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RECREATING NATURE IN CITIES: A RESEARCH PROGRAM FOR THE RIVER'S RENATURATION IN THE GREATER LYON

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HIGHLIGHTS

- Expose the firsts insights on river's renaturation in compact cities.
- Restoring nature in the cities trough the urban project approach.
- City planning and water management retrospective in the Greater Lyon area.
- Apply urban acupuncture principals for river restauration in highly dense areas.

ABSTRACT

From the 19th century, in Western Europe, urban sanitation was meant to create sewers as well as bury small rivers. With the impulse of environmental laws, engineering schemes that once aimed at shaping vegetation around the city is now trying to reintroduce it in the most natural way possible.
In that context, river restoration appears to be a strategic tool for the development of cities. It is also about linking districts to each other with plant pathways, creating public spaces, all while dealing with the issue of heat islands. River restoration designates the re-establishment of a river's natural functions, which used to be highly anthropized.
After a rhetorical review, the paper deals with the firsts results of Lyon's river restoration research program. This research program is enacted by the Greater Lyon, the CNRS (National Centre for Scientific Research) and an engineering agency Artelia. The paper especially treats the subject of Rize's restoration. A former river which was entirely buried in the 19th century. This study contributes to the research on the "shallow" concept of a sustainable city through the consideration of the benefits and shortcomings of recreating a river in a dense urban area.

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1. INTRODUCTION

Since the "Plan Bleu" policy has been implemented in 1991, the Greater Lyon Administration has launched two extensive works sites combining water and town planning.
The first site was intended to reshaping a large industrial harbour area located at the entrance of the city. In order to do so, two new fluvial districts have been built. The first of these districts is the "Cité Internationale", now located north of the city, and conceived by Renzo Piano before its delivery in 2006. The second one, the "Confluence" "éco-quartier" (green neighbourhood), is located down south, from a design by Herzog and De Meuron, with the assistance of Desvignes for the A3 area, with a delivery expected sometime in 2017. The second extensive work for Greater Lyon has been the landscaping of the banks to the Rhône (designed by Tardivon in 2007) and the Saône (first section achieved in 2016). Those projects were aimed at connecting the northern and southern city's urban projects whilst highlighting its rivers

Figure 1: « Lyon-Confluence », Lyon's newest district. *Source : Technivue "Vidéo aérienne: Lyon confluence" – June, 12, 2014)*

Figure 2: Rhône's river redesigned banks. *Credits: Llewella Maléfant (UMR 5281 CNRS, 2016).*

The agglomeration strengthened its European attractiveness to companies and responded to metropolitan challenges for sustainable development (Béthemont & Pelletier, 1990; Gérardot, 2004). Greater Lyon promoted its waterfront by reconquering industrial-harbour wastelands. As titled in 2007 by the French newspaper Le Monde, the city "has reconciled with its rivers". However, at the

time, Greater Lyon did not properly renaturalize its rivers nor its affluent (Brun, Coursière, Casetou, 2014). Most of the work done until now has been about landscaping and not about actual ecological restoration – unlike the cases of the Saint Charles low river, an affluent of the Saint Lawrence River in Quebec (Brun, 2015), and of the Saw Mill River, an affluent of the Hudson River in Yonkers (New-York).

In Western Europe, however, the small urban river's renaturation poses numerous challenges (Carré, 2011 ; Brun, 2015). Indeed, these small rivers were laid-out and buried from the mid-19th century onwards because of many large sanitation works. With pressure from the Hygienist movement, municipalities buried waterways in order to limit epidemics and reduce olfactory nuisances. Damages caused periodically by flooding also encouraged engineers to dam rivers or bury them. Since then, most small urban rivers merge with the sewers network (Mauch & Zeller, 2008). A big part of them are now damaged in France as well as in many cities around the globe (Morley & Karr, 2002) – Lyon being no exception.

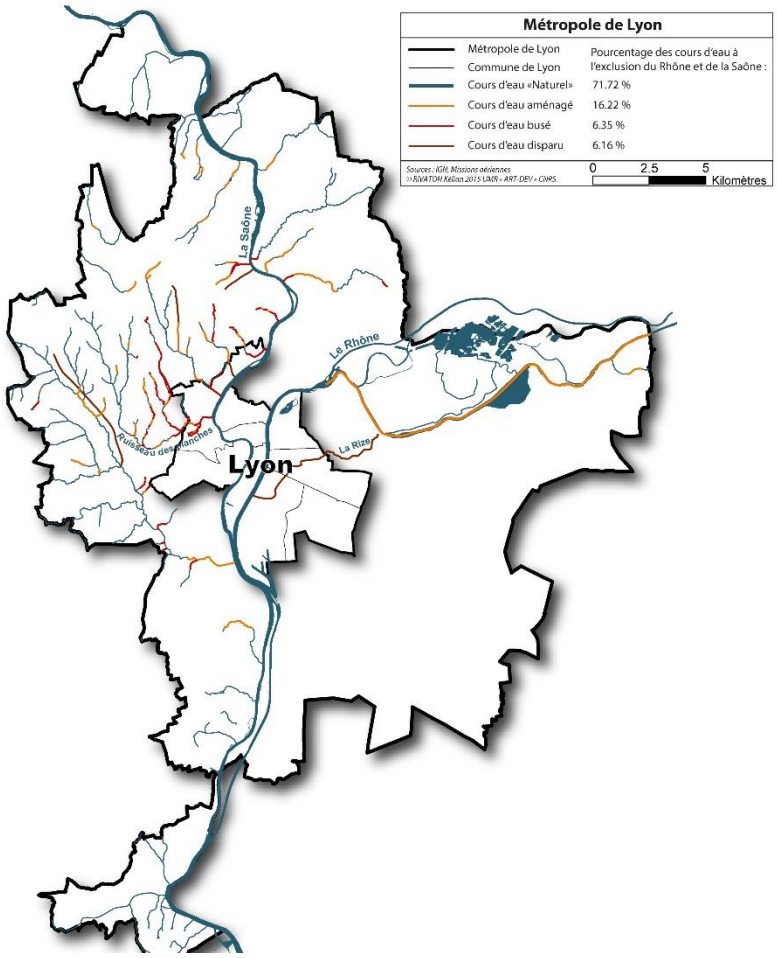

Figure 3: Lyon's river's Hydromorphological state. *Source: UMR 5281 CNRS, 2016.*

The word renaturation means "restoring a watercourse natural functions, especially if it is strongly anthropized". It is a voluntary and planned action, with the owner/builder often being a public agency. Since it has been shown that more than water is needed to restore a wetland (Zedler, 2000) or a river (Bravard, 2000), research has been made since the late 1980s in order to find complementary and efficient ways to handle water. The scientific community developed research programs specialized on rivers' physical restoration to deal with the aquatic environment quality deterioration problem – the ecological state of waterways being linked to hydrologic and hydromorphological processes (Amoros & Petts, 1993; Malavoi & Bravard, 2010).

There are currently over 160 plans and projects in the world, 75% of which are located in Europe and North America (Idarraga, 2010). This number is actually quite far from Morandi and Piégay's estimates (2011), with more than 400 projects identified in France alone. In fact, programs like the framework directive on water management (2000) and the "Grenelle de l'Environnement" (2007) are very much in support of these kinds of initiatives. Re-profiling and putting back waterways in thalwegs were works which were mainly achieved in rural areas, the reason being that land use management is easier to achieve in rural areas than in cities. Indeed, there are major challenges in dense areas: city

lands bordering the waterways are generally built on, there are more underground networks, and the land prices are much greater. In early-1980s Germany, the term "renaturierung" was used to refer to an urbanistic acceptation about Emscher Park in the valley of industrial Rhur (Scherrer, 2004).
In some cities such as Lyon, the hydrographic network was extremely dense and characterized by a very specific organisation, which partly explains the current shape of the city. Today, the renaturation of big rivers is proven to be impossible because of the urbanization and flooding issues as well as because of extensive filling in the 19th century in marshy areas (Perrache, Brotteaux). However, the small urban rivers renaturation is still projected. This article focuses on the main objectives and challenges of a research-action program, as well as the first results relating to the Rize's downstream recreation experimentation.

2. OBJECTIVES, ISSUES AND METHODOLOGY OF A RESEARCH ON THE RENATURATION OF SMALL URBAN RIVERS

2.1 The Ruisseau des Planches renaturation project: the origin of the program

A city planning university workshop which gathers students, researchers and architects, town planners, landscapists, engineers has been set up since 2012. This workshop echoed to a job run by William Hayet (architect) on the relation between city and water leaded by the Lyon school of architecture one year earlier. The goal was to conceive an alternative plan and program of development developed from A to Z which was far away from the usual plans that included nature only on an aesthetic level. The university workshop, which ended in 2015, was based on three research corpus:

1. The Lyon city and Rhône county archives, with the purpose of identifying the small missing urban rivers and finding their layout
2. Public inquiries in order to include the social practices and the inhabitants' perceptions about the small urban rivers
3. A urban diagnosis centered on buildings and urban framework (wastewaters, drinking water, rain water, gas, electricity, urban heating, public lighting, etc.) in order to assess the feasibility of technical solutions.

Meanwhile, two axes were also taken. A first one with the waterway ecological discontinuities and disturbances cartography in Lyon; created with the Greater Lyon administration technical services help. This job was based, on research relating to small urban river physicochemical quality and hydro-biology; and field surveys. It was indeed necessary to raise a "rivers health" report on a metropolitan scale. The second step was about interacting with the urban development, landscape and ecology leaders, in order to analyze their interest with the renaturation as well as the regulation feasibility. The result of those steps is the "Ruisseau des Planches" renaturation project in Vaise.
Vaise is a former popular neighborhood located in the northwest of Lyon. It goes from of the Duchère plateau on the West to the Saône's banks of the Saône to the East. The 12 hectares study area is the cross point with three distinct entities: the former village of Saint-Rambert-l-Ile-Barbe in the north, the old industrial suburb Vaise in the center, and the western Duchère district built in the 1960s which welcomed a large part of immigrant from North Africa. The perimeter includes some commercial wastelands, a small factory (the Maurin fabric, which is supposed to be re-located in the suburbs), two cars dealerships and housing buildings in poor conditions.
The "Ruisseau des Planches" stream structures the urban renewal project. Its program uses Vaise's industrial identity and the stream in order to redevelop the neighbourhood. After the land and

buildings acquisition, the project tends to work on the old automobile fabric and selling spaces: the program plans to design a more compact automobile center instead of the existing larger car dealerships. Beyond the only sales areas, which are devoted to the subcontractors, commercial spaces and offices devoted to research and development are considered. Those spaces, mainly located at the ground-floor buildings, answers the need to host and redevelop a local know-how in the car production field. The different private or public projects are of course guided by the new linear park around the "Planche" stream. The stream would be renatured on a 630 meters' length. The section today buried under the Maurin fabric would be reopened and vegetalized.

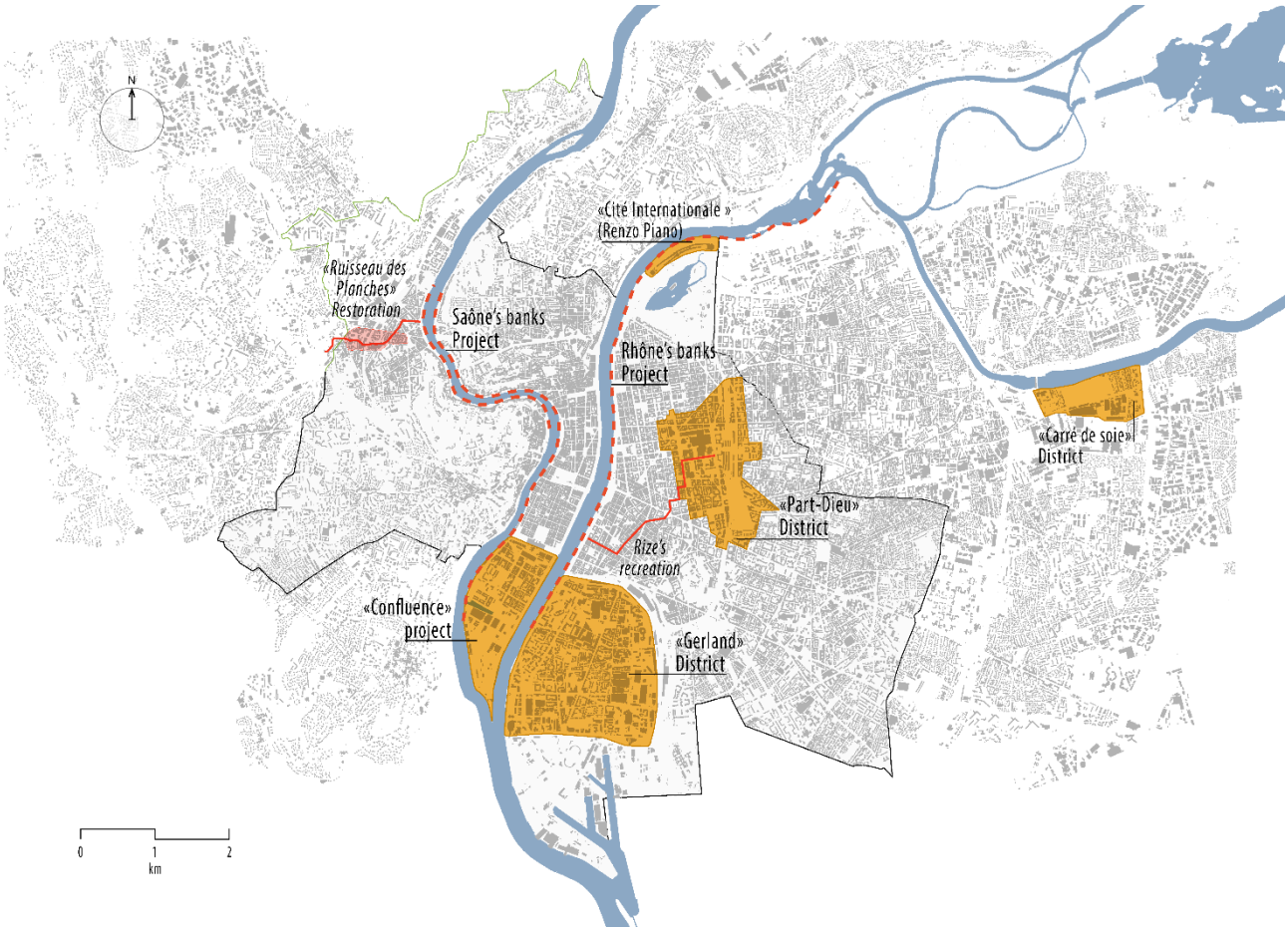

Figure 4: Lyon's urban projects and resarch program on rivers renaturation. *Source: UMR 5281 CNRS, 2016.*

This operation aim to reorganise the totality of parcels by putting the new buildings away from the waterway to limit floodings risks. Fields would be restructured according to landscaping principles (according to the activities' vulnerability to floods). The Stream's banks would be planted (low landings) to reconstruct a riverside forest. The "Planches" stream program, which would last from 10 to 12 years, answers the main concerns of local executives. It would double the housing area and create public equipment's, such as day care, to help and organise displacements in the area. Finally, the program plan to create sale spaces as well as office blocks that follow the market reclamations (comfort, security, environment). The project originality is the green considerations and the river restauration. Its estimated cost approach an hundred million euros (value from 2015).

Figure 5: "Ruisseau des Planches" renaturation: actual state and ground plan project. *By Paul Garcias (UMR 5281 CNRS, 2015)*

2.2 An exploratory approach oriented towards the urban project

The "Ruisseau des Planches" is a heterogeneous project that facilitates the reduction of flooding risks, the management of rain waters, and political priorities of the local town planning project (office buildings, and at least 25% social housing per new housing buildings). It also allows to physically connect two neighborhoods ignoring each other: the popular Duchère upstream, and the bourgeois banks of the Saône. The site is a positive place for the hybridization of the city and nature due to its field characteristics: weak population density, current soil usage, etc. In this way, it is more about revealing the « genius loci » (human geography, topography) rather than building an aboveground project, it looks like the urban development project process such as it is seen by Paola Vigano, David Mangin, Philippe Panerai or Alexander Chemetoff. In 2017, the Grand Lyon's Board of Directors will launch a regulation procedure which would allow an invitation to tender of architectural and urban conceptions, which is a compulsory precondition to the installation of a development zone based on the scale of a perimeter study.
The implementation of such an exercise in a sector much more densely urbanised was obvious to the team. In situation of "research-action", it was also necessary to introduce the problem of a "resurrection" project of a completely gone river (Brun, Caltran, 2015). The research program PR[eau]JET URBAIN explores the operational dimension of the renaturation concept by linking the city regeneration and the water. The river Rize, a former affluent of the Rhône which used to link up the sector of Jonage in and the Brotteaux district, was kept. The approach of PR[eau]JET URBAIN can't be applied in the case of the river Rize, because one does not deal with in a given site. It actually makes a punctuated line of small sites (square, public gardens, etc) in a mutating urban space. The recreation of the river Rize goes through very punctual and displayed actions. That is why our step looks like Lerner's concept of "urban acupuncture" (Lerner, 2014).

3. THE LOST RIVER'S RECONQUEST: THE RIZE'S CASE

3.1 The Jonage channel construction and urbanization altered the Rize's line and flow

According to Lyon's local archives, Jonage's channel building and the urban sprawl changed the line, level and flow of river Rize. Jonnage's channel was dug between 1894 and 1899 in the northweest of

the Greater Lyon to create a Rhône's derivation towards the hydroelectric plant from Cusset in Villeurbanne. The Rize was therefore cut following these constructions. Only the North part of the Rize still remain an open river. The south part of the channel which used to meandered in the Guillotière and Brotteaux's humid plains disappeared because of city's development.

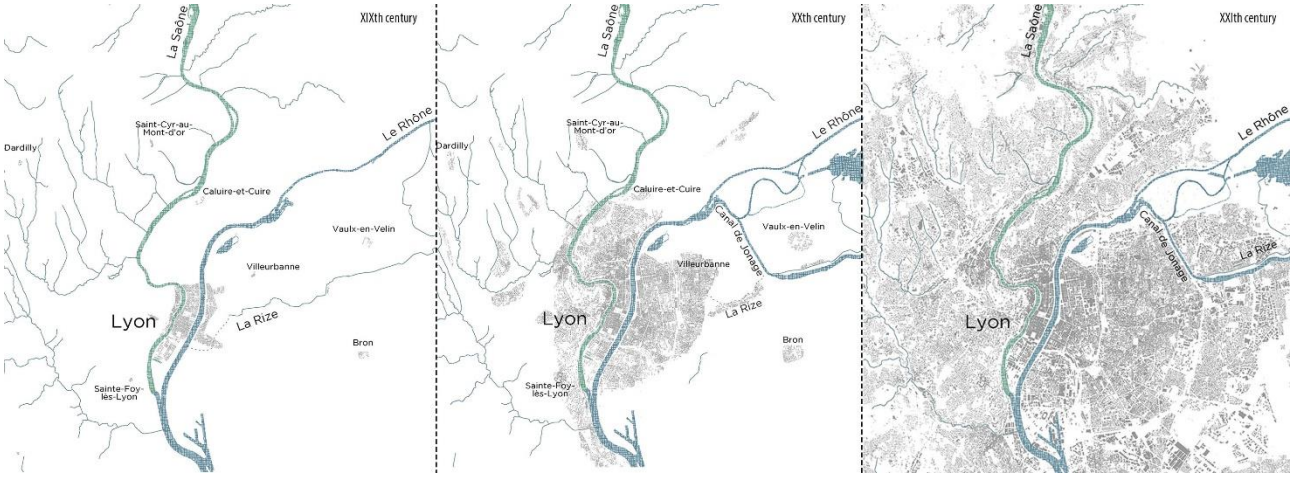

Figure 6: Greater Lyon's urban growth and small rivers extinction. *Source: UMR 5281 CNRS, 2016.*

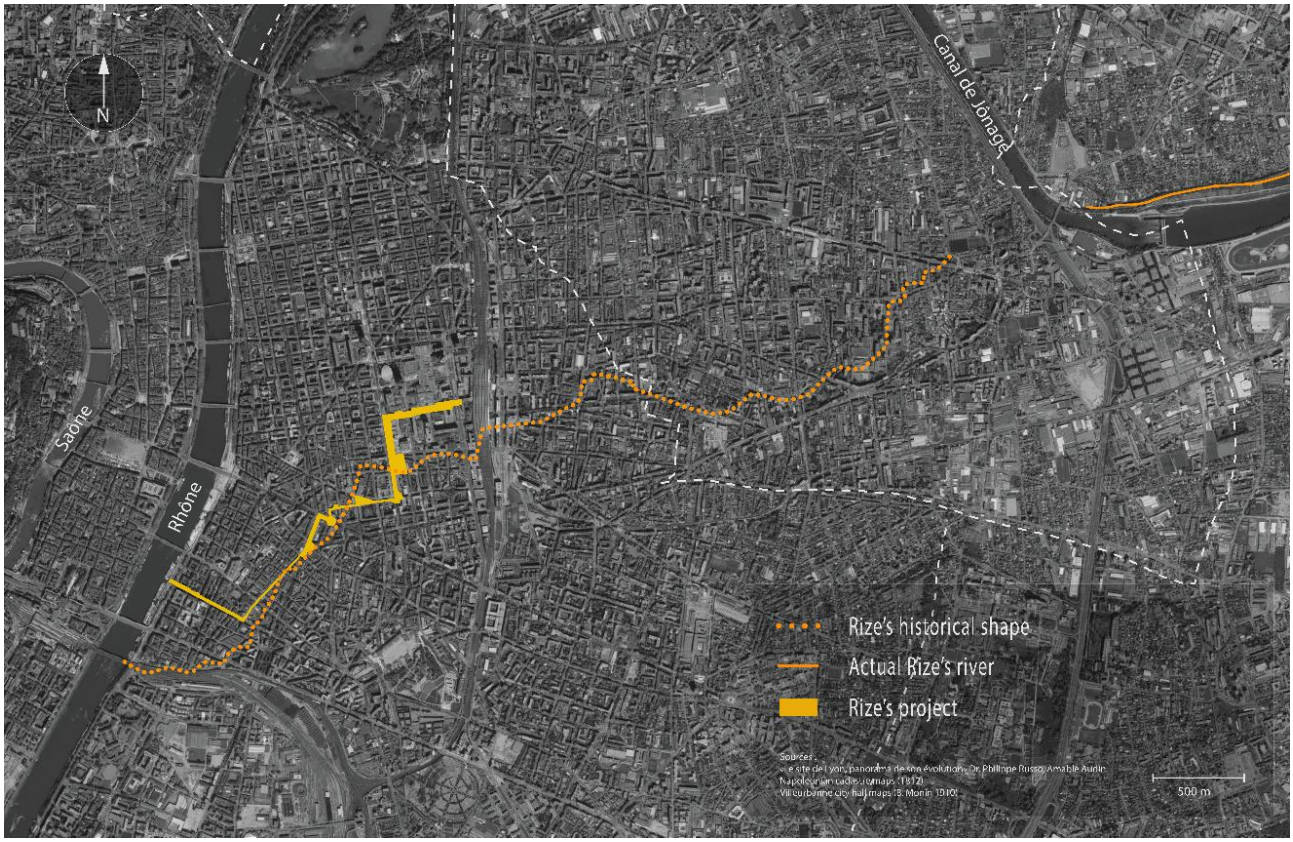

Figure 7: Rize's historical shape and project line. *Source: UMR 5281 CNRS, 2016.*

However, the Rize river still partly flow in the form of an underground network (mixted with the

sewers) located at a small depth (1-1 meters under the natural ground); especialy in the "Part-Dieu" district (Caltran, 2013). The Rize also appears partially in the Villeurbanne city were residential neighborhoods take place. A public survey done in 2015 show that the river is still present in the collective mind of Lyon's residents. Especially in Villeurbanne where it gives its name to public equipment, streets and housing buildings. The Rize's south part as however completely disappeared (between the "Part-Dieu" district and its confluence with the Rhône). In that case, the Rize river strongly differ with the "Ruisseau des Planches" program quoted before. That is why the Rize's program is more about recreating a river rather than renaturing it (Brun & Caltran, 2015).

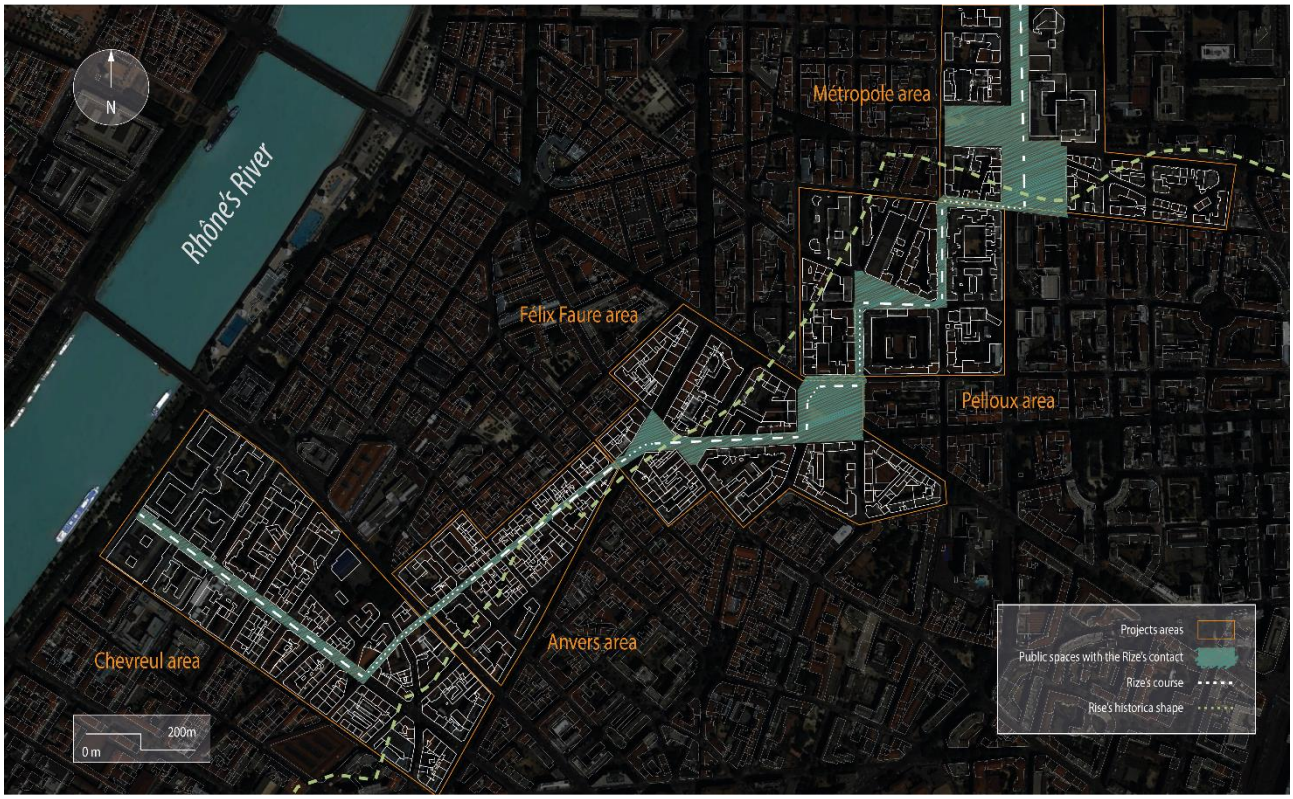

Figure 8: Rize's renaturation ground plan. *Source: UMR 5281 CNRS, 2016.*

3.2 The 4 axes of the project to recreate the Rize downstream

With the achievement of a meticulous historical and technical work - which at the same time intended to identify the historical line of the Rize river and elaborate a technical diagnosis - in 2015 and 2016, the "new Rize" project is focusing on its south area of the Part-Dieu district. This sector is now highly urbanized and gather the city's main resources. The project general intervention plan includes five key sectors and is based on four supplementary axes.

Axe 1 – The beginning of the project is explained by the drainage water management problem. The Part-Dieu construction site (second biggest business district in France after Paris) is subject to a vast urban renewal operation. One of this operation aspect is the underground water management. It requires to evacuate the Rhône water source during the time of construction (estimated at twenty years) because of the pressure on the buildings foundations. According to Caltran (2013), water drainage will probably have to be permanent because of the location (very close to the Rhône water source) and the geological nature of the soils.

Axe 2 – The renewal and modernization of the water underground networks consolidate the project legitimacy. The Greater Lyon should, on one hand, renew its aging water networks (constructed between 1850 and 1950) and on another hand, optimize the rainwaters management (the point is to separate the rainwater network from the sewer system). It is now a question of reducing the loss of water lines in developing a new separate management system. The idea of building this kind of network is the following: wastewater is processed into the underground pipes (modernization of sewers) while the rainwater is evacuated outdoors into specialized gutters, vegetated gaps, and restored waterways. The Rize would be filed with drainage waters (during its regular period) and with rain water (during the rainier seasons). In that way the river would "live" like a regular watercourse and this alternative way to supply the Rize as the benefit to reduce the costs of rainwater management in the "Part-Dieu" district.
Axe 3 – Using the Rize to combat the heat islands. Greater Lyon has revealed its Territorial Climate Energy Plan, however, this plan includes few concrete propositions. The preliminary diagnostic (2009) showed the elevation of diurnal and nocturnal temperatures (measured in urbanized areas in the summer). A study done in 2016 by Grand Lyon confirmed that the open spaces (parks, places, wooded streets, rivers) limit the influence of heat islands in the eastern part of Lyon. The future placement of the Rize has been adapted to contribute to the limitation of the effects of these heat islands on the general health of the population. Two factors could help contribute to this: Firstly the Rize will offer open public spaces, and secondly the water could help to lower the temperature of the earth up to 0.5°c.
Axe 4 – Developing an ecological continuity to link neighborhoods to each other. The sidewalks landscaping along the Rhône and the Saône rivers had the effect to create a link between larger urban operations situated in the metropolis Northern and Southern part. However, the Part-Dieu district is shut off from these green axes. One of the Rize's purpose is to connect the Part-Dieu district to the Rhône's banks through green public places, gardens. Today, theses public spaces are mainly streets of various sizes: from 9 meters (Anvers street) to 32 meters in size (Garibaldi street).

3.3 The firsts urban and ecological orientations in the south area

The "Chevreul" sector is the most downstream. It is generous in term of public property (the land belongs to the City of Lyon and to Greater Lyon), but, the technical problems are numerous. The slope of the streets which go through the Rhône's banks have an inverted gradient, opposite to the one necessary for the proper waters drainage of the "new" Rize in the Rhône. The public allotment of parking places is inconvenient, and the networks of water and energy needing to all be led away, are ones of the problem encountered on the site. These conceptual difficulties brought the team to change the scale and to initiate the thought of a new plan including the urban islands situated nearby: the idea being that every street has a preferential function and that on the scale of the neighborhood, these functions are complementary to some of the others (public transportation and soft mobilities, car traffic, and, of course, ecological continuity). Following this plan, one of the streets will become primarily landscaped and would completely host the Rize (a "street park" about 17 to 25 meters in size). Most of the streets, spaces, squares, and public gardens would retain their status and especially their hierarchy would be consolidated. Only the path that would be worked on to become an ecological and pedestrian continuation would be greatly remodeled. It is not a question of becoming "all ecological" as municipalities contributed to in the 1960's becoming "all car". The irrigating of streets and structuring a city to attribute to a single use would be a mistake.

Figure 9: Rize's project perspective in Chevreul street and its actual state. *By Paul Garcias (UMR 5281 CNRS, 2015)*

The development plan and firsts image of the Rize restoration was focused on the "Chevreul" area. That plan was presented and discussed in 2015 to a local focus group organized and created with the association of Lyon's university 2 and took place in the Chevreul sector. The results showed a large public approval which is a good point for the project concretization appropriate to the sector and. One of the remaining key questions is how to combine the ongoing projects on the Part-Dieu district with (e.g. the requalification of Garibaldi Street), the Rize. What it is certain is that the Rize's project, as well as the Part-Dieu renewal, will have significant impacts on the Grand Lyon water management.

4. CONCLUSION

From the late 19th century, cities engineers and planners have been conscious about the uncontrolled urban sprawl. Therefore, many of them have since tested (experimented) many ways to reconnect cities to nature: we can mention the "garden cities" in the United Kingdom (Howard, 1902) or the "villes nouvelles" program (literally "new cities") in France. These urban designers were, then, guided by a technician and a Saint-Simonian model which conducted them to cultivate the idea of a "wilder nature" serving the urban conception for the coastal cities. More precisely, in the South of France, « nature » has been a pretext for the development of coastal and seaside cities between the 1960s and the 1980s.

The drawl of the sustainable development (mostly in Switzerland, Germany and Scandinavian countries) have once again contributed to put nature in the center of urban design. Although this « nature » has been a cornerstone to urban growth for the past 150 years, the cities ecological footprint (especially the metropolis) has never been so important.

In that context should cities be "renatured" despite the risk of misusing nature once again. The results so far obtained with the Lyon's river restoration research program suggest that renaturing urban rivers gives concrete solutions to the, still shallow, sustainable development concept. Renaturing is about reopening small rivers which were buried under the 18th century hygienist impulse; in other words, it is about using what is left of nature, to create greener urban continuities. Those would be socials as well as naturals and would allow neighborhoods to reconnect to each other.

It is the nature, the one that is almost six feet under, which as to be the pillar of future urban projects. They may be less ambitious then before but far more faithful to the identity of the place. Cities should not be a "nature's wonders" but the masterpiece of human and nature relationship.

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