



POLYTECH[®]
TOURS

Département
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Ecole d'ingénieurs
polytechnique
de l'université de Tours

CITERES
UMR 6173
Cités, Territoires,
Environnement et Sociétés

Equipe IPA-PE
Ingénierie du Projet
d'Aménagement, Paysage,
Environnement

Projet de Fin d'Etudes

ELABORATION OF AN ASSESSMENT FRAMEWORK OF THE PROFITABILITY OF MULTI-USE FLOOD MITIGATION INFRASTRUCTURES

***EVALUATION OF THE GLORIETTE FLOODPLAIN
CASE STUDY, IN TOURS, FRANCE***



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2014-2015

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RESEARCH TRAINING AND FINAL PROJECT STUDIES

ENGINEERING PLANNING

The training in engineering planning, provided by the Urban Planning Department of the Polytechnic School of the University of Tours, associates in the field of urbanism and urban planning, the acquisition of basic knowledge, the acquisition of techniques and know-how, a training in professional practice and in research training. The latter does not intend to form only the students who wish to further their training through doctoral studies, but by opening this path, it aims firstly to promote the ability of future engineers to:

- Increase their skills in professional practice through the mobilization of knowledge and techniques, which foundations and content were explored as thinly as possible to ensure a good intellectual and practice mastery
- Enhance the ability of engineers in urban planning to innovate both in terms of methods and tools, mobilisable to confront and solve complex problems about spaces organisation and management

The research training includes an individual or collective exercise, the final year project (Projet de fin d'études, PFE), occurring during the last years of the engineering planning students' training. This exercise corresponds to an internship with a minimum duration of three months, mainly within the Engineering Team of Planning, Landscape and Environment Project of the UMR 6173 CITERES to which belong the teacher-researchers of the urban planning department.

This research project, whose main objective is to acquire a methodological ability in terms of research, must answer one of these two objectives:

- Develop all or part of a method or a new tool for the innovative treatment of an urban planning problem
- Deepen the basic knowledge to better face a complex issue in terms of urban planning

In order to valorise this research project we decided to put online the reports from the good mention.

FOREWORD

This research project necessitated readings, surveys and interviews.

Any reference to the content of interviews, writings other than strictly personal, any reproduction and citation are systematically subject of a referral.

The authors of this report have signed a declaration of non-plagiarism on their honour.

THANKS

This project could not have been achieved without the help of some persons. So we would like to thank them.

- As a first step, we would like to thank our tutor, Mathilde Gralepois, master of conferences at the François Rabelais University of Tours and teacher at the Urban Planning Department of the Polytechnique School of the University of Tours, for her regular follow, her support and her assistance. We appreciated her knowledge on prevention and flood risk management and her experience as a researcher in the risk and urban planning themes.
- Our thanks also go to Amandine Gatien-Tournat, post-doctoral researcher and member of the TRANS-ADAPT Team, an European research program. Her remarks permitted us to progress in our work and her recent thesis experience was a plus for us.
- Then, we would like to thank all the French team members of the TRANS-ADAPT project, such as Mathieu Bonnefond and Marie Fournier for their advice on our working method.
- Finally, we are grateful to all the persons we met and contacted during this research project, for the time they gave us. Thanks to all the information they shared with us we have been able to better understand the territory of the Gloriette and thus propose an assessment of this site.

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A research subject centred on a global issue

Climate change: an alarming context

Nowadays, climate change is a global issue affecting all of us, directly or even indirectly. In fact, the human activities are influencing the climatic characteristics and modifications of the basic earth settings are becoming visible nowadays. Indeed, everybody knows that temperatures and sea level are rising, that glaciers are melting, that the quantity of greenhouse gases in the atmosphere is increasing and that natural disasters like hurricanes, tornados, tsunamis, landslides or floods, clearly saw their number increase since 1960 (EM-DAT).

In response to all these dramatic changes, public authorities are encouraging people, at every scale, to be more careful to protect the planet for future generations. For now, generally the emphasis is clearly made on environmental protection and reduction of greenhouse gases emissions. In order to achieve these goals, efforts are particularly made on energy transition, evolution of green transports or nature conservation. These actions aim at minimising the impact of humankind on the planet to limit climate change.

Risk management, an important need to act

Furthermore, we can see that natural disaster risk management, which aims to minimise the incurred risks by the society as much as possible, is not one of the most highlighted public policies. It is not as mediatised, important and widespread as energetic or environmental policies, so we chose to work on this issue.

In fact, concerning energy and environment, we can see that numerous policies and objectives exist since the Kyoto protocol in 1995. Internationally for example, industrialised countries have set an ambitious target to reduce the emission of greenhouse gas. By 2050, they aim at reduciing their emission by a factor of 4 in comparison to 1990. On the European scale, another objective exists, called the 3x20, which consists in reducing both the consumption and the greenhouse gas emissions by 20% and increasing the share of renewable energies by 20%. So, in terms of energy and environment the objectives are well known and widespread. In terms of risk management, there are not such ambitious and widespread goals; there are mainly local or national initiatives while the problem is international. Locally, in France there are for example the protection plans for natural risk and the issue of risk management is treated in the local urbanisation plan (PLU) for example. Also, during the conferences such as the “Grenelle de l’environnement” the issue is treated but still not enough. An effort still needs to be made by the international community to make this aspect as important and mediatised as the energetic or the environmental ones.

Besides, the awareness of the ability to control and manage the risk is relatively new, in comparison to the awareness of the capacity to minimise our environmental impact on the planet. In fact, nowadays we all know that a lot of little actions can be done by everyone to minimise our environmental footprint, like driving electric cars or taking the public transports, consume less water, turn off the lights, separate wastes, etc. Risk management concerns a bigger scale than the individual one, so it is more difficult to apprehend and to spread. That is why fewer things have been done for now in the risk management sector. That is also a reason why we chose to work on risk management in particular.

The importance of urban areas

At a more spatial scale, the choice was made to focus on the question of risk management in urban areas in particular for one major reason. Cities seem to be the most interesting areas to study because they represent the biggest stakes, not only humanly speaking but also in terms of economic and societal impacts. Indeed, the density and the population are more important in that kind of space, which makes them more vulnerable than other territories. Moreover, according to INED'S file (Populations et Sociétés, n°394, Octobre 2003) global population could reach 10 billion people by 2050, which will only increase the human stake.

Flood: the major risk for the cities

The question of risk management in urban areas is still a vast topic that needs to be even more restricted to be treated. Indeed, choosing one type of natural disaster would make the subject more precise and workable. So the choice was made to focus on flood risk for multiple reasons. Flood risk can be defined as the product of flood hazard and stakes in a given area. In case of flood it results to a temporary submersion, fast or slow, natural or artificial of a usually out of water area.

Knowing that historically cities often built themselves around water, the hazard is then important, so working about flood risk in particular, instead of considering all kinds of risks, seemed to be a relevant choice. What is more, as it was said before, urban areas represent the biggest stakes, so considering flood risk as the product of the hazard and the stakes, it seems particularly interesting to focus on flood risk. Besides, flood represents nowadays the most frequent of all natural disasters with a share of approximately 34% of all the natural disasters occurring in the world since 1960 (EM-DAT, 2007). So once more, it is appropriate to focus on that kind of risk. Finally, they are the most damaging natural disasters in the world, which makes them all the most interesting.

What management operations to deal with flood risk?

Studying the question of flood risk mitigation in urban areas obviously brings out the question of the initiatives, works and infrastructures implemented to protect cities from devastating floods.

Flood mitigation gathers all the solutions and measures made to manage and control flood water movements. It can be divided in two types of adjustments: flood protection and flood management. The first one aims to build infrastructures to keep water from coming into the territory. The most common examples to illustrate this type of adjustments are dams or dikes. The second type of flood mitigation measures, flood management, consists in coping with the risk, not by blocking water flows but by dedicating some areas to welcome water to ensure that populated areas are not damaged. Floodplains and retention ponds are good examples of flood management measures.

Furthermore, multi-use planning, the concept of using a place at the same time for flood mitigation and one or multiple other activities, is a relatively unknown but interesting approach of flood mitigation. It seems nowadays to be a relevant way of acting against flood that can apply to both flood protection and flood management operations. Besides, this approach perfectly fits into the actual urban sprawling issue that cities are actually facing. The next part will introduce and define more precisely this concept, which will be the main purpose of our research object.

Multi-use, a rising response to flood mitigation

A complex definition

The notion of multi-use concerning infrastructure to protect or deal with flood risk is fairly new. In contrast, the Glossary of Environment Statistics made in The United States in 1997, gives a definition of the “multiple land use”. This notion refers to “*the use of land for more than one purpose, for example, grazing of livestock, recreation and timber production. The term may also apply to the use of associated bodies of water for recreational purposes, fishing and water supply*”. We can transpose this definition to the multi-use for flood infrastructures. In fact, in that case, multi-use means that there are at least two different uses of a place or an infrastructure. In the case of our research project, infrastructures are made to manage flood risk or to mitigate impacts of flood, as we explained before, and this is the first use. The second use could be diverse: park, freeway, sport installation, museum, restaurant, etc.

The different uses can take place at the same time or not. Generally, when we talk about structures to manage flood risk, the first use, that is to say receive water when the river is in flood, prevents the operability of the other uses. But if we look at infrastructures to reduce flood risk, all uses can be operational at the same time. The following paragraph gives some examples to support this definition.

Diversity in the multi-use

To illustrate this concept applied to flood mitigation works, we can take the example of the Afsluitdijk, a 32 kilometres dam in The Netherlands. This infrastructure was made to limit flood risk due to the Zuiderzee, a bay of the North Sea in the northwest of the Netherlands. This dam is also used as a

freeway to connect both ends. Its construction began in 1927 and ended in 1933. This is a good example of a multi-use infrastructure because it is used both to control the flood and to ensure a connection between the ends.



Image 1: The Afsluitdijk¹

But infrastructures to manage impacts of flood, like floodplains or retention ponds, can also have multi-use on them. This is the case of many retention ponds in Vitrolles, a city located near Marseille in France. The city is subject to an important flood risk because of its proximity with the Mediterranean Sea and the presence of lakes. To deal with that, the city built 18 retention ponds. These basins are made to receive water during a long period of rain, especially in areas where a big part of the ground is waterproof. The city decided to use them another way, for example one of them is a velodrome.

¹ Wageningen UR. "Wadden Works at the Afsluitdijk: A Safe Sea Defence through New Nature." Accessed December 9, 2014. <https://www.wageningenur.nl/en/show/Wadden-Works-at-the-Afsluitdijk-a-safe-sea-defence-through-new-nature.htm>.

People can bike on it when there is no water, but when there are heavy rains, the velodrome is used to receive water, in order to limit the spreading of water in the area.



Image 2: Velodrome and retention pond in Vitrolles²

Multi-use in France: conciliation of prevention and development

French policy for flood management is largely submitted to European guidelines. In 2007, the European Parliament and the Council created a flood directive relative on the assessment and the management of flood risk. This directive has three major objectives on a watershed scale: a preliminary evaluation of the flood risk, a mapping of flood hazard and flood risk for floods of low, medium and high probability, and finally the development of a flood risk management plan. This directive was transposed in the French system by two laws, the first one in 2010 bringing national commitment to the environment with a specific part on risk prevention. The second one in 2011, concerns the assessment and management of risk in France. The evolution of French management in flood risk is already very interesting because France is frequently exposed to flood. In fact, the ministry of Ecology, Sustainable Development and Energy declared in 2013 that 11% of the population is exposed to flood risk and 3.7 billion housings are located in a

² Veronique Genoulaz. Bassin de Retention Mixte : Pour Une Vraie Intégration Urbaine. Spport de présentation. Vitrolles, June 3, 2014. http://www.eaurmc.fr/fileadmin/grands-dossiers/documents/Grands-dossiers-Assainissement/Journees_pluviales_2014/Marseille/5_-V_GENOULAZ_-_Bassin_de_retention_mixte_Vitrolles_-_Version_modifiee.pdf.

flood risk area. Therefore, this part will be devoted to the evolution and the changes in flood mitigation policies in France, in order to replace multi-use in this context, where public policies changed from a rather resistant and protective strategy to a more preventive and integrated policy.

During the 19th century, societies wanted to control flood risk, so many structures like dams and dikes were built and people believed they would “destroy forever the flood” (“détruire à jamais les inondations” in French, Duveau, 1967). In fact it was increasing the vulnerability of the territory. Later, in the 20th century, it was the end of the “zero risk” ideology. People actually understand that the risk, its strength and its damages are unpredictable so the objective starts to change. For public policies, the idea is not to control and avoid the risk anymore, but to prevent it and limit its consequences.

Following that, in 1982 planning expertise is given to the municipalities and the Risk exposure plans are established (“Plans d’exposition aux risques”). In 1995 these plans become risk prevention plans and more specifically in our case, flood risk prevention plans (“Plan de prévention des risques inondation”). They aim at delimitating strong risk areas, where urbanisation should be forbidden, and low or medium risk areas where constructions are subjected to conditions. The objective is to limit the impacts by limiting constructions and activities.

The end of the 20th century has also been characterized by the consideration and the respect of the environment. Flood risk management now includes, not only the limitation of constructions in high-risk areas, but also the protection and conservation of floodplains. The concepts of resilience and risk acceptance have been encouraged by the law of July 2003, providing “the principle of conservation of natural floodplain areas” (Flood risk management in Europe – Similarities and differences between the STARFLOOD consortium country, 30 May 2003) and also by the Ministry of Environment of local Actions Plans for Flood Prevention (PAPI).

Moreover, there is an awareness of public authorities, which seems to promote the non-urbanisation in flood risk areas and even the demolition of buildings in an exposed zone or the recapture of floodplains. For example the agglomeration of Poitiers set up a policy of floodplain acquisition, in 1994. Thus, buildings located on the floodplain of the Clain were demolished, the soil was depolluted, and parks were developed. Another example is the Miribel Jonage Park, located near the city of Lyon, where an island was created thanks to two channels from the Rhône, to receive water. After the evolution of legislation the vocation of this space changed many times. In fact, projects to build economic structures like hotels were forbidden.

In addition to these changes in flood management policy, there is a strong mobilisation of populations and associations. It was the case in the French city of Toulon for example. Retention ponds were built to protect the neighbourhood of Sainte-Musse, and today they are also used as sports grounds, playgrounds or skate parks. The establishment of multi-use on these spaces was not a population’s initiative, but the way it is managed now has been influenced by inhabitants. One example is the fact that inhabitants wanted to have at least one retention pond filled with water, to educate residents on the role of these basins. As a result, the multi-use of one retention pond changed, and was made to receive water permanently.

To conclude, given the evolution of flood management policy in France, we can see that the increasing consideration of prevention and non-urbanisation in flood risk management raises the question of what can be done or not in areas exposed to flood. These areas are land reserves, and local communities often want to develop these areas and exploit them to have economic benefits. This is for example the case in Mimizan-Plage, in the south of the country, where a three-storey building was built at less than 100 meters from the coast while the “Loi littoral” forbids it. So in this context, multi-use is a totally relevant initiative in the sense that it can answer the major challenge nowadays, which is to conciliate urban development and flood prevention.

Research issue

Following the work and researches done until now, a major question came. All the mobilisations and the changes in the laws, can lead us to a reflection: multi-use is originally set up to turn a normally unused space into a profitable one, but if we evaluate this multi-use, is the profit real?

This question will be the thread of this research project and the goal is to figure how the multi-use can be evaluated. This kind of evaluation can be done through one case study, preferably in France because we know French legislation better. Among some French case studies of multi-use, the one of the floodplain in the French city of Tours: La Gloriette, appears to be the most relevant. This case seems interesting for multiple reasons. First because there are several uses on this floodplain and the different activities we can find there were made by different actors in different periods. Therefore, assessment and evaluation of this place will then be more complete, because of the number of activities and the complexity of their implementation. Besides, the proximity of the site will be an asset to make appointments with the different actors easier than if we had chosen another case study.

A research project closely related to TRANS-ADAPT

Our research project is closely related to the TRANS-ADAPT project. It is a European research program which began in November 2014. It gathers 10 researchers from four different countries: France, Austria, The Netherlands and Ireland. This project is interested in “the multi-use of flood alleviation schemes with respect to social transformation in communities exposed to flood hazards”. It is based on the fact that there are more and more local initiatives, especially concerning the integration of the protection and management infrastructures in the urban development.

The TRANS-ADAPT research project is divided into 5 different stages, called work packages (WP) and each work package is led by a University of the research program. The first WP is led by the University of Tours, and we can see that it entirely corresponds to the subject we chose to study. Indeed, the aim of this work package is to offer a framework to evaluate local initiatives for the management of flood risk infrastructures and their multi-use design, which is exactly what we previously decided to work on through our research project.

Besides, to achieve this assessment framework, the WP1 proposes different evaluation criteria: economic efficiency and effectiveness, technical feasibility, accountability and legitimacy, vulnerability reduction, social justice and applicability. Thereby, our study will lean on the study of these evaluation criteria. We will define each of them and try to question their operability and their relevance through the analysis of the example of the Gloriette Park in Tours, like we explained before.

To make this evaluation we will, in the first part of this thesis, propose an evaluation method, based on the TRANS-ADAPT criteria beforehand defined. All criteria go with indicators, which permit to turn a reality fact into an evaluable data. These criteria and indicators could be qualified according to the case study and the context of the evaluation. Then we will study the case of Tours, thanks to several interviews with different actors of this space. To finish, we will make an assessment of the evaluation method and criteria. In the conclusion, we will try to use other examples studied to put into perspective the assessment realised. These different cases will not have the same vocations and will not be necessary floodplains but retention ponds also, so it is interesting to take a look at them.

PART I: A GENERAL ASSESSMENT FRAMEWORK FOR MULTI-USE FLOOD MITIGATION INFRASTRUCTURES

This first part of the work will consist in the elaboration of the analytical framework of multi-use flood management infrastructures. As it was said in the introduction, the method will be based on the TRANS-ADAPT criteria. The idea is, in the first place, to understand the criteria to adapt them to our work and our research issue and make them more understandable. Some of them can be kept or others can be modified, according to our subject. We will try to define them precisely and bring out indicators for each of them to make them assessable more easily thereafter. Thus, this first step will bring to a general analysis grid. The second part will then consist in the elaboration of an adaptation method of the assessment grid just realised in order to make it adaptable to any case study of multi-use infrastructure.

I. Five criteria for a complete evaluation

This first sub part will present precisely every criteria forming the analysis framework, namely economic efficiency, technical feasibility, accountability, social justice, and vulnerability. The third criterion, accountability, will be divided into three sub criteria because of the extent of aspects it covers. For each one, a precise definition, including the scoring that can be obtained by an infrastructure, will be presented, followed by the explanation of the indicators elaborated for their analysis.

1. Economic efficiency: a global criterion close to cost-benefits analysis

Concerning flood risk management, the economic aspect is important. Indeed, flood hazards cause important material (and human) damages, being the source of the economic paralysis of the concerned area. The private or public buildings repairs and renovations but also damages on the different networks (transports, telecommunication, water and energy) create important cost for the society. For example, the torrential flood in the Var, in 2010, touched 1000 companies, caused the death of 25 people and the financial damages were estimated to 1 billion euros (Ministère de l'Ecologie, du Développement Durable et de l'Energie, 2011). The prevention principle, applied in French flood risk policies, aims at minimising or avoiding these consequences by reducing the human and economical stakes exposed to the flood risk. Besides, an analysis method called cost-benefit analysis (CBA) has been set up for the development of flood alleviation schemes. This method, intended to the local authorities and engineering consulting firms, aims at calculating the economic profitability of a prevention measure, by comparing the implementation costs and the profits made, that is to say, the avoided damages. This method is largely approved and used by the scientific community, furthermore it has become inescapable to aspire to grants

from the State or the European Union (FEADER) for the implementation of PAPI programs (EPRI, 2011). So, the economic aspect and the evaluation of the avoided damages are an important question in France, and more largely in Europe.

Definition

Economic efficiency is a term that comes from the analysis of economic activities. It is an optimum; the best situation for a business regarding the *“rational consumption of resources, materials, labor and financial resources using for this purpose [but also] scientific methods of management and organization of productive activities”* (Birle Vasile, 2014). In our context, economic efficiency reflects if the multiple use of the infrastructure creates positive outputs and which inputs where necessary for that.

Concerning our study, the indicators to consider relate the difference between outputs and inputs in the following domains. Here we have adapted the economic efficiency to our subject; the multiple use of flood protection infrastructure.

To evaluate the economic efficiency of multiple uses in flood protection infrastructures, we have to see if there is creation of more units of the sub-criterion which are: employment, property value, we also have to look at the monetary indicators and how the environment was impacted or benefitted from those creations.

The scoring here is a blend of three levels, the less there are inputs compared to outputs, the best the economic efficiency is for the project :

- The first level consists on a project which used much more inputs than outputs for its creation.
- The second one is quite ideal because it is the case when the inputs exactly correspond to the outputs. That means that in detail, in each sub-criterion of economic efficiency, there is a balance.
- The third and last level represents the best project concerning the efficiency. It is reached when there are fewer inputs than outputs.

Even if all the sub-criteria cannot be compared directly because they are not of the same kind, the aim of this analysis is also to understand who they are linked to. For example, did the creation of jobs help to increase the property value or impacted the quality of the environment?

Indicators

To evaluate the economic efficiency and discover on which level the project stands concerning this criterion, we need some indicators. As the economic efficiency is a large criterion which embraces many various notions, the sub-criteria imply different indicators. To analyse the impact of the project on employment, we should look if new jobs are created, if some disappeared and what kind of jobs are there. So we can determine the outputs for this sub-criterion and their value. Concerning the property value which represents the cost of houses or flats, we have to find the evolution of it between

the price it cost before the project and after. If the value of the land increases, then the outputs are considered as higher than the inputs. About the monetary indicators, they are studied to understand what the valuable amounts are to create or created by the multiple uses. Monetary indicators represent the amounts of money which are invested for the project and the amount of money gained thanks to it. Here again, the more gains compared to investments, the better the efficiency. Finally, we also consider the environment because it is often impacted by the project. That means that environment (biodiversity, species, quality of it) is like inputs used for the project. Sometimes, there is also creation of new wildlife spaces and in this case the assessment would be positive for this sub-criterion.

2. Technical feasibility: a criterion closely linked to the kind of infrastructure studied

Definition

The technical feasibility concerning any infrastructure depends on the technological knowledge developed around this subject. Feasibility is defined by the Cambridge Advanced Learners Dictionary & Thesaurus as *“the possibility that can be made, done, or achieved, or is reasonable”*. As for Technical, it is defined *“relating to practical skills and methods that are used in a particular activity”*.

In this way, to determine if a flood protection infrastructure is technically feasible, the technicians have to confirm that it is possible to obtain the appropriate technical knowledge to build the infrastructure.

The technical feasibility of flood infrastructure protection depends on the kind of flood it has to deal with, its frequency and speed, the height of the river and its width. All the criteria that define the characteristics of the river and the type of flood have to be considered. Determine if an infrastructure is technically feasible means that the risk is known and the characteristics of the flood as well. An infrastructure is not feasible until the technology does not exist to do it. We also consider that an infrastructure which would not last in time can be considered as technically “non-feasible”.

Therefore we analyse this criterion with three ranks of scoring;

- The infrastructure is feasible regarding the current knowledge and is planned to last in time.
- The infrastructure is feasible but is using a new technology which has not made its proof; it is hard to predict its last in time.
- The infrastructure is not feasible; there is no technology to do it.

The best moment to use this criterion in a global analysis is before the creation of the infrastructure. That can help to define how well-prepared the building plan are and maybe permit to say that the infrastructure is not as feasible as it seemed firstly.

Indicators

To determine how feasible an infrastructure is, we have to look at some indicators which could be innovation, functioning investment and interaction with others techniques. To determine how innovative an infrastructure is, we should find which skills are mobilised, how old they are and if they already have been tried before. The ability to do something also depends on the actors who realise the project. Then to say if the infrastructure was planned to last in time, we can observe the functioning investment that traduces the necessities to maintain the infrastructure. The higher this investment will be, the worst the infrastructure would have been planned to last in time. Finally, concerning the presence of other uses, the criterion of technical feasibility has to consider the interaction between the infrastructure built to protect from flood and the other uses. For example, during our research of latest developments, we found the example of Vitrolles, where a velodrome was built into a retention basin. In this way, we can ask the question; does this use of the infrastructure impact the flood management or not? Then two options appear, on one hand, that can helps maintaining the flow during a flood period, because the maintenance is well-done, in link with this use. On the other hand this use can plug the water evacuation because technically, the compatibility of the velodrome and the flood protection infrastructure did not exist.

Those indicators will allow us to say that the multiple uses are feasible regarding the flood protection infrastructure and if its function to protect from flood is still well working.

3. Accountability: a complex criterion

Now, we will focus on the criterion of accountability. According to the business dictionary, accountability refers to the obligation of a person or an organisation to account for its activities. This means that each responsible of an action must be able to answer at several questions like why he made this project, how, by what means, etc. In other words they must be able to justify their choices and the means they used. In fact, this term can refer to the notion of responsibility of the different actors on a project. Like L. David Brown and Jagadananda wrote on their book “Civil Society, Legitimacy and Accountability: Issues and Challenges”, accountability refers to the “*responsibility to answer for particular performance expectation to specific stakeholders*”. For example, private sectors have to account to owners, and stockholder and public organisms are accountable for voters. Nevertheless, in literature, we can find plenty of definitions of accountability. In our research program, we want to evaluate the multi-use of flood infrastructures. It can concern the responsibility of politics; is the project justified in terms of global policies?

But it can also concern the way that the project is made; was it made with the consultation of the population? Were the needs of population taken into account? To better understand the criterion of accountability, we decided to divide it into three sub-criteria: relevance, legislative legitimacy and citizen legitimacy. Because accountability could have a lot of definitions, it is easier to develop this criterion in three, which is part of the definition of accountability given before. In TRANS-ADAPT, the notion of accountability is linked to the legitimacy, but for us, it is just a part of accountability. J Thomassen defines two ways for assessing the legitimacy in his web publication “Citizens and the legitimacy of the European Union”, in June 2007. The first one consists in “*evaluate the political system against normative theory, inquiring to what extent political system conforms to certain normative*

criteria". That is what we will call in the following paragraphs the legislative legitimacy. The second way to evaluate this legitimacy is "*to empirically determine to what extent the political system is right in the eyes of relevance beholders*". This notion is what we will call the citizen legitimacy afterwards. Finally, accountability is linked to the justification of a project, therefore, to our mind, it seems interesting to evaluate the notion of relevance.

Relevance: the consideration of needs and uses

Definition

With the criterion of relevance, we want to evaluate if the aims of the project are consistent with the users' expectations or the needs of the country, city or neighbourhood, depending on the scale. According to Jorge L. Mendoza, relevance can be evaluated with conceptual criterion and actual criterion. The first one concerns "the theoretical construct we would like to measure", in our case for which activities the multi-use is made. The second actual criterion, is close to "the operational definition that we end up", in other terms appropriate to the multi-use, how the structure is used today and by whom.

The closer the two criteria are, the more the project is relevant. As indicators we can find three levels of results:

- The first one, the most relevant level, is when a new multi-use scheme meets the needs of the population and infrastructures are used as it was planned to be used.
- The second level is when the reasons to make a new use do not correspond to the needs of the population but the creation of this infrastructure creates new needs, and the infrastructure becomes useful.
- The third level is when the reasons to make a new use do not correspond to the needs of the population and the infrastructure is not really used.

Indicators

To evaluate the relevance of the multi-use, we have to focus on the part before the development of the multi-use in the infrastructure and study the needs of population back then. Then we have to see if they correspond to the use today. It seems also important to focus, for this part, on how people use the infrastructures and if actors based on needs to create new activities on the infrastructure. In fact, attendance of the second, or more, use of the infrastructure could be a good point to know if this second use is relevant according to users. To resume, the criterion of relevance can have two indicators: needs of population and the utilisation of the second, or more, use.

Institutional legitimacy: a sub-criterion directly linked to the law

Definition

The second point to evaluate the accountability is to question the legislative legitimacy of the project. In L. David Brown's work « *Civil Society Legitimacy and Accountability: issues and challenges* », legitimacy is defined as “*the perceptions by key stakeholders that the existence, the activities and the impacts*” of a project “*are justifiable and appropriate in terms of central social values and institutions*”. This definition of legitimacy leans on Edward's one, describing the legitimacy as the right to be and to do something in the society. So, in order to study the accountability of multi-use projects, we will focus on the legal legitimacy.

In France, the government has set up a flood risk policy based on a prevention principle. This principle prescribes a quite strict policy of non-urbanisation in flood risk areas which goes against the urban development. Most of the time, there is no urbanisation in the case of multi-use, at least not housings or economical activities which could be devastated by a flood. The multi-use in flood alleviation schemes leads more to recreational or sports infrastructures, like family gardens, playgrounds or sports ground.

After analysing the institutional legitimacy, we can see where the case study is located between the different levels of this legitimacy.

- The first one is the one where the project is in accordance with the law, each stage of the implementation of the project is right and there were no mobilisation against this project because of its illegality. It is the right institutional legitimacy.
- The second one is when this legitimacy is moderately right. For example if the regulations have been changed in order to make a project legitimate or because there were mobilisations against.
- The last level is for a wrong legitimacy. This one occurred when actors break the law in order to realise a project. This is the case for example if they do not respect the regulation given by risk prevention plans or other documents of this type.

Indicators

Considering the definition above, the issue is to know if the implementation of multi-use in flood alleviation schemes is legally authorised by laws and regulations. In fact the main indicator for this criterion is the legal situation of the implementation of multi-use. There may be some incoherence between what is legislated and what local authorities want to do on the infrastructure for flood risk. To evaluate this, we need to focus on the main documents which set up the regulation of flood hazard areas. To see that, it could be interesting to know where the case studies is located comparing to the flood risk prevention plan and what is the regulation of this. Then we can search if there is any decree taken by the prefect to cancel the project or to oblige the city to do something on this area. Then, it could be interesting to see if there was a kind of mobilisation to reconsider the project because of its illegal aspect. This information could be found in press articles or thanks to interviews with different actors of projects.

But this legitimacy also needs to be evaluated through citizen participation, because legitimacy also involves the consideration of population's needs and wishes.

Citizen legitimacy: the influence of the population

Definition

Finally, the last criterion linked to the concept of accountability concerns another aspect of legitimacy, the citizen one. In order to know if the project could be justified, it seems important for us to see if the population accepts the project. In fact, the citizen legitimacy refers to the correctness of the project for the population and users. Three scales can be defined for this criterion, like for the previous one.

- The first one can be defined as the one of the right citizen legitimacy. It implies that the citizen participation is well done and regarding the situation, this participation is on one of the highest levels in the Arnstein ladder. Moreover, at this level, there is no mobilisation against the project led by anyone.
- The second level is when the citizen legitimacy is moderate. In fact, it could correspond to a situation where there is no mobilisation against the project but the participation is not as good as the previous level. In the Arnstein ladder, it corresponds more to the second level.
- The third one corresponds to wrong citizen legitimacy, when there is no participation of the population but a lot of mobilisations.

Indicators

One of the indicators referring to the citizen legitimacy is the participation. According to Myung Jin³, "*citizen participation contributes to legitimating governmental affairs*" and increases the legitimacy in terms of decision-making process. Citizen participation means that citizens can give their opinion on a project or even propose their own ideas. But several methods can be used to involve citizens. Sherry R. Arnstein, has worked on the citizen participation and its evaluation, and has reported her findings in an article: "*A Ladder of Citizen Participation*" in 1969. This ladder is still used today by sociologists to assess how local authorities inform citizens and allow them to participate in decision-making. This ladder has eight types of participation, classified into three levels of engagement, as we can see in the following table.

³ Myung Jin. "Citizen Participation Trust, and Literacy on Government Legitimacy: The Case of Environmental Government." Accessed October 12, 2014. <http://scholarworks.waldenu.edu/cgi/viewcontent.cgi?article=1021&context=jsc>.

LEVEL OF ENGAGEMENT	TYPE OF PARTICIPATION	TYPE OF INVOLVEMENT
Citizen power	Leaner Control	In this last and highest type of participation, citizens are entirely in charge of design, planning and management tasks.
	Delegated power	This type of participation looks like the previous one (partnership) but in this case, citizens have a majority government which confers them a real authority on decision making.
	Partnership	Strictly speaking, participation begins at this type of participation. The decision power is redistributed between citizens and stakeholders via a negotiation. Citizens accept to be in charge of the elaboration of the project and the decision making through institutions like planning committees.
Tokenism	Placation	Placation consists in authorizing or inviting citizens to give advices and to make propositions but stakeholders remain the only judges of these previous advices and propositions.
	Consultation	As the information to the public, the consultation signifies also a type towards effective participation. Stakeholders can consult citizens via public polls, community meetings or public hearing but consulting does not insure the consideration of citizens' expectations and suggestions.
	Informing	This type of participation is the first step to an effective participation, in a sense that citizens are informed about the ins and the outs of the plan, but this type of participation is insufficient. Indeed, it creates a one-way type of communication in which citizens' view are not actively sought in decision making processes.
Non participation	Therapy	This type of participation is used when citizens would/could protest against stakeholders' decisions. So, stakeholders used citizens, making them involved in promoting information campaigns and distracting their protestations.
	Manipulation	In the name of civic participation, citizens are asked to rubberstamp decisions already taken by stakeholder. In reality, this type of participation is used as a communication tool for the benefit of stakeholders; in this way, stakeholders get the support of citizens.

Table 1: Arnstein ladder of participation

To find the level of the participation in case study, it is important to see which power is given to the population, how they can participate. The influence they had on the project could be interesting to study, as well as the way their opinion was taken into account to realise the project.

Moreover, citizen legitimacy can also concern all part relative to acceptance of a project by the population, especially the one directly concerned by the project, but also associations, this is a second indicator. Set up a multi-use in an infrastructure for flood management can have consequences on several points, like nature and biodiversity, flood risk protection, landscape, etc. Population, particularly through associations, can give their opinion, for a better consideration of all aspects of the potential consequences of the project. In fact, to evaluate this, we have to find if there were events or mobilisations realised by citizens or associations to oppose themselves to the project.

4. Social justice: evaluation of the fairness

Definition

The criterion social justice, in the context of multi-use infrastructures raises the question of equity and non discrimination both in terms of protection against flood and in terms of access to the activities. Those two aspects of the infrastructures must be fair for everyone. Thus, the main aim of this criterion is to assess whether the multipurpose serves everyone equally, or on the contrary, if it disadvantages a certain population or an area, concerning both the risk protection and the activities. Then the analysis of this criterion will be divided into two sub analysis, the first one concerning the equity concerning flood protection, and the second one concerning the equity in terms of access to the activities.

So in short, for the risk aspect, the premise is that a measure done in one place to reduce flood risk should not affect negatively other populations or areas in terms of vulnerability to flood. So to judge this equity it is important to see how the most vulnerable and poor populations, are served by the measures and the work. Thereby, the fairness of flood protection in a multipurpose work can be judged by the five following levels of flood management, proposed by Peter Newborne⁴.

- First, there is the negative discrimination, in which there is a most important support to population who are already relatively well protected. This level can also include cases where those actions have negative effects on other areas or populations.
- The second level is the unconsciousness, reflecting a lack of awareness to different levels of vulnerability to flood and/or a lack of concern to help populations who are the most vulnerable.
- There is a third level, corresponding to an impartial treatment. In that case no particular population or area is preferred. This is the privileged one.
- Then comes a fourth level, called consciousness where there is an awareness of the different levels of vulnerability to flood and a concern to help population who are most vulnerable.
- Finally, there is the positive discrimination, where mostly populations relatively poorly protected against flood risk are targeted.

⁴ Peter Newborne. Accountability and Non-discrimination in Flood Risk Management: Investigating the potential of a rights-based approach, Honduras case study, 2008.

Concerning fairness and equity in terms of access to the activities other than the flood protection, the idea is similar. None of the activities practiced on the site should have negative impacts on the other ones, and in any case, activities should privilege or disregard one type of population. So, to evaluate that part of the criterion, a simpler scale can be applied. Three levels, highly discriminatory, moderately discriminatory and not discriminatory at all, are sufficient to assess the fairness of the activities.

Indicators

To determine the level of social justice of a multipurpose infrastructure, two main indicators must be analysed. The first one will focus on fairness and equity in terms of flood protection, and the second one will focus on fairness and equity in terms of access to the activities.

For the first one, it is relevant to wonder if a kind of population or a specific area is prioritised, or on the contrary disregarded, in terms of flood protection and potential or actual impacts in case of floods. This first indicator can be analysed through different aspects. It is for example interesting to see if there are people living on the site, if or how do they chose to come here, if they were present prior to the implementation of the infrastructure and how their presence is taken into account. Besides, if there are or could be some impacts, they need to be analysed, to determine the kind of area or population affected, in or outside the infrastructure area. It is also necessary to find out if before and during the implementation of the infrastructure the fact that it would happen was known.

Secondly, it is necessary to know if the activities practiced on the site serve a specific or a global population. This indicator can be characterised by exploring deeper some interrogations. For example analysing the kind of activities developed on the site and their degree of vulnerability will permit to see if they correspond to activities practiced and aimed to all sorts of populations or not. It is necessary to determine if a type of population is specifically served by the activity or was specifically targeted during its elaboration or not, or on the contrary disregarded. It is also interesting to analyse the location of the infrastructure, because it can be a source of discrimination if it is located in a difficult place to access for everyone.

5. Vulnerability: a compromise between the risk and the benefit

Definition

The vulnerability of a multipurpose work can be defined as the trade-offs made between perceived risk and perceived benefit.⁵ So in short, “*the greater the perceived benefit of a particular activity or area, the greater the risks that a society is willing to accept*”. So this criterion does not consider vulnerability properly speaking as a degree of fragility of the space, but more as a degree of subjective representation of the site given. It depends on the compromise made between the importance attached to the protection and the secondary activity(ies).

⁵ Raaijmakers, Ruud, Jörg Krywkow, et Anne van der Veen. « Flood Risk Perceptions and Spatial Multi-Criteria Analysis: An Exploratory Research for Hazard Mitigation ». *Natural Hazards* 46, n° 3 (septembre 2008): 307-22.

More precisely, there are three major levels of trade-offs, leading to the three following levels of vulnerability, from the most to the least significant.

- If a particular activity is chosen over an effective work against flood risk, the vulnerability is higher whereas the risk could be reduced more significantly. The given activity even accentuates it. This is the first level of vulnerability, where the trade-off is in favour of the activity and not flood mitigation.
- In the second level the trade-off is fair. Measures are taken thinking equally for both the desired activity and flood mitigation. It is the best case.
- The third level of trade-off considers flood mitigation first, over the activity. In that case it is a shame if the land remains poorly or totally unused whereas there is a possible use or need for the area.

Indicators

Here again, in order to associate a level to the case study, a series of interrogations need to be dug deeper. In the evaluation of this criterion there are two main ideas, corresponding to two indicators.

The first aims to evaluate the evolution of the activities installed on the site in order to determine if the possible modification of the activity has impacts on the consideration of flood hazard, which is initially the main importance of the infrastructure. To evaluate this indicator, it is important to focus, inter alia, on the history and the evolution of the activity and to draw a parallel with the eventual events that occurred.

The second indicator aims to analyse the level of consideration of the flood risk in the activities. So here, it is also important to focus on the evolution of the activity and more specifically on the conscience and the knowledge of the risk from the actors. It is important to see how each activity takes the risk into account, to see if it is enough and equal or if the risk has been forgotten with the increase of the activities. In order to evaluate this, it is necessary to look at the flood levels considered for each infrastructure for example, if it is an optimistic or pessimistic prevision.

In conclusion of this part, we can see that the criteria are varied and cover various aspects, from both economical and social issues, as well as political ones. Indeed, the economical aspect is assessable by the criterion economic efficiency, which takes different issues into account, including the employment, the resources or the investments ones. The social aspect is well treated by the criteria social justice, which focus on equity and fairness of the infrastructure. And the political aspect, in a large sense, is treated at the same time by accountability and its sub criteria, which focus at the same time on legitimacy and relevance issues, and by the vulnerability criterion, which is considered here as the result of the management compromise made between flood protection and the activities. So the assessment grid elaborated is rather complete and does not privilege one particular aspect. Now that the general assessment framework has been elaborated, the next part will focus on the adaptation method to make it adaptable to any multi-use flood management infrastructure case study.

II. An evaluation framework adaptable for any case study

Before starting the assessment of the Gloriette floodplain, adjustments must be done on the assessment framework elaborated previously. Indeed, this is a general framework to evaluate all kinds of multi-use infrastructures. Therefore all the criteria will not be appropriate or assessable in every case study.

In order to adapt the evaluation grid and determine which criteria will or will not be analysed, a classification can be done according to different factors. This step also permits to question the relevance of the assessment framework in a more global context, because initially the criteria are supposed to be used for any flood mitigation multi-use operation.

The following method to elaborate an appropriate evaluation grid needs to be adapted to every case study. This sub-part proposes a general guide, and the next part will consist in its application to the Gloriette case study. The first step is the evaluation of every criterion according to the following different factors.

1. The importance

The degree of importance given to the criteria and the sub-criteria is the first factor, because all of them actually do not have the same importance to assess the profitability of an operation. In fact it depends on the different aspects of the given case study. As an example, the kind of activities done on the site is really important to determine the relevance of the criteria. If we consider the Afsluitdijk again, the freeway-dike in The Netherlands, which was presented in the introduction, we can see that the criterion social justice is not a really relevant one, because a freeway is actually a public infrastructure aimed for everyone, so there is not much to discuss about that point.

Thereby, this first stage consists in scoring every criterion and sub-criterion according to the importance and the relevance we consider it has in the context of the given case study. This way, criteria can be divided into three levels of importance, the most important ones having a scoring of 3, the medium ones of 2, and the least important of 1.

2. The evaluability

In addition, we can consider the evaluability of the criteria, because even if they are judged relevant in the previous step, they will not necessarily be quantifiable in the context of the case study chosen. However, an evaluable criterion will be easier to analyse than a non-evaluable one. Thereby, a non-evaluable criterion will get a score of 0, because of the difficulty to analyse it.

Furthermore, for evaluable criteria, the difficulty is to find the data to analyse them properly. Therefore, an evaluable criterion will get a score of 1, and if there is available information and data, this weight will raise to 2.

At the end, the sum of the scores obtained through these two steps will give a final grade for each criterion and depending on their rating, it will be decided if they are kept to realise the evaluation of the case study or not. This step will be realised in the second sub part of the next part, during the elaboration of the assessment framework specific to the Gloriette.

Finally, this part proposed in the first place a rather general analysis framework for the assessment of multi-use flood mitigation infrastructures. The different criteria, inspired from the TRANS-ADAPT ones were defined more precisely to lead to a rather complete framework, gathering the political, the economical and the social aspects. However, the analysis grid itself is not directly usable to make an assessment. The criteria cannot always be appropriate to analyse a case, it depends for example on the type of infrastructure considered, a management or a protection one, but also on the type of flood occurring in the place studied, by overflow or runoff. Thereby, an adaptation of the analysis grid is necessary to make the analysis grid as accurate as possible for any case, an adaptation method, considering the importance of the criteria given the specific context of the case, and the capacity to evaluate the criteria according to the availability of the data.

PART II: THE GLORIETTE FLOODPLAIN CASE STUDY: EVALUATION OF A CONCRETE EXAMPLE

This research project aims at evaluating the multi-use in flood management or protection infrastructures. For that, we have previously set up an analytical framework based on five criteria: economic efficiency, technical feasibility, accountability, social justice and vulnerability. These criteria came from the TRANS-ADAPT research program, which aims at evaluating local initiatives concerning the integration of the protection and management infrastructures in the urban development. Therefore, the five criteria have been defined and estimated, based on the current research project, focusing on the multi-use. Indeed, for each criterion, the reasons why it is important or not were explained as well as the reasons why it is important to study, and then, the indicators to measure each criterion were given. At last, a method has been developed in order to adapt our analytical framework, based on the five criteria, for different case studies. In fact, we consider that some criteria can be relevant to evaluate the multi-use for a certain type of flood infrastructures but less for another.

In this research project, the Gloriette floodplain (Tours, France) has been chosen as the case study. The objective is to transpose our theoretical analytical framework into a specific method for this case. At the end, we should have an assessment of the multi-use practiced in the Gloriette floodplain but also a critical look back on the analytical framework proposed in this report. Indeed, the importance and the evaluability of each criterion will be studied.

For that, a presentation of the case study will follow in this report. Different aspects will be presented: the historical context of the Gloriette floodplain, the reasons of this choice of case study and the description of the different activities considered as multi-use in the Gloriette. Then, we will adapt our analytical method based on the five criteria for the case study of the Gloriette floodplain, trying to determine the importance and the evaluability of each criterion. At last, each criterion will be analysed for the case study.

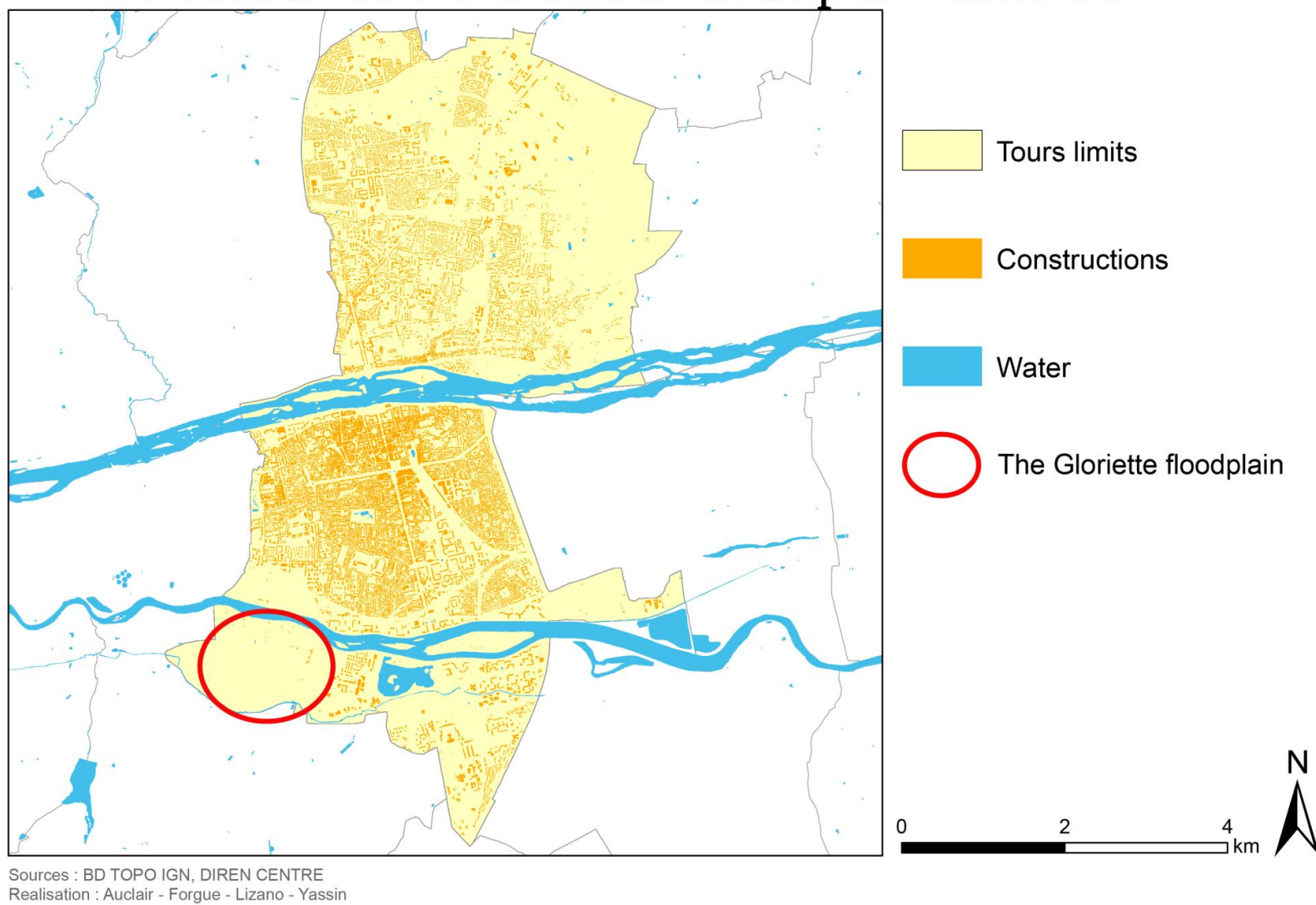
I. A compromise between urban project and flood management

Located in the south of the city of Tours, The Gloriette floodplain has been dedicated, in 1994, to receive the Cher floods. This floodplain is not a flood protection infrastructure like a dam or a dike. Indeed, a floodplain is a land adjacent to a river or a stream that is subject to recurring inundations, in others words, it's an area where water spreads when the stream overflows. So, a floodplain is not a flood protection infrastructure but a flood management infrastructure, according to what was said in the introduction. Moreover, a floodplain is generally a natural area so the term

“infrastructure” is not really adapted in that case. In fact, the term “infrastructure” means that is a man-made structure which is not the case here. The Gloriette floodplain is an abandoned area, with regard to the urbanization.

Even so, the Gloriette has been subject to many urban planning projects, frequently contested, earning it from now on, its status of “compromise” between an urban project and a flood management tool. Indeed, the Gloriette is nowadays, one of the biggest urban parks of the urban area of Tours, constituent of the conglomeration’s green belt, it receives two travellers camps, welcomes many spectators for different events, golf courses and some family gardens. These activities are considered as multi-use in this study.

Location of the Gloriette floodplain in Tours



Map 1: Location of the Gloriette floodplain in Tours

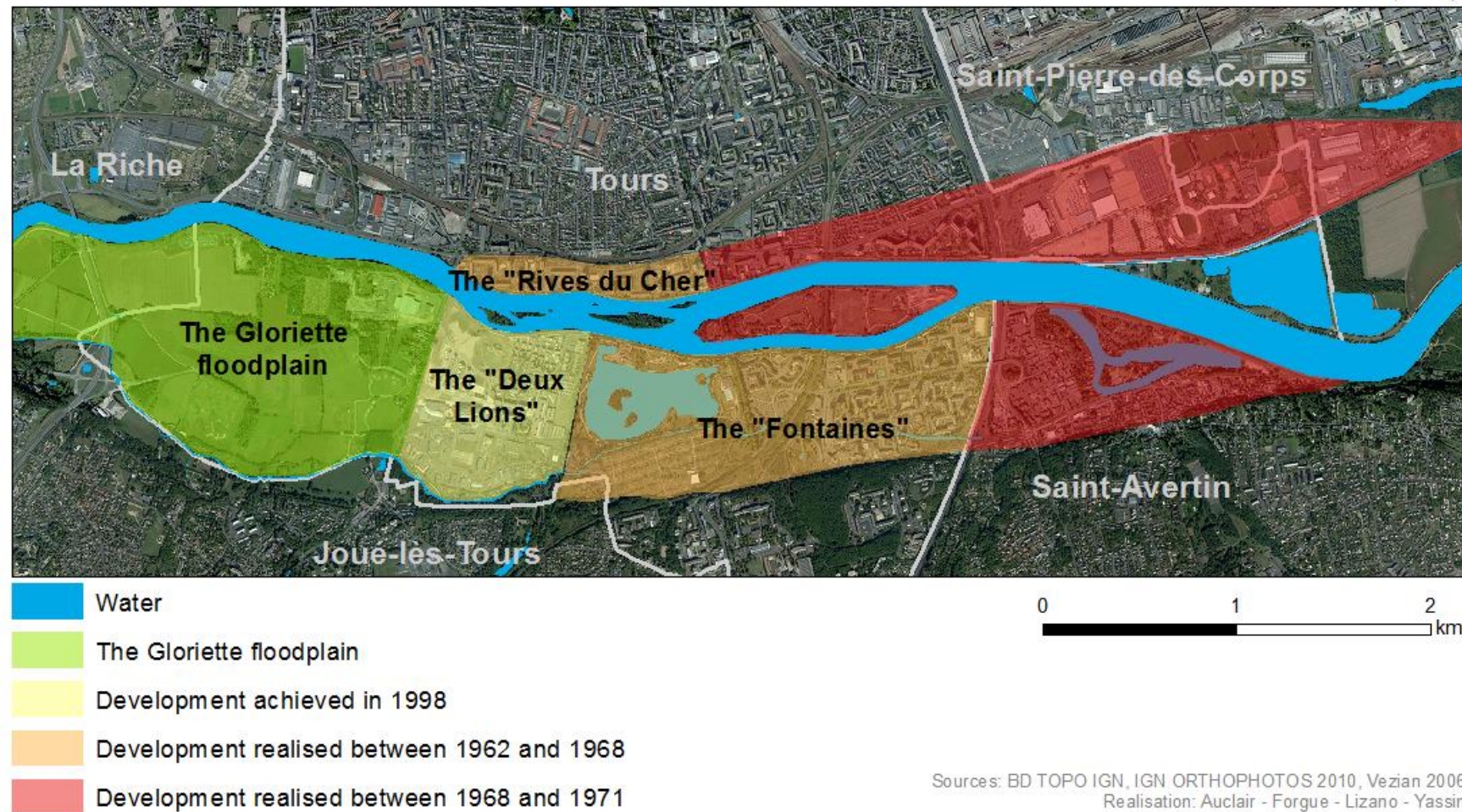
1. An area at the heart of the urban planning project of the Cher valley

The Gloriette floodplain is especially, a good example of multi-use projects on a flood management infrastructure. To understand what it is nowadays, it's important to study its history, beginning, into this report, in the 1960's. Since this date, the Gloriette has been an area under a big land pressure, representing both numerous urban and environmental stakes.

In 1963, the city of Tours, one of the most cramped administrative cities in France, receives a ministerial permission allowing the extension of constructible areas in the South of the city: the Cher valley, a land situated in a flood risk area and only dedicated to the agriculture. Since this date, the area situated between the Pont D'acrole on the East, and the highway A10 to the West is called the Gloriette and will be the subject of an urban planning project. All the projects will be realized under Jean Royer's mandate (1959-1995), who is biased in favour of the urbanisation of the Cher valley, which is in a flood risk area.

Three main phases of the project will follow one another, between 1962 and 1998, and the different districts called "les Fontaines", "les Rives du Cher" or "Les Deux-Lions", which are well known today by the inhabitants of Tours, will be built. These urban planning projects were possible thanks to embankment works and a downstream extension of the Cher's riverbed, because the river is canalised by means of dams and divided into two arms with a central island now called "le Parc Honoré de Balzac".

The different stages of development of the Cher Valley around Tours



Map 2: The different stages of development of the Cher valley Tours

In 1990, in continuity to these previous works, planned since 1962, provides the construction project of a new district on the Gloriette. It's supposed to be the final phase of the urbanisation of the Cher valley.

2. A space dedicated to flood risk management

From 1990, several plans and projects were thought to develop the place. In 1994, still under Jean Royer's mandate, the SEMIVIT (Société d'Economie Mixte Immobilière de la Ville de Tours) and the « Atelier d'Urbanisme de l'Agglomération de Tours » proposed a project called « Operation de la Gloriette ». This project concerned the extension of the technology park situated on the Deux-Lions district. A new district should be built on the Gloriette. The concept was to let a major place for the “city-nature” relation. The map of the area is inspired by the Villandry's gardens, in which there should be cycle lanes, fitness circuits, canal systems thanks to inhabitants could move by rowing boats, kitchen gardens, etc.

This project was confronted, in the same year, to Jean Germain's one. Actually, Jean Germain and Jean Royer were both candidates in the municipal elections in 1995. That is why, Jean Germain proposed an alternative to the urbanisation of the Gloriette floodplain, already contested by different ecologist groups.

Finally, in 1994, the Master Plan was refused by the prefect, therefore, the urban development on the Gloriette was cancelled, and embankment works were forbidden.

In 1995, Jean Germain was elected and Jean Royer's project was then totally abandoned. Concerning the Deux-Lions district, with the change of municipality, the initial project about the technology park will be re-invented. Jean Germain advocated the multi-functionality of the site, so the technology park project was abandoned. Thus, both housings, universities, tertiary and businesses activities would be established.

In 1995, concerning the Gloriette, a project of “Naturoscope” with “cultural gardens” was also proposed by the urban planning agency of Tours: the ATU. Dedicated to nature, the site should welcome family gardens, an observation course of the avifauna, big aviaries, an arboretum, kitchen gardens, orchards and a camping. However, this project was also abandoned: submitted to the “Loi Barnier”, in 1995, related to the strengthening of the environmental protection, the Gloriette floodplain is preserved as it is, in order to assure the manure spreading of the flood.

To conclude, the Gloriette should become a housing district, in continuity with the urban planning project of the Vallée du Cher. Even so, the project has to be abandoned and the reasons were not insignificant. Indeed, the entire Cher valley has always been in a flood risk area, so, in order to urbanise the different districts, big confinement and embankment works have been achieved. However, the flood risk was still present and studies showed that activities and buildings were not adapted to the flood risk. Therefore, the Gloriette floodplain had to stay as it was to receive the Cher floods.

3. The arena of the evolution of the French flood management policies

From 1995, with the law “Barnier”, relative to the protection of the environment, the Gloriette becomes a floodplain and the urbanisation of the area is forbidden. Therefore, a change of strategy, regarding the development of the Gloriette is necessary. However, it seems important to know that, at the same time, French flood management policies and practices have changed, between the 1980’s and the 1990’s. Considering that, the Gloriette can be studied as the arena of this evolution. The different urban projects for the development of the park have to deal with the changes of municipalities and the changes in management policies, set up by the French government.

In the 1980’s, the flood risk management of the Loire was directed to the construction of flood protection infrastructures like dams and overflows (Daluzeau, Oger, 2012). Indeed, in 1986, four constructions of dams were planned, in Serre-de-la-Fare, Chambonchard, le Veudre and Naussac, by the signature of a protocol between the Government, the Water agency of Loire Bretagne and the EPALA (Etablissement Public de l’Aménagement de la Loire et de ses Affluents, directed by Jean Royer, the mayor of Tours). Therefore, on Tours, the confinement and embankment works of the Cher are authorized and legitimized. However, in the same time, a scientist and ecologist group gets organized, creating the association Loire Vivante, in order to contest against the construction of the dams. Thanks to communication and mediatisation, the association try to spread a new ideology about flood risk management. This ideology disapproves the “zero risk” concept, and then the constructions of dams or embankment as well. However, it advocates the recapture of the streams’ banks. Finally, French flood management policies begin to change towards this new concept, and the construction of the four dams will be forbidden by the State. Therefore, in Tours, the Gloriette became the arena of conflicts between the scientists group and the EPALA, which advocated the urbanisation of the Gloriette.

For the first time, the French Government would show its absolute revolt for the protection of the environment and create, in collaboration with the local authorities the “Loire grandeur Nature” plan in 1994. This plan is initiated by Michel Barnier, the minister of Ecology, and should be a « *necessary framework to overtake the conflicts in order to engage some actions which associate the Government, the local authorities and the environmental associations and to focus the sustainable development of the stream and its floodplains as the politics priorities*”(Plan Loire).

From this date, the Gloriette became a floodplain. There were both political and governmental reasons that changed the projects on the park. Indeed, the election of Jean Germain against Jean Royer was the first step of the non-urbanisation of the Gloriette, with his project of Naturoscope, dedicated to the nature. Finally, the realisation of the “Loire Grandeur Nature” plan forbids the construction on the Gloriette and dedicates the site to its initial role: being a floodplain. The following part on this report will present the functioning of the floodplain and the flood risk present on the Gloriette.

4. A territory highly exposed to flood risk

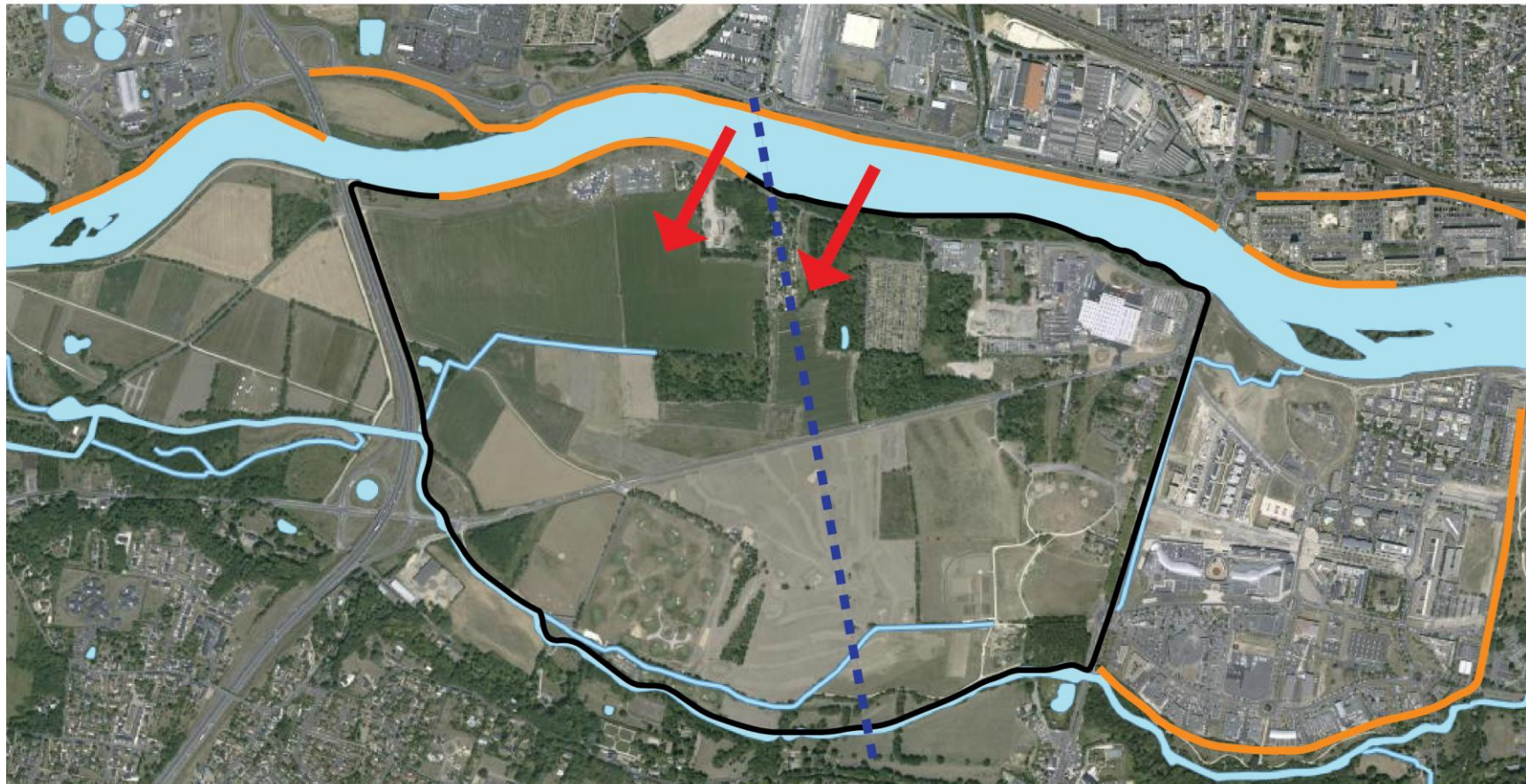
This part will describe the Gloriette as a floodplain. First, after explaining the meaning of floodplain, we will describe its geographical position in relation with the waterways. Then, we will show the important role of the Gloriette as an infrastructure to protect from flood. Finally, we will show that tools exist to inform public about flood risk but also that those tools are not used at their best.

The Gloriette floodplain: reasons and meanings

A floodplain represents a space where a waterway can extend its flow when its discharge becomes too important for water to stay on the action stage. So the floodplain is part of the flood major stage. As far as a waterway is part of the natural elements, floods are natural events. Each actor who is responsible of urbanisation has to keep in mind these recurrent events.

The Gloriette is placed side by side between the Cher to the North and the Vieux Cher (or Petit Cher) to the South. It is put to flood by expansion of the Cher which is a 367.8km long river starting in the Creuse department. The Cher is canalised from Noyers-sur-Cher to Villandry where it goes into the Loire. As we can see on the following drawing, to protect Tours, dikes have been built on each side of the river. Before the Cher could extend on 1000m, and nowadays the Cher can only extend on an artificial width of 230m due to the dikes. That justifies even more the need to keep the Gloriette as a floodplain.

Flood risk on the Gloriette floodplain



- The floodplain limits considered
- Dikes
- Transect of the elevation profile



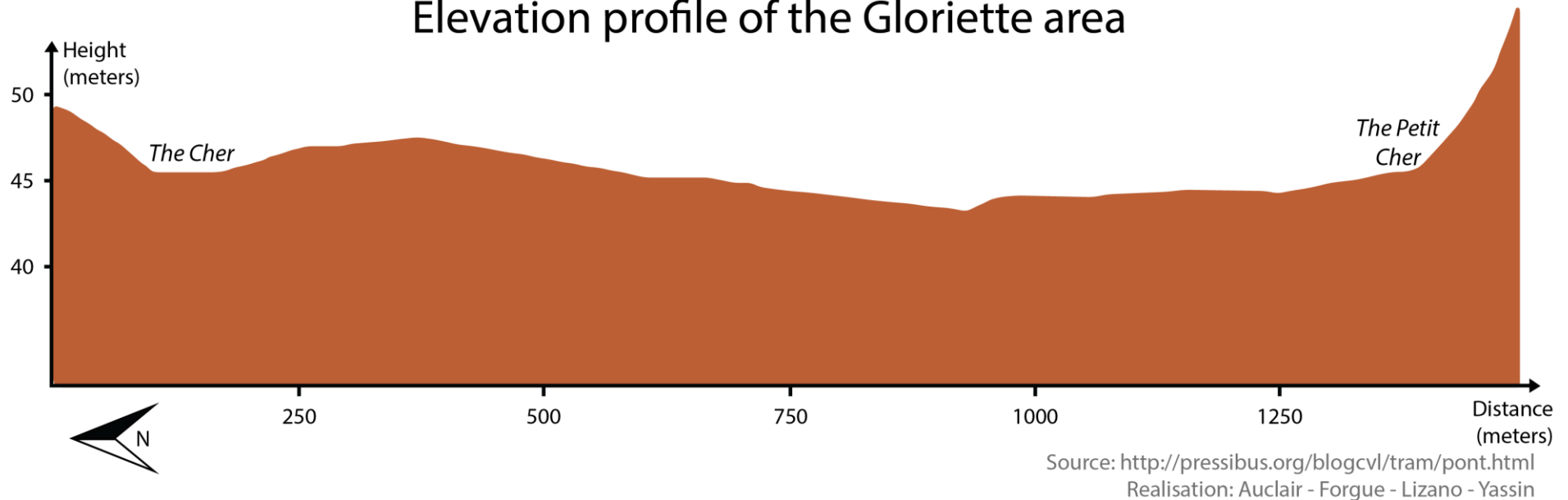
Flood risk on the floodplain

200 meters

Sources: GeoPortail, IGN, La Nouvelle République
Realisation: Auclair - Forgue - Lizano - Yassin

Map 3: Flood risk on the Gloriette floodplain

Elevation profile of the Gloriette area



Scheme 1: Elevation profile of the Gloriette area

The Gloriette, memory of a larger floodplain

The discharge of the Cher is around $95.6\text{m}^3/\text{s}$, but it is important to clarify that the water flow can increase until $196\text{m}^3/\text{s}$ in February⁶. It is also important to notice that the monthly average water flow between December and May included is in $112\text{m}^3/\text{s}$ and $196\text{m}^3/\text{s}$. Concerning the « Petit Cher », it is an artificial stream which comes from and flows in the Cher.

The referenced floods are the same for the Loire and the Cher. There are 3 dates to remember; 1846, 1856 and 1866. At those dates the water flow reached respectively the threshold of 7.17m, 7.58m and 6.58m over the Loire's usual level. The Gloriette was under water each time as it is expected, sometimes under 3 meters of water flow. For those reasons and because 100 000 persons live in a risked area in Tours' conurbation⁷, it is essential to dedicate spaces to flood.

⁶ Hydrological station : K6710910 Le Cher à Tours (1966 – 2008)

⁷ aquavit37.fr/2014crues/

A flood event on the Cher can be due to different reasons⁸.

- At first, a flood could be due to a lot of rainfalls from the Oceanside. As the Cher is part of the Loire's basin, the rainfall would supply both the Loire and the Cher. Those floods are the most frequent and happen mostly during winter. Water can reach a flow of 2 300m³/s in middle Loire.
- The second kind of flood is due to rainfalls in the Cevenole region; those rainfalls coming from Mediterranean Sea cause important damages but are located in the high Loire and if there is no rainfall from the seaside, it does not go until Tours.
- The third kind of flood is a mix of the two previous. There are both rainfalls in Cevenole region and from the Oceanside. It was the case for the flood of 1846, 1856 and 1866.
- Then, during the winter season, when the Cher's discharge is the most important, it happens that the water flow freezes. In addition to that, ices melt, and then the discharge increase and can lead to a flood.



Image 3: The Gloriette under water, Savonnières road ⁹

To protect the inhabitants, the dikes are not sufficient. That is why the Gloriette is used as a floodplain. A major part of the water flow would go in it in case of a flood event.

⁸ www2.centre.ecologie.gouv.fr/azi1/htm/Notice.htm

⁹ Bruno Marmiroli

Prevention tools not highlighted enough

Since 1987, the French law obliged the French State to give information about risks to local communities and to the public. In response to this duty, flood atlas for each catchment area in France was created.¹⁰

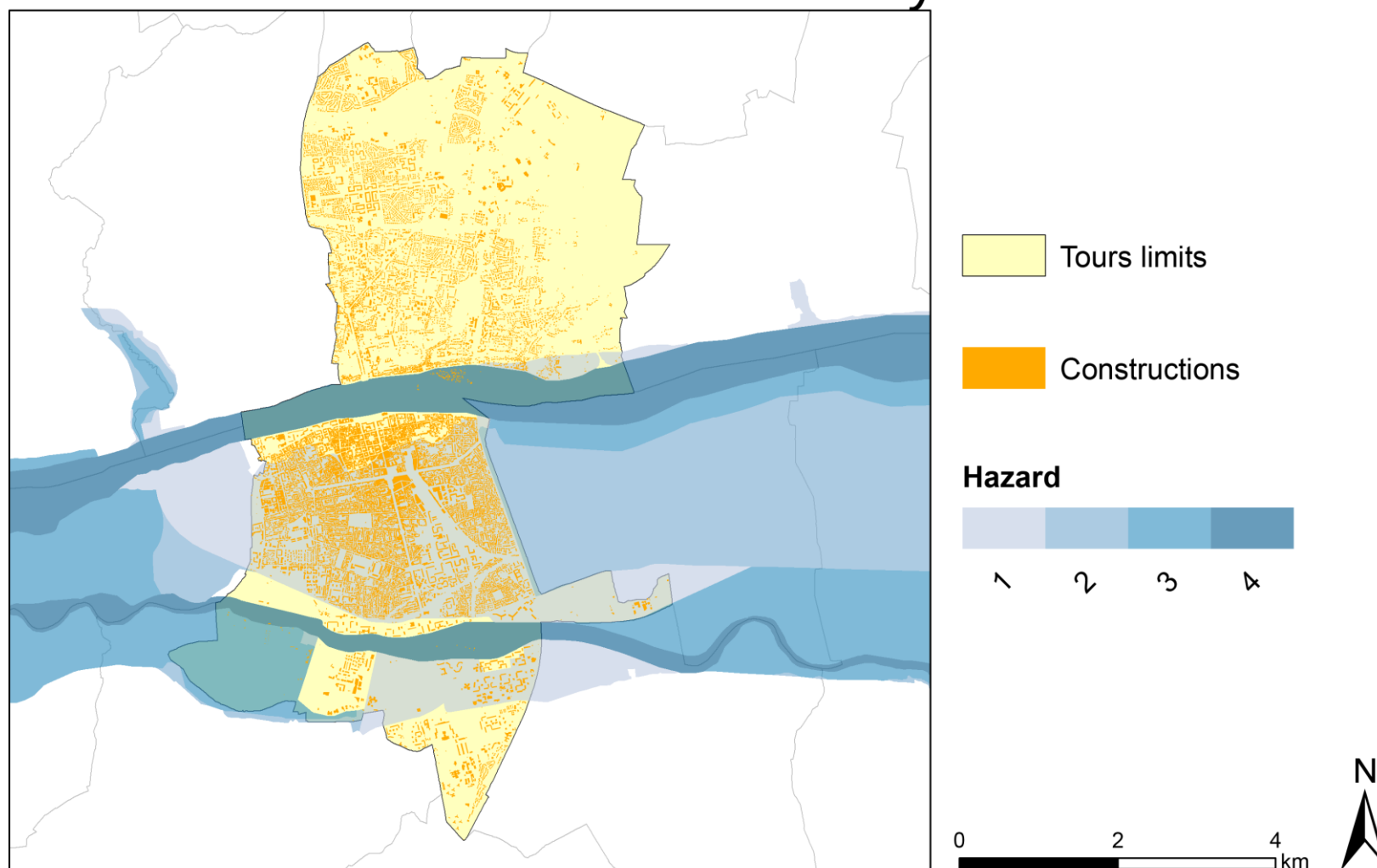
Some websites created by the government exist to prevent from flood. The website Vigicrues.gouv.fr for example allows seeing hour after hour if there is a flood risk in the Loire's basin. The SPC (Service de prévision des crues) Loire-Cher-Indre, part of the DREAL (Direction régionale de l'environnement, de l'aménagement et du logement), is a government service. Composed by 20 flood forecasters, the SPC aims at preventing inhabitants about flood. Thanks to them, and there 24/7 work, a flood can be detected 48 hours before it happens. That lets the time to leave the city and diminish the damages on populations.

Despite the existence of those sources of information, as inhabitants of Tours since 3 years, we can say that nothing is really done by the local authorities to make flood risk a priority. Nothing more than information about the risk hazard that concerns the place we live in was given to us when we settled in Tours.

In fact, it works this way; if a citizen wants to learn about flood hazard, there are tools to help him, like text messages sent to its mobile phone concerning the flow evolution, for example. He can also simply consult the vigicrues website which informs about flood in France.

¹⁰ Can be consulted on this website : http://www.vigicrues.gouv.fr/niv_spc.php?idspc=10

Flood hazard levels in the city of Tours



Sources : BD TOPO IGN, DIREN CENTRE
Realisation : Auclair - Forgue - Lizano - Yassin

Map 4: Flood hazard levels in the city of Tours

5. A compromise between urban project and flood risk management

The “exposition de préfiguration de l'aménagement de la Plaine de la Gloriette”: an expensive project

In 1999, under the new municipality of Jean Germain, the Gloriette still represented a big urban stake, but the law was strict, no urbanisation is authorized on the site. So, the municipality decided to develop an urban park on the Gloriette, the priority was given to the protection of the site; light arrangements were planned in order to showcase the natural resources existing. The idea is to develop the place, without disturbing the first role of the park: receiving the Cher floods.

In 2000, the municipality launches a call for projects in order to highlight the site. For that, Jean Germain assigned an important budget. Therefore, « l'Association pour la préfiguration de la plaine de la Gloriette » was created and would be the contracting authority. Its mission was to organise, for the two successive years, during the summer, the preliminary exhibition for the Gloriette's development (exposition de préfiguration de l'aménagement de la Plaine de la Gloriette). The CIPJP (Conservatoire international des parcs et jardins et du paysage) was chosen to organise the first exposition, as the project manager. The two exhibitions aimed at experimenting light “planning prototypes”, which could be developed and used in the future park, experimenting animations in the park and sharing with the public the future project in the park.



Image 4: An example of lights “planning prototypes” for the first exposition, in 2000¹¹

Finally, the first year, the balance assessment was moderate. On one side, the exhibition received a large public, estimated at 28 000 people, but on the other side, it was a considerable cost for the municipality, which used financial, too important human and technical resources, all the most since the exhibition is free. The second year, there is a charge to the public so the exhibition received less people, about 10 000. Moreover, the project is confronted to short work deadlines, and because of the bad weather, the works fall behind. The municipality therefore decided to abandon the exhibitions projects for the future years.

¹¹ www.scene.fr

From 2002, different projects have been developed on the Gloriette giving rise to the actual park, studied in this report. So, the presentation of the actual Gloriette floodplain, the activities established there and the reasons why we chose this case study will follow in the next part.

The Gloriette floodplain: a space with multiple projects

The choice of the Gloriette: reasons and delimitation

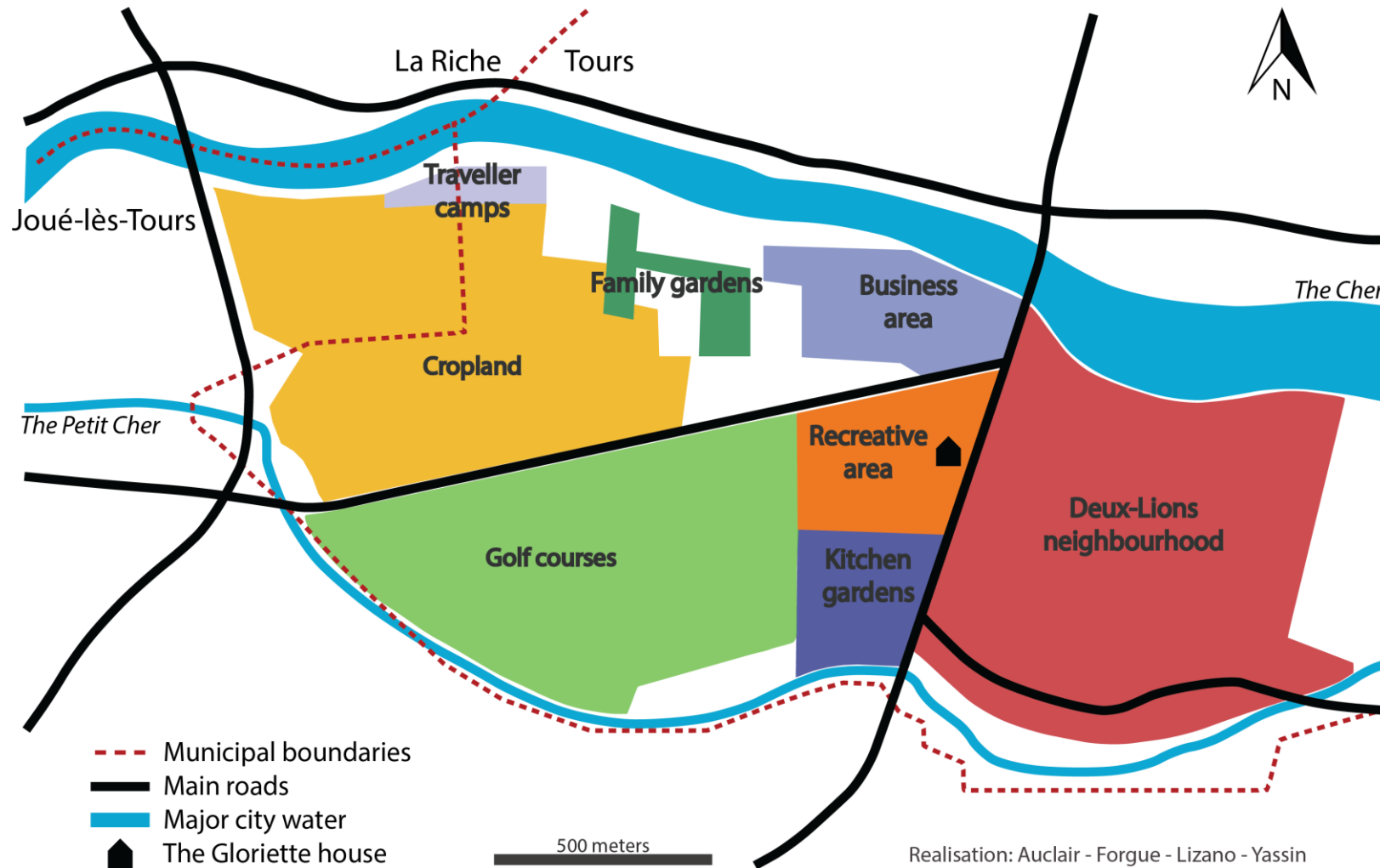
This research project focuses especially on the area delimited on the East by the Pont du Cher Avenue and, on the West, by the road ring D37. From the South to the North, it is delimited by the Cher and the Petit Cher. The studied area, covering 180 hectares, is characterised by the presence of different activities:

- A compact golf
- Two reception areas for travellers
- An urban park composed of a kitchen garden, two playgrounds (one seasonal and the other all the year), a seasonal bar called “Bar de la Gloriette” and a pedagogic apiary
- Family gardens
- Some cultural manifestations
- Some companies
- Private accommodations
- Croplands

These different activities are considered as multi-use because they are established on a floodplain, therefore a flood management infrastructure. In this report, we will consider only the activities that have been implanted after the creation and the approval of the “Loire Grandeur Nature” plan and the 1994 order of the prefect in which the urbanisation of the Gloriette floodplain is forbidden. Indeed, constructions which have been realised before this date can’t be considered as multi-use because the Gloriette was not a floodplain regarding the law. The concerned area was open to the urbanisation so were not subject to the same laws and stakes as now. The construction standards weren’t the same as now, for example, today the constructions have to be easily knockdown or constructed on piles. (PPRI de la Loire – Val de Tours – Val de Luynes, 2001). The activities developed on the Gloriette, since 1994, have to answer to a two-fold challenge: they have to respect the first mission of the place, which is to receive the floods from the Cher and they also have to answer urban stakes and needs. For example, we can suggest that the construction of the Golf and the development of the park answer to sports and leisure needs by the Tours’ inhabitants.

Therefore, the private accommodations and the companies have a particular status in this study. Indeed, they have been built during a period when the urbanisation was authorised, and so, are not under the same laws and urban stakes as now. Even so, they will be evaluated for some criteria but not the others, like institutional legitimacy since they do not answer the current legislation.

Organisation of the different activities in The Gloriette floodplain in Tours



Map 5: Organisation of the different activities in the Gloriette floodplain in Tours

An important multi-use on the Gloriette

As it has already been said previously, the Gloriette is in the heart of several urban stakes. On one hand, it has to play the role of a flood management infrastructure. So, for flood warning, no obstacle shall obstruct the rise of water, but especially, no economic or human challenges shall be in stakes. This is the strict application of the prevention principle: avoiding or minimizing the economic, human or cultural stakes. On the other hand, the Gloriette has always been the subject of urbanisation projects. Indeed, it was a space dedicated to the extension of the city. With the construction of the different districts nearby, like the “Deux-Lions” or “Les rives du Cher”, the Gloriette is a privileged place to develop several urban projects answering the inhabitant’s needs. Moreover, the place is very well connected to the rest of the conglomeration thanks to the tramway, to bicycle paths (especially la Loire à Vélo), roads and the ring road are nearby.

For Tour(s) Plus, which has become, now, the main administrator of the Gloriette, but also for the municipalities of Tours and Joué-lès-Tours, the projects developed on the Gloriette have to answer these two previous goals. The different activities present on the Gloriette will be described in this part, by chronological order.

The croplands

Historically, the Gloriette was totally dedicated to agriculture but since it is subject to many urban projects, the area is considering the abandonment of farmland. Indeed, the cities of Tours and Joué-lès-Tours, and then, Tour(s) Plus, have gradually bought the lands to develop the different actual activities like the Golf, the travellers’ camps or the Gloriette park.

In 2006, six farmers, who cultivated cereals, were still present in the Gloriette (Oriane Vezian, 2006). They were not the owners of their lots, they had to rent the lands they used. From this date, the golf has been extended, the two traveller camps have been built, so the lands dedicated to the agriculture has decreased.

The “Pont aux Oies” family gardens

The family gardens situated on the Gloriette, in the area called “Pont aux Oies”, have been created in 1999, by the municipality of Tours. At this date, a first phase began and 40 gardens were created to replace the original gardens situated in the “Deux-Lions” district and destroyed during its development. Then, 43 gardens were created to welcome a part of the former gardens situated in La Riche and deleted in order to develop the “Levéé du Cher” area.

Today, the family gardens situated in the Gloriette still counts 83 gardens. The management and the maintenance of the site are entrusted to the municipality of Tours via its parks department, but also to the maintenance pole, which ensure the maintenance of fences and garden sheds. The roads service realises the maintenance of the paths. The internal management of the site is entrusted to the president of the “Groupement des jardins de Saint-Sauveur” which organises the rent of the plot.

The culture about family gardens is really important in the region of Tours. The number of family gardens keeps on rising and the demand is still high. In 2014, the family gardens of Clos-Moreau, in the North of Tours, counts 10 more gardens, but more than 25 people are still waiting for the location of a garden (La Nouvelle République, 14/03/2014).

So, the family gardens of Pont-aux-Oies have been created to save old family gardens which have been destroyed for urban projects. The conservation of these gardens appears like the conservation of cultural practices. This first project developed in the Gloriette, whereas the site is dedicated to be a floodplain, is both a natural and cultural project. Indeed, the family gardens highlight agricultural practices appreciated by the inhabitants of Tours but also answer to a need of nature in a very dense urban area. This project is more a social project, the municipality of Tours does not hope for huge benefits from the family gardens. Besides, the annual rent price for one square meter of lot is estimated to 2€ (La Nouvelle République, 14/03/2014).

The urban park of the Gloriette

In 2002, the municipality of Tours decides to support itself the management of the park via its Parks Department. The budgets are squeezed, compared to the previous budget given to the “exposition de préfiguration”. The project consists in the construction of a modest kitchen garden, of 700m². The Gloriette house, created in 2000, by the municipality and the “Association de préfiguration de l’aménagement de la Plaine de la Gloriette”, manages the development of the kitchen garden. This garden grows edible and aromatics plants on the theme “World Gardens”. The objective is to achieve several projects dedicated to the education to the environment.

Finally, for a lack of financial resources, the projects are making no progress, and Tour(s) Plus therefore becomes the administrator and the owner of the Gloriette house. Moreover, the Gloriette is situated both on Tours and Joué-lès-Tours, so the transfer of management to Tour(s) Plus is pertinent. The Gloriette is supervised by Tour(s) Plus via a management agreement from the Park Department of Tours to the sustainable development service of Tour(s) Plus. It is not a question of transfer of competences yet. Indeed, the shell is still realised by the city of Tours. For example, the shearing is still realized by the park department of Tours, although it is supervised by Tour(s) Plus.



Image 5 : From left to right, the pedagogic apiary, the playground, the kitchen garden and the Gloriette bar¹²

Over the years, the garden will grow up: in 2010, its surface is 5000m². It is one of the biggest kitchen gardens developed by a local authority, in France. Bulletin boards are present in all the kitchen garden explaining to the public the different plants cultivated and the agricultural practices. The educational aspect is still privileged.

A few years later, an old house is rehabilitated and becomes the Gloriette house settlement, in which works now four employees: a person in charge, an animator and two gardeners. The Gloriette house manages the kitchen garden and organizes different events like the pumpkin festival or the kite festival. These events can be meetings, workshops or guided tours, centred on the gardening and the environment, in a broad sense. The educational aspect is still highlighted via the organisation of these different events. Indeed, two animation programs are realised by the Gloriette house, one for the large public and the other for schools. For example, in the 2014 animation program dedicated to the large public, cooking and gardening classes are organised. An educational apiary has been built in order to raise awareness about the role of bees in our global ecosystem. Finally, during the summer, a huge playing field for children is open with, for example, a giant Checkers or Parcheesi games and the Gloriette bar is opened every sunday. All along the year, a permanent playing field is present on the Gloriette.

¹² Source : Auclair – Forgue – Lizano – Yassin



Image 6: Different events organised by the Gloriette house, the kite festival, the pumpkin festival and the beekeeper festival¹³

So, the urban park of the Gloriette, mainly managed by the Gloriette House privileges the educational aspect, dedicated to the general public and to schools, with two animation programs. The respect and the knowledge concerning the environment are really important in this park. This is a site dedicated both to leisure, sport (for runners or walkers) and learnings.

The compact golf

In 2007, the golf is inaugurated. Tour(s) Plus is the contracting authority, but it delegates the management of the golf to a private administrator via a public service delegation. In 2012, the extension of the golf is inaugurated too: it is 25 hectares bigger and is composed of a practice, a 9 holes course and a 18 holes course. The Gloriette golf is a public golf: there is no need to be a member for playing, and there is no entry-fee. Admission tickets cost 10€ for the 9 holes course and 17€ for the 18 holes course, which are very low prices¹⁴. Student prices also exist.

¹³ www.tours.fr

¹⁴ www.golfdelagloriette.com



Image 7: The club house and the 18 holes course¹⁵

So, the Golf is an equipment dedicated to leisure, but Tour(s) Plus makes it one of its top priorities, to make the golf accessible for everyone, whereas it is generally seen as a sport dedicated to wealthy people.

The two receptions areas

The two traveller camps have been built following the law of July 2000, relative to the elaboration of a plan for the reception of travellers in every department and the obligation for the 5000 inhabitants and more populated municipalities to build receptions areas expected in these plans. Therefore, in 2007, the two municipalities, Tours and Joué-lès-Tours, have built receptions areas on the Gloriette. The two areas are placed side by side but respectively on their administrator municipality.

The areas provide 24 locations. The Tours reception area is managed by a private company, via a public services delegation and the Joué-lès-Tours one is managed by the municipality. The two camps are opened all year. Generally, the parking time is limited to three months, but dispensations are authorised for children's schooling or in case of hospitalisation.

In 2014, a high traffic area was built by the municipality of Tours, but on the Joué-lès-Tours' municipality. This area aims at welcoming travellers, from April to October, for religious gatherings. This area is planned to welcome thousands of travellers, and then provides 200 locations.

The location of the three reception areas has been chosen due to the historical presence of the travellers on the Gloriette. Indeed, travellers have been established for long on the plain, not far from the place they are now. Flood risk existing on the Gloriette has never seemed to be a constraint for them. Therefore, because of the availability of lands on the Gloriette, it seemed logical for the two municipalities of Tours and Joué-lès-Tours to develop the reception areas on this place.

¹⁵ Id.

From the interview with Mr Bouthet, the Joué-lès-Tours reception area administrator, families are semi home-body and they attempt to settle. Indeed, each family stay several years because all the children are schooled. Moreover, as it was said previously, a strong family connection exists on the two camps: it is always the same families who are present. For five years, only two families have not a strong family connection with an old family already present on the site.

So, it seems that the municipalities of Tours and Joué-lès-Tours have found a good compromise for the creation of these two areas. Indeed, they have conserved the historical connection between the travellers and the Gloriette, and they valorised the site in the same time. Moreover, these two reception areas seem to be exceptions, since they are generally situated “in the depths of the industrial parks, behind the waste reception centre (Libération). In Tours and Joué-lès-Tours, the two camps are situated near the town centre, as the “Deux-Lions” district.

The different private manifestations

Different events take place on the Gloriette, non-organized by the Gloriette house. The municipality of Tours is in charge of the socio-cultural activities on the site, and its maintenance. There is especially a big event: The Aucard2Tours festival. This festival, created in 1986, was originally organised on the Aucard Island, but for security and logistical reasons, the event now takes place on the Gloriette. The Aucard2Tours festival welcomes every year more than 15 000 spectators, which makes it one the biggest festivals in the region (La Nouvelle République, 04/06/2013). There is also the “Potager Electronique”, a free concert, organized by the association “les hommes verts”, since 2007. This event is on a smaller scale than Aucard2Tours, welcoming in 2011 about 2000 people.

The Gloriette is also a site where different events take place on the scale of the conglomeration. The Gloriette can be seen as a place of many festivities and activities. The characteristic of these activities is the short live aspect. Therefore, these manifestations cannot be an obstacle for flood. Besides, the infrastructures used for these events shall be easily knockdown.

To conclude, the Gloriette floodplain provides large spaces to develop numerous projects and activities. The municipalities of Tours and Joué-lès-Tours, but also Tour(s) Plus, which are the main administrators and owners on the Gloriette, have principally developed projects dedicated to nature, but also to leisure, sport and education.

The objective of this research project is to analyse the multi-use on the Gloriette floodplain, that is to say, to analyse how the projects integrate both the flood risk and the urban stakes like the education to environmental challenges or the demand of nature by the inhabitants. In order to have a general representation of the different activities on the Gloriette, we decided to realize a calendar permitting to know the annual open season of each activity. This calendar also shows the periods during which the flood risk is high. From December to May, when the flood risk is the highest, there are less activities. It seems, at first glance, that the activities considered as multi-use are adapted to the flood risk. This analyse will be more developed in the flowing part of this report.

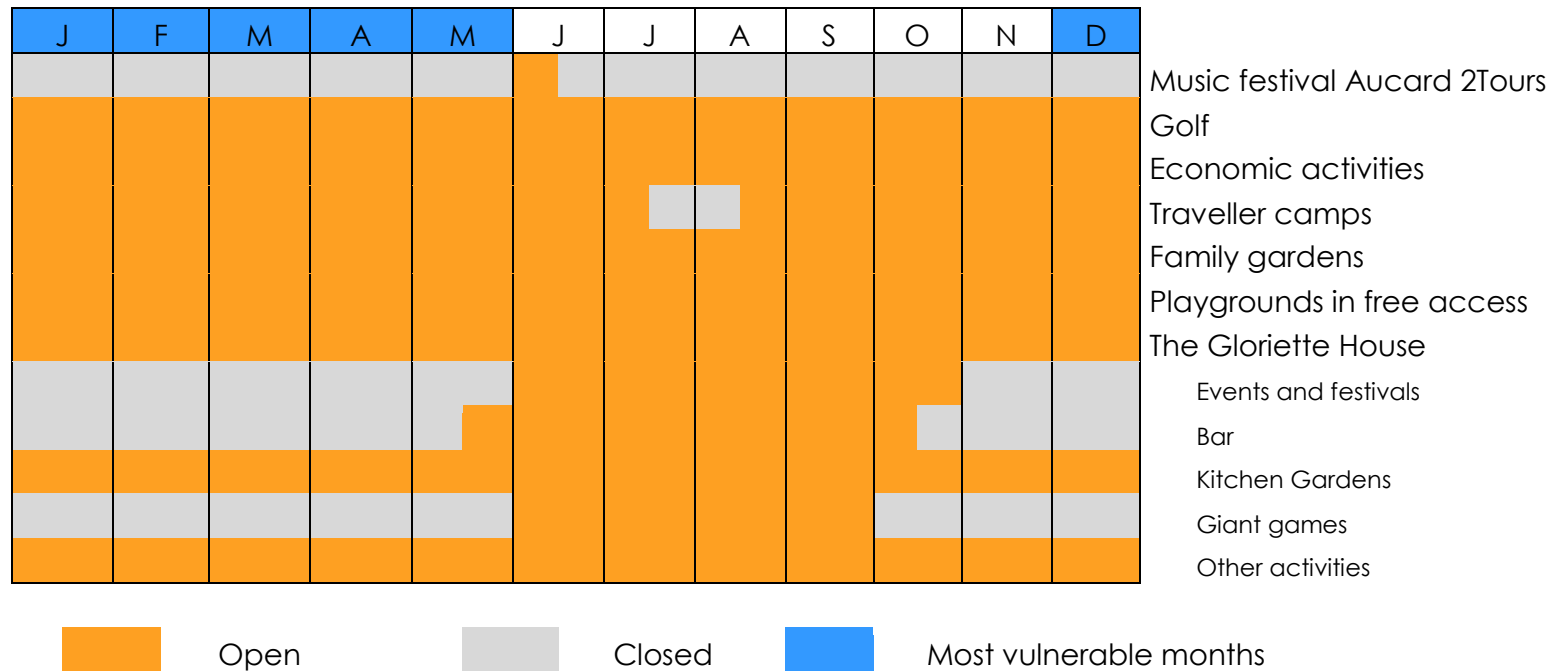


Table 2: Calendar of the open seasons of each activity

II. An evaluation method relatively adaptable to the Gloriette case

In the first part of the report a general multi criteria assessment grid was elaborated, and then a method was proposed to adapt it to any case study. Now that the Gloriette has been presented, this part will now be devoted to the adaptation of this analysis method for the case study of the Gloriette floodplain, in Tours.

Then, the main idea of this part will be to put into perspective the criteria to decide whether they are kept for the Gloriette assessment or not. For each criterion, its importance to answer the research issue will be questioned. So if it is judged unimportant to determine the profitability of the Gloriette it will not be taken into account for the analysis. Besides, the evaluability of each criterion, that is to say the availability of the data, will also be considered.

This part will then present the classification of each criterion, to eventually come to the final applicable grid for the assessment of our case study. To be brief, we will show that the majority of the criteria will be retained for the Gloriette assessment, except from technical feasibility, which is really irrelevant in that case. What's more, the criteria kept do not necessarily have the same importance, the most important ones being social justice and vulnerability.

1. Economic efficiency: a territory not concerned by economic activities

As we saw in the global definition, Economic Efficiency is a criterion which embraces various notions that describe the inputs and outputs used for a project. Here we justify our choices regarding the importance of it and its evaluability.

A low importance

The time we got for this project did not permit an exhaustive analysis of this criterion. Nevertheless, a global analysis through our documentary research and interviews allows us to say that the economic efficiency is not the priority in the Gloriette. It looks like Tour(s)Plus invests a lot in it and uses this floodplain as an educational place about biodiversity and a land of outside leisure activities without expecting a financial gain. We chose to give a note of 1 for the importance of Economic Efficiency, because we can feel it is not the point that justifies the presence of multiple uses in the Gloriette as we explain it in the Analysis part.

A criterion hardly evaluable

We note this criterion with a 1 concerning the evaluability. Because of the complexity of this criterion, and due to the short amount of time we had, we cannot access to all the information we need for a complete analysis.

2. Technical feasibility: an irrelevant criterion

Since we consider flood protection infrastructures that already exist, the criterion of Technical Feasibility loses a part of its sense here. Moreover and more specifically, because of its status of floodplain, La Plaine de la Gloriette and its multiple uses could not be described by the technical feasibility. To describe the impact of the multiple uses on the efficiency of the floodplain to welcome a flood, we choose to use the criterion of vulnerability which is larger than technical feasibility as far as it implies the technical issues and the inhabitant's issues.

That is why we note this criterion with two 0, both for the importance and the evaluability.

3. Accountability: a rather important criterion

As we have seen, accountability refers to the fact that all actors of a project are able to justify or account for their activities. In order to evaluate this, it seems easier to decline this criterion in three: the relevance, the institutional legitimacy and the citizen legitimacy. Several indicators can be released

from these criteria like needs of population, respect of regulation in the establishment of the multi-use, number of mobilisations made by population or association, participation and involvement of the population. We will see in the following part that this accountability is not the most important criterion, it seems important to study in the case of the Gloriette, even if data are not always available or accessible. These characteristics made the accountability the third criterion in terms of importance and evaluability.

Relevance: an interesting location

Relevance has been defined as the fact that the aims of the project meet the users' expectation or the needs of the neighbourhood. In order to evaluate this criterion, needs and uses seem to be good indicators to focus on. In this part, we will see that relevance is one of the most important criteria of accountability, in view of its importance and its evaluability.

A strong importance

The relevance criterion is really strong to understand in the Gloriette case study because this site is ideally located, not so far from the city centre of Tours. Moreover, districts around the Gloriette are relatively dense, with many collective housing. This situation and characteristics lead to strong urban issues. We can also notice that the "Deux-Lions" district and the Gloriette are not the less expensive districts of Tours, according to the newspaper Le Point¹⁶.

Moreover, this is an important place for the entire agglomeration because it is one of the last natural areas of Tours. Furthermore, the Gloriette is well connected to other districts of the town, thanks to the tramway, buses and roads. As a result, its area of influence is quite big and extend through the Tour(s) Plus territory.

A moderate evaluability

To evaluate relevance of the project, two main indicators were defined in the part before: needs and utilisation. To study these indicators it seems interesting to see how people use the place today, how it was planned to be before the multi-use was set up and also know the attendance of the place. Unfortunately, some information, like attendance, is not easily available because of the free activities, particularly those organised by the Gloriette house. Moreover, it is difficult to find specific needs of population of the neighbourhood because of a lack of time. That is why this criterion is moderately assessable.

¹⁶ Le Point. "Tours - La Cote Quartier Par Quartier - Le Point." Accessed December 9, 2014. http://www.lepoint.fr/villes/tours-la-cote-quartier-par-quartier-04-10-2012-1515864_27.php.

All these characteristics, on positioning and connectivity of the floodplain, justify the strong importance of the evaluation of this criterion of relevance for this case study. But the evaluability of this criterion is more difficult because of the access of information. All this make the relevance an important criterion but not the most important.

Institutional legitimacy: a sub-criterion linked to urban stakes

In a previous part, institutional legitimacy was defined as the right to be or do something in the society. For this criterion, precisions were made to focus on the legal aspect of the project set up in the Gloriette. Even if the importance of this criterion seems moderate comparing to other criteria, its evaluability is well ranked. That made the institutional legitimacy one of the highest ranked criteria of accountability.

An importance classified as medium

Institutional legitimacy has been considered as middle-range important criteria. In fact, the floodplain is located between the Cher and the Petit Cher, which is why it got this vocation. This implies that the area of the Gloriette is classified as high hazard by documents for flood risk prevention. Consequently, there are strong legislative constraints about what can be built or not. So it seems important to see if actors of the multi-use respect this legislation. But as we specified before, this area represents strong urban issues and the institutional legitimacy seems less important than the vulnerability or the social justice for example, as we will see later.

A good evaluability

In order to evaluate this criterion we will look at the main documents about risk prevention and documents determining land uses, like the PPRI and the PLU, which are available on the web site of the city. These documents are public documents and are consultable by anyone. The second indicator of this criterion is population mobilisations, their number and their impacts on the advancement of the projects. This data is available thanks to the interviews of different actors and article in local newspapers. With all this information, this criterion seems well assessable.

Thanks to an easy access to the information, first under the regulation of the land use on the Gloriette and then under the mobilisations that could exist on the site; but also thanks to the relative importance of this criterion, citizen legitimacy is, as relevance, in the middle in the scale of criterion for the case study.

Citizen legitimacy: a criterion becoming significant

As it was described before, citizen legitimacy refers to the correctness of the project for populations and users. In order to study this criterion, two main indicators have been proposed, the participation of population in the design of the projects and the events or mobilisations against the projects. Compared to the importance and the evaluability of relevance and institutional legitimacy, this criterion, regarding the case of the Gloriette, appears as the least important of the three sub-criteria of accountability.

An importance classed as medium

Citizen legitimacy is as important as the institutional one. In fact, because the Gloriette concerns a lot of people, as it is explained previously, it is important to see if the project is accepted by the population and if citizens have been consulted for the future of the Gloriette. In addition to the population, we also include all the associations fighting for ecological principles for example. Moreover, today, in a lot of country, participation principle is more and more spread, and it affects more and more the legitimacy.

A moderate evaluability

To evaluate the citizen legitimacy we need to know how the populations have participated to the project and if there was some mobilisation against. Some of this information, as the degree of participation for example, is difficult to find in the time we have to do this research project. As a result, a full evaluation of this criterion seems a complicated.

We have seen before, that the definition of accountability was complicated, and that it could be separated into three main sub-criteria to be easier to evaluate. Finally, this difficulty of definition is reflected in the difficulty to find information to do the best evaluation as possible. Because of these constraints, accountability is in a middle place in the classification of all criteria for the case of the Gloriette.

4. Social justice: an importance based on the numerous activities

The diversity of the activities proposed in the Gloriette makes the analysis of the criterion social justice easier. In fact, analysing equity and fairness both in terms of flood protection and access to the activities appears really relevant in the Gloriette case. Moreover, we will see that the data can be considered as available, so the criterion will then be one of the most appropriate to study.

A strong importance

Social justice seems to be a really relevant criterion to evaluate in the Gloriette case study. In fact, given the multitude and the diversity of the activities proposed on the site, we can easily imagine that a lot of different populations and people will come into consideration during the analysis. Thus, it will be particularly interesting to focus on the equity in terms of activities and in terms of flood protection in this case, because we can imagine that the interactions between the different actors must be interesting. Therefore, the score given to this criterion in terms of importance can easily be a 3.

A good evaluability

In terms of evaluability, this criterion will require more qualitative than quantitative data to be evaluated. Indeed, as it was said in the description of the criterion, in the previous part, the aim of this criterion is to assess whether every population and area are treated the same way concerning access to the activities and risk protection. So the kind of information needed will rather concern the purpose of the activities, the consideration of the different populations by each one, or even the consideration of the risk in each case, etc. So thanks to the interviews done with the different actors

concerned, and the different information found in the literature, it has been judged that the data is available for this criterion, so in terms of evaluability this criterion also gets the maximum score, that is to say 2.

So, eventually this criterion has the maximum scoring in this assessment grid with a total of 5. As a result, it will be one of the most relevant criteria of our analysis of the Gloriette case study.

5. Vulnerability: multiple uses involving multiple trade-offs

The criterion vulnerability is one of the most important criteria as well. Indeed, once again, due to the diversity of the activities proposed, it is interesting to study the different trade-offs made between risk protection and each activity to evaluate the perception and the importance given to flood protection by each activity.

A strong importance

The vulnerability criterion also appears relevant to study since the Gloriette is particularly exposed to flood risk because of its location on a maximum hazard area. Besides, it is not only a protective infrastructure but a space entirely dedicated to welcome water, which is not the case of every multi-use infrastructure that exists. Thereby, the question of vulnerability appears totally appropriate. Besides, the fact that there are numerous activities on the site questions especially the consideration of the risk by each of them and the impacts they have. Consequently, vulnerability also obtains the maximum score for its appropriateness, 3.

A good evaluability

Concerning the accessibility to the data, this criterion has also been judged as a good one. In fact information is collected the same way as for the social justice criterion, so via the interviews essentially or thanks to the literature and the internet. So the data is considered as available too, and the criterion obtains a score of 2.

Finally, the vulnerability criterion is as important to study as the social justice one for the Gloriette case study, with a total score of 5, the maximum.

CRITERIA	SUB-CRITERIA	IMPORTANCE	EVALUABILITY	SUM
ECONOMIC EFFICIENCY		1	1	2
TECHNICAL FEASIBILITY		0	0	0
ACCOUNTABILITY	Institutional legitimacy	2	2	4
	Citizen legitimacy	2	1	3
	Relevance	3	1	4
SOCIAL JUSTICE		3	2	5
VULNERABILITY		3	2	5

Table 3: Summary of the criteria's weights

In conclusion, the majority of the criteria are considered as important and appropriate to analyse for the assessment. In fact, the only one that will not be used is the technical feasibility. The others are all interesting to keep, even if for some of them, especially economic efficiency, citizen legitimacy and relevance, a complete data is not always findable. The most important ones are then social justice and vulnerability, which will be the easier to analyse thanks to their good evaluability.

III. Assessment of the Gloriette: a good example of multi-use flood management

The aim of this part is to evaluate the multi-use in the floodplain of the Gloriette, thanks to the method described in the part before. As it was explained, each criterion of the assessment framework was classified thanks to its importance and its evaluability. This evaluation of the Gloriette will follow the order of this classification as it was given in the part just before, so it will begin with the social justice and vulnerability of this multi-use. Then the evaluation will consider all the sub-criteria of the accountability criteria, namely relevance, institutional legitimacy and citizen legitimacy. Then, the economic efficiency criterion will be analysed. Finally, the technical feasibility will not be study because, as it was explained before, it does not appear relevant for the case of the Gloriette.

This assessment will be based on several kinds of data. First, we have made some interviews with different actors, linked in some ways to the development or the management of multi-use in the Gloriette. In the order that we met or contact them, the different actors are the followings.

- Joël Nouet, responsible of the Gloriette house
- Serge Bouthet, responsible of the Joué-lès-Tours travellers camp
- Enzo Petillault, one of the organisers of the music festival “Aucard de Tours”
- Catherine Boisneau, ecologist and lecturer
- David Chollet, an elected member of the Europe Ecologie les Verts political party
- Michel Durand, president of the SEPANT association (Société pour l’étude, la protection et l’aménagement de la nature en Touraine)
- François Chapacou, worker of the parks and gardens service of the city of Tours, responsible of the southern subdivision

Secondly, this assessment is based on a reading work. Media were varied, the evaluation appealed to institutional documents as documents for risk management, reports of other researchers on the Gloriette, but also some press articles.

All along this part, we will see how the Gloriette is situated concerning the different criteria defined and explained before. We will see that the social justice and the vulnerability of the project, the two most important criteria, have been evaluated relatively positively. Indeed, vulnerability is considered as a fair trade-off and social justice not so far from an impartial treatment, considering fairness in terms of flood protection, and at a high level considering fairness in terms of access to the activities. Concerning the accountability, even if the institutional legitimacy appears right, as well as the relevance, the citizen legitimacy seems less good. Finally, the evaluation of the economic efficiency of the project shows that the Gloriette and its multi-use were not established to produce economic benefits but more to give a better image of the city.

1. Social justice: a protection and an access fair for everyone

Social justice is one of the most relevant criteria kept after the elaboration of the analysis grid for the Gloriette case study. As the following analysis will show it, this site is a relatively rich space in terms of activities and frequentation. Therefore, according to the two evaluation scales proposed in the previous part, we can consider that the level of social justice corresponding to the Gloriette floodplain is rather good both in terms of flood protection and in terms of access to the activities. So, this part will focus on the analysis of the indicators elaborated in the assessment method to justify why the Gloriette is considered as a quite good example of social justice.

A significant diversity

This first part of the analysis will focus particularly on the first indicator elaborated in the second part of this paper, which concerned the type of population or area aimed by the activities. The information given in this part was collected thanks to the different interviews and the data found elsewhere.

As it was shown in the presentation of the Gloriette, numerous different activities are present on the site. First, there are the leisure activities, with the golf course, the accrobranche park, the wood games for kids, the kitchen gardens and the family gardens. What's more, every year in June, a music festival called "Aucard de Tours" takes place in the Gloriette. Secondly, there are economic activities, with the companies which were installed on the site before the development of the area. And finally, there are two traveller camps, also present prior to the development, and a high traffic area.

A great sports offer, in addition to the golf

Golf has always been considered as a rather expensive activity reserved to rich people. So in the first place we can think that the presence of golf courses is not a strength but on the contrary that it will only attract a certain kind of population and more particularly rather wealthy people. But the golf course studied here is actually a public one as it was said before, and in a more general way, golf is becoming a more and more accessible and affordable hobby. The image of this sport is actually changing, and as a matter of fact, the membership of the French Golf Federation has been growing steadily since 1970. In fact, at that time it counted only 20 000 members and between 2000 and 2009 this number rose from almost 300 000 to 410 000 members.

What's more, golf is an intergenerational sport gathering everyone. People can play golf with their family, or their friends, it is user-friendly. More specifically, the Gloriette golf is open to everyone and very affordable in comparison to other golf in France, with a price of 10€ for the 9 holes and 17€ for the 18 holes. Also, it is particularly interesting for young people because there are special prices for those under 26 years old and there is a partnership with the SUAPS (University department of physical and sports activities), a sport association dedicated to the students of the University of Tours. This allows them to benefit from even more preferential prices and access.

So even if people still have prejudices or misconceptions about this sport, the Gloriette courses are supposed to be open to everyone and not to serve only a certain kind of population. Plus, efforts are made by the golf to make it more affordable to everyone and especially thanks to special prices for young people and a partnership for the University students.

Furthermore, the sports offer also includes a beach volley field and an accrobranche park. So we can see that in terms of sports offer the Gloriette is relatively well furnished. What's more, the current unused territories are sometimes used as football or rugby fields. So people

The Gloriette house: educational activities for young and old

We can also see that entertaining and pedagogical activities are proposed for children and their parents. Indeed, from June to October, different animations are organised by the Gloriette house around nature and biodiversity to make the children concerned and interested about environment. For example, there is an area dedicated to kitchen gardens where children can learn more about culture, vegetables, etc, with school or not. Its area increased from 500 m² in 2002 to 7000 m² in 2010. There are also hives and since 2013 an educational apiary has been installed. Moreover, different manifestations are organised, like the pumpkin feast, the kite feast, etc., as it was said before.

Furthermore, the Gloriette welcomes family gardens, and even before going into details, we can see that in terms of social justice the principle is good as well. The aim is to gather families and rent them a piece of land to cultivate what they want. In the Gloriette we can count 83 family gardens, but it is a small part in comparison to the 1300 family gardens of the city, distributed in 18 different sites. The only problem that can be raised about these family gardens concerns the offer. Actually there is a much more important demand than the offer, so all the family cannot obtain one or have to wait a long time for it. But it also reflects the interest of the place and its success.

So a lot of activities are centred on nature to welcome children and family, and this is a good point in social justice because it gathers an intergenerational population.

An entire area dedicated to travellers

Inhabitants were present on the site before it started to be developed. In fact, travellers settled in the north of the area along the Cher, and now there are two traveller camps next to each other, but separated by the limit between Tours and Joué-lès-Tours. So each one is managed independently of the other one.

We can see that the development of the other activities presented before did not have any impacts on their location. It was considered that their presence did not bother any of them so they could stay there and not be excluded. What's more as it was said a high traffic area has been created to welcome religious manifestations during the summer.

So the presence of traveller camps and a high traffic area shows once more that population frequenting this place are really varied, and that no one is excluded or prioritised.

The working places

Furthermore, companies and farmers are located on the site. They were there prior to the development of the current activities. However we can see that they stayed there, and that the development of the area did not change anything for them. So they are still as vulnerable as before, but this is not due to the development of the area, given that their construction was allowed back then.

Leisure activities for all

Finally, concerning leisure activities, the public aimed is also varied since the activities go from games for kids, to an annual music festival. There are indeed two playgrounds, a tyrolean traverse, a pirate ship, and the accrobranche path. So it is an attractive place for children to play together, and in the same time it is a user-friendly zone for the parents accompanying them. It is a kind of meeting area gathering all type of populations from all ages.

A favourable location

Besides, if we focus rapidly on the location of the site we can see that it benefits from a remarkable situation, in the city itself near the centre of Tours, not in the periphery. It takes about 10 minutes to go downtown by car, and around 20 minutes by bus or tramway. Plus, the tramway and the bus stations are just a few minutes' walk from the site and the cycle route "La Loire à vélo" also deserves the area. Thus, the Gloriette has a great location, which allows it to be accessible to everyone by walk, car or public transports, rapidly.

So in conclusion, we can see that the Gloriette is a diverse and mixed space and then corresponds to a high level of social justice in terms of fairness of the activities. None of the activity presented has an influence on another one. Each one is spatially limited and there is no conflict between them. Given the wide range of activities proposed on the site and its location, we can see that the Gloriette gathers a lot of different people, from all types of populations and all ages, it is not intended to a particular population. So, even if at first sight we can think that the golf courses for example are aimed for rather wealthy people, or the family gardens for rather average people, the site offers a wide range of activities for everyone, from leisure to work.

A global knowledge and protection of the risk

The second part of the analysis will now focus on the second indicator, the evaluation of the fairness and equity in terms of flood protection.

The traveller camps, a privileged location

Globally, at first sight a surprising thing appears: travellers are located along the Cher, so they are the closest to the river, and then the most vulnerable. But, we learnt during the interview we had with Joël Nouet that travellers are actually located in the higher zone of the Gloriette, so they are the less vulnerable. This way, if the water table overflows, they are not the first ones in danger.

Moreover the overflow is predictable for the entire site, because it begins to be visible about two to three days before near the cities of Villandry and Savonnières before it happens in the Gloriette. In that case, concerning the travellers, Mr. Bouthet, administrator of the Joué-lès-Tours camp, is alerted and travellers are evacuated according to the evacuation procedure of the city. The principle is supposedly the same for the Tours camp.

Besides, in both the Tours and Joué-lès-Tours traveller camps, electricity meters are installed on top of little mounds to be protected in case of floods. There are also retention ponds and a ditch to welcome rainwater. So, finally we can see that travellers, unlike we could thought in the first place, are relatively well protected, due to their elevated position on the floodplain.

An inappropriateness of the activities

Concerning the other activities, as the law stipulates it, nothing can be built to welcome people permanently and that is what has been done in the Gloriette. Except from the travellers, no place welcomes people permanently. This way, we can consider that nobody is actually concerned by the risk on the other activities proposed in the Gloriette.

Vulnerability only concerns the activities strictly speaking, because in reality the crops, the kitchen gardens and the family gardens do not welcome people permanently. The impact is not the same for all these activities because in fact for the family gardens and the kitchen gardens the production is not sold. On the contrary, for farmers cultivating on the site, a flood will have big impacts on their season.

To conclude, the people exposed to flood risk in the Gloriette are the travellers and the farmers. But we saw that travellers are well protected, by both their localisation and the infrastructures implemented on their area. On the contrary farmers are really vulnerable so we can conclude that the fairness in terms of flood protection is not right for everyone even if it is for the majority. The Gloriette will then correspond to an intermediate level between impartial treatment and unconsciousness, because except from the farmers, nobody is exposed to flood risk in this area, thanks to the absence of permanent construction. However, it is not justified neither to talk about unconsciousness because the area is not flooded very often, so farmers are not exposed to a permanent risk, there can be a long time without any water and they knew about the risk before and chose to stay. In that sense, the level of unconsciousness exists but is really low.

An assessment depending on the period considered

Furthermore, an additional aspect seems important to be mentioned to put into perspective the analysis just made. In fact, if we consider the Gloriette floodplain according to its former boundaries, the Deux-Lions neighbourhood is included in the area and, to some significant degree, its construction had negative impacts on the Gloriette floodplain as it is known nowadays. The backfilling realised for the urbanisation of the Deux-Lions neighbourhood kind of sacrificed the current floodplain, because initially the whole Deux-Lions neighbourhood was a part of the floodplain, as it was explained more precisely in the presentation of the Gloriette. Considering this fact, the Deux-Lions neighbourhood didn't respond to the social justice principle, which implies that a measure taken in some place should not have negative impact somewhere else.

2. Vulnerability: trade-offs respectful of the risk

Vulnerability is also one of the most important criteria chosen for the analysis of the Gloriette floodplain. In this part, we will see that the trade between perceived risk and perceived benefit characterising the Gloriette is actually fair, so the level of vulnerability is low. The area is of course at risk, because it is a floodplain, but the various activities installed on the site are appropriate and they take the risk into account very well.

A well thought out development

In terms of impacts on the risk, it is clear that none of the activities has negative effects. Indeed, they are relatively simple and did not imply any physical modification of the area. There has not been any hydrological modification during the development of the different activities present today on the floodplain. The only modifications realised concern the change of land use with the construction of the golf courses especially, but also with the family and the kitchen gardens. But those changes do not have any impacts on the risk.

Given that activities do not have any impacts on the risk, it is not necessary to make a parallel between the evolution of the activities and the occurrence of floods, because they will not be linked. Especially since there has not been significant flood since the development of multi-use in the Gloriette.

A territory involved in flood protection

Concerning the consideration of the risk in the development and the management of the activities we can also see that the Gloriette is a good example for multiple reasons. First, a great importance is given to this place. There is a strong will to preserve the area as a floodplain and make it a showcase of the environment in the city. This will is shared by the different actors met, whatever their role is. So this testifies to the awareness of the risk and the desire to take it into account. This part will show more specifically how the risk is actually taken into account by the various activities.

First of all, in a general way, as it was said before, nothing permanent can be built on the Gloriette. People cannot stay permanently in the site, except from the travellers who lived there before. The policy is strict, the area must be preserved from all kind of permanent urbanisation.

If we look closer at the golf, the Gloriette house activities and the traveller camps, we can see that the risk is a really important part of the management. Indeed, the infrastructures installed by the Gloriette house for example, are all built in wood, and are removable so in case of a flood they can be disassembled. What's more, the Gloriette house also uses a system of dry toilets to save water and reduce water pollution.

Concerning the traveller camps, measures are also taken. In fact, retention ponds are installed on the site, and a ditch was created to welcome rainwater. In addition, as it was already said previously, the camps are on the higher zone of the Gloriette and the electric metres are installed on top of mounds so they are supposed to be protected in case of a flood.

The golf is also taking measures. Indeed, the reception building is built on stilts so it is not supposed to be damaged in case of a flood event. Moreover, even if it is less significant, another initiative is taken, pesticides are forbidden for the maintenance of the greens with a concern to limit the water pollution in case of a flood.

So we can conclude that there is an awareness and a respect of the risk through the development and the management of every activity present on the Gloriette. They are quite simple so they are appropriate to the context and they do not imply any modification of the hydrological system or anything, the risk remains unchanged. The only exceptions are the travellers camps, because they welcome people permanently, which is supposed to be forbidden. But they were present prior to the development of the area, and measures like the retention ponds, the ditch, and the elevation of the electric meters reflect the desire to reduce the risk for the populations. So in terms of vulnerability, the Gloriette can be qualified as a fair trade-off.

Besides, as it was said at the end of the previous criterion analysis, if we consider again the Deux-Lions neighbourhood in the Gloriette boundaries, then the trade-off is not fair, on the contrary, in that case it privileged the activity, which is the urbanisation of the neighbourhood, over risk protection.

3. Accountability

A relevant use across the city

Addressed needs

The first step to evaluate the relevance of the project is to study the needs of the population and the neighbourhood before and after the project. In fact, as we saw it in the historical part of the Gloriette, the entire area represented by the floodplain of the Gloriette, and the “Deux-Lions” district, was to expand the city of Tours, in the continuation of the already existing buildings. The main idea was to build a technology park, then, the next mayor of Tours decided to create a place with a functional diversity with housing, economical structures and services. The area of The Gloriette was left free of any construction because of the urbanisation of the “Deux-Lions” district, making flood risk more important in this area. This space became a protected area where no more constructions were allowed and the city had the ambition to make an “ecological showcase”. Today, the projects set up in the Gloriette are respectful of nature and linked to an idea of an ecological place, with, especially the family gardens and the kitchen gardens, which have a pedagogical aspect. In those terms, the Gloriette respects its ambitions. Moreover, a part of the Gloriette is a public space, open to everyone, something quite rare in the neighbourhood. Moreover, the Gloriette is one of the only urban parks in the agglomeration, so it meets the needs of this type of infrastructure in Tours. Concerning the specific needs of the population, data are not available, because of the lack of time, so it seems difficult to evaluate this point.

So concerning the need, the Gloriette seems to answer to the general needs of the city and the urban agglomeration, and ranks as one of the largest urban parks of the territory.

A reasonable use

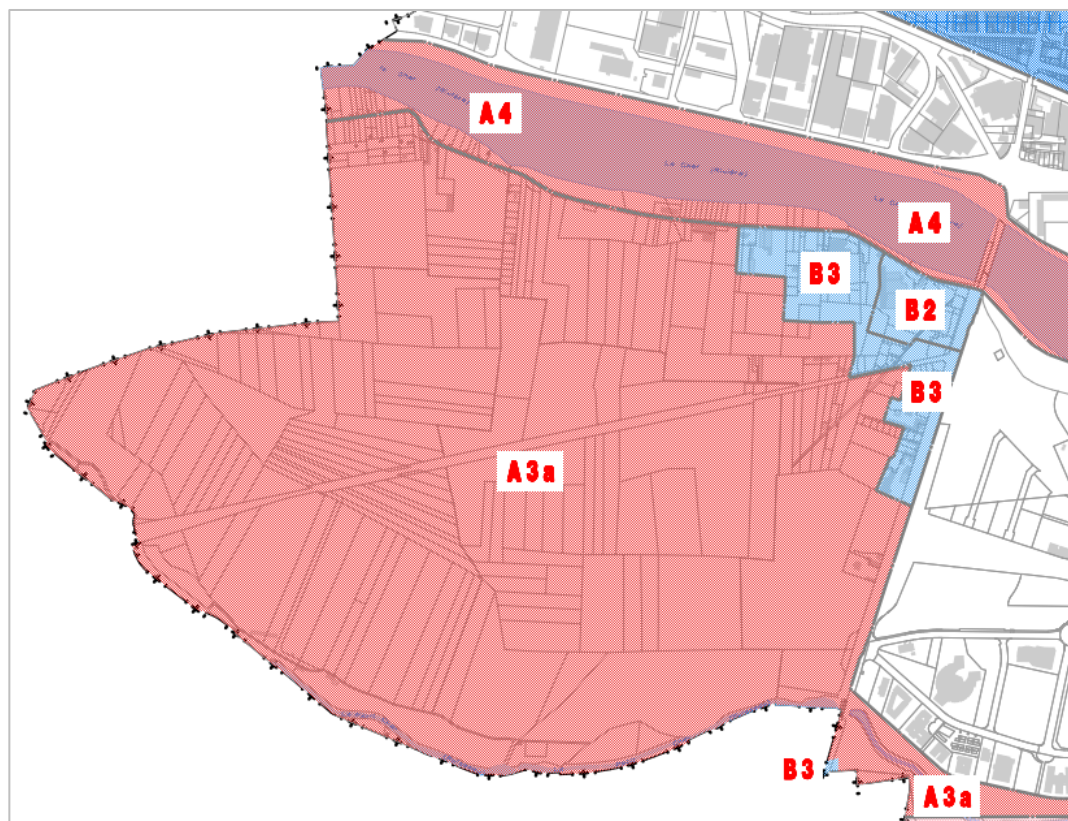
In order to evaluate the relevance of the project, we decided to look at the utilisation of this space. We saw in the Gloriette's presentation that there are several uses of this space. That implies that several types of population are involved in the use of this space and its activities. In fact, events taking place in the Gloriette are varied: the beehive feast, the pumpkin festival, the kite festival, etc. and addressed directly to all populations. Moreover, a lot of these events are free. Concerning attendance, there is no real data because of the free events, and the difficulty to have exact data, for the golf especially. But Joël Nouet, responsible of the Gloriette house, told us that attendance of the different festivals have increased, thanks to the tramway and the rising urbanisation of the "Deux-Lions". Moreover, the recent extension of the golf shows that this infrastructure works well and that the frequentation is good. Finally, the demand for family gardens are more important than the number of gardens available. The different activities of the Gloriette seem to be used by a lot of people and adapted to the most numerous. Finally, because some activities like playgrounds are open all year and accessible by everyone, we could notice, with observations on site that there are often used by several families.

To conclude on this criterion, difficulties to find information concerning the needs of the population do not allow us to say if the activities set up in the Gloriette meet the needs of the population. But we can notice that the Gloriette is in line with the broader needs of the city. Moreover, the place seems to be well used by different type of population. So we can classify the case study in the first level of relevance, where the utilisation seems to meet the needs of the population, in a big scale.

Institutional legitimacy: a project in accordance with the law

Activities respectful of the legislative documents

To evaluate the institutional legitimacy of the multi-use in the Gloriette, it appears important to see if the constructions of the different activities set up in the site are in accordance with flood risk prevention documents. As it has been specified before, in France, two main documents are considered as references in terms of risk prevention and land use: the "Plan Local d'Urbanisme" (PLU) and the "Plan de prévention des risques" (PPRI). In those of Tours, the Gloriette is divided in 4 areas as we can see on the map below.



Map 6: Classification of the lands in the Tours PPRI¹⁷

The North-East of the site is classified in B, that means that it is a flood urbanised area. The index for each area represents the degree of exposure to flood risk, so for an area classified in B2 the hazard is average and for a B3 area, the hazard is strong. In fact, areas situated close to the Cher are more exposed to the risk; as a result, regulation is stricter.

The remainder of the floodplain is classified in A, which is an area to preserve of any urbanisation. A3a means that this area is classified as a strong hazard one and as a frequently flooded area and A4 means that this is a very strong hazard area. In this kind of area, no construction is allowed. But,

¹⁷ Web Geo Service. "PLU Tours - Zones de Risques Naturels." Accessed December 5, 2014. http://ville-tours.webgeoservices.com/pdf_maps/148/.

according to the settlement of these documents, exceptions may be made. For example, in an A3 or A4 area, all constructions, works, amenities, or operating fields are forbidden, except from the followings.

- Maintenance work on existing facilities
- Modernisation and extension of wastewater treatment plants
- Reconstruction affecting by something other than floods
- Open shelters for animals
- Shelters for family gardens
- Shelters for pumping installations
- Public facilities for sanitation or electricity
- Stopping place for travellers
- ...

It is stated that all this constructions or installations need to be dismantled in 48 hours and needs to be built with materials waterproof.

For areas classified in B, the regulation is the same, but constructions already built have standards to respect. For example, all the products that can harm the environment need to be placed in a waterproof container and no basement are allowed. The evaluation of the institutional legitimacy needs to be done by looking if all activities present on the Gloriette meets these standards.

For all things organised and managed by the Gloriette house this standards are met. The few constructions are legal: shelters for family gardens are authorised in the regulation, the local of the Gloriette house is an old building renovated, and all the constructions like playgrounds are easily dismantled in less than 48 hours, or equipped with pumping systems, according to Joël Nouet, responsible of the Gloriette house.

Concerning the golf, the building was built in 2007. In a legislative point of view, even if the Gloriette is classified A3, this building is authorised. In fact the A3 classification involves a non-urbanisation of the area but exceptions are possible. For example, it allows the construction of new building or amenities for sports, leisure and tourism, as long as they do not welcome people permanently. That is the case of the golf's building. Moreover, this building is built on stilts to be more protected in case of flood.

Finally, buildings relative to economic activities were built before this quite strict regulation appeared, so their legitimacy does not seem to be questioned.

So, regarding all the activities in the floodplain, the Gloriette seems to be legitimate in the regulation point of view.

No significant mobilisation

In order to evaluate the institutional legitimacy, it seems also interesting to see if there were any mobilisations against the different projects planned to be in the Gloriette. With the different interviews we had and the different documents we could read about the Gloriette, we did not find any trace of this kind of event for activities present today. In contrast, there were some mobilisations of ecological associations like “Loire vivante”, for previous projects. These mobilisations led the Gloriette to be a non-urbanised area, and a place devoted to nature. Moreover, there was no decree taken by the prefect opposing any project since Jean Germain has decided to leave the area without urbanisation.

With all this information, the Gloriette and its multi-use appears as right concerning the institutional legitimacy.

Citizen legitimacy: a strong acceptance but no participation yet

Citizen legitimacy is the last sub-criterion of accountability. According to the classification of the criteria adapted to our case study, this sub-criterion is not the most important of all and it is the last one of accountability, regarding its importance and its evaluability. As it was explained before, citizen legitimacy has two indicators: acceptance and participation.

A development not called into question

This first indicator is really close to the one of institutional legitimacy, mobilisation. In fact, several reasons could exist to be mobilised against a project but they are all often made by citizens or associations. Citizens can protest against a project because it is not legal, because it is not relevant to put it there, because of the dangerousness of this project, because of the nature protection, or because of the excessive price for example. No mobilisation of citizens or associations can show that they agree with the project, on all the points discussed just before. For the Gloriette floodplain, it does not exist a lot of mobilisations against the project. In fact, as it was said earlier, since the Gloriette is totally dedicated to receive flood, the multi-use proposed seems not to go against the will of citizens. The association Loire Vivante is certainly the only association fighting for the Gloriette, but that was before Jean Germain, when the Gloriette was planned to be urbanised like the “Deux-Lions” district. As such, we can say that the different multi-uses on the Gloriette are accepted by everyone.

A low level of participation

Concerning the participation of the population in the project, we decide to evaluate it with the Arnstein ladder, described in the part where criteria are defined. Thanks to this ladder, we can determine if people were involved in the definition of the different projects of the Gloriette. Before evaluating the participation in our case study, it is important to precise that the phenomenon of participation is quite recent in France. Even if it is tending to develop itself, only a few actors ask for a population’s participation, like the Arnstein ladder defines it, that is to say a participation where population have a real power in decisions taken. The Arnstein ladder gives 3 levels to qualify the participation: citizen power, tokenism and non-participation; each one divided into several levels. In the case of Tours and more specially the Gloriette, decision making is not left to the citizen. As we could learn

thanks to some press articles and interviews made with the responsible of the Gloriette house, Joël Nouet and the president of an ecological association, Michel Durand, we could evaluate a part of the participation in the different projects set on the Gloriette. It seems that there was not a lot of participation for the different multi-uses. Since today, population was not involved in the decision-making but information under the project was available and searchable by everyone. In the Arnstein ladder, it was a non-participation level and the type of participation was only information. Now things seem to change. For example, a project of goat barn was proposed by the old municipal team, but this was abandoned by the new municipal team because of its important cost. Nowadays, to determine the future of this space, the Gloriette house and the city of Tours want to involve the population, and ask for its opinion. No concrete actions have been launched yet but the local newspaper had made a survey to know what inhabitants want instead of the goat barn. But there were only a few participants and that was not something official.

So to conclude on the evaluation of citizen legitimacy, we saw that the mobilisation of association and population was not so strong and that people seem to agree with the different projects realised. However, participation of the population is quite low too. That shows that citizen legitimacy is good, in the sense that population seems agree with the projects but in the sense of taking into account the desire of the population, the citizen legitimacy is not so good. As a result, we chose to classify citizen legitimacy in the middle class.

4. Economic efficiency: not the main objective of the Gloriette

An historical situation and political choices opposed concerning the environmental consideration

The criterion of Economic Efficiency needs surroundings in time. Here, the creation of the “Deux-Lions” district is the point of reference to consider the inventory of biodiversity. Before it, the Gloriette was part of a large floodplain where there were essentially fields and wild spaces progressively separated from the river by dike. Some associations like the SEPANT, fought against the project to build a district on the current Gloriette. Due to the new neighbourhood of Deux-Lions, the Gloriette situation evolved and ended up being more included in the urban area of Tours than before. Since the district was built, the Gloriette is now situated between a neighbourhood and a biodiversity zone. That justifies the will of Tours to use it as a space dedicated for “sport and leisure [...], an open space”¹⁸ dedicated to the whole urban conurbation.

The presence of a “biodiversity zone” described like it and situated in the west of the Gloriette seems to justify in its turn the use of the Gloriette as an open space for sport and leisure and not as a space for biodiversity and wildlife. To go further, if the Gloriette is regarded as showcase of biodiversity for the urban conglomeration nowadays it is only because it is compared to the Deux-Lions district.

In fact, the Gloriette has been used to develop a laboratory of observation about nature. For example, the Gloriette House was created in 2000 by Tours and aims at promoting environment and biodiversity to schools, thanks to animations. The fact that the Gloriette House depends on the Sustainable

¹⁸ Rapport de présentation du PLU, 11.07.2011, Ville de Tours

Development department of Tours municipality gives an idea about how the future development of the Gloriette is considered: respectful of the ecosystems, an example of sustainability.

Finally, concerning the environmental incomes and outputs, we can only conclude that currently, the biodiversity present on the Gloriette is less wild than before, it is a nature under control. The farmers' activities are less and less present even though the municipality shows a will to maintain agriculture near to city area with some project like the goat farm, especially since this project has been abandoned by the current and new municipality.

Employment: a gain thanks to new activities

The sub-criterion "employment" is considered at the scale of the activities present in the Gloriette and the surroundings depend on their creation or disappearance.

Since new activities have been established in the Gloriette, there are some employments that have been created. The Golf employs 6 persons for its management and maintenance. The Gloriette's House employs a total of 9 persons including three part-time jobs. Concerning the shared-garden, jobs are linked to Tours department, so we cannot consider them as created jobs linked to the Gloriette. Moreover, the shared-garden where not created in the Gloriette, but moved from Menneton's ZAC and Port-Corbon. Because they should have been created anyway, even if the travellers' areas employ for both the one of Joué-lès-Tours and Tours a total of 10 persons, they cannot be considered as the other jobs which were created because of the special status of the Gloriette.

To create those activities, lands for farming were used. Compared to the jobs that were created, we can believe that it is minimal, even if we did not have the time to evaluate it.

So, the assessment concerning employment seems to be positive. A total of around 25 jobs were created with the different activities present on the floodplain.

Activities in the Gloriette to justify the property value of the "Deux-Lions" district?

The property value is hard to estimate is the case of the Gloriette. The fact that the Deux-Lions district was only built 10 years old ago impacts highly the price of the land. Moreover, since the tramway was built in 2013, the district is easily accessible and the prices, by this means, are above the average of Tours' property which is around 2350€/m² to buy an apartment, while the average price in the Deux-Lions would be around 2 440€/m²¹⁹.

¹⁹ meilleuragent.com

Prices before the construction of the district are not known, but if we consider that they were field before or that the land were not used, we can say that the price increased a lot.

Anyway, the Gloriette is regulated and as the land cannot be built, the property value stays low: For example, Tours bought a land for the travellers area in 2014 and the price was of 2€/m² as it is said in the municipality reunion report which took place the 5th of May, 2014, that law price is linked to the interdiction of building any solid infrastructure.

Because there is the tramway, and a lot of facilities in the Deux-Lions, we cannot conclude that the property value of this district is directly linked to the activities in the Gloriette. Nevertheless, we can imagine that those activities add value to this district and to the lifestyle which is promoted.

A lot of financial investment for few gains on the Gloriette

The Gloriette is a floodplain which means that there is no possibility to build any new building on it. The current public policy is to buy all the lands and dedicate all the plain for public uses with multiple activities. That means some investments; Tour(s)Plus invested around 2 million € in 2007 for the Golf, for the Gloriette's House it invests around 270 000 € for renovating it. There is also functioning investment for the travellers' area. Tour(s)Plus is asked for 17400 € each year by Joué-lès-Tours to maintain its travellers' area.

To consider the gains, we know that the Golf is among the cheapest Golf in France. Unfortunately, we lack information like: the price to reserve the land for a festival or for an educational working group.

Finally, what the monetary indicators tells us is that Tour(s)Plus does not regard the Gloriette as an interesting financial place. They invest on it for the community, not to earn money. That makes sense for a public organisation.

Economic efficiency is hard to evaluate in our study case, due to a lack of information. Putting aside the environmental aspect, it seems that the assessment is quite good. But we need to be careful about that conclusion because we do not have all the information we need and especially the employment which disappeared, the gain linked to the activities or the details of wild species which were present before and the one that are still there now.

The only conclusion we could make would come from a global feeling that the activities in the Gloriette were not created for their economic efficiency but more to improve the image of the town.

5. The Gloriette: a complicated path for a coherent result

CRITERION	EVALUATION OF THE GLORIETTE
SOCIAL JUSTICE	High level (fairness for the access to the activities)
	Between impartial treatment and unconsciousness (fairness for flood protection)
VULNERABILITY	Fair trade-off
RELEVANCE	Right
INSTITUTIONAL LEGITIMACY	Right
CITIZEN LEGITIMACY	Middle
ECONOMIC EFFICIENCY	Not created for an economic efficiency but for the image of the city
TECHNICAL FEASIBILITY	Not treated

Table 4: Summary of the analysis for each criterion

This evaluation of the multi-use does not consider the neighbourhood of the “Deux-Lions”, but only the Gloriette floodplain like it is today. Otherwise, this evaluation would not have been the same, especially for the vulnerability and the social justice. These two ones would have been ranked lower, because the urbanisation of the “Deux-Lions” and its embankment has a real impact on the vulnerability of the Gloriette. If we look at the evaluation of the criteria chosen and we find relevant to evaluate, we can note that none of them have a bad evaluation. Some criteria have an average rating but sometimes, this note is more due to a difficulty to find information than a bad evaluation.

With these results, we can say that it is profitable for Tours to do multi-use in the Gloriette but it seems important to specify that there are no big economic issues in this area. Multi-use is not set up to make financial profit but more to improve the image of the city thanks to this urban park, where

nature and educational aspects are met. In that sense, the establishment of multi-use in the Gloriette is a good thing, it is well done and well thought not to affect the main purpose: receiving the water when there is a flood.

Finally, since 2001, there was no flood in the Gloriette, and at this date multi-use was not so developed. We cannot know how the different infrastructures and activities will support a flood, and what it will cost to the different owners. But judging the consideration of flood risk in the establishment of the different activities in the Gloriette, we can think that it will not be problematic.

A not so general assessment framework

Thanks to the assessment of the Gloriette case study we have been able to put into perspective the evaluation method elaborated during the first part of the work. Indeed, once the assessment grid was realised, in the first part, it clearly appeared that some criterion would be more difficult to study in the case of the Gloriette, which we chose, than for other cases. So the assessment framework is not directly applicable to any case, it depends on the geographical context, the type of infrastructure, the type of multi-use, the economical context, etc. A specific adaptation is necessary for each case to make the grid appropriate and usable.

Two main things are useful to adapt the grid. First, it is necessary to evaluate the relevance of the criteria for the chosen case study. Secondly, the availability of the data is also an important factor. A relevant criterion for which the data is available will obviously be more important to study to analyse the case. On the contrary, an irrelevant criterion with no data will not necessarily be analysed. So the work done during this research project was the occasion to notice the imperfection of the analysis grid elaborated in the first place, and find a solution to make it more adaptable.

Multi-use: a compensation solution towards urbanisation?

To conclude on the multi-use generally, we can notice that all the multi-use infrastructures are not the same in France, both on the establishment and on the management, it could depend on the history of the city and the type of flood the city is concerned by. Unlike the Gloriette in Tours, where the multi-use was set up to value a place normally non-use, in the French city of Vitrolles, multi-use was necessary. In fact, Vitrolles is a recent city, built in the 1960's in an area highly exposed to flood risk. The urbanisation of this city increased the flood risk by waterproofing the ground for example. In order to better manage this flood risk, especially risk by runoff, several retention ponds were built in the city, some of them were directly built in urban parks. In order to keep green spaces in the city, a retention pond has been integrated into the park, so it was just a modification of the park to include the basin. These following pictures illustrate the change of use of a space in Vitrolles, the square Marguerite de Provence. In that case, the second use of the retention pond was actually here before, it was the first use and the retention pond was built in order to compensate the urbanisation towards the flood risk.



Image 8: Change of use in the Square Marguerite de Provence in Vitrolles²⁰

An abandonment of multi-use in favour of the activities?

Thanks to the evaluation of one case of multi-use in France, another question may be raised: did the multi-use change the management objectives for politicians and technicians? For the evaluation method we proposed, vulnerability was one of the criteria. It permits to evaluate the consideration of the risk before and during the establishment of the multi-use. But once the multi-use is set up, we can wonder if the flood risk is still present in the populations' minds, but also in the ones of politicians and actors of the territory. In Toulon, a city in the south-eastern France, a retention pond was also used as a park with sports infrastructures, playgrounds and a skate park. After a feedback of the population, it appears that inhabitants of the neighbourhood preferred seeing the retention pond more often filled of water to be more aware of the flood risk in the area. This example show that the multi-use is not always accepted by everyone and it seems important to find a balance between the flood risk and the profit of a non-used area.

²⁰Ville de Vitrolles. Réaménagement de l'Avenue de Marseille. Support de Réunion Publique, November 12, 2012. http://www.vitrolles13.fr/fileadmin/infos_chantiers/avenue_de_marseille/Avenue_de_Marseille.pdf. Modifications : Auclair – Forgue – Lizano – Yassin

The importance of the hydrological aspect

As it was said before, the analysis we made allowed us to put into perspective the accuracy of the assessment method elaborated and especially concerning the relevance of the criteria selected. But in fact, it was also the opportunity to think about an important criterion that has not been treated in this paper. Indeed, it seems really important to consider the technical aspect during the analysis of the multi-use in a flood management infrastructure. To assess the profitability of this kind of operations it is necessary to know whether the hydrographical system has been modified because of the implementation of the infrastructure and the multi-use or not. Besides it is important as well to see if the potential modifications have negative or positive impacts and if they were done on purpose or accidentally. In fact, since the main objective of a multipurpose infrastructure is the flood protection it would be totally contradictory to find out that the hydrological system has been disrupted.

What's more, this criterion is important in every case study, unlike the technical feasibility for example. Whatever the case is, it is important to know if there are negative impacts or not on the hydrological system given that in the first place the main purpose of the infrastructure is to protect from floods and then not to have any negative impacts.

Finally, this technical aspect is linked to some other criteria studied. In fact it could justify a lot of choices particularly concerning the social justice, the legitimacy and the relevance. Indeed, a multi-use project will not be legitimate or socially fair if its implementation leads to negative impacts on the hydrological system. Especially if these changes have the effect of shifting the flood risk further. It was for example the case in the Miribel Jonage urban park located near the city of Lyon, in France, mentioned in the introduction. In fact, the construction of the canals delimitating the island where the park is installed, induced modification in water flows and then a doubling of flood risk on the right bank of the Rhône. Some non-flood cities became flood.

A responsible use of multi-use in France

In France, we can see that multi-use is rather respectful of the environment. In the cases we studied, the activities located on flood management infrastructures are natural or outdoor activities in a general way, like urban parks, natural spaces, gardens, sports fields, etc. The only example we studied for which the activity was not natural is the retention pond used as a velodrome in the city of Vitrolles. So, in terms of preservation of the environment multi-use is rather good. Given that activities are generally simple and natural activities, they do not create really important economic stakes, they are not realised to make profit, so they do not increase the vulnerability of the territory in case of floods.

Besides, the law is really strict about what can be or cannot be done in terms of urbanisation in flood areas, and we could see through the different examples studied that France is really respectful of the law. For example in the Gloriette we saw that the risk is really taken into account in the

activities, there is a strong will to preserve the area by not building anything. In the park Miribel Jonage, near Lyon, we also saw that despite the wish to build a hotel and a holiday camp, there was too much political pressure so the project was never realised.

Multi-use: a good alternative

This research project has also reinforced our approach of multi-use in flood management, and especially thanks to the Gloriette case. In fact, using a dedicated space to do various activities, like it is done in the Gloriette is really appropriate in this context of densification to reduce urban sprawling nowadays. Thereby, the presence of a huge natural plain like the Gloriette one, in the heart of the city, is an incredible opportunity. Of course, the idea is not to use this kind of spaces to urbanise them, but on the contrary to maintain them as they are, and create a recreative area, with outdoor activities as sports activities or agricultural activities, like it is done in the Gloriette. This is a good way to preserve an area, give it back to nature and open it to the population.

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**ELABORATION OF AN ASSESSMENT FRAMEWORK OF THE PROFITABILITY
OF MULTI-USE FLOOD MITIGATION INFRASTRUCTURES**
Evaluation of the Gloriette floodplain case study, in Tours, France

Abstract : Nowadays, the evidence of climate change is increasingly important, glaciers are melting, temperature is rising, sea level is increasing as well as the quantity of greenhouse gases or the number of natural disasters. They seem to be the less treated change by public policies. Floods are the most frequent natural disasters, they represent 34% of them. Over the years, humans built infrastructures to protect themselves from flood or to manage the increasing flood risk. Today, one of the issues is to conciliate flood risk management and protection and development and urbanisation of the cities. Multi-use of infrastructures to manage or protect from flood risk appears as an answer to this issue. In brief, multi-use for flood mitigation means that infrastructures to manage flood risk, as floodplains, or to protect from flood, as dikes, have also at least one more use, as for example playground, garden or sports ground. This concept is not widespread in France in comparison to the Netherlands. Through this research project we try to build and evaluate this concept of multi-use and see if the profit made thanks to this is real, through the case study of the Gloriette floodplain in Tours. Finally we discuss the relevance of our evaluation.

Résumé : Aujourd'hui, les preuves du changement climatique sont de plus en plus nombreuses, les glaciers fondent, les températures augmentent, tout comme le niveau de la mer, les gaz à effet de serre ou le nombre de catastrophes naturelles. Ces dernières semblent être le changement le moins traité par les politiques publiques. Les inondations sont les catastrophes naturelles les plus fréquentes sur la Terre, elles représentent 34% des catastrophes naturelles. Au fil des ans, les Hommes ont construit des infrastructures pour se protéger ou pour gérer le risque inondation, en constante augmentation. Aujourd'hui l'un des enjeux est de concilier la protection et la gestion de ce risque inondation avec le développement des villes et des zones urbaines. L'usage multiple des infrastructures de gestion ou de protection contre le risque semble être une solution pouvant répondre à cet enjeu. L'usage multiple des infrastructures liées au risque inondation signifie que les installations pour gérer le risque, comme les plaines inondables, ou les installations pour limiter le risque inondation, comme les digues, ont également un ou plusieurs autres usages, comme des aires de jeux, des terrains de sport ou des jardins. Ce concept n'est pas très répandu en France, contrairement aux Pays-Bas. A travers ce projet de fin d'étude, nous tentons de construire une évaluation de ce concept d'usage multiple et de voir si le profit fait est bien réel à travers le cas d'étude du champ d'expansion des crues de la Gloriette à Tours. Pour finir, nous revenons avec un regard critique sur notre méthode d'évaluation.

Key words : Flood, multi-use, Infrastructure, Tours, Gloriette, Floodplain, Risk, Protection, Management, Mitigation, Climate Change, Criteria, Assessment, Evaluation, Framework