create a new stream with all the aspects mentioned above, Cemeta put together a team with a project leader from the company and experts in ecology and geohydrology from consultancy companies.

For the construction work, Cementa contracted a company with local expertise in Skövde. It was important to find a contractor who truly understood the case i.e. not digging a ditch but creating a complex and diverse natural looking stream.

The initial pre-studies were conducted in 2014. The actual construction work started in late 2016, just weeks after receiving the new extraction permit. The construction phase lasted until April 2017. In the beginning of May 2017, the water from the old stream was led into the new Hållsdammsbäcken.

The construction works were delivered on time thanks to the excellent coordination. The inauguration of the new stream involved local school children who could learn about stream ecology.

The project has turned out to be very successful. The appearance of the new stream corresponds very well to the written goals and the photomontages produced in the pre-study.



All in all, the new Hållsdammsbäcken is about 50 % longer, includes three new ponds and has a much more diverse and natural profile in the sections crossing agricultural land, compared to the old Hållsdammsbäcken (see table 1 below).

The year since the construction (as of to date) has been unusually dry. This rendered it impossible to fully “test” the features of the New Hållsdammsbäcken.

Table 1. Length of sections through different habitats for Old and New Hållsdammsbäcken

	Old Hållsdammsbäcken	New Hållsdammsbäcken
<i>Forest</i>	700 m	1000 m
<i>Agricultural land</i>	300 m (straightened ditch, no ponds)	360 m (meandering stream with 3 ponds)
<i>Total length</i>	1000 m	1450 m

Time is needed for the vegetation to regrow, the sediments to settle, the benthic fauna to colonise and amphibians to reproduce in the new ponds (most likely Moor frog *Rana arvalis* and Common Frog *Rana temporaria*).

**Main success factors**

- Setting, from the outset, clear biodiversity goals, based on detailed understanding of the baseline situation and a clear vision about the solution.
- Establishing a team with broad range of expertise and experience in the environmental assessments of quarries.
- Creating a very detailed pre-study on both technical and biological aspects, with descriptions of each section of the stream, technical drawings, maps and photomontages.
- Starting a monitoring programme of the key hydrological and biological parameters prior to construction and its continuation afterwards.
- Contracting a construction company on the basis of quality execution plan and not based on low cost.
- Involving ecology experts in the construction process, with continuous meetings in the field and in the office together with the constructor.

## References

[https://www.cementa.se/sites/default/files/assets/document/db/f5/bilaga\\_1\\_nya\\_hallsdammsbacken.pdf](https://www.cementa.se/sites/default/files/assets/document/db/f5/bilaga_1_nya_hallsdammsbacken.pdf)

[https://www.cementa.se/sites/default/files/assets/document/bilaga\\_2\\_ritning\\_over\\_uppdaterat\\_backlage.pdf](https://www.cementa.se/sites/default/files/assets/document/bilaga_2_ritning_over_uppdaterat_backlage.pdf)

[https://www.cementa.se/sites/default/files/assets/document/bilaga\\_4-biologiskt\\_uppfoljningsprogram.pdf](https://www.cementa.se/sites/default/files/assets/document/bilaga_4-biologiskt_uppfoljningsprogram.pdf)

## Authorship and acknowledgements

Prepared by Boris Barov with information provided by Cajsa Björkén from Ecogain consulting company and Cementa, Heidelberg Cement Group, Sweden.

Photos provided by Ecogain.



## SERRA D'AIRES E CANDEEIROS

### Strategic assessment and planning of quarries in a Natura 2000 site

**Minerals:** Ornamental and industrial limestone.

**Location:** Santarem, Portugal.

**Natura 2000 site / habitats and species:** the Natura 2000 site (PTCON0015, 44,223 ha) holds 17 habitats of Community interest and 31 species listed in Annex II of the Habitats Directive, including many bats and plants. The total area allocated to quarry concessions represents 1.9% of the site, i.e. 872 ha.

Photo: Banco de Imagens Geológicas



#### Summary

Serra d'Aires e Candeeiros was used for limestone extraction since the 14th century and includes many small quarries. It is a large karstic complex with very interesting flora and fauna, which has been designated as a Natural Park and also included in the Natura 2000 network. A spatial plan was elaborated to regulate the extractive activity in the protected area and ensure the preservation of its natural values. This involved the establishment of five permitted areas and new rules for quarrying, which required that a master plan be elaborated for each of these areas. Each master plan was subject to a Strategic Environment Assessment, including an Appropriate Assessment, to ensure that the quarry operation was compatible with the preservation of the Natura 2000 site.

The SEA included very detailed surveys and mapping of habitats and species of EU interest present in the quarry master plan areas. It gave the possibility to properly define the areas that can be used for limestone quarrying and the areas that require stronger protection and where extractive activities shall be excluded. In this case, the SEA was considered an effective spatial planning tool for the extractive activities in the Natura 2000 site. Each particular quarry must now also be the subject of an EIA and Appropriate Assessment in accordance with the Habitats Directive.

#### Background

Serra d'Aires e Candeeiros limestone extraction for ornamental use dates back to the beginning of the 14<sup>th</sup> century. Limestone is used from housing to monuments such as the Batalha Monastery (14<sup>th</sup> century). This specific type of limestone is the main material of the typical Portuguese pavement that covers public spaces, such as sidewalk and squares. Lime is the main industrial product of the stone extracted in these quarries.

During the 80's, limestone extraction had a major expansion thanks to an increasing demand from both the private and public construction sector. The industry in the area supports more than 1500 jobs and represents an annual income of 100 million euros.

In the past, the majority of the quarries were established without legal permits in small plots where limestone was extracted by hand or with the use of simple machinery. In total more than 300 quarries were identified in

the site, with ranging areas from 200 m<sup>2</sup> to 100 ha.

In 1979, the area was designated as a Natural Park (Parque Natural da Serra d'Aires e Candeeiros - PNSAC) and, in 1998, it was proposed for the Natura 2000 network.

The site is a very large karstic complex. It is important at national level for bats, holding some of the biggest colonies in the country. It is also notable for plant species, including several endemic flora species (such as *Arabis sadina*) as well as priority habitats under the Habitats Directive, such as 3170\* - Mediterranean temporary ponds, 6220\* - Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea* and 8240\* - Limestone pavements.

Part of the site is seasonally flooded and the flooded area is classified as RAMSAR site - "Polje de Mira-Minde e Nascentes Associadas". The area also encloses several sites of geologic importance at international

level. It includes the most significant known deposits worldwide of sauropod footprints of the Middle Jurassic. The track was found in a former quarry.

#### **Master plans and SEA of quarries in the Natura 2000 site**

With the designation of the area as a Natural Park in 1979<sup>8</sup> and following its proposal as a Natura 2000 site, the national administration adopted land planning and legal tools to regulate activities within the Park and render the extractive industry compatible the preservation of its natural values.

The first step was to elaborate the Park's spatial and management plan (POPNSAC). This took some time and involved all the relevant stakeholders including the Portuguese federation of stone industry. It came into force in 2010 with the publication of the spatial and management plan regulation.



Mediterranean temporary pond (H3170\*) and limestone pavement in the quarries area (ASSIMAGRA)

<sup>8</sup> 'Decreto-Lei 118/79, 1979-05-04'.

This plan took into account the Natura 2000 site designation and its natural values and the need to maintain the integrity of the site.

In particular it established 5 areas<sup>9</sup> within the Park/Natura 2000 site where extractive activities would be allowed, called Specific Intervention Areas (AIEs – *Áreas de Intervenção Específica - Áreas Sujeitas a Exploração Extractiva*) subject to particular conditions :

- detailed planning of the current and expansion of quarrying areas,
- detailed assessment of the extractive activity impact on species and habitats listed in the Nature Directives,
- definition of protection areas and quarrying deactivation,
- definition of restoration areas,
- stakeholder involvement.

For each of these areas, the relevant the quarrying companies need to propose a detailed master plan in order to be able to continue their activities. Once approved these plans become legally binding.

Table 1- Specific Intervention Areas for extractive activities (AIEs) in the Natura 2000 site

AIEs subject to master plan	Area (ha)	% of the N2000 site
Cabeça Veada	29	0.07
Pé da Pedreira	1373	3.10
Portela das Salgueiras	63	0.14
Cadoçal	98	0.22
Moleanos	147	0.33

<sup>9</sup> The AIE Alqueidão da Serra is located outside the Natura 2000 site and partially outside the PNSAC.

<sup>10</sup> <http://www.pegadasdedinossaurios.org>

All quarries outside these 5 master plan areas have to be deactivated and subject to restoration actions in accordance with the POPNSAC regulation. A good example of deactivation and restoration of quarries outside these master plan areas is the quarry “Pedreira do Galinha” with the world longest sauropod footprints track<sup>10</sup>.

The quarries located in the areas where extractive activity is allowed are owned by several companies, the majority of which are small family companies. They were not organized and had no technical and financial capacity to fulfil the POPNSAC legal requirements for the submission of master plans for these areas.

But the Portuguese association for extractive industries (ASSIMAGRA) together with the ICNF (nature public administration that enforces the POPNSAC) were able to indicate a project, with the support from the EU Cohesion fund<sup>11</sup>, to submit the 5 master plans. The objective of this project is to develop all the master plans and to make compatible the natural values with the extractive industry in the Park and Natura 2000 site.

All master plans were then subjected to a Strategic Environmental Assessment (SEA) according to Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment. One of the main aspects of the SEA is its obligatory public discussion and inclusion of the results of the discussion in the improvement of the plan.

Figure 2 below shows the participatory approach used in the elaboration of the plan and SEA of one of the master plans.

<sup>11</sup> <http://www.assimagra.pt/project/sustentabilidade-da-industria-extrativa/>

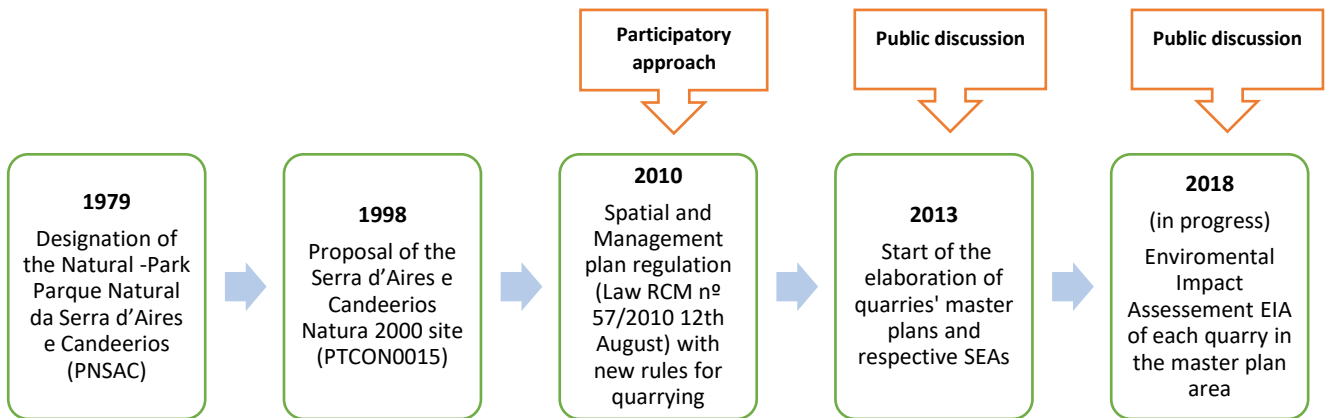


Figure 2. Legal framework process of the quarries in Serra d'Aires e Candeeiros site

The whole process from the master plan proposal and SEA to a final spatial plan integrates the natural values and socio-economic interests in the decision making about the extractive activity to be carried out in each specific area.

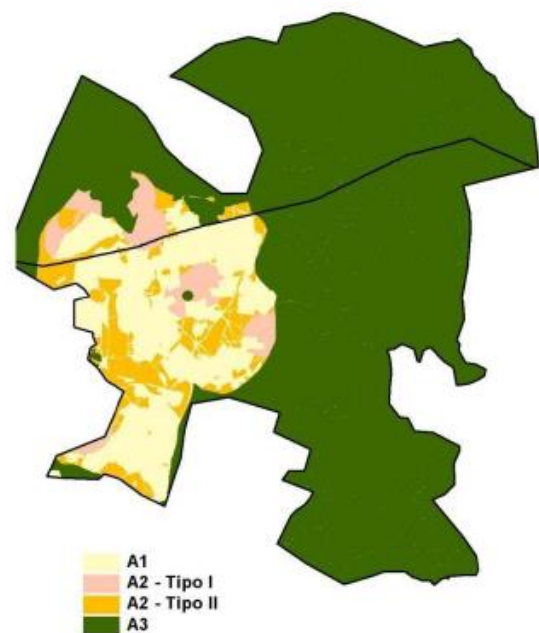
#### Example: Pé da Pedreira AIE Master plan

The master plan for the Specific Intervention Area Pé da Pedreira (1700 ha) established the following zones:

- A1 – Area compatible with extractive industry
- A2 – Area compatible with extractive industry but subject to mitigation measures
  - Type I - Very high natural value
  - Type II – High natural value
- A3 – Areas for nature conservation (no extractive industries allowed).

It is to be noted that each individual quarry in the master plan is also subject to an EIA if the aim is to expand its activities or if it requires a new permit for its activity. Some of the quarries in the 5 master plans areas in the site are currently under EIA evaluation.

The final AIEs master plans are not yet approved by the 6 local municipalities involved in the process. However, all the SEA



reports and public discussions were completed during 2017 with participation of all the relevant stakeholders, NGOs and local population. In addition, some EIAs for groups of quarries in the AIEs areas have been prepared but the final Environmental Declaration<sup>12</sup> has been conditioned to the master plan final approval.

#### References

Decree that establishes the Natural Park Serras de Aire e Candeeiro Decreto-Lei 118/79, 1979-05-04. Diário da República Eletrónico. Available at: <https://dre.pt>

<sup>12</sup> EIA Decision on the Quarries at Pé da Pedreira: <http://siaia.apambiente.pt/AIA.aspx?ID=2877>

Resolution that approves the Spatial plan of the Natural Park Serras de Aire e Candeeiros. Resolução do Conselho de Ministros 57/2010, Pub. L. No. Resolução do Conselho de Ministros 57/2010 (2010). Available at: <https://dre.pt>

ASSIMAGRA project:

<http://www.assimagra.pt/project/sustentabilidade-da-industria-extrativa>

EIA Projeto Integrado do Núcleo de Exploração de Pedreiras de Pé da Pedreira. Sistema de Informação sobre Avaliação de Impacte Ambiental – APA

<http://siaia.apambiente.pt/AIA.aspx?ID=2877>

**Authorship**

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## MONTE TONDO QUARRY

### Managing habitats for bats and other species

**Minerals:** Gypsum open pit and underground mine.

**Location:** Emilia Romagna, Italy.

**Habitats and species:** the Monte Tondo gypsum quarry is located inside the SAC-SPA IT4070011, Vena del gesso romagnola (5,538 ha), which hosts very important populations of bat species, including *Rhinolophus ferrumequinum*, *Miniopterus schreibersii*, *Myotis myotis* and *Myotis blythii*, as well as other habitat types and species of EU interest.

*Cava Monte Tondo. Ildirettore. CC-BY-3.0*



#### Summary

The Monte Tondo Gypsum quarry is the only mining area currently allowed in the Emilia-Romagna Region, where there has been historically intense exploitation along the Gypsum outcrops of the Vena del Gesso. Every five years the Region renews the mining permit on the basis of an extractive plan, subject to EIA and to an appropriate assessment (AA) of the effects of the extraction activity in the Natura 2000 site.

According to the last AA, the impacts will not be significant once the extraction activity is subject to prescriptions concerning the measures required to reduce the impacts. In addition, the conservation measures adopted for the Natura 2000 site include regulation, implementation and monitoring measures specifically aimed at the Monte Tondo quarry. They include measures to protect the bats' habitat and avoid disturbance to the bat species present in the site. As a result, Important bat populations continue to live in the caves and have now additional roosting sites in the artificial tunnels. What is more, the restoration plan for the quarry aims to further enhance the caves for the bats.

#### Background

The Monte Tondo Gypsum karst area is at the centre of the Messinian evaporitic basin of the "Vena del Gesso romagnola". It hosts two separate karst systems, which are considered among the largest in Italy and, in a broader perspective, in Western Europe.

The area is located inside the SAC IT4070011 and the Regional protected area Parco Regionale della Vena del Gesso Romagnola.

It is an important roosting and feeding area for some 15 bat species thanks to the large number of caves. In particular, it hosts:

- a large breeding colony of *Miniopterus schreibersii*, *Myotis myotis* and *Myotis blythii* in the tunnels of the Saint-Gobain quarry;
- a *Rhinolophus euryale* breeding colony in the Re Tiberio Cave;
- a very large winter colony of *Miniopterus schreibersii*, as well as several individuals

of *Rhinolophus ferrumequinum*, also in the quarry tunnels;

- other rare species, such as *Nyctalus noctula* and *Myotis mystacinus* are reported in the area.

### The Monte Tondo gypsum quarry

The Monte Tondo GYPROC Saint-Gobain quarry is the only mining area currently allowed in the Emilia-Romagna Region, where there was once intense exploitation along the Gypsum outcrops of the Vena del Gesso.

The existing Monte Tondo quarry is an open pit mine with traditional drilling and blasting excavation and mineral processing. The total annual crude Gypsum production is about 200,000-300,000 tons which are used almost exclusively in construction. In the past, activities have included both opencast and underground.

The quarry underground is characterized by 13-15 kilometers of tunnels, excavated from

1958 to 1990, on 4 different surface levels, from 220 m to 140 m above sea level.

The extractive activity involved the retreat of the ridge, the regulation of the waters and the destruction of the external karst morphologies present. 20 kilometres of artificial tunnels intersected and partly destroyed the natural caves and caused the alteration of underground hydrology. Daily activities lead to acoustic and dust pollution.

Nonetheless, scientific studies demonstrate that bats continue to live in the caves and have now additional roosting sites thanks to the artificial tunnels. Today, the entire wintering Italian population of *Miniopterus schreibersii*, a priority species, is located in the Monte Tondo quarry. Every five years the Region renews the mining permit on the basis of an extractive plan, subject to EIA, which has to include the provisions of the appropriate assessment (AA) of the extraction activity in the Natura 2000 site.



La Vena del Gesso. Ildirettore. CC-BY-3.0

According to the last AA, the impacts will not be significant because the extraction activity is subject to prescriptions (mining regulations) concerning the cultivation phases, the environmental recovery and other specific environmental requirements of the site that impose control, monitoring and management measures to reduce the impact of noise, on air quality, on surface water and groundwater, on nature and the landscape, linked to ecosystems (including karst systems), flora and fauna.

### **Conservation measures for the caves habitat**

Meanwhile, the Emilia-Romagna Region has also produced and adopted the conservation measures for the SAC IT4070011 *Vena del gesso romagnola*, where the quarry is located. They include regulation, implementation and monitoring measures specifically aimed at the Monte Tondo quarry.

The regulation measures include:

- the obligation to place, in the entrances of caves and quarry tunnels, suitable gates or bars, to maintain flight corridors for the different bat species;
- the obligation to take all measures needed to reduce dust, especially in caves and artificial tunnels used by bats as a flight corridor. To this end, a monitoring system by the regional management body for parks and biodiversity must be set up, paid for by the quarry owner;
- the prohibition to carry out works that may disturb the bats in artificial tunnels and caves in which their presence is reported.



Bent-winged bat (*Miniopterus schreibersii*). FJAH, Shuttestock



- the creation of small wetlands for amphibians and aquatic invertebrates in the basal areas;
- the creation of wooded and alternate areas with modest open spaces, using only native species and characteristics of the woods of the Vena del Gesso Romagnola, with natural planting layouts and floristic composition consistent with the natural habitats;
- the obligation to protect the karst phenomena (epigean and hypogean) present in the immediate vicinity of the excavation area.

The implementation measures form part of an agreement between the owner of the Monte Tondo quarry and the regional speleological association to carry out exploration, research, study, surveying, documentation and information on possible disruption of passages in known karst systems, as well as the search for new cavities.

The monitoring measure also includes a programme to monitor the recolonization and evolution of brownfield areas .

### **Environmental restoration plan**

At the end of the extraction activity the quarry will be included in the Regional park (at the moment it is located in the pre-park zone). The owners of the quarry have been restoring the landfill heaps in the areas no more excavated since the 1970s'. During the first 27 years of activity, more than 100,000 plants were placed on a surface of about 60 ha.

Typical local species have been used since the start of the activity and more recently particular attention is given to the floristic composition which, according to the conservation measures, should be consistent with the natural habitats present.

Since 2011 a planting project of tree species is being carried out in the areas affected by mining, in collaboration with the Department of Arboreal Cultures of the University of Bologna.

The restoration plan includes the protection and enhancement of the caves, which has led to a project to ensure the safety of the Re Tiberio Cave, important from a geological, archeological and biological point of view, as it hosts a *Rhinolophus euryale* breeding colony.

### **Communication and research activities: collaboration with speleological associations and universities**

In response to concerns by local residents, the mining company responsible of the Monte Tondo quarry, GYPROC Saint-Gobain, has promoted a series of initiatives in order to inform about its commitment to the protection and enhancement of the territory the environmental sustainability initiatives that the company has carried out.

### ***Opening to the public***

Local cultural events were organized (for example, readings in the quarry) and other events have also taken place (including sports, as trekking routes) sometimes with national resonance, as in the case of the Romagna Rally, the fourth most important European bicycle race that Saint-Gobain Gyproc sponsors.

After its restoration, the Re Tiberio Cave was open to the public thanks to an agreement with the speleological association.

Numerous conferences and seminars have been promoted in collaboration with the Municipalities of Riolo Terme and Casola Valsenio, the Emilia-Romagna Region and the Superintendence for Archaeological Heritage of Emilia-Romagna.

### **Research activity**

GYPROC Saint-Gobain has financed several geological-structural research projects, transforming the quarry into an "open-air scientific laboratory".

The new and recent scientific results have allowed to increase the knowledge of the karst system of Monte Tondo and, in particular, the karst system of the Grotta del Re Tiberio.

### **References**

Natura 2000 site IT4070011

<http://ambiente.regione.emilia-romagna.it/parchi-natura2000/rete-natura-2000/siti/it4070011>

Ercolani M., Lucci P., Piastra S., Sansavini B., 2013 - *I Gessi e la cava di Monte Tondo*. Memorie dell'Istituto Italiano di Speleologia, Serie II, vol. XXVI. Faenza.

Molducci P. 2016 – *Piano di gestione*. LIFE Nature project "Gypsum-Tutela e gestione degli habitat associati alle formazioni gessose dell'Emilia-Romagna" (LIFE+08NAT/IT/000369).

### **Authorship**

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## SPECIES AND HABITATS PROTECTION in a metal mine in Portugal

**Minerals:** copper, zinc and lead

**Location:** Neves Corvo, Baixo Alentejo, Portugal

**Natura 2000, habitats and species:** SPA Castro Verde (PTZPE0046) and the Guadiana SCI (PTCON0036). The main habitats in the area are evergreen holm oak (*Quercus rotundifolia*) “montados”, pseudo-steppe grasslands, Mediterranean scrubland, and intermittent riverine vegetation.



### Summary

The Neves Corvo mine is one of EU's largest underground copper mines. The mining concession area (1.619 ha) and the industrial area (840 ha) partially overlap with 2 Natura 2000 sites: the SPA Castro Verde (PTZPE0046) on the north of the industrial area, and the Guadiana SCI (PTCON0036). The totality of the concession's non-mining areas are managed in order to maintain biodiversity.

As part of the EIA procedure, several potential environmental risks were identified, which posed possible risks some habitats and species included in the Natura 2000 sites, in case of an accident or inappropriate environmental management. In particular, there are risks from the accidental rupture or overflow from the tailing (sedimentation) ponds to the Oeiras river that passes through the mining area. Taking into account the EIA, Somincor set up a very strict Environmental Management System that includes a permanent and comprehensive soil and water monitoring with the aim of minimizing and mitigating any unexpected impacts, but also to identify opportunities for habitat and species' management. Somincor created partnerships with nature conservation NGO's, local farmers and local and national authorities to promote biodiversity conservation, in particular in Natura sites management and habitat restoration.

Neves Corvo mine is operated by Somincor (Lundin Mining group) and started its operation in 1988. It is one of EU's largest underground copper mines, with yearly outputs of around 220K Tons of copper, 145K Tons of zinc and 10K Tons of lead.

It employs more than 1000 workers and 1100 contractors, being the biggest private employer in the Alentejo region.

Part of the mining concession area overlaps with 2 Natura 2000 network sites (SPA Castro Verde (PTZPE0046) and the Guadiana SCI (PTCON0036), although the extractive activities are not carried out in the Natura 2000 sites. The Guadiana SCI however includes the Oeiras river that is the main water course in the concession area.

### **Environmental impact assessment (EIA) and risk management**

This mine was one of the first operations subject to EIA in 1982, even before environmental legislation was in place in Portugal.

The mining has since been subject to several EIAs (the latest in 2017) that assessed the impacts of mining expansion areas and new industrial facilities for zinc processing.

Several environmental risks that can have potential impact on the Natura 2000 sites were identified and analysed. The leaching of soils and waste rock, leaking or rupture from tailing dams and drains, water treatment and spills, were identified as potential risk pathways, although with low probability, in the EIAs and Environmental Audit Reports.

The main negative potential impacts identified were:

- on aquatic fauna resulting from discharge of treated water from the mining site into the Oeiras River;
- soil contamination from contaminated dust dispersion;
- noise.

In order to mitigate these potential impacts, the mining company has committed following EIAs decisions:

- Setting up a comprehensive monitoring plan.
- Continuous control and elimination of risks at the source.
- Setting up emergency plans and ensuring their regular revision. In particular there is in place a specific emergency plan in case of rupture or overflow of the tailings dam.

- Implementing a noise minimization project to reduce noise in the industrial area and nearby populations.

In order to mitigate potential impacts that could pose threats to Natura 2000 sites the EIAs foresee several actions:

- Risk reduction of rupture or leaking of the tailing dams by continuous and detailed monitoring of the dam structure, water levels and quality. In addition, there are in place systems for rerouting the water in case of overflow or leakage of the dam, and thus preventing the contaminated water to reach the river in the Natura 2000 site.
- Continuous monitoring of the water quality and levels in the Oeiras river
- Substantial reduction of the wastewater discharges to the river coming from the mine extraction and industrial areas, especially during the dry season. Currently 90% of the water used in the extraction and industrial areas is recycled and reused in the process, and thus reducing the production of wastewater. Somincor with the support of European Regional Development Fund (ERDF) set up an innovative system to reduce the deposition of tailing pulp in the tailing lagoons and thus reducing the water use and the risk of accidental wastewater discharges to the nearby river in the Natura 2000 site.

Somincor has maintained, since 1990, an annual biodiversity monitoring program carried out by teams of biologists from the University of Lisbon and Coimbra University.

The researchers from the Centre of Environmental Biology, Lisbon Faculty of Sciences have been supporting Neves-Corvo in the area of environmental studies since 1992.

### **Cooperation with farmers and hunters to secure habitats and species**

Half of the mining concession area (1.619 ha) is not used for mining or industrial facilities. These areas are leased to local farmers and beekeepers to maintain extensive agricultural and forestry activities. Part of these areas are in Natura 2000.

The mining company has also set up a hunting plan where 60% of the area is managed for sustainable hunting by local hunting associations. Hunting is not allowed on the remaining area (Natura 2000 sites).

### **Neves-Corvo's Biodiversity Management Plan**

Somincor set up a Biodiversity Management Plan in the mining area that is focused on habitats and species present in the Natura 2000 sites, also taking in consideration national priorities. The main actions of this Plan include:

- Planting up to 1,300 holm oak trees in 2020 s to enhance the evergreen holm oak (*Quercus rotundifolia*) "montados" habitat.
- Implementing projects for bivalves' conservation with the Évora University.
- Updating the Mine Closure Plan, delivered to the authorities in 2016, to consider the potential use of existing mine shafts as bat habitat during post-closure period.
- Raising awareness of the natural values in the mining area and Natura 2000.

### **Building partnerships with NGOs and national authorities**

Partnerships are important to the success of Neves-Corvo's initiatives in management of biodiversity.

In 2007, the company signed an agreement with the Institute for the Conservation of Nature and Biodiversity (ICNB) to contribute to the European target of halting biodiversity loss. Neves-Corvo maintained their support to this program voluntarily beyond the expiry of the agreement, continuing their biodiversity-related initiatives, including:

- biodiversity studies;
- review of best available techniques in industrial effluent management and treatment;
- stewardship of the Oeiras River;
- conservation of aquatic communities; and
- following of the Management Plan of the Natural Park of the Guadiana Valley (Natura 2000 site).

Somincor has also been working closely with a Portuguese NGO - League for the Protection of Nature (LPN) namely by supporting the following LIFE Nature projects targeting the Natura 2000 sites close to the mining:

- LIFE Estepárias (LIFE07 NAT/P/000654), providing financial, logistic and technical support. The main goal of the project was to promote the conservation of Great Bustard, Little Bustard and Lesser Kestrel in their main Portuguese distribution area that includes the Castro Verde and Guadiana Natura 2000 sites.

- LIFE Saramugo (LIFE13 NAT/PT/000786), providing financial, logistic and technical support. Saramugo (*Anaecypris hispanica*) is an endemic fish listed in the Annex II of the Habitats Directive which is in bad conservation status.

Somincor, as part of the Lundin Mining Corporation is adherent to the Business and Biodiversity Initiative.

### Communication and local community engagement

As part of the Biodiversity Management Plan foresees, Somincor aims to boost awareness of biodiversity in the mine area and surroundings. It set up several activities, including the production of a “Field Guide of the Neves-Corvo Region - A Mine of Biodiversity”, which was published in June 2013 by the Universities of Coimbra and Lisbon.

The website “A Mine of Biodiversity”, created by the Neves-Corvo Environmental department in collaboration with local universities and environmental science groups, aims to share all the biodiversity information that was collected from environmental reports and studies since 1982.

The company also produced a film “O Cante da Terra”, showing the natural values of the area that was aired on the Portuguese television channel, SIC.

Other communication initiatives are developed by the mining company with local communities and in partnership with municipalities and schools.

One example of this type of engagement is the event “Walking for Biodiversity”, organized in 2018, and the construction of bird observation towers.



Website “A Mine of Biodiversity”

## References

<http://www.biodiversidade-somincor.pt>

O Cante da Terra

<https://vimeo.com/78904290><https://www.lundinmining.com/operations/neves-corvo/>

[https://ec.europa.eu/regional\\_policy/en/projects/major/portugal/innovative-technology-to-bring-business-and-environmental-benefits-to-mining-facility](https://ec.europa.eu/regional_policy/en/projects/major/portugal/innovative-technology-to-bring-business-and-environmental-benefits-to-mining-facility)

## Authorship

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**REHABILITATION:  
HABITAT RESTORATION AND  
IMPROVING SPECIES CONSERVATION**



## SOTO PAJARES QUARRY

### Enhancing biodiversity in Natura 2000

**Type:** sand and gravel quarry.

**Location:** South East of Madrid, Spain.

**Natura 2000 site / habitats and species:** The quarry is located in a Natura 2000 site (ES3110001, 36,063 ha), which includes river plains, cliffs, wetlands and moorlands along the Jarama and Manzanares rivers. The site is especially important for waterfowl, steppe birds and raptors, and as stepping stone for migratory birds.



### Summary

A Biodiversity Action Plan (BAP) implemented in the site allows for the proper design and implementation of mitigation and restoration measures that take account of the particular needs of species and habitats of the Natura 2000 site. The BAP, supported by baseline surveys, is carried out through cooperation with nature conservation experts of SEO/BirdLife.

The restoration model applied in the area aims at creating a mosaic of different habitats that increases the ecosystem's diversity, such as the creation of shallow water habitats, riparian forests, management of landscape elements in agricultural habitats, etc. Environmental awareness and education activities aim to sharing their experiences with the civil society and the company staff. A discussion forum is also established to increase communication and cooperation among stakeholders.

### Background

In 2007, CEMEX signed a worldwide cooperation agreement with BirdLife International (the company operates in 4 continents) to develop a Biodiversity Action Plan methodology, aimed at making their mining activities compatible with biodiversity conservation and enhancement, as well as to promote research and environmental education, in different sites used by the company.

In Spain, SEO/BirdLife signed an agreement with CEMEX in 2011 to design, implement and monitor the BAP of Soto Pajares quarry, as one of the CEMEX BAP pilot areas.

The entire area has a long tradition of gravel extraction. Several gravel quarries are already exhausted and restored, providing an excellent refuge for wildlife.

Soto Pajares gravel quarry has been in use since the early 70s'. It is located in a valley bottom and produces gravel and sand (with a production capacity of circa one million tons per year). The extractive activity is still ongoing in the permitted areas and restoration activities are carried out in the areas where the activity is completed. More than a hundred species of birds, fish, amphibians, reptiles and mammals, including many threatened species, are found in the area, which also holds a rich and varied flora

and various habitats of Community (EU) interest.

A Natural Resources Management Plan regulates both the implementation of extractive activities, which are only permitted in certain areas, and the restoration work that is to be carried out once the activities cease. It also establishes the need to carry out an Environmental Impact Assessment of all new extractive activities, which has to include an appropriate assessment of any potential effects on the Natura 2000 values.

### **A Biodiversity Action Plan for the quarry**

The Biodiversity Action Plan for Soto Pajares quarry was conceived as a dynamic process designed to improve the biodiversity conservation on this site, based on the CEMEX & BirdLife BAP Standard.

It provides guidance to CEMEX operations, including how to gather essential information about biodiversity, to gain an understanding of potential site impacts on wildlife through consultation with stakeholders and other sources, and to identify priorities with which to set conservation objectives and actions.

With this background, the main aim of the Biodiversity Action Plan is at minimum to achieve no net loss of biodiversity and, at best, to achieve a lasting and overall positive impact on biodiversity, compared to the state prior to when operations began.

The first step was therefore to collect baseline data about wildlife in the site and surrounding areas. A first survey in 2012 identified 128 bird species, including 27 species from Annex I of the Birds Directive. 91 species found in the area are also included in the regional catalogue of threatened species, including 1 endangered, 1 vulnerable, and 87 species under special protection.

Based on these baseline studies, an action plan to enhance biodiversity in the area was prepared, which includes a number of actions

to protect species and enhance the habitats on the site.

### **Species protection actions**

#### ***Surveillance and safeguard of bird colonies and other species in the extractive areas***

At the beginning of each breeding season, the extractive areas are surveyed in order to locate possible breeding sites and to define operational changes to be eventually applied. In many cases it is enough to delimit and signal the breeding areas and ensure that they are not destroyed during the breeding period.

It is also possible to prospect and detect in advance the areas that can be potentially used by nesting birds (e.g. sand martins) and assess which ones could be affected by the planned extractive activities. If appropriate, slopes are created for the species in "safe" areas of the site, as an alternative to those that might be destroyed before the arrival of the birds, thereby preventing the colonies from settling in unsafe areas.



#### ***Protection of nesting areas and preventing disturbance during the breeding season***

Some species breeding in "Soto Pajares" are especially sensitive to human disturbance during the breeding period (e.g. *Ciconia ciconia*, *Milvus migrans*, *Ardea cinerea*). The nests of these species are usually found in the wooded or marshy areas of the site, where actions should be avoided when they involve human presence for relatively long periods

(more than 15-30 minutes) in quick repetition (short but frequently repeated disturbance).

The zones that may host nests of sensitive species are delimited and it is recommended that any activity in the vicinity of these areas is carried out outside the breeding season of these birds.

Where the extraction would affect such an area (e.g. a lake with marsh vegetation), activity must be undertaken once alternative areas have been created in the site and these have been occupied by the relevant species affected by the resumption of the extractive activity. Moreover, once the extraction has ceased, the area could be restored to a lake with marsh vegetation and open waters suitable for bird species.

#### **Actions to enhance habitats**

##### ***Recovery of riparian forests and natural vegetation***

The recovery of the riparian forest in areas surrounding the Jarama River is a priority

measure, since these forests have practically disappeared in the area and have declined significantly in the entire region. The area covered by this vegetation in the site was less than 1 ha and the goal is to extend it to about 32 ha. This action will also enhance biodiversity by increasing the availability of food and shelter for numerous species and will recover the role of these forests as ecological corridors. Some other areas are managed to promote natural regeneration of the vegetation, including wet grasslands, reeds and riparian vegetation (*Tamarix gallica*, *Populus alba*), which provide suitable habitats for different bird species (e.g. *Acrocephalus* sp., *Emberiza schoeniclus*).

##### ***Creation of hedges and boundaries in agricultural plots***

A significant part of the restored area is dedicated to dry farming (cereals) where the creation of hedgerows was implemented by planting woody shrubs and trees around agricultural plots.



Marsh harrier (*Circus aeruginosus*). Luis Martínez

The objective of this action is to improve the ecosystem diversity and ecological connectivity, as well as crop productivity through wind attenuation, reduction of soil erosion, water and nutrient input retention.

### **Creation of shallow water lagoons**

The main objective is to create a new type of lagoon ecosystem, with characteristics very different from those existing on the site and its surroundings, with little depth and with the presence of bare areas of marsh vegetation, to favour the arrival of new species, contributing to their conservation at local and regional level. A large group of waterfowl and marshland birds will benefit from this action (e.g. *Chroicocephalus ridibundus*, *Charadrius dubius*, *Himantopus himantopus*, *Podiceps nigricollis*, *Anas acuta*). The action must be undertaken once the extractive activity is finished.

### **Expansion and modification of existing lakes**

The extractive activity of the underground aggregate deposits generates water bodies which are extremely attractive to a large number of bird species. The lakes which currently exist have poor geomorphological

characteristics due to the steep profile of their shores and their excessive depth. In the only area where an extensive swamp habitat has formed, there is an important breeding colony of herons, marsh harriers, and other aquatic and marsh birds. This action will increase the biodiversity and ecological value of existing water bodies, and encourage the settlement or expansion of aquatic bird populations with stricter ecological requirements.

### **Management of agricultural areas**

At present, most of the already restored quarry area is managed as farmland. These lands harbour certain species typical of drylands, for example the stone curlew (*Burhinus oedicnemus*) and the crested lark (*Galerida cristata*), and serve as feeding grounds for a large number of granivorous species. A suitable management regime is to be promoted on these farmland areas, based on alternate ploughing of contiguous plots, so that plots which are ploughed one year, are left un-ploughed the following year. This favours structural complexity and provides diverse ecological niches, shelter areas with vegetation

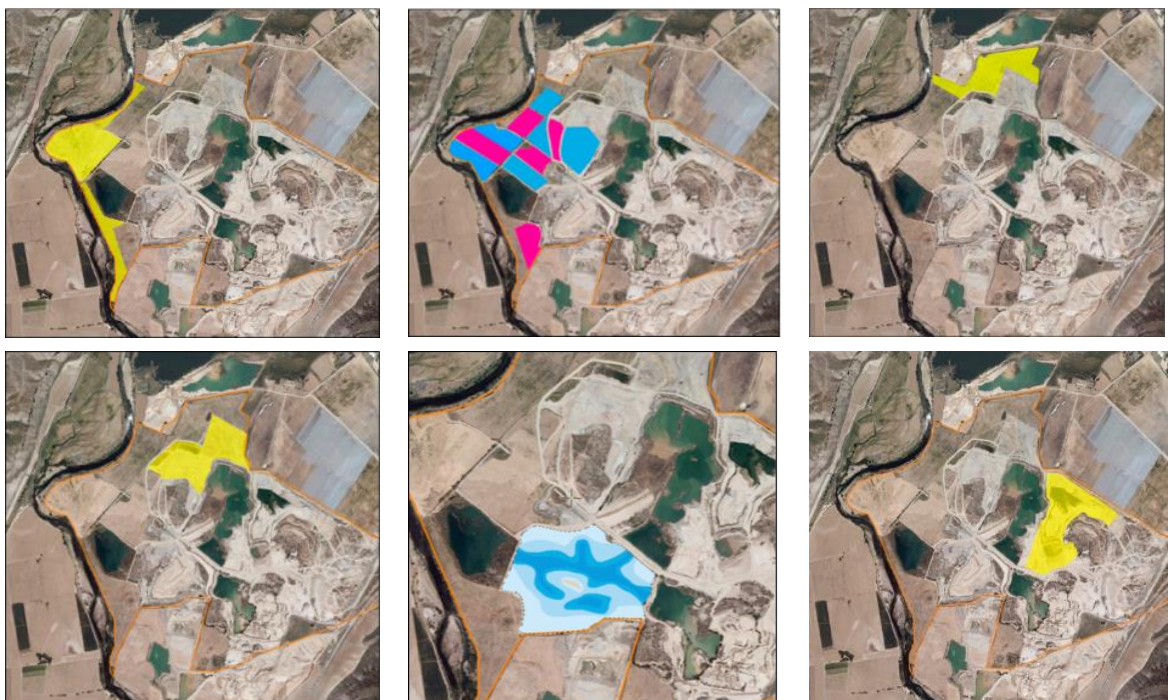


Figure 1. Some proposed intervention areas in Soto Pajares quarry (restoration of riparian vegetation, management of farmland, vegetation recovery, creation of lagoons, etc.)

### Implementation of actions through an environmental volunteering program

Some of the actions included in the BAP are carried out through volunteer activities with the participation of the local community. These activities mainly involve planting riparian vegetation, construction / placement of nest boxes for passerine birds and their subsequent monitoring and cleaning, construction of a floating artificial island, etc.

These volunteer actions are also implemented through the participation of employees of CEMEX Spain, including the staff working at the Soto Pajares site and their families, which make them aware of the site's natural value and of the BAP contribution toward its preservation.

### Monitoring and evaluation

Monitoring activities are essential to follow the evolution of the natural recovery and restoration, the implementation of the planned actions in the BAP and assess their results and effectiveness.

A long-term monitoring plan is proposed to follow the vegetation recovery and natural colonization, fauna, landscape evolution, soils, etc.

Detection and control of invasive species and pests is also planned to allow the implementation of actions needed to combat these potential problems.

### References

Plan de Acción para la Biodiversidad en la finca "Soto Pajares". SEO/BirdLife. Enero 2013.

*(Action plan for biodiversity in Soto Pajares estate. 2013)*

Cemex crea una Comisión de Sostenibilidad en la gravera de 'Sotopajares'. Infocemento, Boletín septiembre 2010 – Sostenibilidad.

[http://www.infocemento.com/printNot.asp?id\\_rep=1122](http://www.infocemento.com/printNot.asp?id_rep=1122)

La Gravera de Soto Pajares, premio europeo por su promoción de la Biodiversidad. Interempresas Net/ Minería y Perforación 04/12/2013.

<http://www.interempresas.net/Mineria/Articulos/140358-la-gravera-de-soto-pajares-premio-europeo-por-su-promocion-de-la-biodiversidad.html>

Empleados CEMEX plantan 650 árboles para restaurar la gravera de Soto Pajares. Notas de Prensa CEMEX 2016.

<https://www.cemex.es/-/empleados-cemex-plantan-650-arboles-para-restaurar-la-gravera-de-soto-pajares>

### Authorship

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## NEEDINGWORTH QUARRY

Habitat creation at one of the largest sand and gravel extraction sites in the UK

**Minerals:** sand and gravel quarry.

**Location:** Cambridgeshire, England.

**Natura 2000 site / habitats and species:** Reedbeds (the UK's largest area), bittern (*Botaurus stellaris*), marsh harrier (*Circus aeruginosus*), bearded tit (*Panurus biarmicus*), European otter (*Lutra lutra*) and water vole (*Arvicola amphibius*).



### Summary

Habitat creation at Needingworth Quarry, one of the largest sand and gravel extraction sites in the UK, which is now becoming a nature reserve (now known as Ouse Fen), is making a substantial contribution to achieving the UK Biodiversity Action Plan targets for reedbeds and bitterns and supports the characteristic assemblages of plants and animals which were once widespread in the Fens. The wetland creation scheme following gravel and sand extraction at Needingworth quarry demonstrates the benefits of:

- taking a strategic approach to habitat creation after mineral extraction;
- aligning public policy, i.e. planning policy and objectives, to community needs (biodiversity priorities, landscape and public access); and
- being bold, visionary and collaborative to provide high-quality biodiversity-rich habitats for target species at a large scale.

Although the wetland creation is underpinned by a legal agreement, the success of the scheme in practice and development of the required high quality habitat is ensured by close collaboration between Hanson UK (the quarry company) and the RSPB.

### Background

Needingworth quarry, which is currently owned by Hanson UK (part of the Heidelberg Cement Group) extends over 975 ha alongside the River Great Ouse in Cambridgeshire, England, making it one of the largest sand and gravel extraction sites in the UK. Following smaller scale extraction from the 1980's, the large-scale project started in 2001, and is expected to continue in phases over the site for 30 years, during which 28 million tons of sand and gravel will be extracted.

The pre-quarry site consisted of mainly arable farmland, and was therefore of low biodiversity value (with no EU, national or local nature conservation designations), although it held some typical farmland birds, some of which are declining in the UK.

When the original planning application for the whole site was submitted in 1994 by the gravel company, it was intended that the site would be mainly returned to agriculture using retained soils, which at the time were considered to be of high quality.

### The revision of the planning conditions for after use

The proposals for the agricultural restoration of the site were challenged by environmental NGOs, the Royal Society for the Protection of Birds (RSPB), Cambridgeshire Wildlife Trust and the Wildfowl and Wetlands Trust, and English Nature on the grounds that the large site provided an opportunity to create a wetland of national and international importance, contributing to UK Biodiversity Action Plan habitat restoration and species recovery targets. In particular it had the potential to create reedbed habitats of sufficient size that it could significantly contribute to the recovery of the Eurasian bittern (*Botaurus stellaris*), a Birds Directive Annex I species that had undergone major declines in the UK.

Furthermore, the creation of the habitat on the site could help join up isolated bittern populations and compensate for losses of reedbed habitat that are expected at key sites for the species on the east coast as a result of increasing coastal erosion and flooding (Wotton et al, 2009). It was also recognised that the site could help to reduce summer

flooding pressures on the Ouse Washes, a downstream wetland that is a Special Protection Area (SPA) for wetland birds, including the black-tailed godwit (*Limosa limosa*). The godwits, have had low breeding success in recent years due to higher spring and summer river flows in part caused by upstream land uses changes and climate change (Ratcliffe, Schmitt and Whiffin, 2005).

At the same time, a survey of the proposed quarry site by the Ministry of Agriculture found that the soils were of lower quality than assumed, which provided the possibility for other forms of post extraction use than agriculture.

Although planning consent was given for the quarry to be restored to agriculture, a condition that a feasibility study for possible wetland restoration was carried out first. The study confirmed the suitability of the site for wetland creation, and subsequent public consultations revealed overwhelming support for the proposals, which would provide significant recreational benefits for local people, through access to wildlife rich countryside, as well as for nature conservation.



View of the reedbed and wetland habitat created after mineral extraction at Needingworth Quarry. RSPB.

As a result, the quarry owners Hanson decided to work with the RSPB to create a scheme for a new wetland nature reserve on the site, instead of the planned restoration to farmland.

The public were also given the opportunity to put forward their views on the restoration proposals.

This led to a new planning application that was approved by Cambridgeshire County Council in 1999, as well as receiving the Royal Town Planning Institute Award for Planning Achievement in 2000, and being nominated for the 2002 European Planning Awards (Davies, 2006).

### The habitat creation scheme

#### Objectives

The objectives agreed with the planning authorities for the site were to restore the mineral works with the following aims:

- to establish a wetland of at least national importance which will make a substantial contribution to achieving the UK government's Biodiversity Action Plan targets for reedbeds and bitterns and support the characteristic assemblages of plants and animals which were once widespread in the Fens;
- to contribute to the alleviation of Ouse Washes summer flooding;
- to enhance the landscape through wetland creation and management;
- to provide informal recreational opportunities for the benefit of local communities and visitors to provide an educational resource which will foster wider interest in, and support for, biodiversity and conservation; and
- to provide a best practice example of beneficial conservation after-use following large-scale mineral extraction.

More specifically, Needingworth Quarry is now becoming a nature reserve (now known as Ouse Fen), of which 460 ha will be reedbed (the UK's largest and enough to meet 40% of the UK BAP target for that habitat).

The remaining areas will comprise a matrix of high-grade agriculture, broadleaved woodland, scrub and wetland habitats including fen, reedswamp and grazing marsh.

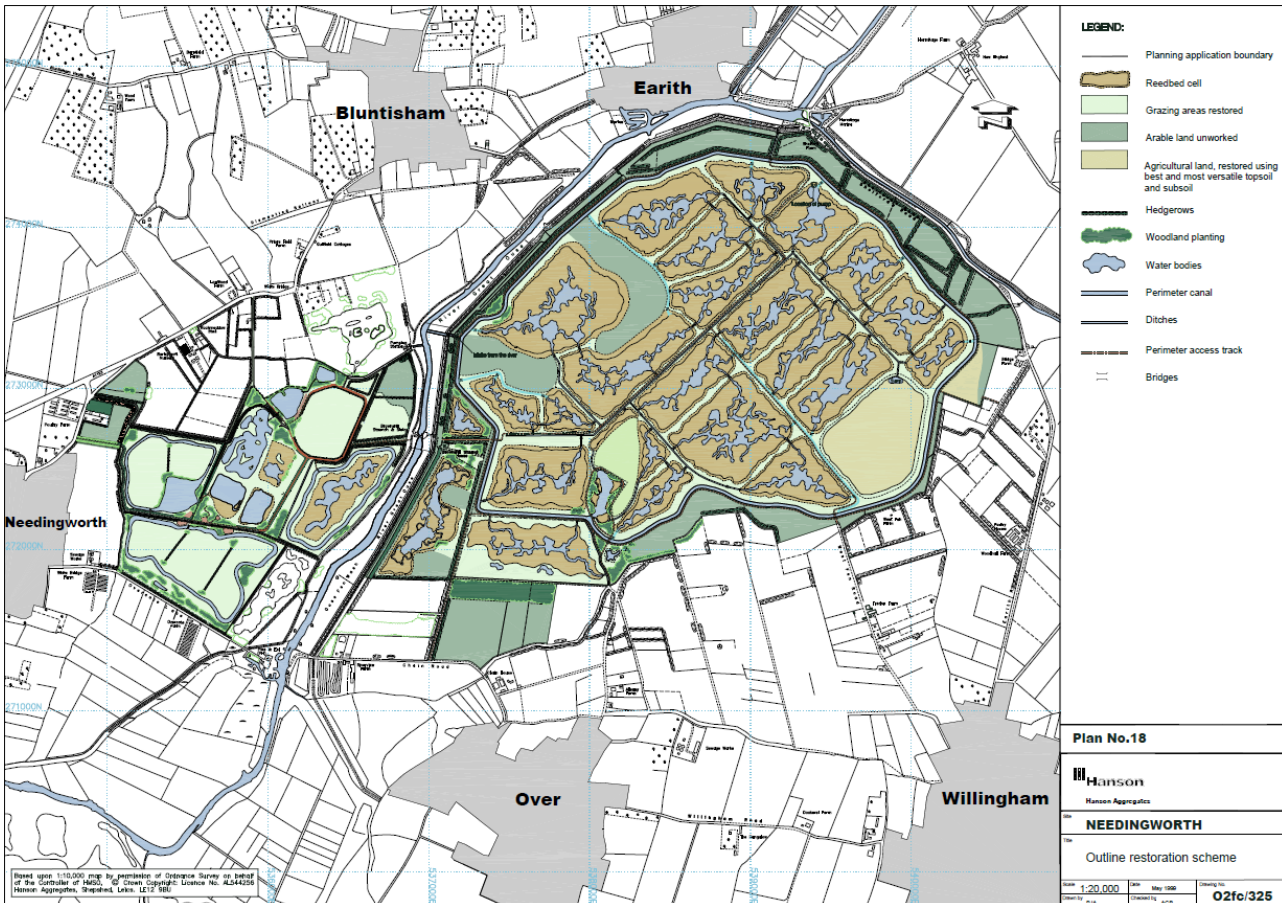
Particular care is being taken to design and manage the reedbeds and associated open water habitats according to the requirements of the bittern, as revealed by a concerted research programme and practical lessons learnt from EU LIFE funded habitat creation and restoration projects (White, Purps, and Alsbury, 2006).

Other target species for the site include marsh harrier (*Circus aeruginosus*), bearded tit (*Panurus biarmicus*), European otter (*Lutra lutra*) and water vole (*Arvicola amphibius*). Taking these requirements into account, the key habitat design targets include:

- Overall totals of approximately 60% wet reed, 20-30% open water and fen, 5-15% drier reed and 5-10% scrub.
- An interface of reed and water of approximately 400 m/ha.
- Spring water levels of between 20 – 100 cm above bed level with natural summer drawdown.
- Fish biomass (<300g) of greater than 10 kg/ha.
- Up to 15% dry grassland margins rotationally ungrazed or cut for 2-3 years.

In addition, the nature reserve will provide 32 km of public access footpaths and cycle paths within the site.





Needingworth Quarry – Nature Reserve Masterplan. Source: Hanson

**Wetland creation and management**

Although the wetland creation is underpinned by a legal agreement, the success of the scheme in practice and development of the required high quality habitat is dependent on close collaboration between Hanson and the RSPB. Following the gravel extraction, the initial landforms are carried out by Hanson using their earth moving machinery and the soils that are stripped from the areas that are being opened up for gravel extraction. At this stage, the RSPB provides detailed design inputs (e.g. 3D ground models to provide the required topography to meet the design targets), management of some aspects of the restoration, and quality control.

As it is such a large site, with extraction to take place over 30 years, the wetlands are being created in 10-40 ha modules, each of which is surrounded by earth bunds to create

hydrological units that can be managed independently. Each module includes a mix of reedbeds, open water pools and ditches, to create a high proportion of water-reed edge habitat (see Figure 2). Water for the wetland areas is taken from the adjoining river in the winter (when water levels are highest) and stored on site. It is then distributed as needed using a network of ditches and sluices. As water levels start to fall on the site in spring and summer then water can be transferred from some modules to others where higher water levels are required (i.e. the wet reedbed areas).

Once the earthworks are completed the modules are handed over to RSPB for vegetation establishment and their long-term management, as part of their estate of over 200 nature reserves in the UK. The establishment of the reedbeds in the first wetland modules was by planting young reed

plants by hand, using contractors and volunteers, but now most of the reed areas are self-seeded from nearby reeds. Some initial site management funding is provided via the Hanson Environment Fund (Entrust) but the principal long-term management funding is from the RSPB, with some additional financing from the Environment Agency.

Management and monitoring is being undertaken according to a detailed site management plan for 2018-2023, with key management actions including water supply and level management, vegetation control, fish stocking, visitor management (e.g. to maintain disturbance free areas) and detailed monitoring of site conditions, habitats and target species.

Of particular importance is rotational reed cutting, to reduce litter build up and maintain open areas, and this may be carried out in future using commercial reed cutters who use the reeds for roofing thatch. Cattle and ponies are also being used to graze some areas. However, as the bittern, and some other target species, require open and wet reedbed, about 15 years after their establishment more substantial interventions will be required to halt their natural succession (i.e. drying out and gradual conversion to willow scrub). This will require some vegetation removal and rewetting to allow reed to re-establish.

### ***Achievements and future plans***

As the wetland creation is being carried out in phases, only 1/3 of the nature reserve and 85 ha of reedbed has been created so far (and much of that is in a relatively early stage of development). Nevertheless, in 2015 this already held 10 booming male bitterns (i.e. males that were 'singing' to hold a territory and attract a female), which was about 7% of the UK population at the time.

When completed in 2030 it is anticipated that it will support at least 20 booming male

bitterns. Other target species for the wetland creation that also occur on the site include marsh harrier (7 pairs) and bearded tits, water voles and otters.

Furthermore, the wetlands are becoming more generally biodiverse, as indicated by the 21 species of dragonfly and damselfly that have been recorded.

It is therefore clear that the wetland restoration scheme has already been successful and achieved many of its objectives. As a result it is foreseen that it will be designated as an SPA for its breeding bitterns at least, as it has been recognised by the Joint Nature Conservation Committee (responsible for SPA designations in the UK) that the SPA network for the species needs to be expanded (Stroud et al, 2016).

### **References**

- Davies, A M (2006) Case study: Needingworth. In *Nature after minerals: how mineral site restoration can benefit people and wildlife*. RSPB.  
<https://afterminerals.com/about-us/history/>
- Hanson UK – Needingworth Quarry Community Page <https://www.hanson-communities.co.uk/en/sites/needingworth-quarry-community-page>
- Hanson (2013) Site Biodiversity Action Plan. <https://www.hanson-communities.co.uk/en/sites/needingworth-quarry-community-page>
- Ratcliffe, N, Schmitt, S and Whiffin M (2005) Sink or Swim? Viability of a Black-Tailed Godwit Population in Relation to Flooding. *Journal of Applied Ecology* 42: 834-43.
- Stroud, D A, Bainbridge, I P, Maddock, A, Anthony, S, Baker, H, Buxton, N, Chambers, D, Enlander, I, Hearn, R D, Jennings, K R, Mavor, R, Whitehead, S & Wilson, J D - on behalf of the UK SPA & Ramsar Scientific Working Group (eds.) (2016) *The status of UK SPAs in*

*the 2000s: the Third Network Review*. JNCC, Peterborough.

[http://jncc.defra.gov.uk/pdf/UKSPA3\\_Bittern\\_Botaurusstellaris\(breeding\).pdf](http://jncc.defra.gov.uk/pdf/UKSPA3_Bittern_Botaurusstellaris(breeding).pdf)

UK Biodiversity Action Plan

<http://jncc.defra.gov.uk/ukbap>

UKBAP (1995) Species Action Plan – the Bittern (*Botaurus stellaris*). Originally published in: Biodiversity: The UK Steering Group Report - Volume II: Action Plans (December 1995, Tranche 1, Vol 2, p98).

<http://webarchive.nationalarchives.gov.uk/20110303153203/http://www.ukbap.org.uk/UKPlans.aspx?ID=159>

White, G, Purps, J and Alsbury, S (2006) The bittern in Europe: a guide to species and habitat management. The RSPB, Sandy.

Wotton, S, Brown, A, Burn, A, Cunningham, R, Dodd, A, Droy, N, Gilbert, G, Rees, S, White, G and Gregory, R (2009) Boom or bust – a sustainable future for reedbeds and Bitterns? *British Wildlife*: 20: 305-315.

### **Authorship**

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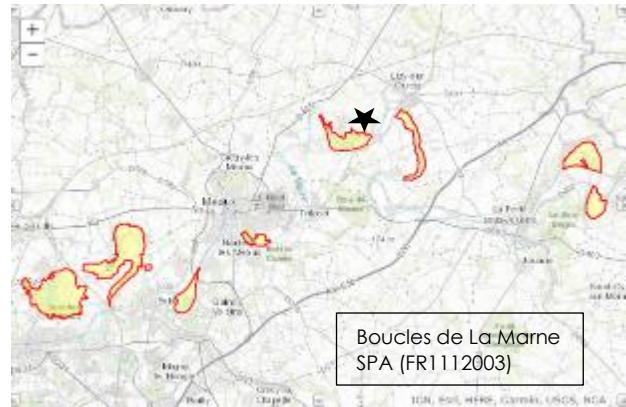
## GRAND VOYEUX

### Ecological restoration of a sand and gravel quarry In the Marne river

**Minerals:** sand and gravel extraction.

**Location:** Île-de-France, East of Paris

**Habitats and species:** the site is in one of the 8 sub-sites included in the Special Protection Area Boucles de la Marne (2,641 ha). It is also partly designated as a Regional Nature Reserve (160 ha). The area hosts a rich bird community including many waterfowl species protected under the Birds Directive.



#### Summary

The Grand Voyeux pits, along the Marne River, were exploited since 1973 for sand and gravel extraction. In 1995, a rehabilitation project was launched and later on a more ambitious restoration plan was implemented with the contribution of relevant stakeholders.

The gravel pits were remodelled into a close-to-natural wetland and the reestablishment of reed beds, grasslands and willows has been promoted through habitat management measures. The restoration of natural habitats has achieved very successful results, including for example the breeding of the Marsh Harrier, the Little Bittern and the Bluethroat.

The “Agence des Espaces Verts”, an organisation of the Île-de-France Regional Council is currently responsible for the management of the site in cooperation with a local association that contributes to the implementation of conservation measures and species monitoring.

#### Background

The site of Grand-Voyeux is located east of Paris in the “Île-de-France” (French administrative unit). Quarrying alongside the Marne River, which is the main industrial activity of this territory, has deeply reshaped the landscape. In the meanders of the river, the first quarries date back to 1950.

The company Capoulade was the main owner from 1970 to 2008 of a 150 ha quarry in the Grand-Voyeux site.

The extraction of sand and gravel by soil scraping and excavation created several water bodies which cover 60 % of the SPA.

#### Ecological restoration and after care management

The type of the quarry rehabilitation strongly influences future opportunities for hosting birds and other species. Along the Marne River, most of the excavated areas had created water bodies with geometric shapes that were of little value to protected bird species.

The quarry company had envisaged a usual rehabilitation plan but was initially reluctant to undertake a more ambitious ecological restoration works at the end of the operational phase. They were gradually made aware and convinced to get involved through

the technical and financial support of other stakeholders, including the “Agence Espaces Verts” (an agency of the Regional Council for natural areas) and the “Agence de l’Eau” (public body in charge of the water quality), local authorities and NGOs.

In addition, the company agreed to slightly adapt some technical aspects of their operations, for example water was discharged into the settling ponds at various levels to favour the development of reed beds.

In the Grand-Voyeux site, the rehabilitation plan was amended to be part of a global project of ecological restoration, which was carried out between 2003 and 2007 (Fig. 1) and included the following main activities:

- Restoration of wetlands and the creation of additional ponds, channels and reed beds: earthworks to create varied topographic conditions favourable to different habitats (with a balance of excavations / backfilling).
- Restoration of grasslands and woodland.
- Enhancing flood management and the functioning of the water ecosystem. When operational activities ended, water pumping was stopped and water levels rose sharply, causing the reed beds to regress. Water management has therefore been implemented.
- Public amenities.

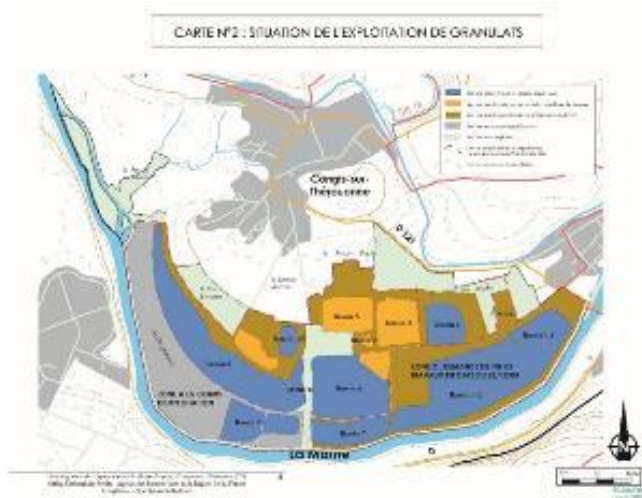


Figure 1. State before restoration  
Source: Ecosphère, 2001

Funding was provided by the quarry company but also by several partners interested in developing the site amenities.

The restoration works resulted in the diversification of wetlands at the edge of the water bodies, and the presence of mowed grasslands and various woodlands in the surrounding areas.

After the restoration works ended, management of the site has continued in order to maintain the natural assets, which requires controlling the dynamics of willows, both on reed beds and on grasslands.

Maintenance of open spaces is carried out by sheep grazing through an agreement with a local farmer since 2008. Mowing is also carried out in some areas.

The site of Grand-Voyeux was designated as a SPA in 2006, which hosts the following species included in Annex 1 of the Birds Directive:

Species		Status
Little bittern	<i>Ixobrychus minutus</i>	Resident
Eurasian bittern	<i>Botaurus stellaris</i>	Wintering
Bluethroat	<i>Luscinia svecica</i>	Breeding
Eurasian stone-curlew	<i>Burhinus oedicnemus</i>	Breeding-Wintering
Common tern	<i>Sterna hirundo</i>	Breeding
Black kite	<i>Milvus migrans</i>	Breeding



Figure 2. Proposed restoration project.  
Source: Ecosphère, 2001

The Natura 2000 site management plan was adopted in November 2010 and a second phase of implementation started by the regional body “Agence des Espaces Verts” - AEV and a local association created in 1996 (“Association de Valorisation des Espaces Naturels” - AVEN du Grand-Voyeux). 220 bird species have been recorded over the last 10 years. In addition to the six species listed in the above table, the restoration led to the presence of new annex 1 species – the marsh harrier *Circus aeruginosus*, which is breeding in the site since 2010. Furthermore, 41 bird species use the site during their migration period.

The quality of the site and its value with respect to biodiversity, beyond the species of community interest present, led to the designation of a Regional Nature Reserve in 2012, on 160 ha included in the site. This will further strengthen the measures to preserve this site. A new regulation and especially a five-year management plan help to improve species conservation, while making this site an area of discovery and education for the public. For the period 2014-2025, the cost of the planned operations (one-off investments, recurrent management, studies and monitoring) is estimated at 8 million euros.

Several contextual elements have contributed to this successful restoration project:

- The lead role of local experts and ornithologists to propose an ecological restoration project at the end of extractive activities during the licensing application for the extension of the quarry in 1995.
- The involvement of several relevant stakeholders: “Agence Espaces Verts”, “Agence de l’Eau” (public body in charge of the water quality), local authorities and NGOs and consultants (Ecosphère), providing a suitable combination of technical knowledge, site responsibility and decision making.
- In 1999, the site of Grand-Voyeux was sold to the Agence Espaces Verts-AEV, which is both the owner and operational manager. In 2005, the AEV owned 150 ha and today 192 ha.
- The restoration project for the site of Grand-Voyeux benefited from the drive of the Natura 2000 network, unlike previous rehabilitation projects of other quarries in the same area.
- The AVEN, Association pour la Valorisation des Espaces Nature provides expert advice and raises awareness on the wetlands of northern Seine-et-Marne.



Grand-Voyeux site. Yoann Martin (Ecosphère)

**References:**

Association pour la Valorisation des Espaces Nature du Grand-Voyeux, web site: <http://www.grandvoyeux.fr/>

AVEN du Grand-Voyeux, 2016. *L'Aven et le Grand-Voyeux : L'histoire humaine d'un espace naturel.*

Lelaure B. et al, 2010. Document d'objectifs du site Natura 2000 FR1112003 « Boucles de la Marne ». Agence des espaces verts de la Région Île-de-France, PARIS, 2010. 148 p.

AEV d'Île-de-France. *Réserve Naturelle régionale du Grand-Voyeux : plan de gestion 2014-2025.* 254 p.

Ecosphère et Greuzat, 2001. Aménagement de l'espace naturel du Grand-Voyeux, Congis-sur-Thérouanne (77). Office National de forêts. Agence des Espaces Vert d'Île-de-France. Tome 1 et 2.

Martin Y. (Ecosphère), 2017. Retour d'expériences anciennes de génie écologique. Aménagement d'une ancienne carrière à Congis-sur-Thérouanne (77). 5p.

Compte-rendu du 8ème comité de pilotage du site Natura 2000 FR 1112003 Boucles de la Marne. 28 juin 2018. 9p.

**Authorship and acknowledgements**

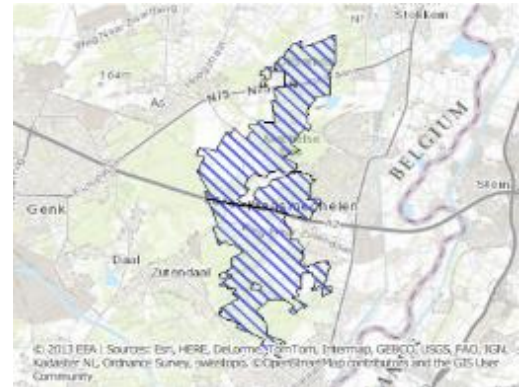
Prepared by Claire Pirat, Ecosphère, with information and comments provided by Véronique Leloup, Ecosphère, Jean-François Antoine, Agence Espaces verts, Jean-Pierre Labourdette, AVEN, and the Company Capoulade (currently Suez group).

## QUARTZ SAND EXTRACTION in the Mechelse Heide Natura 2000 site

**Minerals:** Quartz sand open pit.

**Location:** Flanders, Belgium.

**Natura 2000 site / habitats and species:** the quarries are within or close to a Natura 2000 site designated as SAC (BE2200035 - Mechelse Heide en vallei van de Ziepbeek; 3,741 ha) and SPA (BE2200727 - Mechelse Heide en de Vallei van de Ziepbeek; 2,344 ha). The area harbours 15 habitat types and 16 species of EU interest.



### Summary

Quartz sands are extracted from 40-60m deep sand pits in the Mechelse Heide (Natura 2000 site), which is part of the Hoge Kempen National Park. The extraction activities carried out by Sibelco preceded the designation of the protected areas and continue under a special plan agreed with the Flemish Government. The measures agreed to make compatible the extractive activity with the conservation and restoration of nature include the closure and renaturation of one quarry and its proper integration into the natural protected area, the relocation of industrial facilities outside of the protected area and the complete removal of lorry transport thanks to the construction of an underground pipeline.

Mining activities are currently managed in a way that favours the long-term conservation objectives of the Natura 2000 site by re-establishing typical heathland vegetation and diverse wet and dry grassland habitats, which are home of protected species. The case demonstrates the ability of extractive operations to be adapted to site conditions and to ensure proactive habitats and species management and mitigation in accordance with the Habitats Directive. A concerted dialogue with local and regional stakeholders is a key prerequisite for the success of this model.

### Background

The Hoge Kempen National Park is the only National Park in Belgium. It is located in the province of Limburg in the Flemish region and was officially promulgated in March 2006. With an area of nearly 60 square kilometres, it incorporates two sites of the Natura 2000 network, a Special Protected Area (SPA) for birds designated in 1988 and a Special Conservation Area (SAC) designated for other species and habitats in 2002.

The pre-industrial land-use of livestock grazing was gradually replaced by pine

plantations with the development of coal mining in the early 20<sup>th</sup> century. The typical Atlantic heath biodiversity formerly present in the area was lost to a large extent. With the decline of coal mining at the end of the century another underground resource exploitation started, the sand and gravel extraction.

Most sand pits in the area of the Hoge Kempen National Park resulted from the excavation of extremely pure quartz sands or bright white “silver sands” at a depth 40-50 m below the surface.



The group Sibelco is the only company extracting these valuable quartz sands in Belgium and the deposits in Maasmechelen are of strategic importance for a whole range of high added-value downstream industries.

### Adapting the extractive activities in the site

With the development of nature conservation policies in Belgium, and especially following the concerted efforts of numerous stakeholders to designate the Hoge Kempen National Park in the early 2000, Sibelco and the Flemish Government and regional stakeholders signed a protocol with several commitments.

Three large sand-pits are found in the central part of the heathland (Fig. 1), one of which already closed (Opgrimbie). Arrangements for the restoration of the pits have been made so that they can be integrated in the original landscape as soon as possible.

Thus, already during active exploitation, the steep sides are re-shaped, eventually heather is re-introduced and the vegetation is managed to prevent undesired spread of pines.

Sibelco committed to relocate its plant at Berg to a location outside the park (and Natura 2000) area. Sand extraction would continue on the Berg site by dredging and pumping the sand through an underground pipeline, following linear surface features, to the newly constructed industrial facility.

Taking into account these mitigation measures, in 2001 the Flemish Government approved an extension of the mining operations at the Berg quarry (23ha) and a permit was given for a new quarry MHZ (270ha).

Sibelco's extractive operations continue in the Natura 2000 area at the Berg quarry. The industrial facilities and buildings were demolished in 2011, 3.000 m<sup>3</sup> of overburden soil was replaced and 5.000 m<sup>2</sup> of asphalt were removed. A new energy-efficient plant was built just outside the border of the Natura 2000 area.

A special walking trail was also constructed to show to the visitors of the National Park the transformation of the industrial land-use to nature conservation and to make nature accessible for everyone.

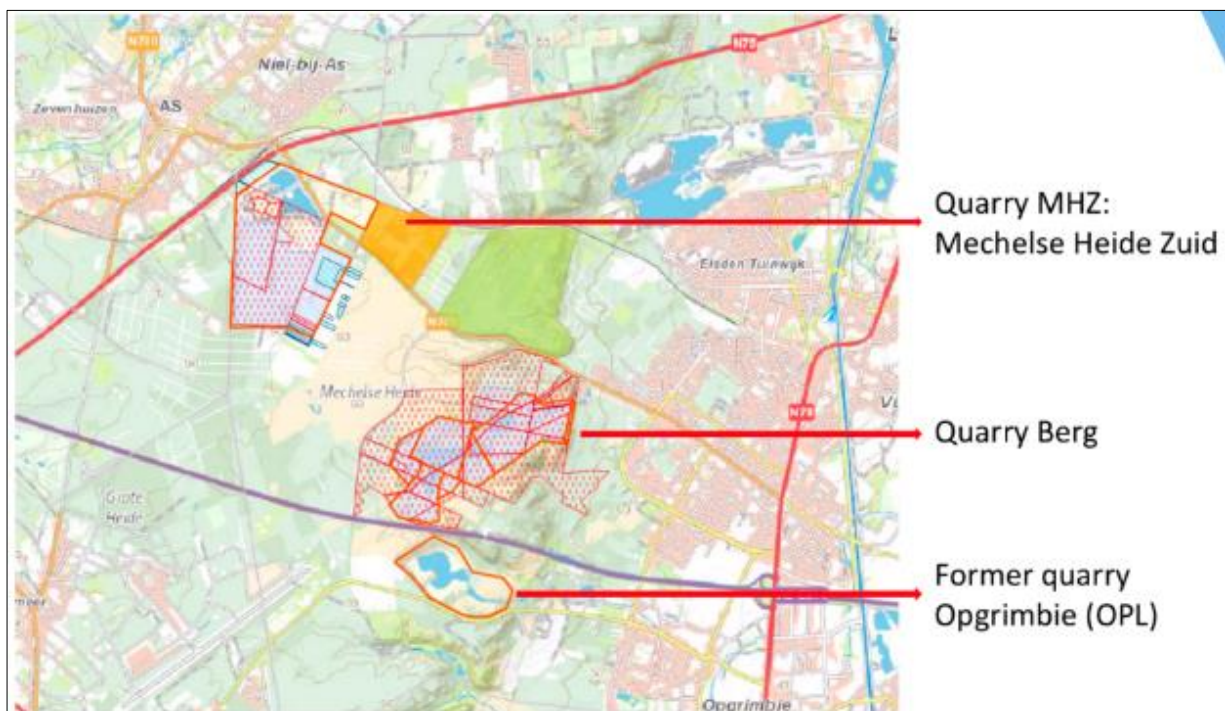


Figure 1. Location of the three quarries operated by Sibelco in the Mechelse Heide site.

## Mitigation and habitats restoration

A constant dialogue between Sibelco and the Flemish government makes sure that nature is taken into account in every step of the exploitation: from the management of fens, to the restoration of heath and the strict monitoring of groundwater levels during excavation.

In the new quarry Mechelse Heide Zuid, alongside the new plant, extraction goes hand in hand with progressive rehabilitation according to the principle that nature may not deteriorate.

On the areas that are not to be mined in the near future, habitats are created for grassland and marshland birds.

The forested landscape is re-opened and shallow water bodies are created to the benefit of amphibians and insects.

Once the extraction activities on the Berg quarry are completed the area will be included in the Natura 2000 site. This has already been done on a different location, at the former Opgrimbe quarry, which was

restored in 2005 and is now part of the nature area Kikbeekbron.

The main nature management activities in the protected areas are control of water levels, sod cutting and partial mowing.

Mining activities are taken into account and integrated into the development of a nature management plan through:

- Mitigation and temporary nature management (before and during exploitation) e.g. management of water levels to prevent drying up and maintain hygrophilous vegetation, adaptation of the extraction plan, careful planning of the soil and subsoil heap storage, buffering of noise and dust.
- Restoration after exploitation e.g. creation of shallow water bodies with vegetated banks and open heathland.
- Removal of spontaneous afforestation and re-opening the landscape.
- Selective removal of trees.



Sabrina Tolenaers, Shutterstock.

The sustainable development of mining activities in the Berg quarry in the National Park and Natura 2000 zone followed five pillars (Fig. 2):

1) *Avoidance and minimisation of impacts: mining integration*

The impact of mining activity in the Natura 2000 is low:

- The noise produced is very low and negligible, the only source of noise is a dredger.
- The extracted sand is pumped through an underground pipeline to the factory to reduce the impact (no transport by lorries). The construction of the pipeline took natural aspects fully into account. No important vegetation was removed and therefore the pipeline does not follow a straight line.
- The lake in quarry Berg will be divided in sections. Overburden and land stock will be used to make terrestrial bridges that will result in three smaller lakes.

- The new factory is an initiative towards CO<sub>2</sub> neutrality due to:
  - The use of renewable energy (solar panels and geothermal heat pump)
  - Closed water circuit, rainwater for the toilettes and cleaning, natural reed drainage system for cleaning sanitary water, parking lot in permeable material
  - Green roof on top of the office building.
  - Reduction of light pollution thanks to light study and special lamps.

2) *Mitigation of residual effects and restoration/rehabilitation*

- Ecological restoration of sand pits at MHZ quarry includes re-modelling of the shoreline and depth of the waterbodies according to nature-friendly design in cooperation with the Agency of Nature & Forest.
- Sheep grazing in quarry Berg to ensure the growth and naturalness of heathlands.

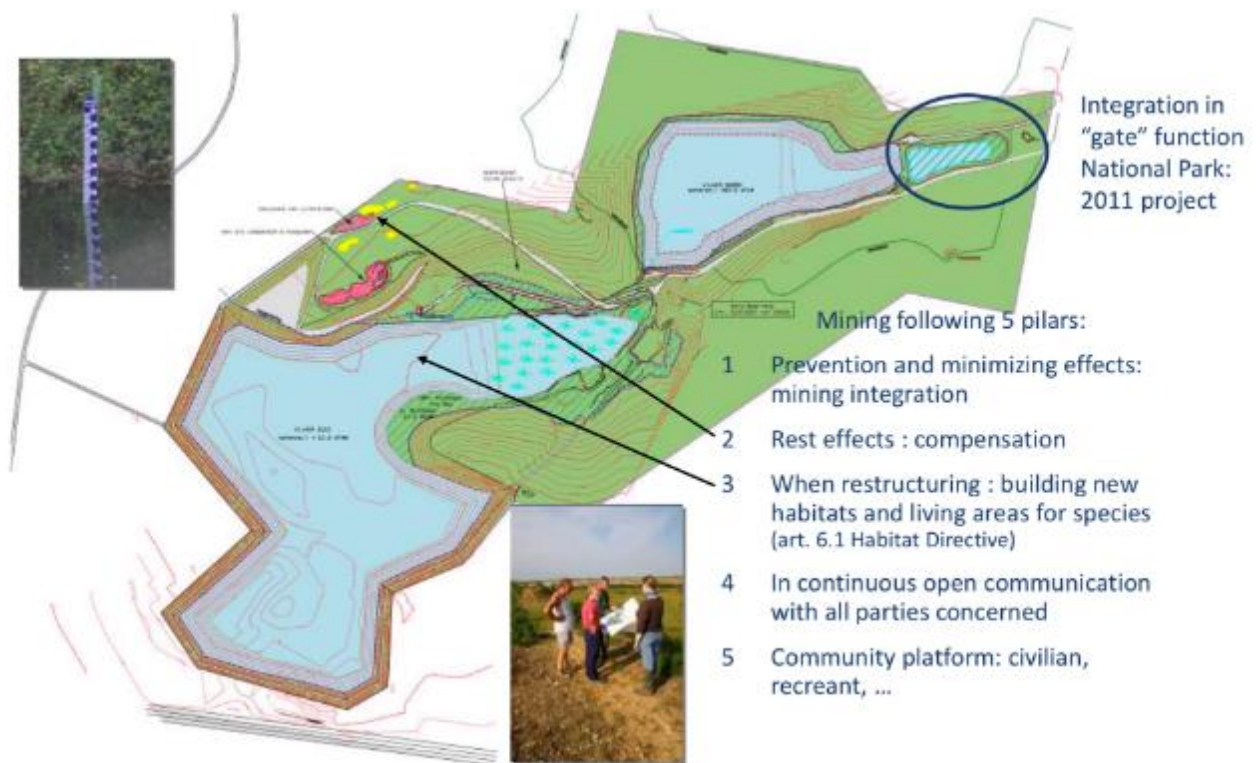


Figure 1. Integration of mining and nature protection at Sibelco's Berg quarry

### 3) *During restructuring operations – creation of new habitats and living areas for species, proactive management of biodiversity*

The restructuring of the quarry Berg focuses on the following Natura 2000 goals:

- Development of new living habitats for endangered species, such as the natterjack toad, moor frog, palmate newt, smooth snake, reed bunting, nightjar, woodlark, silver-studded blue and large gold grasshopper;
- Maximize the opportunities for development of open habitats (habitat 4030 - European dry heaths).
- Construction of small water bodies: fens, groundwater pools, and water control pools.
- Provide steep edges for sand martins, bee-eaters and solitary bees. These steep slopes also maintain dynamic processes in the quarry.
- Construction of shallow bank zones along the larger ponds.
- Minimising of forest development through grazing (horses, sheep).
- Limiting of erosion through control of surface water flows and accumulation.  
Creation of land bridges as ecological corridors through the large lakes for the movement of terrestrial animals.

### 4) *In continuous open communication with all parties concerned*

The expansion of the nature-oriented recreational opportunities in the National Park include creation of walking paths and bike routes, visitor information areas and signposting. In 2014, Sibelco opened together with local and national partners a walking trail for disabled people (“het Zandloperpad”). A path of 1.5 km that shows the restoration of a typical heath and dune landscape of the Kempen.

The former Opgrimbie sandpit (Kikbeenbron) is a site of outstanding geological value. In the

abandoned sandpit several geological ‘windows’ are set up as well as a geological rock garden. This will allow visitors to understand the complex but fascinating geological history of the Hoge Kempen.

### 5) *Community platform*

Permanent contact with the local and regional stakeholders is organized through the National Park.

## References

Sibelco and Natura 2000 Example of Sibelco’s quarries in Maasmechelen. Presentation by Mark Stulens. Intoe bvba. 2017. Aanmelding Mer Sibelco Verderzetting Industriezandwinning Maasmechelen (Environmental Impact Assessment report). <https://mer.lne.be/merdatabank/uploads/b2640.pdf>

Nomination of the Hoge Kempen National Park for UNESCO: <https://whc.unesco.org/en/tentativelists/5623/>

## Authorship

Prepared by Boris Barov and reviewed by Inez Goris, Sibelco.

## OUTÃO QUARRY RESTORATION in the Arrábida/Espichel Natura site 2000

**Minerals:** limestone land marl.

**Location:** Setubal, Portugal.

**Natura 2000 site / habitats and species:** the quarry is located in the Arrábida/Espichel Natura 2000 site (PTCON0010, 20,662 ha), which hosts arborescent matorral with *Juniperus* spp. and *Laurus nobilis* and evergreen forests with *Quercus suber* and *Q.faginea*, among other habitats. It is also important for bats and birds species.



### Summary

Secil's company marl and limestone extraction in the Arrabida Natural Park and Natura 2000 site integrates quarrying and habitat restoration with the implementation of a Landscape Rehabilitation & Exploitation Plan. This plan aims to minimise impacts on natural habitats and species and maintain the integrity and coherence of the Natura 2000 site.

A Biodiversity Action Plan was also started to promote the restoration of the original ecosystems. It includes a monitoring programme to evaluate the effectiveness of implemented actions and to assess vegetation and fauna populations' status. The restoration techniques were adapted and currently the restoration process is fully incorporated in the quarry exploitation. The plan thus ensures the adaptation and improvement of the quarrying activities based on monitoring of the success of restoration actions in terms of fauna and flora communities and ecosystem functioning.

### Background

The Outão quarry is part of a complex that includes quarries, a cement plant and transport facilities. This plant, owned by Secil Group, was established in 1904 in Setúbal and is one of the largest cement plants in Portugal, with an annual production of around 2 million tonnes. It is located in the Arrábida Natural Park and Natura 2000 site (Arrábida/Espichel PTCON0010) in south-west Portugal.

The quarry area covers about 99 ha, which includes two active quarries, one for limestone and another for marl.

Before the designation of the Arrábida Natural Park in 1976, Secil started to gain awareness of the impact of the quarries on the natural area. In 1965, it carried out the 1st

Study of Landscape Rehabilitation and in 1973 it submitted a Landscape Rehabilitation & Exploitation Plan to the authorities, which started the rehabilitation of closed quarry areas in 1983.

Following vegetation monitoring since 1998, a Biodiversity Action Plan was launched in 2007, which integrated quarry activity and restoration together with fauna and flora monitoring. So far 44 ha of the extractive areas have been restored, which corresponds to almost half of the quarries' area.

### Landscape Rehabilitation & Exploitation Plan

Started in 1983, the restoration process aimed to ensure the recovery of natural habitats similar to those that surround the

quarries and that are present in the Natura 2000 site.

The habitats consist mainly of evergreen Mediterranean scrubland (5210-Arborescent matorral with *Juniperus* spp. and 5330-Thermo-Mediterranean scrub). The company created their own plant nursery using seeds from the surrounding habitats. Currently, 17 native plant species are grown and used for restoration. All collected seeds come from natural habitats found around the quarries, thus securing genetic variability as well favouring local biodiversity.

This not only promotes the recovery of the natural habitats in the site, but also facilitates the recolonization of the restored areas and improves self-sustainability and resilience of the ecosystem, for example to fire (Meira-Neto et al. 2011).

The quarry restoration process included the following steps:

- Re-establishment of substrate (soil) to enable plant development.
- Use of hydro-seeding for herbaceous and shrub vegetation.
- Plantation of woody species
- Maintenance and adaptive management.

Moreover, Secil established partnerships with Lisbon and Évora universities in order to incorporate applied research and monitoring as part of the restoration process. Scientific studies are considered essential for monitoring, identification of problems and development of new restoration techniques.

Since 1998, an extensive team of researchers from the Faculty of Sciences of the University of Lisbon (FCUL) carried out scientific monitoring of the results of restoration actions, including continuous monitoring of the evolution of vegetation, soil, ecosystem functions. Meanwhile, Evora University carried out fauna monitoring (since 2007) on the restored areas.



Outão quarry restoration Alexandra Silva (Secil)

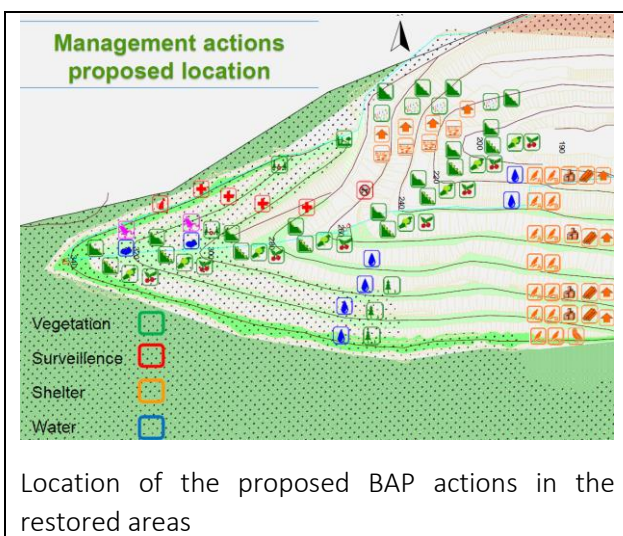
Restoration actions have been adjusted and improved, taking into account the findings of the monitoring work.

### A Biodiversity Action Plan for the quarry site

In 2007, a Biodiversity Action Plan was started to boost the process of natural re-colonization (already initiated for vegetation) through actions that focus on restoration of the structure and functioning of the original ecosystems (including fauna).

A monitoring programme was also designed to evaluate the effectiveness of implemented actions and to assess fauna populations' status.

The objective in the first phase was to compare the fauna in the restored areas with the natural surrounding areas, after 25 years of restoration. Baseline data was used to define an Action Plan for fauna and flora recovery linked to the existing Landscape Rehabilitation Plan.



Based on the results of the first monitoring activities, a set of actions was proposed under the BAP in order to boost fauna in the restored areas, which involved:

- Environmental Awareness
- Surveillance
- Feral animals control
- Vegetation management (IAS control)
- Shelters
- Water availability.

### Main outcomes of the Biodiversity Action Plan

The implementation of the BAP is still ongoing but preliminary monitoring data already show some positive results on fauna:

- Species composition of rehabilitated areas is similar to that of natural habitats.
- Increased connectivity has been detected, e.g. for some mouse species and for the dispersal of seeds by carnivores.
- 72% of the terrestrial fauna species present in the Natura 2000 site area is currently present on the restored areas.
- The restoration areas created new opportunities for some fauna species presence (abundance of prey and predators in rocky habitats)
- Grassland restored habitats boost the presence of rodents that attract more predators.

### Main elements of good practice

- The restoration process aims at the recovery of natural habitats present in the Natura 2000 site and surrounding the quarry.
- A plant nursery using seeds collected from natural habitats found around the quarries ensures the conservation of local biodiversity and secures genetic variability.
- Scientific studies and monitoring are carried out as part of the restoration process through partnerships with the Lisbon and Évora universities, allowing restoration actions and techniques to be adjusted and improved when needed.
- The restored areas have provided suitable habitats for some fauna species and increased connectivity for some of them.



## References

Mira, A. 2018. Quarries Meet Biodiversity: Insights from a Long-Term Project of Quarry Rehabilitation in a Natural Park. Presented at the Quarries Alive 2018. Enhancing Biodiversity and Ecosystems Services in Quarries: Challenges, Strategies and Practice. Evora, 2 May 2018.

<http://quarriesalive2018.uevora.pt/co.html>.

Clemente A.S., Werner, C., Máguas, C., Cabral, M.S., Martins-Louçao, M.A. & Correia, O. 2004. Restoration of a Limestone Quarry. *Restoration Ecology* Vol. 12 No. 1, pp. 20-28.

Oliveira, G. 2018. Evaluating the Success of Different Restoration Actions at SECIL-Outão'. presented at the Quarries Alive 2018. Enhancing Biodiversity and Ecosystems Services in Quarries: Challenges, Strategies and Practice. Evora, 4 May 2018. [http://quarriesalive2018.uevora.pt/downloads/photos\\_and\\_presentations/QuarriesAlivePresentations/SIV5\\_Oliveira\\_G\\_FCUL.pdf](http://quarriesalive2018.uevora.pt/downloads/photos_and_presentations/QuarriesAlivePresentations/SIV5_Oliveira_G_FCUL.pdf).

Meira-Neto, J.A., Oliveira, G., Clemente A. & Nunes, A. 2011. Post-fire and post-quarry rehabilitation successions in Mediterranean-like ecosystems: Implications for ecological restoration. *Ecological Engineering*. 37(8):1132-1139.

## Authorship

Prepared by João Pedro da Silva in consultation with Secil and FCUL Team.



## MAŠOVICE STONE QUARRY

### Rehabilitation of an important site for the Crested Newt

**Minerals:** granite stone quarry.

**Location:** South-Moravian Region, Czech Republic.

**Natura 2000, habitats and species:** The site is a Special Area of Conservation (SAC) with the name “Mašovice - the quarry” (CZ0623357, 9.3 ha).

The main protected species is the Italian crested newt (*Triturus carnifex*), which currently has one of its most important localities in the Czech Republic in the Mašovice quarry.



Antonín Reiter, archive of the South Moravian Museum in Znojmo

#### Summary

Following the cessation of quarrying activity in Mašovice, a restoration plan was developed in 2001 that aimed at preserving valuable habitats for an endangered amphibian species in the site, the Italian crested newt (*Triturus carnifex*).

The rehabilitation of the quarry was discussed in advance with nature conservation authorities and the representatives of the municipality. Thanks to this cooperation, the restoration of the site was successfully carried out between 2001 and 2005, mainly ensuring the preservation of aquatic habitats and promoting natural succession of vegetation.

The area was proposed as a Site of Community Importance for the Natura 2000 network already in 2005 and it was designated as a Special Area of Conservation and a Nature Monument in 2013. The management of the site is currently carried out by the Regional Authority of the South Moravian Region in accordance with a management plan approved for the years 2013-2022.

#### Background

Mining has a long tradition in the Czech Republic and is still an important part of the country's economy, although the activity has recently decreased.

Mining regulation laws require the provision of a financial reserve during the mining process for the rehabilitation of the site after the mine closure.

The site rehabilitation normally requires the area to be restored to its original state, which is usually forest, agricultural land or meadows.

The Mašovice stone quarry, excavated in the granite of the Dyje massif, in the South-Moravian Region, ended its activity in 1999.

The company Českomoravský štěrk (member of Heidelberg Cement Group in Czech Republic) decided to cease extraction and to convert the site into a natural and aesthetically valuable area.

The reason for stopping more than thirty years of extraction was the decline in construction in the region. At the same time, there was a growing public interest in nature conservation in this locality due to the close proximity to the National Park Podyjí and the

discovery of the Italian crested newt (*Triturus carnifex*) in a small area near Mašovice in 1997. The species had disappeared in many localities in this region and was considered critically endangered in the Czech Republic.

Other rare and endangered species associated to wetlands and temporarily waterlogged and disturbed areas can also be found in the former quarry and its surroundings.

### Near-natural restoration

Taking into account the proximity of the Mašovice quarry to the Podyjí National Park, the site was considered suitable for the expansion of valuable plant and animal species. Therefore, a new quarry restoration plan was developed in 2001, replacing the original plan that envisaged a more traditional rehabilitation to afforestation and the creation of agricultural land.

The quarry activity had created a wetland area that was suitable for amphibian and other aquatic species in the area. The rehabilitation was discussed in advance with nature conservation authorities and the representatives of the municipality. Thanks to this cooperation, the rehabilitation of the site was successfully carried out between 2001 and 2005.

The restoration of the quarry ensured that the water areas were preserved and the walls were left to the natural succession. The area was divided into 13 sub-sites based on the biological characterisation of diverse fragments present on the site. The restoration of different valuable habitats was achieved through targeted recovery mainly promoting natural and controlled succession.



Mašovice stone quarry. Českomoravský štěrk a.s.

The restoration consisted of the following steps:

- Creation of a protective vegetation belt.
- Diversification of the aquatic environment.
- Management of tree species
- Regeneration of plant species
- Support of recreational use of the area
- Long-term management and monitoring.

After the rehabilitation work was completed, and thanks to the monitoring activities carried out in the area, the following species have been recorded: Smooth Newt (*Lissotriton vulgaris*), Agile Frog (*Rana dalmatina*), Sand Lizard (*Lacerta agilis*), Common Spadefoot (*Pelobates fuscus*), Fire-bellied Toad (*Bombina bombina*) and green lizard (*Lacerta viridis*).

Snakes are represented by Smooth Snake (*Coronella austriaca*) and Grass Snake (*Natrix natrix*). In the clear water of the quarry, it is also possible to find the crayfish (*Astacus astacus*). A rare ephemeral moss, *Aloina brevirostris*, also colonises the extreme habitat represented by the exposed kaolin wall.

The area was proposed as a Site of Community Importance for the Natura 2000 network already in 2005 and it was designated as a Special Area of Conservation and a Nature Monument in 2013. A management plan for the site was approved for the years 2013-2022.

The management of the site is carried out by the Regional Authority of the South Moravian Region.

The natural processes have also contributed to the recovery of a valuable locality with optimal conditions for the endangered species *Triturus carnifex*, *Bombina bombina* and *Lacerta viridis*, which are nowadays among the conservation objectives of the site.

The biotope provided by the quarry re-naturalisation is very rare in the surrounding countryside. The endangered species *Triturus carnifex* has disappeared from the current landscape mainly due to changes in the water regime caused by drainage of meadows and forests or regulation of streams.



Mašovice stone quarry. Českomoravský štěrk a.s.

### **Main success factors**

The mining company decided to invest into near-natural restoration, which replaced the formerly planned technical reclamation.

The restoration of the quarry was discussed in advance with the state nature conservation agency, with representatives of the Administration of the National Park Podyjí, the Regional Authority of the South Moravian Region and the municipality.

The quarry is currently a valuable natural area for rare species and much appreciated by local inhabitants and tourists. It is freely accessible to the general public for bathing and even for scuba diving.

### **References**

Website of the Heidelberg Cement Group in the Czech Republic: <https://www.nase-biodiverzita.cz/cs/nase-projekty/masovicky-lom>

Řehounková, K., Řehounek, J., Prach, K. (eds.) 2011. Near-natural restoration vs. technical reclamation of mining sites in the Czech Republic. Faculty of Science, University of South Bohemia in České Budějovice. ISBN 978-80-7394-322-6.

Jeřábková L., Krása A., Zavadil V., mikátová B. & Rozínek R. (2017): Červený seznam obojživelníků a plazů České republiky. In: Chobot K. & Němec M. [eds.]: Červený seznam ohrožených druhů České republiky. Obratlovci. Příroda, Praha, 34: 83–106..

### **Authorship and acknowledgements**

This case study was elaborated by Viera Šefferoová (Daphne) and reviewed by Ing. Kristýna Šebková, Českomoravský štěrk, a.s.

## ARJUZANX MINE

### Restoration on a migration corridor for cranes

**Minerals:** Lignite open-cast mine<sup>13</sup>.

**Location:** Landes, France.

**Habitats and species:** the rehabilitated site was designated a Special Protected Area for birds (SPA, FR 7212001, 2,119 ha) and National Wildlife Reserve (2,552 ha). The site hosts heaths and wetlands as well as many waterfowl species and is located in an important migrating corridor for cranes.

*Réserve d'Arjuzanx. SMGMN*



#### Summary

A long term ecological rehabilitation project was carried out after the mine's closure with the aim of recreating important biotopes for waterfowl in order to support crane migration along one of its main routes. The rehabilitation was carried out with the support of a public body in charge of wildlife conservation and has been very successful in terms of bird populations established in the site, which was therefore designated as a Special Protection Area for birds.

After care is very important to ensure long-lasting results and it has been secured by the creation of a public body with representatives of regional and local authorities, which is now in charge of the site management and conservation.

#### Background

The open-cast mine of Arjuzanx, in the "Landes" (100 km south of Bordeaux) was mined for its lignite from 1958 to 1992 by Electricité de France (EDF).

The mining activity created artificial, new open landscape in an area formerly covered by pine forest, agricultural fields, vineyards and heathland.

The mining works created big hollows and rather barren grounds.

The first phase of restoration of the excavated areas started in 1975 and mainly consisted of

securing the frontage of the quarry face and to limit soil erosion through revegetation (e.g. planting more than 1.5 million trees).

In 1983 a turning point took place when a project for the ecological rehabilitation of the site started with the support of a public body in charge of wildlife conservation, the "Office National de la Chasse et de la Faune Sauvage" (ONCFS), which provided technical guidance and assistance.

#### Ecological rehabilitation to favour protected bird species

The ecological rehabilitation was aimed at recreating biotopes of high value for

<sup>13</sup> NB: Although this case study concerns a site for extraction of energy minerals (lignite), it is included as an example of design of long term rehabilitation to support biodiversity and ecological functions (bird migration) and of after care and suitable management to further enhance the site's natural value.

biodiversity and for wetland birds, which started to frequent the site as early as the 1980s. Among others, the northern part of the site was flattened and transformed into open heathland bordering a lake to accommodate the Common crane (*Grus grus*), taking into account that this species frequented the more northerly arable land as a foraging ground.

Thanks to the rehabilitation works, former hollows became lakes and other surrounding areas were recovered as forests and pastures. The rehabilitation was also careful to preserve some natural /non-altered areas in the site, which hosted habitats of Community interest, including a priority habitat: Temperate Atlantic wet heaths with *Erica ciliaris* and *Erica tetralix* (4020).

On the other hand, it also took advantage of the pools created by the mining activities (a network of 250-300 pools), which could be recovered as lagoons with limited costs.

The rehabilitation works lasted 27 years, ending in 2002, and had a total cost of 14

Million Euros. After the rehabilitation was completed by the mining company (EDF), the site was acquired in October 2002 by the Department of Landes.

The site acquisition was made possible with the financial support of the Departmental Tax of Sensitive Natural Areas.

The site is now managed by a public body set up for this purpose, the “*Syndicat Mixte de Gestion des Milieux Naturels*”, which includes representatives of the Aquitaine Region, the Landes Department and several local councils.

It is managed in accordance with two management instruments elaborated for the site:

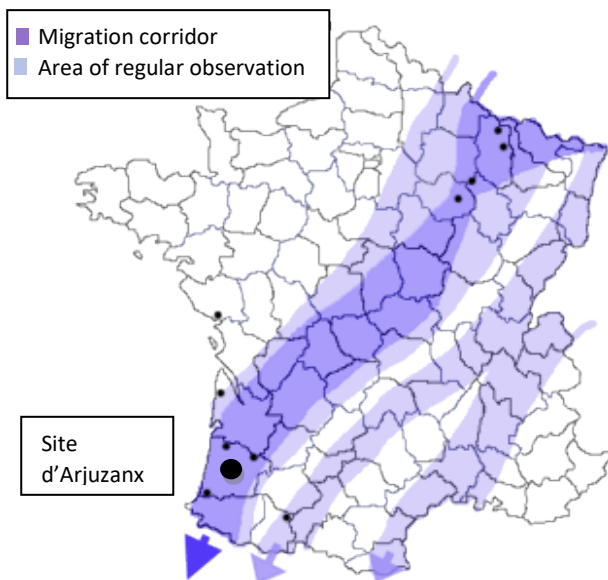
- The Objectives Document for the Natura 2000 site (Document d’Objectifs du site Natura 2000-DOCOB).
- The Management Plan for the National Hunting and Wildlife Reserve.



**Rapid results in biodiversity improvement and good cooperation for nature protection**

The diversity of birds and their populations rapidly increased with the rehabilitation works (10 *Anatidae* species were counted in the 1990's).

The site is located within a main migration corridor for cranes (*Grus grus*) which makes it particularly favourable to staging migrating flocks of this species. In the Arjuzanx site and the surrounding wetland areas the cranes find the necessary tranquility, while corn fields on the outskirts provide food resources and therefore foraging areas. The first crane stayed over on the site in 1982.



The rehabilitation works were relevant to protect and enhance biodiversity which already existed and to develop favorable areas for other species, particularly breeding areas for watefowl, passerines also raptors.

As a result, the site was designated in 2002 as SPA for the bird species present (Table 1).

The site was already designated on a slightly larger perimeter as a National Hunting and Wildlife Reserve, since 1987.

Table 1. Bird species present in then site, as resident or wintering.

Species	
Common snipe	<i>Gallinago gallinago</i>
Montagu's harrier	<i>Circus pygargus</i>
Marsh harrier	<i>Circus aeruginosus</i>
Hen harrier	<i>Circus cyaneus</i>
Eurasian curlew	<i>Numenius arquata</i>
European nightjar	<i>Caprimulgus europaeus</i>
Dartford warbler	<i>Sylvia undata</i>
Common pochard	<i>Aythya ferina</i>
Common crane	<i>Grus grus</i>
European bee-eater	<i>Merops apiaster</i>
Red-backed shrike	<i>Lanius collurio</i>
Eurasian teal	<i>Anas crecca</i>
Northern lapwing	<i>Vanellus vanellus</i>

The common crane is now the flagship species because a large part of the EU population winter on the site (25,000 cranes recorded).



SMGMN, Réserve d'Arjuzanx

**After care of the site to ensure long-lasting results**

The site presents very dynamic ecological systems and requires an on-going management for the conservation of the biodiversity currently present, and in particular to keep open habitats. *Ulex europaeus*, *Pinus maritimus*, *Robinia pseudoacacia*, *Baccharis halimifolia* and *Gynerium argenteum*, *Salix sp.*, some of which come from the old plantations on the site,

have a strong capacity for colonizing. A recurrent and regular management is therefore essential.

The designation as a Natura 2000 site helped also to continue the surveys and to improve the protection and conservation of the site after the restoration works were completed.

Works have been implemented further, with the help of the Natura 2000 contracts, in particular to improve habitat conditions for the cranes with the creation of 5 additional resting areas with a shallow water depth, which are also beneficial to other animal and plant species, as wet grasslands, dragonflies (including *Leucorrhinia albifrons*) and the European pond turtle (*Emys orbicularis*).

Depending on the operations undertaken, the funding may come from public sources, as the “Agence de l’Eau” (public body in charge of the water quality) to control the *Ludwigia sp.*, an invasive species that appeared in 2010), or from Natura 2000 funds.

A charter/policy/code of conduct was established for the protection of the Common crane (*Grus grus*) called « *Grus gascogna* », which has been signed by several government representatives, NGOs and the natural park authority.

The site is developing activities for tourists about the crane and biodiversity in general to highlight the results of the rehabilitation work.

The site management and after care has good acceptance and the support of all relevant stakeholders in the area and is well appreciated by the public and visitors that enjoy the high quality facilities provided to them.

### References

Site d’Arjuzanx. Syndicat Mixte de Gestion des Mileus Naturels.

<http://www.reserve-arjuzanx.fr>

Project for landscape restoration and public access in Arjuzanx.

[http://www.ook-paysagistes.com/amenagement-du-site-de-lente--arjuzanx---40.htm?ob=r&act=view&proj\\_id=83](http://www.ook-paysagistes.com/amenagement-du-site-de-lente--arjuzanx---40.htm?ob=r&act=view&proj_id=83)

The Arjuzanx Reserve, a stopover site for cranes.

<https://champagne-ardenne.lpo.fr/grue-cendree/grus/arjuzanx>

### Authorship and acknowledgements

Prepared by Claire Pirat (Ecosphère), with information and comments received from Serge Avignon, consulting engineer and designer of restoration work in the ONCFS, and Sophie Laugareil, Natura 2000 desk officer.



## GRENSMAAS PROJECT

### Gravel extraction, flood risk management and nature restoration on the Meuse River

**Minerals:** sand and gravel extraction.

**Location:** The Netherlands and Belgium.

**Habitats and species:** 'Grensmaas' (NL9801075, Netherlands, 314 ha) and 'Uiterwaarden langs de Limburgse Maas met Vijverbroek' (BE2200037, Belgium, 778 ha).



#### *Summary*

The three overarching goals of the Dutch integrated Grensmaas project were 1) to achieve by 2017 a reduction of flood risk in line with national agreements; 2) to restore by 2018 at least 1,000 ha of nature and hand it over to managing authorities; and 3) to extract at least 35 million tonnes of gravel for national use. Even though the Grensmaas project is in the process of finalization, gravel extraction will continue up to 2024 with an expected gravel output of 52 million tonnes.

At the core of the success of the project has been the vision of a triple win for flood risk reduction, nature restoration and jobs and growth creation. It ensured an early and broad consensus between key stakeholders which made it possible to integrate this vision into long-term regional planning processes.

#### **Background and context**

Gravel extraction in the Limburg region in north-Eastern Belgium and south-Eastern Netherlands can be traced back to Roman times and became increasingly industrial in the early 20<sup>th</sup> century. While initially gravel extraction was rather small-scale and mostly undertaken in the summer bed of the Meuse river, in the 1960's activities were significantly scaled up and increasingly moved into the river's floodplains.

Gravel extraction on the 45km of river on the border between the Netherlands and Belgium (Dutch: Grensmaas) was initially driven by navigation interest to facilitate trade with the Dutch and Belgium mining areas in the region. However, disagreement between the two countries led to a decision by the Dutch government to dig the Juliana Canal (1925-

1935) preventing canalisation of the Grensmaas and preserving much of its ecological value. Nonetheless, two centuries of extraction and river regulation for flood risk management left a significant mark on the once shallow and meandering river.

In the 1970's and 80's social dissatisfaction with industrial gravel extraction and agriculture in floodplains grew, and new visions on river restoration were explored, leading to more integrated approaches to nature conservation, flood risk management, farming, recreation, navigation and mineral extraction. Although this immediately triggered concrete pilot projects that combined gravel extraction and nature restoration on both sides of the river, political support really picked up after critical flood events in the Dutch Meuse in 1993 and 1995.

In 1995 the Dutch national government adopted the Delta Plan Large Rivers (NL: Deltaplan grote rivieren) which included the accelerated implementation of integrated nature restoration and gravel extraction on the Grensmaas. Implementation of the plan on the Meuse River started in 1997, and in 2003 the Grensmaas project was formally approved. This case study focusses on the developments since then.

The Meuse is a river with high water level fluctuations mainly dependent on rainfall patterns in the Belgian and French Ardennes region. The Grensmaas stretch is a rather fast-flowing middle course gravel river with relatively high dynamics in a wide river valley. These river dynamics in the past created a geologically varied floodplain with a mosaic of lobes, gravel banks, swales and levees, which due to intensifying agriculture however lost many of their characteristic riverine habitats and species.

Moreover, the rivers deep summer bed caused by both navigation measures and historic gravel extraction significantly reduced flooding events, erosion and sedimentation dynamics and resulting diversity of substrates and habitats.

Nonetheless, in 2003 the EIA and appropriate assessment of the Grensmaas project emphasized the remaining ecological value of the river itself for a number of characteristic species of fish (*Squalius cephalus*, *Barbus barbus*, *Cottus perifretum*, *Lampetra fluviatilis*, *Petromyzon marinus*), dragonflies (*Gomphus vulgatissimus*, *Gomphus flavipes*, *Onychogomphus forcipatus*) as well as wintering birds (*Mergus merganser*, *Mergellus albellus*).

The floodplains still held a number of characteristic habitats such as gravel banks and grasslands, hard- and softwood broad-leaved floodplain forest, steep natural river banks and -cliffs, and pioneer habitats, as well as important relict populations of threatened key such as *Populus nigra*, *Inula britannica*, and other representative species of the river habitats such as *Actitis hypoleucos* and *Riparia riparia*.

In 1998 the Grensmaas was first proposed by the Netherlands as a Site of Community Interest (SCI) under the Habitats Directive, approved in 2004 and designated as a Special Area of Conservation (SAC) in 2014.



Grensmaas pilot project at Meers

The Dutch SAC designation (314 ha) only concerns the river itself, except for a small section of floodplain with older nature restoration in a former gravel extraction site, and is based on four habitats and four species of community interest.

These include a representative share of Dutch watercourses with submerged vegetation (H3260) and as well as EU priority habitat alluvial forests (91E0), two habitats in Unfavourable-Bad status in the Atlantic biogeographic region. Although the remaining floodplains were not designated as Natura 2000 site, they are part of the Dutch national nature network of protected areas.

The floodplains on the Belgian side of the river (Uiterwaarden langs de Limburgse Maas met Vijverbroek, 778 ha) were proposed as SCI by the Flemish authorities in 2002 and also adopted and designated in 2004 and 2014 respectively. The SAC is especially important for its xeric sand calcareous grasslands (EU priority habitat 6120, 61 ha), riparian mixed forests (H91F0) and river with muddy banks (H3270).

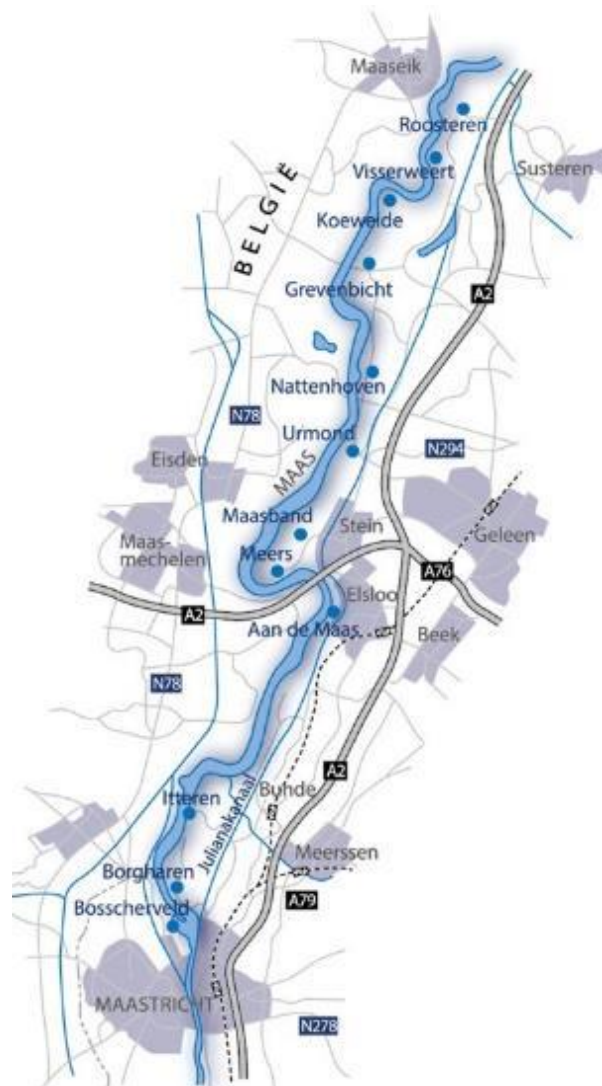
The environmental impact assessment (EIA) of the Grensmaas project, which included information from the appropriate assessment, estimated that 98% of the European and nationally legally protected and/or red-listed species found on the Grensmaas would benefit from the foreseen extraction and restoration works.

Nonetheless, the large-scale earthmoving would have significant impacts on a small number of species. These included a number of farmland bird species requiring remaining landscape elements that would be removed, such as *Emberiza calandra*, *Perdix perdix* and *Athene noctua*.

Moreover, the EIA advised to either safeguard or transplant a number of relict plant populations with *Sambucus ebulus*, *Allium oleraceum* and *Silaum silaus*.

More importantly, because of both the widening of the riverbed channel as well as lowering of many sections of the floodplain, water levels during both periods of low and high discharge would be reduced, negatively impacting no less than six surrounding designated Natura 2000 sites on both sides of the river.

These included three SACs and two SPAs (largely overlapping with the SACs) on the Belgian side of the river and one SAC on the Dutch side. After 11 Belgian organisations responded negatively to the appropriate assessment, the Dutch and Flemish authorities made new agreements on mitigating measures both in the project plan itself and in case future monitoring results during project implementation would demonstrate a need for additional ones.



In 1997, a governmental agreement was struck between I&W, the Dutch ministry of Economic Affairs and Climate and the Dutch Province of Limburg which marked the start of the larger Meuse flood risk management programme (NL: Maaswerken) which in 2003 became an independent project financed through the Dutch Major Projects Regulation further enabling financing and political scrutiny.

The Grensmaas project, together with the similar Zandmaas project further downstream and the Maasroute project on improving navigation, is one of the three pillars of the Maaswerken. In 2005 an implementation agreement was signed for the Grensmaas and in 2008 the works on the ground were officially started for a period of 15 years.

Following growing public dissatisfaction with large-scale gravel extraction in the Belgian Limburg region, the Flemish gravel act of 1993 for the first time regulated gravel extraction in the Limburg province with the aim of end this activity after 2005. Until then, the sector was allowed to extract 59,5 million tonnes of gravel in the Meuse valley. The act was amended in 2001, 2005 and 2009, which included among others the scrapping of the 01 January 2016 end date and exemptions from the target for gravel extraction in relation to projects of overriding public interest such as large-scale floodplain restoration.

Cooperation between Flanders and Netherlands intensified too following the 1993 floods, and in 1995 a bilateral agreement was struck to reduce flood risk in a cross-border fashion. This included measures in three locations on the Flemish side of the river. In 2003, ministers reconfirmed this cooperation and agreed on an additional set of measures. To improve coordination of measures on both sides of the river, a

coordination committee (VNBM) was established in 2005.

In the Netherlands, responsibility for both flood prevention as well as Natura 2000 implementation in large national water bodies such as the Meuse River sits with the Ministry of Infrastructure and Water Management (I&W), and practical implementation of the Grensmaas project is led by its executive agency Rijkswaterstaat (RWS). The Belgian counterpart of RWS in relation to water and flood-risk management is the Flemish government agency De Vlaamse Waterweg nv, while responsibility for Natura 2000 implementation sits with the Agency for Nature and Forests (ANB).

### **Key actions**

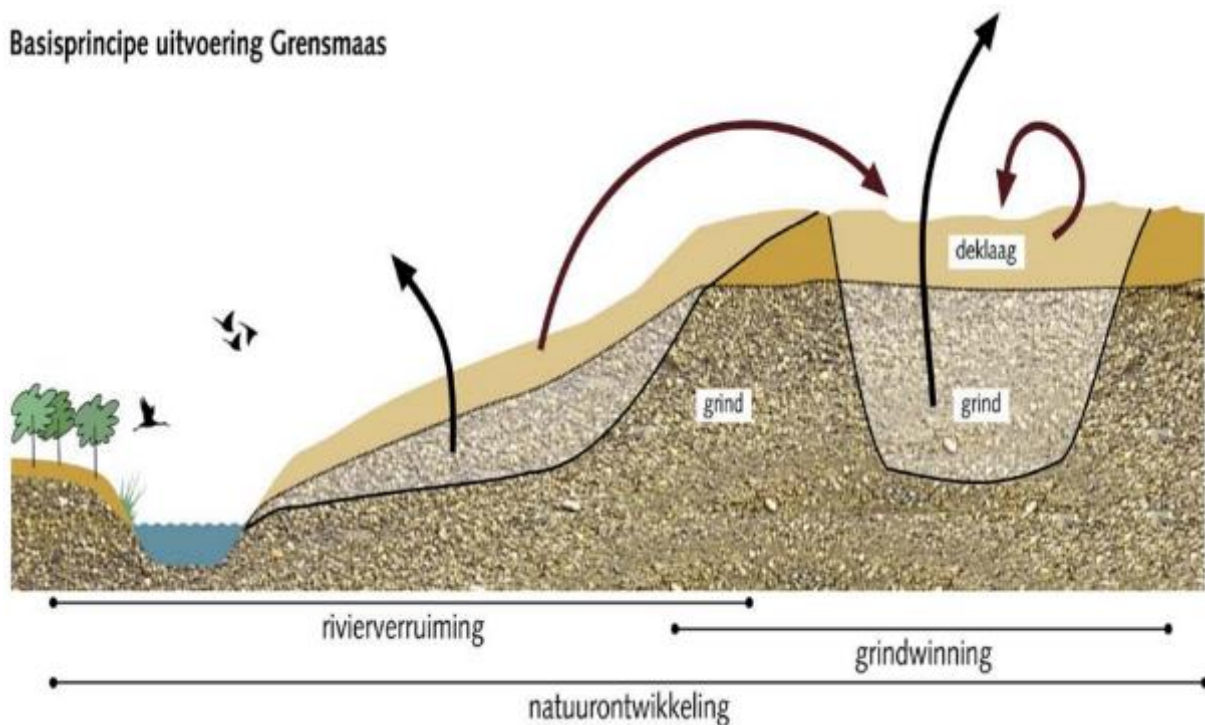
The Grensmaas project included measures on twelve different locations as part of the Dutch project. Additionally, on the Belgian side measures were taken in another nine sites. In most places, activities consisted of a combination of flow channel widening, lowering floodplains and deep gravel extraction. While the first two activities also delivered gravel and sand to market, the third activity was the primary economic objective.

The gravel pits that remained after the deep extraction were used to place back the substrates from the river widening that were more difficult to market, in particular the clay soils. Figure 1 shows a schematic representation of the main activities.

For the Dutch part of the project, RWS established the private Grensmaas Consortium consisting of three contractors (Boskalis, Van Oord, Van den Biggelaar), 11 gravel companies united under a joint venture (Geo-Control), and the largest Dutch private nature managing organisation Natuurmonumenten (Society for preservation of nature monuments in the Netherlands).

## Figure 1: Basic measures Grensmaas project

Key: grind/gravel; grindwinning/gravel extraction; deklaag/top soil; rivierverruiming/river widening



Such public-private partnerships are not uncommon in the Netherlands, however the Grensmaas project has been the largest public-private cooperation on river management in the Netherlands to date.

The implementation costs of the Grensmaas project (about EUR 550 million) by the consortium were covered through the income generated by the extraction of 54 million tonnes of gravel and 10 million tonnes of sand.

Before implementation, detailed EIAs were undertaken both for the Dutch as well as the Belgian side of the river, as well as an appropriate assessment under the 1998 Dutch Nature Conservancy Act (transposing the EU Habitats Directive provisions in this respect) which was approved by the Province of Limburg in 2004.

Under the condition that the consortium would respect the EIAs and appropriate assessment recommendations to avoid impacts, the Province integrated the

Grensmaas planning in its regional spatial plan, which meant that no additional permitting was required for activities in all twelve project locations.

However under the overall excavation permit, the Province included the requirement for the consortium to develop and implement a specific management plan with interim measures to prevent impacts of works for example by avoiding run-off from temporary storages, final starting dates for the start of grazing management and how to (sustainably) deal with natural forest regeneration causing higher flood risks.

Next to these mitigating measures at site level, a particular cross-cutting challenge of the entire project has been to take appropriate measures to avoid desiccation effects in surrounding nature- and agriculture areas resulting from lower water tables caused by the river widening. Most measures had to be taken in Belgium, and The

Netherlands provided additional funding for this.

### **Main elements of good practice**

Integrated vision and -spatial planning: At the core of the success of the project has been the vision of a triple win for flood risk reduction, nature restoration and jobs and growth creation. It ensured an early and broad consensus between key stakeholders which made it possible to integrate this vision into long-term regional planning processes. This in turn ensured the possibility for timely integration with other spatial developments that, for example, greatly reduced permitting procedures.

Political and financial security: The 15 years' timeframe posed a significant risk regarding ongoing public support and -funding. The 2008 financial crisis did present significant direct challenges (reduced gravel demands) as well as indirect ones (cuts in public spending on water and nature policy implementation). As the Grensmaas' physical location is relatively far away from The Hague-based policy- and decision makers and the project received relatively little attention compared to the similar Room for the River Project on the Rhine river, its status as a 'major project' under Dutch legislation and therefore regular scrutiny by Parliament was important to ensure continued political visibility.

Self-realization by the gravel sector and nature managing organisation: A particular success factor of the Grensmaas project has been its model of cooperation based on self-realisation. Although this decision was initially born out of necessity as much of the land concerned was owned by the gravel sector, and the Dutch water authorities have been criticized for having taken too much a role of contractor rather than a partner, it has ensured a large ownership by the gravel sector in the project.

The inclusion of the nature managing organisation from the start facilitated an ecologically sound implementation of the works and continuity.

Coordination and adaptive management: Regular coordination mechanisms were set up both between key stakeholders on both sides of the river as well as through the bilateral committee. This made it possible to maintain and build trust and adapt to unforeseen circumstances.

Citizen participation: In particular the large-scale earthmoving of approximately 150 million m<sup>3</sup>, meant that many residents and municipalities were directly confronted with the project's implementation. Despite initial resistance and fears of inconvenience, the pro-active local stakeholder management at each local site, direct (one-to-one) approach and rapid response to complaints have greatly improved buy-in.

Major improvement in ecological resilience: By the last progress report, 1,208 ha were restored from mostly low-nature-value and scarcely flooded farmland to a diversity of natural habitats and wetlands. Early monitoring results confirm the prediction made in the 2003 EIA, and various quickly responding indicator species such as fish and birds are showing signs of recovery, which provides an important contribution to the achievement of a range of national and international conservation and restoration objectives.

Important spin-offs in tourism and recreation: The tourism sector has benefitted and embraced the large-scale landscape transformations as an opportunity. A Belgian regional landscape NGO and tourism office took the initiative for a River Park Meuse Valley which consequently joined forces with its Dutch counterparts into an inter-regional initiative promoting the region internationally as a tourism destination in four languages.

## References

Website of the Grensmaas Consortium (in Dutch): <https://www.grensmaas.nl/>

Dutch government, Final evaluation Zandmaas/Grensmaas (in Dutch): [https://www.rijksoverheid.nl/documenten/rapporten/2018/03/23/eindevaluatie-zandmaas-grensmaas](https://www.rijksoverheid.nl/documenten/rappporten/2018/03/23/eindevaluatie-zandmaas-grensmaas)

EU RESTORE project factsheet on Grensmaas (Ecosystem Services and Valuation), in English: [http://www.restore-quarries.eu/download/i/mark\\_dl/u/4012156712/4617354877/Factsheet%20Grensmaas.pdf](http://www.restore-quarries.eu/download/i/mark_dl/u/4012156712/4617354877/Factsheet%20Grensmaas.pdf)

## Authorship and acknowledgements

Prepared by Erik Gerritsen (IEEP) with contribution from the Grensmaas Consortium.

Photos provided by the the Grensmaas Consortium.

## TOVAČOV LAKES

### Increasing biodiversity during aggregates extraction

**Minerals:** sand and gravel extraction.

**Location:** Czech Republic.

**Habitats and species:** Tovačov lakes I, III and IV are included in the larger SAC Morava-Chropýňský Floodplain (CZ0714085, 3,205 ha) for their floodplain habitats. The site is important for the conservation of the European beaver (*Castor fiber*) and also as a stopover site for at least 70 bird species.



#### Summary

Gravel and sand extraction at Tovačov Lakes resulted in a landscape of significant value for biodiversity and recreational use, reminiscent of the Central European river floodplains lost to river regulation. Secondary habitats are constantly created through extraction and processing of aggregates and deposition of silt.

Reclamation of the deep water filled pits through technical measures was replaced by the creation of shallow water bodies and shore lines formed through bank profiling and partial filling. Through targeted excavation, an island can be created as a zone of low disturbance for more sensitive species. Artificial nesting platforms made of concrete float on the deep lakes, offering safe nesting sites to a common tern colony of national significance.

Early succession habitats are being created and plant succession is managed according to the needs of target pioneer species. An experimental trial reintroduction of the critically endangered variegated horsetail (*Equisetum variegatum*) is underway. These and other similar measures are integrated into the Biodiversity Management Plan of the mining operation and are being implemented in close cooperation with nature conservation organisations, authorities and local communities.

#### Background

The four Tovačov lakes, at the confluence of the Morava and Bečva rivers in Central Moravia, were created by gravel and sand extraction in the last 60 years. Their water surface is 380 ha. Three of the lakes are still actively used for gravel extraction, while additional uses include fishing, swimming, boating and drinking water provision. The lakes surrounded by floodplain vegetation are also recognised for their high biodiversity.

In recent years, following the establishment of the Natura 2000 network, numerous stakeholder meetings were dedicated to the future use of the lakes and a management plan was elaborated.

The interests of mining, nature protection and recreational activities were reconciled and a more transparent management approach was adopted by the mining company Českosomoravský štěrk (member of the HeidelbergCement Group).



Different use zones were agreed between the mining company, the municipality of Tovačov, an association of the local villages and the environmental organisations - the Czech Society for Ornithology (CSO/BirdLife in Czech Republic) and the Nature Protection Agency. A local NGO “For Tovačov Lakes” was established to facilitate the dialogue through regular meetings and common planning.

The Tovačov Lakes attract about 10,000 visitors a year. The site is promoted on the web pages of all partners. A viewing tower for birdwatching and other visitors’ facilities and information boards are provided, including public parking and waste collection.

### **Biodiversity management activities**

Sand and gravel extraction since the mid-20th century has resulted in the creation of four lakes of varying age and depth. Most of the lake shores have been reclaimed in the past by levelling the terrain and afforestation or seeding with grass. However, some parts were left for spontaneous ecological succession.

The mining company started paying attention to biodiversity in recent years and has carried out, together with partners, several projects focused on promotion of biodiversity. The following are some of the selected biodiversity management projects carried out so far.

### ***Project to promote nesting of common terns***

Common terns (*Sterna hirundo*) find suitable conditions to breed and raise their chicks in gravel pits. This typical freshwater colonial bird breeds on gravel banks and bars of larger rivers. Such habitats are now scarce, mainly due to the regulation of watercourses.

Since 2010, concrete islands designed by VUT (Czech Technical University), Betotech (Českosomoravský Beton) and Českomoravský štěrk have been floated on gravel pits across Central Moravia. This project was initiated on the Tovačov Lakes where it proved very successful. The platforms regularly host up to 15% of the entire national breeding population of common terns.



Floating concrete islands terns like to occupy. Zdeněk Vermouzek/archive CSO

Monitoring and ringing birds is financially supported and takes place annually in cooperation with the Czech Society for Ornithology, together with educational events. From 2016, webcasting is also available, thanks to a webcam on a floating island, allowing the public to follow the breeding of terns.

### ***Surveys contribute to the Biodiversity Management Plan for Tovačov Lakes***

Biological surveys of different taxonomic groups of organisms are performed in the area of Tovačov lakes since 2014 and have described significant species richness. Appropriate management measures were developed to maintain and further improve the biodiversity.

Lake shores and disturbed open areas represent the most species-rich habitats. The fluctuating water periodically floods and retreats from the shores, resembling floodplain dynamics.

The disturbed open habitats are strongly transitory and undergo ecological succession. These habitats quickly vanish and would be lost without periodic management. Hence, mining activities are very important for their creation and maintenance. In relation to these habitats, the following measures were proposed:

1. Sites prepared for mining should be escarped at different levels to allow the formation of new water bodies and substrates with different granularity.
2. Sections of gravel pits scheduled to be filled with mining residuals should not be filled completely. It is recommended to stop material deposition when a sandy island is created and shallow water bodies cover about half of the area.
3. The banks dividing sections of the lakes should be low to allow willows and reeds to grow on them.

4. By mining and deposition of residuals the aim should be to create an uneven shore line to allow for development of hygrophilous vegetation and shallow water communities.

5. Subsoil and other unused materials should not be deposited on waste heaps but used as material to fill in the deeper part of the lakes in order to create shallower water.

6. Field depressions, shore zones and small waterbodies and pools should not be filled with mining residuals. Shore zones should be 30 cm to 1.5 m deep with maximum of 4° inclination. Low inclination is appropriate in combination with fluctuating heights of the water levels.

### ***Promoting the unique environment of silt lagoons***

Sandy gravels are extracted mainly by floating excavators from the bottom of the lakes, and the gravel is being washed and screened into different particle size assortments. The fine material washed off the gravel is deposited into silt lagoons. There are silt lagoons of different ages and in different phases of vegetation succession at Lake Tovačov, from the oldest, already overgrown by forest, to the still bare surfaces.

Silt is an extreme habitat with minimal nutrients and high temperature fluctuations, so plant succession is slow. The sun-lit bare surfaces are however very interesting from the point of view of nature conservation and represent a unique habitat for a variety of very rare species of organisms.

In 2017, with the participation of the Nature Protection Agency, the Protected Landscape Area of Litovelské Pomoraví, a project on the restoration of the critically endangered horsetail (*Equisetum variegatum*) was started and the older silt lagoon of Tovačov gravel was used as substrate to grow this rare plant. The horsetail requires a fully sun-lit open wet habitat which is extremely rare feature in Czechia.



Photo: Kamila Botková

In spring 2017, another project in cooperation with the CSO was started focusing on the unique environment of silt lagoons. The aim of the project is to not only explore these habitats, but above all to create a practical management plan to make the most of their potential for biodiversity conservation.

Through ongoing management and with the help of volunteers, part of the overgrown silt lagoon was cleared of reeds. Prescribed burning was done in winter. Heavy machinery is used to clear up larger areas of the silt lagoons.

At the beginning of 2017, a number of small ponds were excavated as habitat for water beetles and protected amphibians on the old silt lagoon.

### ***Bird Island Remízek***

One more project will help increase the biological value of Tovačov Lakes: the creation of a permanent island. An existing peninsula covered by natural forest exists in the eastern part of the mining area. A 7 ha large piece will be cut by mining and a new, isolated,

disturbance-free zone will be created to offer shelter for many species, in particular as a nesting site for large water birds and birds of prey. The most valuable part of the floodplain forest will be preserved, the littoral zone enlarged, and the area left to spontaneous succession.

The plan also includes the creation of one small island that will serve as a breeding ground for terns.

### **Main elements of good practice**

The gravel pits at Tovačov Lakes represent a large scale mineral extraction operation compatible with nature protection and social functions.

At the core of this successful example is the active dialogue among all interested stakeholders, as well as the long-term vision championed by the company.

Apart from sand and gravel, the lakes offer clean drinking water and recreational attractions in a natural environment such as fishing, boating and swimming.

The biodiversity value of the area was recognised and included in the European Natura 2000 network. The lakes host migratory birds, a breeding colony of the threatened common tern, as well as habitats of rare flora and fauna.

The preservation, maintenance and creation of new habitats is now integrated into a Biodiversity Management Plan for the extractive operations.

There is a good replicability potential in Czechia as well as in other Central European countries.

A similar stakeholder network has been established in another mining area in South Bohemia since 2016 where habitat restoration activities are discussed annually between the mining company, Protected Landscape Area Třeboňsko and the scientists from University of South Bohemia. The use of artificial nesting platforms was already replicated on other mining lakes in Czechia and Poland.

The Tovačov Lakes area is an example of successful integration of mining activities and nature restoration.

## References

Website of the HeidelbergCement Group in the Czech Republic, 2016: <https://www.nase-biodiverzita.cz/cs/nase-projekty/vyperkoviste-tovacov>,

Website of the HeidelbergCement Group in the Czech Republic, 2017: <https://www.nase-biodiverzita.cz/cs/nase-projekty/ostruvky-pro-rybaky>,  
<https://www.heidelbergcement.cz/cs/aktuality/tune-tovacov>

Botková K. 2017. Česká společnost ornitologická: Dobrovolná akce na štěrkovně v Tovačově [online]. 8. 11. 2017 [cit. 2018-04-13].

Available at:

<http://www.birdlife.cz/dobrovolna-akce-na-sterkovne-v-tovacove/>

Mikulašková K. 2018. Návrh strategie udržitelného rozvoje pro oblast Tovačovských jezer na střední Moravě. (Proposal of the sustainable development strategy for Tovačov Lakes area). In Czech. Bachelor thesis. UNIVERZITA PALACKÉHO V OLOMOUCI, Přírodovědecká fakulta.

Ševčík J., Holec V., Machač O., Trávníček B., Trnka F. 2014. Research of the biodiversity of Tovačov lakes (Czech Republic). Available at: [https://www.quarrylifeaward.co.uk/sites/default/files/media/final\\_sevcik\\_tovacov.pdf](https://www.quarrylifeaward.co.uk/sites/default/files/media/final_sevcik_tovacov.pdf)

Šafránek J. 2016. Moravský ornitologický spolek – středomoravská pobočka ČSO: Přátelé rybáků se sešli v Tovačově a spustili webkameru z hnízdiště rybáků [online]. Available at: <http://www.mos-cso.cz/cz/tiskove-zpravy/2015/pratele-rybaku-se-sesli-v-tovacove-a-spustili-webkameru-z-hnizdiste-rybaku>.

## Authorship and acknowledgements

Prepared by Viera Šefferova (Daphne) and reviewed by Ing. Kristýna Šebková, Českomoravský štěrk.

## MIRIBEL-JONAGE PARK

### Ecological restoration of sand and gravel quarry in the Rhone alluvial plain

**Minerals:** sand and gravel extraction.

**Location:** Rhône, France

**Natura 2000, habitats and species:** the quarries are located in the Miribel-Jonage Special Conservation Area (FR8201785. 2,850 ha), which holds grasslands, alluvial forests and wetlands, including also protected fish species and the Eurasian beaver (*Castor fiber*).

Photo: Jean-Louis Michelot



#### Summary

Gravel extraction has been carried out in the site since the 1950s. In 1968, 17 local authorities created an organization, SYMALIM, to manage the area, including dealing with the expansion of floods and leisure activities. The excavation of aggregates was at the heart of this project by creating large water bodies and providing financial resources.

SYMALIM purchased the land and managed the concessions that were granted to private aggregate mining companies, following a strategy that integrates biodiversity conservation and drinking water provision. About 350 hectares of water bodies were created, areas for leisure activities have also been developed and several million visitors per year frequent the park.

The site is also part of the Natura 2000 network and a management plan was adopted in 2009. It still contains rare habitats as remnants of what was the natural river before the civil engineering works. It includes riverbank forests and wetlands associated to the river Rhône as well as dry orchid meadows, also of Community interest, and is home to many protected species. Gravel extraction is on-going and contributes to the implementation of the site management plan.

#### Background

The Miribel-Jonage site is located in the alluvial plain of the river “Rhône”, about fifteen kilometres east of Lyon.

Gravel extractive activities began in a punctual and unorganized way on the site in the 1950s.

In 1968, an organization, SYMALIM was created bringing together 17 local authorities in order to properly manage the activities

carried out in the area, including dealing with the expansion of floods and leisure activities.

The excavation of aggregates was at the heart of this project, creating large water bodies and providing financial resources.

SYMALIM defined the development strategy of the site and set the main directions. It purchased the land and managed the concessions that were granted to private aggregate mining companies.

As a result, sand and gravel resources of the Rhône were extracted by excavation at a limited depth (about 5 meters) and about 350 hectares of water bodies were created.

The unused materials were used for the development of the surroundings of water bodies (beaches). Land areas have also been developed (lawns, trails, sport facilities) and nowadays several million visitors per year frequent the park.

In 1993, the development project was renewed to further integrate two management objectives for this area: biodiversity conservation and drinking water provision. The park is in fact located within the water catchment area of the urban agglomeration of Lyon (1.2 million inhabitants) and the water bodies present in the site constitute a back-up resource.

The site was proposed as a Natura 2000 site (pSCI in 2003) and a management plan (DOCOB) was established in 2009. This site is exceptional because it still contains rare habitats as remnants of what was the natural river before the civil engineering works.

It includes riverbank forests and wetlands associated to the river Rhône as well as dry orchid meadows also of Community interest.

The site is home to many protected species, including six fish species of EU interest, the Large Copper butterfly, the Southern damselfly and the Beaver, which find here favourable conditions to thrive.

The park has been developed into three large areas, distributed from west to east, devoted to leisure activities, environmental education, biodiversity conservation and agriculture. This zoning is interesting because it allows the presence of different land uses in the same area, with various human activities locally compatible with the maintenance of biodiversity. The excavation of gravels is ongoing and contributes to the implementation of the site management plan.

### Ecological restoration

The rehabilitation of the extraction areas is carried out by the mining companies under the direction of SYMALIM, and follow two main patterns.



Photo: Jean-Louis Michelot

On the one hand, the quarrying companies, which have a rehabilitation obligation, carry out landscaping and ecological works, in particular using by-products of their extractive activities that are not sold. These works are financed with part of the income generated by the sale of aggregates.

Moreover, some sites that were mined before considering ecological features (eg they had steep bank slopes, sterile soils, etc.) have been rehabilitated through the provision of additional European funding (LIFE Environment).

The ecological restoration principles of the excavated areas include the following:

- Development of banks on gentle slopes.
- Creation of many islets with varied topography, sometimes in archipelagos.
- Creation of pools, shoals, micro cliffs.
- Use of non-marketed materials to develop islets and other habitats.
- Limited vegetation to let natural colonisation take place.

Furthermore, ecologically rehabilitated areas are protected from disturbing activities (boat traffic, hunting, etc.).

In the last decade, thanks to the establishment of the Natura 2000 site, biodiversity has been further enhanced, natural habitats are better preserved and no longer suffer deterioration.

Reconciling the various activities in the site (leisure, nature conservation and water provision) remains however a major challenge in the site management.

Another major interest of this site is the consideration of the drinking water resource. The water bodies are developed and managed to protect the water quality, with upstream water bodies functioning as sediment traps, control of polluting activities, etc.

In addition, several works have been carried out and facilities have been set up, often in connection with the excavations, for the discovery of the habitats by the visitors, which include trails, panoramic view points, bird hides, etc.

### **Main results achieved to date**

Until about twenty years ago, excavations led to the destruction of natural habitats (alluvial forests, dry grasslands, etc.). Conversely, the extractive activities are now reduced in size and limited to areas of low ecological value (e.g. agricultural land).

The restored areas have been rapidly used by water birds, thanks to their attractive features: large shallow water from excavations, no hunting, proximity to the valley of the river Rhône and the “Dombes” (over 1000 water bodies).

The restored areas have also been colonised by other interesting flora and fauna species. The islets and the reed beds host a breeding population of Beaver, the Reed warbler and the Great Reed warbler, the Grey heron, etc. Islets of gravels and floating platforms also allow the Common terns to nest.

### **Main strengths: social and institutional context**

This project is particularly remarkable in the ways it has tried to balance human activities with the preservation of nature. The changes towards stronger consideration of biodiversity were linked to the evolution of the social demand and the presence of elected representatives interested in this issue. Natura 2000 has reinforced and improved this evolution by creating a framework for exchange through the management plan (DOCOB) and the establishment of a managing body with local authorities' representatives (SYMALIM).

This project has also been the subject of a major consultation between the local authorities involved and many other stakeholders including the organisations responsible for the protection of drinking water, the manager of the dams on the Rhône River (“Electricité de France”) and nature conservation NGOs. Several consultancy companies have also worked and provided assistance on ecological engineering, landscaping and water management activities.

Aggregate companies have gradually taken environmental issues into greater consideration, particularly in order to sustain their activity, improve their public image and respond to the social demand.

The Natura 2000 Management Plan (DOCOB), approved in 2009, has been largely implemented by the local authorities (SYMALIM) and SEGAPAL (the company responsible for the management and development of the site). The DOCOB is a reference document that provides a framework for all the projects of this park and its partners.

## **References**

ECOSPHERE. 2009. Document d’objectifs du site FR8201785 – Pelouses, milieux alluviaux et aquatiques de l’île de Miribel-Jonage. 261p.

## **Authorship and acknowledgements**

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