



The French network of
public and private stakeholders
for sustainable cities

Innovative solutions for sustainable cities

The value of soil



THE VALUE OF SOIL: PROTECTING, RESTORING AND COMPENSATING SOILS, THE KEY RESOURCES OF SUSTAINABLE CITIES.

According to figures from the French national federation of Safer (land development and rural settlement organizations), the artificialization of land is on the rise again since 2015, and 50,000 to 60,000 hectares of land is urbanized every year, i.e. six times the area of Paris or the equivalent of a French department every 6 years. This subject worries citizens, since the soil issue is related to the preservation of resources but also to public health and risk. Indeed, the soil is a rich, vital, non-renewable environment... and is subject to multiple pressures. The soil is therefore a topic in itself to be approached in a comprehensive way:

► **Soil and food:** the soil is the basis of our food, but it is threatened by intensive agricultural practices and the pressure on fertile lands to develop towns and transport infrastructures.

► **Soil and pollution:** at present, there are more than 400,000 polluted or potentially polluted sites in France. Their contamination threatens health, biodiversity and the environment via water and food.

► **Soil and climate change:** the soil plays a major role in the fight against climate change. It stores carbon and regulates extreme climatic events such as heatwaves or droughts.

/// CONTEXT: WHY ACT IN THE DOMAIN OF SOIL?

► **On a global scale,** approaching the quality of the human environment through the soil is becoming increasingly evident and 3 initiatives can be taken as a basis:

- **The World Soil Charter** was unanimously approved and signed by the member states of the FAO (Food and Agriculture Organization of the United Nations)

at the 39th FAO Conference in June 2015. It is the main standard-setting instrument agreed by the Member States, and it is incumbent upon the Global Soil Partnership (GSP) to promote the principles. The 13 principles listed in the Charter of 1981 are still valid, but they need to be updated and revised to integrate new topics: ecosystem services, food security, and so on;

- Among the **17 Sustainable Development Goals (SDG)** adopted by the member states of the United Nations, SDG 11 - Make cities and human settlements inclusive, safe, resilient and sustainable - explicitly proposes in its monitoring indicators the rate of artificialization, in a spirit of sustainably managing urbanization with an overhaul of the food systems in a town / countryside equilibrium;
- Likewise, **Habitat III**, the United Nations Conference on Housing and Sustainable Urban Development, which took place in Quito, Ecuador, from 17 to 20 October 2016, led to the adoption of a **New Urban Agenda**. The commitments include sustainable urban development and controlled resilience at the environmental level. Issues related to soil restoration and preservation can rely on these commitments.

► **At the European level,** citizens are taking action to put in place a legislation. By using the participative democracy instrument "The European Citizens' Initiative" (ECI), an initiative to save soils has been launched, calling on the European Commission to introduce a directive.

► **In France,** unlike water and air, soil does not benefit from any specific legal protection. Indeed, the theme of soil is scattered across articles in both the French Environmental

Code and the French Town-Planning Code and locally in documents of diverse categories (ScoT, SRADDET¹, Climate Plan, PLU/PLUI [local town planning], rights and duties in urban planning procedures, and so on), although the Alur law enables municipalities to determine the area reserved for biodiversity of a specific plot.

/// WHAT ARE THE MAIN AREAS OF INNOVATION IN THE DOMAIN OF SOIL?

► **At the citizen level: air quality, equilibrium with forest areas, presence of recreational areas nearby, park, water-food quality, development of organic farming sectors, and so on.** These pressing health and food issues as basic needs call for the mobilization of an academic knowledge of excellence to be popularized, shared and disseminated, by involving citizens in actions of co-production and renewal of urban practices.

► **At the territory level: scarcity of land in urban tense areas, taking account of the potential pollution of wastelands and adapting their use according to the soil quality and the water cycle.** The theme of soil is also increasingly coming into play in the urban issues of adaptation to climate change (carbon capture, fight against heat islands, and so on). The innovation lies in the reinforcement of the systemic approach between actions on the soils (protection, restoration, compensation), town planning documents, and urban development choices.

► **At the level of urbanizing areas: soil preservation, restoration (pollution abatement) and compensation as part of the urbanization and urban renewal.** The aim is to take better account of the agricultural value and fertility of the soil in the activity programming, and to respond to citizen and political claims to support short circuits, especially short food circuits. The purpose is also to promote a sober m² and m³ urban planning for decision-makers and planners in response to the issue of combating urban sprawl initiated in 2000 by the law on Solidarity and Urban Renewal and consolidated by the ALUR law².

► **At the level of town-planning and real estate professionals: town planning obligations (environmental assessment, climate plan, green and blue belts, and so on), social demand.** For professionals, it is important to be able to mobilize “bridges” between the understanding of issues and new know-how such as the EcoConception chair, labels such as Biodiversity, the EcoJardin label, the Nature in the city portal, and so on.

/// WHAT ACTIONS ARE BEING DEVELOPED IN FRANCE TO SUPPORT THESE INNOVATIONS?

The actions developed by France include:

► **The ‘New’ land/soil uses:** development of land uses that do not require artificialization: agriculture, food sector, development of gardens and water features, development of the circular economy, and so on;

► **A better use of legal and tax instruments to serve land / soil:** the legislative and regulatory instruments, the conventional and contractual arsenal, enable strong and effective actions on issues such as the fight against urban sprawl (landscape protection), the rules covering commercial and artisanal zones, a density policy supporting soil protection, and so on;

► **The different scales** (building, islands, macro-islands, district, town, agglomeration, territory) The Grenelle laws and in particular the green and blue belt approach have improved the links between the responsible authorities, the associated technical arms (green space services, water agencies, etc.) and the reference instruments (town planning procedure, PLU, PLUi, SCOT, Climate Plan, SRCAE, etc.);

► **Soil characterization:** defining the economic value of the soils’ agricultural quality in the light of an economic activities with high added value (market gardening, viticulture, etc.), developing solutions based on nature / ecosystem services, label levers, certifications, Life Cycle Analysis (LCA), regulation to build awareness of the quality /fragility of soils;

► **Wasteland renewal, soil re-conquest in urban areas:** reducing soil artificialization, taking account of run-off risks, water management, pollution abatement, promoting ecodesign with a focus on restoration, land / soil change, and so on.

The pilots of the thematic workshop are:

**Geneviève Laferrère, FNE³,
Fabienne Marseille, CEREMA⁴,
Franck Fauchoux, Vivapolis Network.**

¹ The NOTRe law - on the occasion of the establishment of the new Regions (in 2016) - requires these new regions to produce a new planning scheme, called SRADDET (regional planning, sustainable development and territorial equality scheme) which will merge several existing sectoral documents or schemes (regional sustainable development and planning scheme known as SRADDT, Waste Plan, Regional Intermodality Scheme, SRCE and SRCAE). At the same time, the regions will develop a new Regional Biomass Scheme. .

² Under the Alur law, there is a mechanism that facilitates the rehabilitation of industrial wastelands in order to increase the density of buildings in urban areas. This mechanism consists of entrusting to a third party who so requests the rehabilitation works of a site where a classified installation (ICPE) was located, by substituting for the last operator if he agrees.

³ FNE, France Nature Environnement, French federation representing nature and environmental protection associations, recognized as a public utility.

⁴ The Cerema, Centre for Studies and Expertise on Risks, Environment, Mobility and Urban Planning, a public administrative body (French: EPA), under the supervision of the ministries in charge of sustainable development, transport, and urban planning, provides reinforced scientific and technical support to develop, implement and assess public policies on sustainable development and planning.



↑ Parc Marianne in Montpellier

DESTISOL

INTEGRATING ECOSYSTEM SERVICES RENDERED BY SOILS IN THE DESIGN OF DEVELOPMENT PROJECTS

The aim of the project is to propose a decision aid methodology to:

- *assess the potentialities of soils based on the ecosystem services they can render, in relation to their characteristics,*
- *establish a zoning on the scale of the development site based on this characterization,*
- *and adapt the development project to the soil potentialities.*

The purpose is to enable planners to take better account of the soils in terms of constraints or opportunities in their preliminary reflections (programming, pre-operational studies).

This project was tried out on two sites: Lannion (Côtes d'Armor) and Mureaux (Yvelines).

INNOVATIONS

The DESTISOL project makes it possible to:

- ▶ assess the services rendered by soils in urban environments such as the capacity to produce foodstuffs, regulate the heat island phenomenon or mitigate flood risk;
- ▶ produce a methodology and tools to link these services with soil condition indicators;
- ▶ connect uses, ground cover hypotheses and services to adapt a site's development plan to the soil characteristics.

This project makes it possible to identify relevant analyses to be performed at the different stages of the project and on different programming scales.

KEY DATA

- **Ecosystem services: socio-economic benefits for humans from the sustainable use of the ecological functions of ecosystems, which humans may potentially change or exploit by bringing capital or work.**

STAKEHOLDERS

▶ The methodology is intended for planners. It was tested in the district of Garenne at Les Mureaux where eight hectares of wasteland, initially occupied by a metal profile production factory and a concrete manufacturing site, were reused. The characterization of the site's soils revealed the presence of fertile soils suitable for landscaping, thereby avoiding the need to bring in topsoil. The soil characterization made it possible to identify the permeable soils that facilitate water infiltration for the creation of ditches, to enhance areas of ecological interest and to optimize the installation of parking areas.

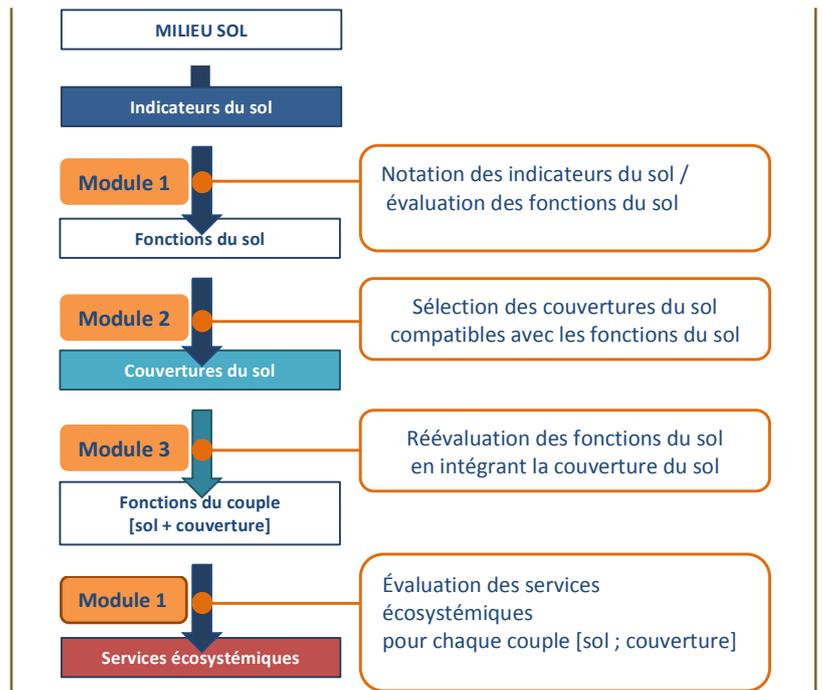
▶ The first phase of the research project supported by Ademe was completed at the beginning of 2017. A tool and a guide are planned for 2019. Model standard specifications may also be proposed.

▶ The project brought together the Cerema, the consultancy firm SCE, the Laboratoire Sols et Environnement (Lorraine Univ./INRA) and operational players: the EPF of Brittany and EPAMSA.

IMPLEMENTATION

► The implementation of the project is based on several stages:

- a preliminary study: documentation review and on-site study focusing in particular on the history of its occupation, observation of the physical and natural environment (especially vegetation), research on its possible pollution;
- the zoning of the site based on an advanced diagnosis resulting from excavations and the description of soil profiles;
- the identification of possible covers;
- the analysis of the development project's compatibility with these covers and its possible revision.



Principe de fonctionnement de l'outil Destisol

RESULTS

/// The project site was divided into homogeneous zones

Following the approach described above, the soil in some zones did not lend itself to the hosting of either vegetation or buildings / roads as initially planned in the project.

/// The planner then had two solutions:

- maintain the initial project, subject to intervention on the soil in order to change its characteristics (e.g. addition of topsoil or backfills, liming) in the event of incompatibility between the soil in place and the planned cover;
- amend the project on the basis of the contributions of the Destisol tool by integrating the potentialities of the soils in place and the possible ground covers in the reflection so as to limit the development cost.

The resource saving and services maintenance that the second solution allows is part of a strategy for renewal of the city on itself and for the construction of sustainable and resilient cities.



→ The environmental benefits (maintenance of the services rendered by the soils and vegetation) and economic benefits (limitation of interventions on the soils) expected from the optimization of the projects should largely compensate for the additional investment needed to characterize the soils and their services.





REDEVELOPMENT OF THE BECKER INDUSTRIAL WASTELAND

THROUGH USES THAT ARE ALTERNATIVE OR TRANSITIONAL IN THEIR CONSTRUCTION

PROJECT OWNERSHIP EPFL OF DAUPHINÉ AND MUNICIPALITY OF PONT DE CLAIX

The aim of the project is to redevelop a 4.25 hectare site consisting of 17 buildings with 14,000 m² of floor surface into an urban renewal operation with integrated housing. This site, located in the immediate vicinity of a school complex and houses, initially hosted a classified activity subject to authorization (manufacture of industrial paints and varnishes). The epfl took possession of the partially dismantled site, the manufacturer having removed all the dry and water systems as well as the chemical storage tanks. The soil from the bottom and edges of excavations was excavated and stored away from buildings.

Dossier submitted within the framework of the Call for Expression of Interest "Regional action in favor of wasteland restoration" initiated by the Rhône-Alpes Region.

THE INNOVATIONS DEPLOYED

- ▶ The innovation concerns the implementation of the project "CRISALID – Centre de Réflexion Isérois en Aménagement Durable" (Isère's center for discussion on sustainable planning), thought out within the framework of the call for projects of the Auvergne Rhône-Alpes Region 'Encouraging polluted wasteland restoration' with the aim of developing innovative techniques to enable a faster and less costly restoration. The CRISALID project sets up its own laboratory to house on-site a start-up incubator in the domain of pollution abatement, a temporary center destined to move every 3, 5 or 10 years.
- ▶ In addition to the demonstration zones and the associated analysis laboratory, the site will include spaces for the training of students and professionals. This initial establishment of the center will enable the implementation of an inno-

KEY DATA

- **2009: Cessation of activit.**
- **2011: Rehabilitation report drafted by the company** [complemented by letters dated 15 May 2012 and 28 June 2012].
- **January 2013: prefectural order no. 2013007-0017** establishing the restoration works to be undertaken within two years from 10 January 2013 and mainly guarding of the site;
 - groundwater surveillance;
 - pollution abatement works.
- **May 2013: Acquisition of the site: €1,274,160 - 4.25 ha** – 9 storage and production workshops, administrative building and laboratory, 6 houses, 1 administrative building, land – 14 000 m² floor surface. The payment for the pollution abatement works is taken into account in the cost assessment.
- **Tripartite agreement between company / Municipality of Pont de Claix / epfl of Dauphiné** relating to the resumption of the commitments for the pollution abatement works under the supervision of the epfl of Dauphiné, the former operator remaining in charge for carrying out the works for the DREAL.

vative methodology for the non-intrusive and online monitoring of the pollution bio-abatement process. This method – called SwAGG for Surveillance of biodegradation coupling Geoelectric measurements and surface Gas analyses – combines integrative geophysical measure-

ments and CO₂ analyses. It enables a full spatial and temporal monitoring of the biodegradation process, while providing a financial gain by reducing the number of surveys and laboratory analyses and by optimizing the treatment process.

STAKEHOLDERS

- ▶ Etablissement Public Local Foncier du Dauphiné (local public land institution of Dauphiné)
 - Town of Pont de Claix
 - Auvergne Rhone-Alpes region
 - MOE: project manager - ENVISOL

IMPLEMENTATION

- ▶ The local publicly-owned industrial and commercial establishment was created by prefectural order dated 31st October 2002 on the initiative of the Agglomeration Community of Grenoble Alps Metropolis and the Departmental Council of Isère. Any intervention by the epfl of Dauphiné

is based on the notion of heritage management over time, with a concern for phasing with the public project, which generates a management and occupation strategy.

- ▶ In the present case, the project is managed as part of the 'Urban renewal' component for a maximum period of ten years. The final use may be housing including social housing, the production of areas for economic use, or a mixed housing/economy operation. It should be noted that since the acquisition of the property by the epfl of Dauphiné, well before the urban project's operational phase, the site has been permanently occupied.

- ▶ An adhoc structure (the legal form of which is currently being defined) bringing together the epfl of Dauphiné, its project manager and other partners, should be set up soon in order to supervise the establishment of the various activities on the site and the Region / epfl of Dauphiné / Moe partnership terms will be studied within the framework of the call for expression of interest or the upcoming calls for projects.

RESULTS

/// Deconstruction of the superstructures

This period enables the epfl of Dauphiné to reflect upon the temporary occupation of the site during the holding period. Within this framework and that of its participation in the work on defining a regional industrial wasteland restoration channel, in partnership with the Auvergne Rhône-Alpes Region and Europe, a joint reflection is underway with its "pollution abatement" project manager on an innovative use.

The epfl aims at systematizing its intervention "process" in order to become more efficient. Its project manager wants to develop new experimental axes in the characterization, measurement and mapping of pollutants in the soil. The analysis of the site (location, pollution), of the ultimate needs for pollution abatement and the availability period have led the epfl and its project manager to search for an innovative, temporary, mobile and economic use, integrating the pollution abatement works still to be carried out.

- **Innovative:** with its concept - mobility of installations – and its philosophy - temporary association of diverse know-how of the 'pollution abatement' channel or related know-how - ;
- **Temporary:** on-site presence for several years but with a short term, the facilities put in place must be mobile: offices, laboratories, installation etc. to be moved to another site of the epfl of Dauphiné;
- **For economic use:** development of new technology, cooperation, sharing;
- **Sustainable:** autonomous power management and generation, mobility;
- **Works:** the aim for the epfl is to clean up the site during this period and to strive to optimize the medium/long-term time factor in its approach to the pollution abatement issues.

FINANCIAL ASPECT OF THE OPERATION

/// Acquisition cost: €1,274,160

/// Phase 1: €1,212 000 committed since 2013;

/// Phase 2: amount remaining to be committed of approximately €565,000 for the final pollution abatement (about €365,000) and the deconstruction of infrastructures (about €200,000).



Contact:

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RECYCLING ASPHALT: GREEN RECONQUEST OF A CAR PARK OR HOW TO RECREATE A GROUND TO SUPPORT A NEW FERTILITY

A CONTEMPORARY AND EXPERIMENTAL ROCK GARDEN

The district of the Maladrerie is a garden city built in the 1980s in Aubervilliers (93). At the city entrance, a former car park is currently in a state of neglect. It has been dismantled: the asphalt layer was broken and left untouched during the summer 2015 to prevent any access to motor vehicles. The car park is now surrounded by barriers. The dismantled car park creates a chaotic landscape, which can be seen and experienced in a variety of ways by the inhabitants. Insofar as a project for the rehabilitation of the district is under study (ANRU 2), the OPH requests a frugal development proposal.

Wagon Landscaping, a landscaping agency, proposed transforming this bitumen chaos into a giant rock garden of 1,500 m². The passage from the smooth plane of the car park to this mosaic of plates, interstices and holes has multiplied the aspects, depths and surfaces making it ideal for the development of a specific and very rich flora.

INNOVATIONS

- ▶ The innovation consists of bringing a renewed fertility to accommodate nature based on a sterile, impermeable and nonexistent soil.
- ▶ Wagon-landscaping carried out the whole mission, including the works. This enabled a reduction in timelines and a better project economy. The description of the project in the study phase remains at the stage of a quantified outline.
- ▶ No watering, development of an extensive garden maintenance at the heart of the city.
- ▶ No export of materials.
- ▶ Creation of living dynamics on a totally artificialized and impermeable ground (the car park is laid on a slab).



KEY FIGURES

- Car park surface area: 1,500 m²
- 45 m³ of substrate to be brought in
- 15 m³ of gravel
- 1,000 perennials
- 2,000 sedums
- 500 g of special seeds
- 100 trees and shrubs more than 150 different species of plants
- Duration of the works: 5 days

STAKEHOLDERS

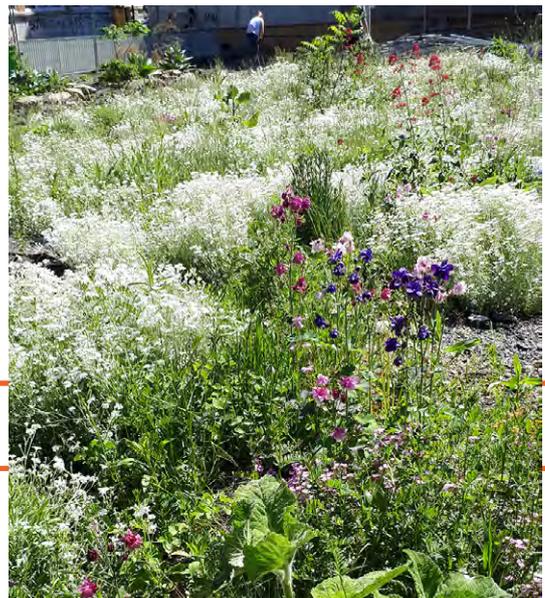
- ▶ The town of Aubervilliers
- ▶ The OPH Aubervilliers
- ▶ The inhabitants of the district of the Maladrerie
- ▶ The local associations
- ▶ Wagon Landscaping and Sylvie Da Costa, artists and landscape architects

IMPLEMENTATION

► Six months elapsed between the initial contact, the design, the presentation to inhabitants and the implementation. This rapid implementation is due to the capacity to create a single mission for the landscape gardeners so they have full control of the project from the design to communication, and then from the realization by their efforts to the maintenance. The works were carried out in 5 days by the Wagon Landscaping team.

► **The two main difficulties identified were:**

- communicating with the population to generate understanding of the approach. A communication plan was put in place in 2018 to organize visits and install an information noticeboard.
- the garden maintenance of the site. This garden requires little maintenance (about 5 visits per year) but it is fragile if bad intervention techniques are adopted. The maintenance requires an extensive gardening know-how to identify the plants and their seeds, act at the right time and perform appropriate gardening work. The question of the transmission of the site management to a company or an authority requires the setting up of a training plan and the continuity of field teams.



RESULTS

- /// 1. Improvement of the living conditions.
- /// 2. The creation of a unique biodiversity-rich garden in a very urban environment.
- /// 3. Improved rainwater management.
- /// 4. No export. The asphalt was kept and recycled within the garden.
- /// 5. Possible medium for observation of natural dynamics in town (evolution of the flora, presence of pollinators).
- /// 6. Educational medium for observation of the living world in the heart of the city.
- /// 7. Demonstration of the possibility of frugal developments in towns.



FINANCIAL ASPECT OF THE OPERATION

- /// The project was funded by the OPH Aubervilliers.
- /// Cost of the service (design, realization and maintenance for 2 years):
30,000 euros excluding tax + 7,000 euros of fences i.e. a cost of 21 euros/m²





SILVER GARDEN OF THE JOLIOT CURIE DISTRICT

PROJECT MANAGEMENT FOR THE LANDSCAPE AND TECHNICAL DEVELOPMENT

MOULON ZAC (JOINT DEVELOPMENT ZONE) – SACLAY PLATEAU (91)

The silver garden project, located on the northern edge of the Joliot Curie district, in the Moulon ZAC (Joint Development Zone), is in an area undergoing a process of rapid transformation to host an innovative urban campus of international stature. The silver garden plot is located at the entrance of the Moulon district, fringing various university buildings. The garden represents one of the links of the hydraulic system on the scale of the Moulon ZAC. It is part of a general and phased reflection on the management of daily and exceptional rainwater.

INNOVATIONS

► Water management, a key issue for the Plateau

Taking account of the nature of the soils in the design of the Silver Garden to facilitate natural water retention. The hydraulic infrastructure falls within the regulation on rainwater management of the Moulon district. Hence, the garden manages and buffers the difference between the 50-year rainfall averages and the 20-year occasional floods from the Ecole Centrale Supélec building held back upstream. This very detailed altimetric work ensures the gravity flow to the lowest point. Apart from a total reduction in water quantities, the wetland thus constituted enables the vegetation to be preserved from any alteration in the winter period. This vegetation layer also helps to expand a natural biodiversity adapted to the ecological conditions of the Plateau.



STAKEHOLDERS

► Project ownership:

- Etablissement Public Paris Saclay (Paris Saclay Public Institution)

► Project management:

- D'Ici Là,
- ALTO STEP,
- GMGB,
- ATP,
- BIODIVERSITA

► Delivery: December 2017

IMPLEMENTATION

► The silver garden addresses several issues:

- Creating an accessible public space by proposing a comfortable, simple lead-in that is evident from the Deck, linked to the future metro station, the Learning Center and the main entrance of the ECPA.
- Developing and supporting new amenity uses.
- Proposing technical solutions to hydraulic management in line with the site's pedological and regulatory constraints.

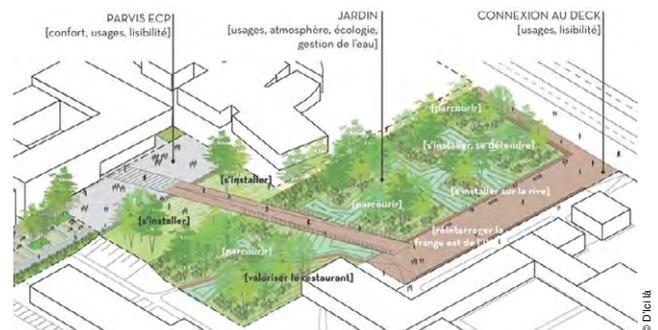
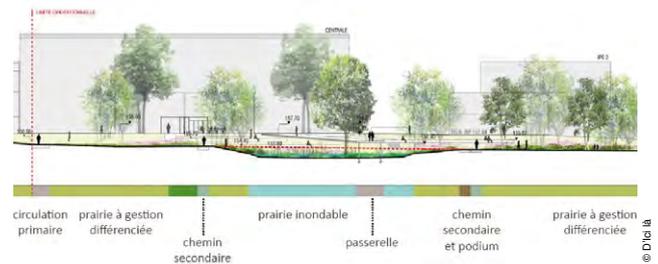
► Development principles of the Silver garden

The development of the Silver Garden is based on the breakdown of the following principles:

- Relating to the soil
- Places to connect
- Places to stroll around
- Places of comfort
- Places for nature
- Relating to trees

► Content of ALTO STEP's mission

- Overall project management (ESQ, AVP, PRO, ACT, VISA, DET, AOR)
- Hydraulic technical design, including the design of a qualitative landscaped retention basin ensuring district-wide rainwater management, in light of the altimetric constraints of the site
- Soil management (excavation/backfill)
- Technical design of external networks, integrating the creation of a walkway
- Economic synthesis of the project
- Creation of the public space digital model (BIM, CIM) connected to the digital model of the Ecole Centrale.
<https://www.youtube.com/watch?v=S3VP1PIU Nmg&feature=youtu.be>



FINANCIAL ASPECT OF THE OPERATION

- /// Total cost of the works: €2 000 000 excluding tax
- /// Programming: A public space in the form of a garden
- /// Area 1 of the Joliot Curie District
- /// Surface area: 1.35 ha





PUBLIC SPACES AT MERIGNAC SOLEIL

MUNICIPALITY OF MERIGNAC (33)

As part of the operation '50 000 new housing units near public transport routes' backed by Bordeaux Metropolis, a strategic opportunity for urban renewal was identified for the Mériçnac Soleil area, in connection with the extension of the tramway line A linking Bordeaux city center and the Bordeaux-Mériçnac airport, in order to support the reclassification of this district which is currently in commercial use into a mixed neighborhood with housing, shops, and facilities.

STAKEHOLDERS

- ▶ **Project ownership:**
 - La Fabrique de Bordeaux Métropole (La Fab)
- ▶ **Project management:**
 - OMA
 - Michel Desvigne Paysagiste (MDP) (landscape architect)
 - ALTO STEP
 - 8'18"
- ▶ **Execution of the service:** 2016-2018

INNOVATIONS

- ▶ The project described and presented here addresses a number of issues related to the city entrances and to the reclassification of commercial zones.
- ▶ The landscaping achievements and developments arising from the guide plan, by reintegrating housing and nature into the city, enable the redevelopment of this commercial zone into a genuine urban entity combining city entrance commercial activities and neighborhood life.



A collection of micro-neighborhoods with a unique and diverse urban culture

- ▶ **The Sustainability strategy of the 2017 guide plan is divided into 3 themes:**
 - **Repermeabilizing and regenerating the soils:** precovered soil permeability, soil regeneration with sustainable techniques;
 - **Developing varied green spaces:** ERCA (avoid, reduce, compensate, support) approach on existing ecosystems, creating new ecosystems and relationships with nature by extending the green and blue belts;
 - **Recovering natural regulation functions:** restoration of the water cycles, identifying and optimizing the reduction of the heat island effect.

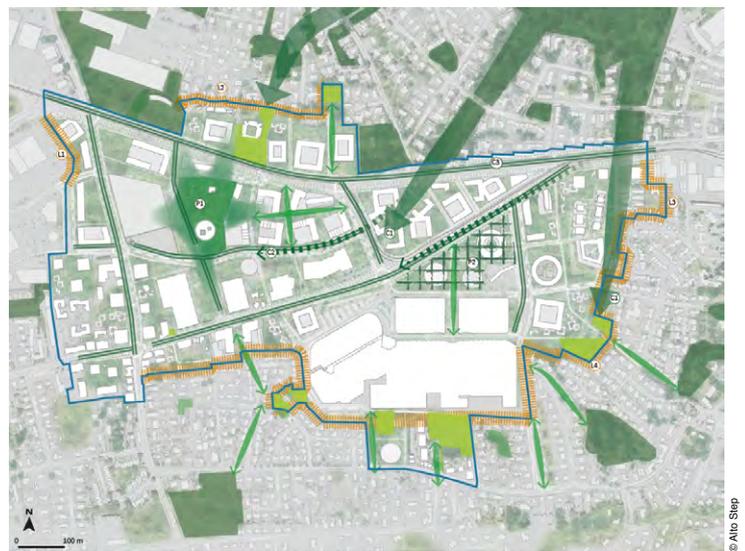
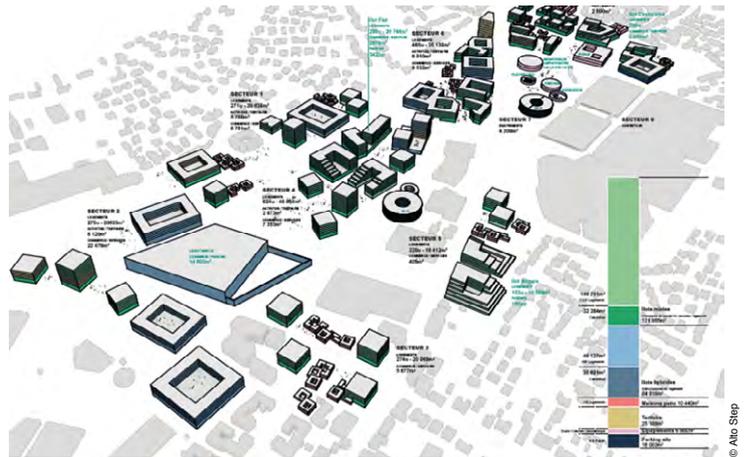
IMPLEMENTATION

► The Mérignac Soleil area is marked by heavy urbanization and intensely built-up areas (about 80% of the perimeter is sealed). Bordeaux Metropolis is implementing a '55 000 ha for nature' approach within its territory, for the purpose of restoring a landscape identity to the town centers, but also to rediscover biodiversity, enhance nature areas and locally establish the green and blue belts of the Metropolis.

► The requalification of the Mérignac Soleil area offers the opportunity to refertilize this territory, by redeveloping areas that are currently sealed into green spaces, and to enhance the nature areas within them.

► Missions of ALTO STEP

- updating and taking further the Guide Plan (OMA, 2012): development of the Sustainability strategy, sunshine study on the scale of the operation;
- establishing the architectural, urban and landscaping requirements and the lot records;
- coordinating the urban project management and monitoring environmental compliance throughout the urban project development process;
- roads and External Networks Project management mission on all the public spaces of the Mérignac Soleil operation;
- preparing the Environmental Assessment dossier for the Mérignac Soleil operation (Impact Study, Feasibility Study on the Potential for Development in Renewable Energy);
- preparing the Water Legislation Dossier;
- analyzing the Guide Plan according to the 'avoid, reduce, compensate, support' (French: ERCA) strategy;
- **assistance à la réalisation de l'étude qualité de l'air.**



FINANCIAL ASPECT OF THE OPERATION

/// Estimated cost of the works (public spaces and networks): 40,000 000 euros excluding tax

/// Surface area: 69 hectares



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REHABILITATION OF A FORMER FERTILIZER PRODUCTION SITE

AS PART OF THE DEVELOPMENT OF THE FLAUBERT ECO-NEIGHBORHOOD IN ROUEN

This site is located in former industrial and port areas and is now in the heart of the agglomeration through a logic of urban re-conquest and enlargement of the Metropolis center. For both TOTAL RETIA and the Metropolis, its redevelopment poses a challenge: to reduce the environmental impact of the grounds linked to the previous industrial activities, and enable the development of the future Flaubert eco-neighborhood, one of the districts with the greatest potential for attraction and dynamism of the territory. All this is only possible through shared objectives and an association from the outset of all the stakeholders, including the project owners and the technical service providers or State services for the inspection and support of this project.

This ambitious project proposes to:

- Transform 90 ha of abandoned areas into a multifunctional neighborhood;
- Reconnect the city to the Seine;
- Integrate in the best way the highway infrastructure project backed by the State;
- Reduce the environmental impact of the polluted grounds;
- Contribute to the development of biodiversity;
- Manage interfaces between the City and the Port.

INNOVATIONS

► The site has been subjected to a historical study and a diagnosis of the soil and sub-soil condition, and to a cost-benefit analysis of the remediation techniques applicable to the site. The rehabilitation measures decided on involved the excavation and on-site treatment of a part of the soil. The other part required treatment offsite. The rehabilitation works were launched at the beginning of 2014 and completed in June 2016.

► The following should be emphasized for the successful rehabilitation of the site:

- A permanent priority given to safety
- The important study phase which integrated a third party's full expert assessment of the dossier,
- Ambitious rehabilitation objectives, in particular for the radiological aspect,
- The assistance from specialized companies as a complement to the consultancy firms and construction companies: Permanent presence of the Project management and the Company specializing in radiology during the 2 years of works, support from the company specializing in pyrotechnics during the sensitive phases.

STAKEHOLDERS

► The Project owners

- TOTAL RETIA (rehabilitation of the Grande Paroisse site)
- DREAL Haute-Normandie (Road development of the permanent connection of Pont Flaubert)
- Rouen Normandy Metropolis (Urban project)
- Rouen Normandie Aménagement (Urban project on behalf of the Metropolis)

► The inspection and assistance bodies

- DREAL Haute-Normandie: Sites and polluted soils
- Prefecture of Seine-Maritime: SIRACEDPC

► The technical providers called upon by the Rouen Normandy Metropolis or RETIA:

- Project management consortium Atelier Osty / Attica / Egis / Burgeap
- Environmental consultancy URS AECOM
- Project manager ARTELIA
- Rehabilitation works company SOLEO
- Radiology assistance company ALGADE

IMPLEMENTATION

► Following the soil characterization, performed by the Metropolis, its planner (Rouen Normandie Aménagement) and the EPF of Normandy, several options were chosen:

- The slightly polluted soils were excavated to constitute a wooded mound in a park in order to contain the polluted soil underneath: this procedure enables the development of biodiversity, mitigation of the heat island effect in the city, and an environmentally and economically responsible management of these soils.
- Specific treatments, such as bioremediation into a biomound were put in place in areas not being used in the short term.
- Finally, on the former fertilizer production site of Grande Paroisse, a project partnership was formed between the various stakeholders in order to bring about changes in the town planning. The choice was made to allocate this space to public use at the highway viaduct and to

economic development in light of the rehabilitation cost and the potential risk of non-compliance with a residential use even after rehabilitation. This adjustment on this area of the future eco-neighborhood required the full re-examination of the major urban and programmatic equilibriums.



RESULTS

/// The rehabilitation of this site has the particularity of bringing together many problems: radiological, chemical, asbestos, pyrotechnic. The radiological pollution comes from the use of phosphate (which contains elements of the uranium chain) as a raw material in the complex fertilizer manufacturing process. The resulting soil pollution is considered as Reinforced Natural Radioactivity (RNR). It is worth noting in particular as part of this rehabilitation:

- Characterization of the chemical and radiological contamination of the site in the various environmental compartments,
- Several security operations to search for metal objects buried under the ground, in cooperation with the Prefecture,
- Discovery of a bomb forcing an immediate suspension of the works followed by an intervention by the Prefecture services to remove it, with the setting up of a safety perimeter and evacuation of 150 persons of the neighborhood,
- 2 km of sewer network completely opened and cleaned out,
- 12,000 t of soil treated on-site and then kept for backfill on-site, including: 9,000 t of soil contaminated by hydrocarbons treated by landfarming and 3,000 t of acidic soil treated with limestone,
- 23,000 t of soil evacuated to authorized channels: 15,000 t of soil contaminated by cyanides and 8,000 t of soil radioactively contaminated,
- A final gamma dose rate mapping in order to validate the remediation objectives,
- 0 accident target achieved thanks to the strong commitment of all the partners to security,
- Monitoring of the personnel and the environment (ambient air and groundwater) for the radiological and chemical aspects.

FINANCIAL ASPECT OF THE OPERATION

/// The global budget for the rehabilitation of this site is about €10 M of the €240 M of the Eco-neighborhood project.





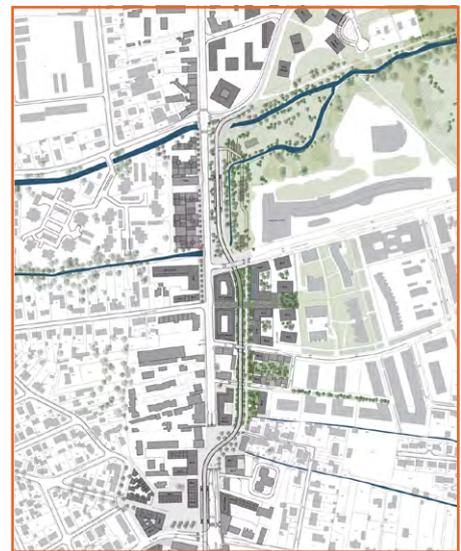
DESIGN OF PUBLIC SPACES AROUND AN URBAN PUBLIC TRANSPORT

WHEN DEVELOPMENTS AROUND A PUBLIC TRANSPORT MAKES IT POSSIBLE TO LIMIT SOIL SEALING, ENHANCE THE EXISTING HYDRAULIC NETWORK, AND REINFORCE THE VEGETATION COVER, IN KEEPING WITH THE URBAN SITUATION OF THE PROJECT SITE: TWO EXAMPLES.

As part of two projects, the green lane of the road from Toulouse to Bègles and the project in the railway station area in Châteaurenard, the consultancy firm ALTO STEP supports the local authorities to accommodate green and blue belts across the territory that link with the transport routes. Indeed, the programming of these development projects around a public transport network includes the creation of many public spaces, a green lane, and central green spaces.

ENVIRONMENT OF PROJECTS

- ▶ **The road from Toulouse to Bordeaux** is currently a transit point, leading towards the city center of Bordeaux from the southern bypass. This route is subject to heavy congestion on weekdays. The extension of the tramway line and the development of a meeting area adapted to soft modes of transport near the service road will enable a better modal split, as well as a densification of the surrounding urban fabric. The construction of housing near the tramway line will make it possible to address the environmental issues with a view to achieving a 'short distance city' and is included in the operation "50,000 new housings around public transport corridors until 2030" supported by Bordeaux Metropole.
- ▶ **The urban project of the Châteaurenard railway station district** includes a total of 930 housing units, 12,381 m² of commercial activities, and 4,943 m² of facilities (including a school and a medical center). The programming provides for the creation of many public spaces, including: the redevelopment of the Genevet Boulevard, the creation of a green lane on the former railway line, several green spaces and a main square.



STAKEHOLDERS

- ▶ **Toulouse road**
 - **Project ownership:** La FAB (Fabrique Métropolitaine de Bordeaux Métropole)
 - **Project management:** PDAA Pranas-Descours, Agence Ter, Alto Step, Sepia
 - **Execution of the service:** 2015-2017
- ▶ **Châteaurenard**
 - **Project ownership:** Town of Châteaurenard
 - **Project management:** OBRAS, Horizons Paysages, Alto Step, Trajéo, Transversal
 - **Execution of the service:** 2016-2025

IMPLEMENTATION

- In both cases, the mission concerns all the public space project management missions from the Outline phase up to the assistance to the guarantee of perfect completion phase, as defined by the MOP law (ESQ, AVP, PRO/DCE, ACT, VISA, DET, AOR, DOE, assistance to the guarantee of perfect completion).
- As regards the environmental aspect, the missions concern:
 - Update of the urban project: setting the environmental targets by area;
 - Realizing a study of opportunities for renewable energy and common networks;
 - The drafting of environmental technical requirements for the public spaces and private constructions;
 - The analysis of building permits for the environmental component;
 - Participation in consultation workshops for the whole urban project.

RESULTS

/// Main choices of the Chateaufrenard urban project

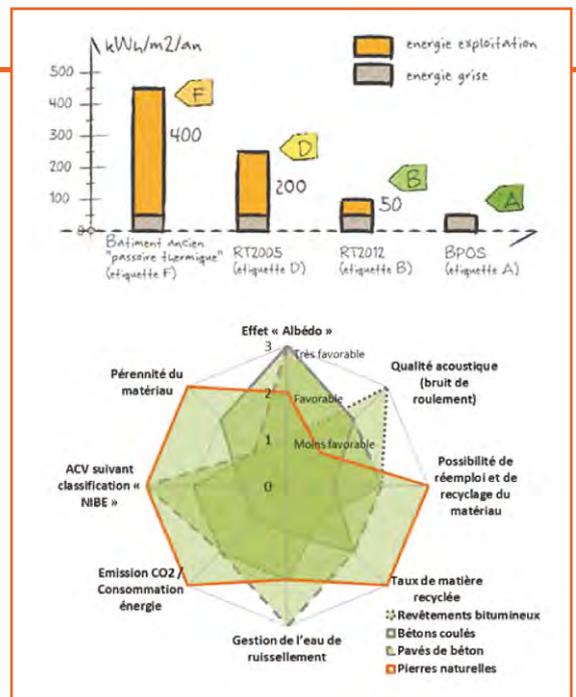
The aim is to set up a public transport lane on the Genevet boulevard, while supporting the relocation of the wholesale market (marché d'intérêt national – MIN) scheduled for 2025: the project therefore proposes to change a boulevard currently used by heavy goods vehicles to and from the MIN into a public space that can host the Saturday morning market for the public, the major events of the municipality, the parking needs for events, and so on. It is also an opportunity to enhance the views of the castle's hill and preserve and enhance the vernacular urban heritage and more specifically that related to the rail activity.

Environmental ambitions of the project

Promote sustainable developments, limit soil sealing, enhance the existing hydraulic network, reinforce the vegetation cover, propose sustainable development objectives in keeping with the urban situation of the project site.

/// Green lane of the Toulouse Road ZAC (Joint Development Zone)

The arrival of the tramway provides the opportunity to develop soft modes of transport along the service road, set back from the car flows of the Toulouse road. The direct proximity of remarkable natural environments (Mussonville park, estey de Franc) influenced the decision to create a green lane in this area. It was therefore decided to develop a lane designed as a true vegetated "lane-park", in continuity with the Mussonville park. The public space thus supports both mobility and biodiversity. Ultimately, 1.5 km of green lane will be developed within the joint development zone (ZAC), along the service road.



FINANCIAL ASPECT OF THE OPERATION

/// Toulouse road/Bègles/Villeneuve d'Ornon

- Estimated cost of the works (public spaces and networks): 7,300,000 euros excluding tax
- Surface area: 10.6 hectares



PRANLAS-DESCOURS

agence ter



/// Chateaufrenard

- Estimated cost of the works (public spaces and networks): 15,900,000 euros excluding tax
- Surface area: 40 hectares of studies / 26.4 hectares operational





KEY FIGURES

- More than 95% of the polluted land managed in situ.
- A project area of 45 ha
- 7.5 ha of building sites for economic activities and housing
- 5.5 ha of urban parks
- 10 000 m² of leisure and commerce areas
- 6 300 m² of offices
- 38 000 m² of activity premises to be rehabilitated

↑ The Hall in One leisure and shopping complex.



NOVACIÉRIES (SAINT-CHAMOND, LOIRE)

A DISTRICT BUILDING A NEW FUTURE

Novaciéries is located south-west of the Saint-Chamond town center, at the edge of the Pilat Regional Natural Park. Novaciéries has an area of approximately 45 ha and is mainly made up of the large industrial zone called “anciennes aciéries” (former steel mills) where metallurgical activities were developed from the 19th century onwards.

Following the departure announced in the early 2000s of GIAT Industries and then SIEMENS (the last 2 large companies installed on the site of the former steel mills), the local authorities started a process of wide-reaching reflection on the state and the fate of this vast area.

Negotiations were conducted with GIAT Industries for the programming of pollution abatement actions on its former tenements; many important diagnoses in terms of polluted soils and buildings were ordered, programming and feasibility studies were planned and delegated...

On this basis, the Aciéries ZAC (Joint Development Zone) was created in 2010 and by a vote of the population, a name was chosen for this project: NOVACIERIES: symbolic and ambitious, it refers both the glorious past of the site of the steel mills and the ambition of novelty and future now placed on it. Since the end of the 2000s, Saint-Etienne Metropolis has had overall control of the project, in liaison with the town of Saint-Chamond and the various partners. However, for its operational implementation, it has decided to entrust the continuation of the studies and the realization of the works to the local public company Cap Métropole for a period of 15 years.

INNOVATIONS

► One of the major challenges is the treatment of the site’s pollutions built up over 200 years of industrial activity. The formation of a heap of more than 1,600,000 m³ of coke back-fill and foundry sand whose arsenic and lead concentrations must be integrated into the environmental and health management of the site. As well as the impact on the soils and groundwater of organic elements from hydrocarbon pollution, fuel tank leaks, transformer leaks, and occasionally the impact of components related to leaks of quenching pits or to the use of degreasing agents. This innovation entails creating a platform for the management, recycling, treatment and control of contaminated soils within the joint development zone, according to an appropriate management plan, approved by letter by the Prefecture in 2010.

STAKEHOLDERS

- **Project management:** Saint-Etienne Metropolis
- **Partner and co-funder:** Town of Saint-Chamond
- **Planner:** SPL Cap Métropole
- **Land leaseback, pollution abatement, demolitions:** EPORA
- **Funders:** Auvergne-Rhône-Alpes Region, Loire Department, ADEME, European Union (dossier in the process of filing under the ERDF)..
- **Other partners:** state services (DDT42, DREAL, etc.), Club Gier Entreprises and local economic fabric...

IMPLEMENTATION

► Creation of a platform for the sorting, treatment and control of contaminated soils on the site of the Acières, managed by Cap Métropole and other public planners (Saint-Etienne Métropole and EPORA), which receives all the earthwork excesses (mainly those considered as unhealthy in the site's management plan) in order to define their condition for reuse or their treatment.

► Creation of a containment cell for excess excavated earth contaminated by heavy metals. This containment cell is located in a former 'crater' created by the military industry to trial and test the war vehicles built on-site. The design of the cell had to ensure that it fitted into the constraints and the topography of the area resembling a crater, in order to limit the excavation works. Thereby, the 3 existing 'terraces' which are remains of the military activity and of the test beds of armoured vehicles will be kept and will constitute three foundation zones for the cell. This 'crater' is being progressively filled, tier by tier, with an interior containment to avoid a migration of pollution towards the soils in place, and an exterior containment to prevent pollution runoff and the possibility of coming into contact with it. The con-

tainment cell has a storage capacity of about 45,000 m³ and is at present filled to slightly less than half of its capacity.

The following economic assessment is identified for the management of the NOVACIERIES lands:

- **Reduction of treatment costs compared to a classical management:**
 - from 22 to 56% of organic pollution
 - 80% of inorganic pollution
- **Gain on the management costs** of the sorting platform compared to the classical management of excavation works of €6 - 8 excluding tax per tonne of excess excavated earth
- **The limitation of greenhouse gas emissions:** the Carbon Footprint performed in 2012 shows a reduction in greenhouse gas emissions estimated at about 475 tonnes of CO₂ i.e. the emissions from 20 cars each driving 200,000 km.

RESULTS

/// **Theme 1 : ICpE (Installation classified for Environmental protection) tenement by the former operator (GIAt):** The pollution abatement carried out according to the current legislation, subject to Prefectoral Order, of about 7,600 t of materials contaminated by organic pollution (THCs, VOCs, PAHs, PCBs).

/// **Theme 2 : Pollution abatement of the hotspots excluding ICpE tenement by the EporA:** First finalized phase of pollution abatement of about 3,700 t of materials contaminated by organic pollution (THCs, VOCs, HVOCs, PAHs, PCBs). In the long run: there remains between 2,000 and 5,500 tonnes of contaminated soils to manage depending on the development projects.

/// **Theme 3 : Management of excavated earth (Excesses) outside hotspots: Three main development phases finalized:** PHASE 1 - treatment and sorting by the platform of about 60,000 tonnes of soils contaminated by heavy metals/ PHASE 2 - treatment of about 5,200 t of materials contaminated by organic pollution (mainly THCs and PAHs)/ PHASE 3: there now remains about 40,000 m³ of excess excavated earth from the different construction projects to be managed (75,000 t).

→ Selected in 2010 by the Rhône-Alpes Region, "Sustainable Neighborhoods of Rhône-Alpes".

→ Novaciéries has been granted the Ecodistrict label by the ministry of environment and aims at getting level 3 for 2019.

→ These investments were subsidized by the Auvergne-Rhône-Alpes Region, ADEME and ERDF funds.

FINANCIAL ASPECT OF THE OPERATION

/// **The total cost of the project about €80 M excluding tax (acquisitions, studies, works...) distributed into:**

- 31% for land acquisitions, evictions, demolitions, pollution abatement,
- 59% for the works.

/// **Income:**

- €28 M excluding tax from sales of land, leases of buildings, subsidies,
- €51 M excluding tax of participation from Saint-Etienne Metropolis.

SAINT-
CHAMOND

SAINT-ÉTIENNE
la métropole

Loire
LE DÉPARTEMENT

capmétropole
Aménagements publics

EPORA

ADEME
Agence de l'Environnement
et de la Maîtrise de l'Énergie

UNION EUROPÉENNE

L'EUROPE S'ENGAGE
en région
Auvergne-Rhône-Alpes
avec le FEDER



VIGISOL,

A SCIENTIFIC, TECHNICAL AND OPERATIONAL MECHANISM
AT THE HEART OF TERRITORIAL MANAGEMENT

PRODUCING, EXPLOITING AND SHARING SOIL DATA TO SUPPORT THE DEVELOPMENT PROGRAMS OF STAKEHOLDERS

Vigisol, a non-profit association, was created to reinforce and consolidate a partnership established in 2008 between a teacher-researcher from the University of Caen Normandy, whose applied research topics place the soil as a major interface in territorial management, and the SAFER of Lower Normandy which, by virtue of its public service tasks, mobilizes rural and peri-urban land to support a balanced agriculture, promote local development, and contribute to the prot.

INNOVATIONS

- ▶ Making an inventory of soils and their properties and mapping their spatial distribution.
- ▶ Characterizing since the end of the 1990s the consumption patterns and dynamics of agricultural, natural and forest areas linked to urbanization.
- ▶ Developing applications based on this data to produce tools and databases relating to: the agronomic potential of soils (SQUAT model), the vulnerability of catchment areas (PRADO model), water erosion risk (MASURE model), agricultural production constraints due to climate change (STAR model) and the consequences of land artificialization on rain water infiltration, on soil carbon storage, on agricultural productions, and on the spreading capacity of farmland effluents (PICTUS model).
- ▶ Undertaking training initiatives on the functions and services rendered by soils, and becoming involved in regional and national scientific popularization events in order to make the broadest possible public aware of the need to encourage initiatives such as those of Vigisol.

KEY DATA

- Vigisol: association under the law of 1901 created in 2011
- 30,000 surveys to map the soils
- Normandy observatory on land consumption by urbanization since 1998
- Development of 5 decision aid applications for local territorial management
- A partnership with more than 400 municipalities

STAKEHOLDERS

- ▶ Local authorities of the 5 departments of Normandy
- ▶ Syndicat d'eau SPEP Sud-Calvados (SPEP Water Syndicate of South-Calvados)
- ▶ General education and professional schools
- ▶ DREAL of Normandy
- ▶ DDTM of Calvados

IMPLEMENTATION

- ▶ The SAFER of Normandy endeavors to provide human, material and financial support to the scientific production and promotion of the data generated by both soils mapping and the observation of land consumption by urbanization. In return, it uses this information to carry out its public service tasks and the provision of services to various stakeholders within the territory with whom the SAFER of Normandy enters into agreements (operational backing).
- ▶ The technical and scientific backing of the production and exploitation of the data relating to soils and land consumption is ensured by Patrick Le Gouée, teacher-researcher at the University of Caen Normandy. His involvement comes down to managing the soil mapping, developing decision aid tools, drafting popularization articles, communicating results in seminars and conferences, as well as undertaking training initiatives for diverse audiences (individuals, primary and secondary school pupils, stakeholders within the territory).

Jean-Pierre Féret,

Departmental Council of Orne
Mayor of Orgères
President of the Association des Gîtes de France in the Orne

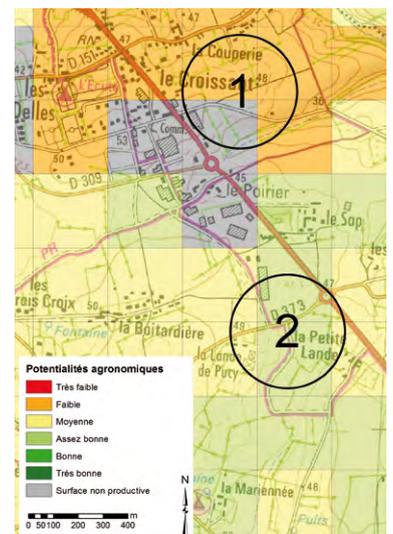
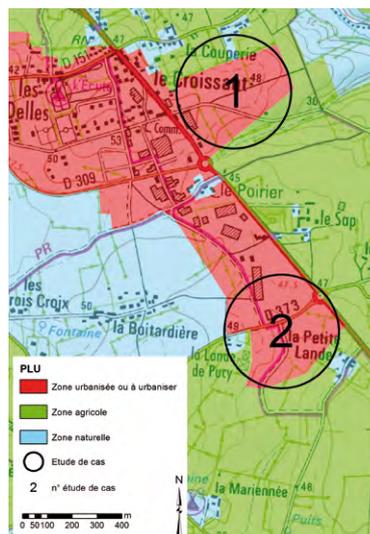


For us, at the Departmental Council of Orne, it is very important to know the soils and, with Vigisol, we are able to know the quality of the grounds as we are currently planning to deviate transport routes around the town... We must protect good farmland and, with Vigisol, we can immediately find out about the land to allow the best grounds to be left to agriculture, for Orne's agricultural economy.



RESULTS

- /// Observation of land consumption by urbanization over the last 15 years shows that Normandy loses 2700 ha of agricultural, forest and natural land every year, and that at this rate, agricultural land could totally disappear in 7 centuries. This should raise awareness and lead us to rethink the conditions of urban development.
- /// The fine-scale mapping of the agronomic quality of soils now allows local authorities to target areas to be urbanized without encroaching upon good farmland and to reclassify some areas to be urbanized as agricultural land, thereby limiting urban spread.



The PRADO model provides a precise and complete diagnosis of the vulnerability of catchment areas, favoring the multi-partner building of an action program with the aim of protecting the water resource in a sustainable way.

FINANCIAL ASPECT OF THE OPERATION

- /// The actions of Vigisol are exclusively funded by the Safer of Normandy.

→ The funding from the Safer of Normandy for the works of Vigisol is part of a multi-year investment strategy voted by the Managing Board.



Powered by French creativity

The Vivapolis network aims to federate French public and private stakeholders involved in conceiving, building and operating sustainable cities, in France or abroad, in order to improve synergy and help them be, individually and collectively, more efficient in their action.

These sheets have been produced by the Vivapolis network members who attended different work groups to promote examples of innovative solutions for sustainable cities.

www.cohesion-territoires.gouv.fr/vivapolis

