Preventing the flooding of the Seine in the Paris – Ile de France region

PROGRESS MADE AND FUTURE CHALLENGES



OECD High Level Risk Forum
Public Governance Directorate

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BETTER POLICIES FOR BETTER LIVES

Foreword

Ensuring the resilience of large cities against major risks is a fundamental responsibility of public authorities, who have to ensure the safety and well-being of their citizens and maintain confidence in government. Serious floods, such as those that recently affected the cities of Houston in the United States, Bombay in India, or the Seine Basin in France in June 2016, are reminders of the vulnerability of major urban settlements and the fragility of critical systems in a context of climate change.

In the face of such challenges, there is a need for risk management policies to help reduce these risks in the long term, increase the level of preparedness against any likely crises, and mobilise public authorities, business and civil society to improve resilience. This is the main message of the OECD Recommendation on the Governance of Critical Risks.

The risk of the Seine flooding the Ile de France region is a major one. In 2014, the OECD estimated that a flood comparable to the historic flood of 1910 could pose an unprecedented challenge for public authorities. According to projections, such a shock could affect up to 5 million citizens and cause damage costing between 3 and 30 billion euros. This could have significant repercussions in terms of employment, economic growth and state finances.

The OECD's 2014 *Review of Risk Management Policies: Resilience to Major Floods in the Seine Basin* also highlighted challenges to improving resilience to this risk in terms of governance, knowledge, urban development, infrastructures and funding. The review identified opportunities, especially those offered by the Greater Paris project, to meet these challenges, through 14 recommendations made within the framework of the OECD High Level Risk Forum.



Following the floods that affected the Seine Basin in June 2016, the Regional and Inter-departmental Directorate for the Environment and Energy *(Direction Régionale et Interdépartementale de l'Environnement et de l'Énergie, DRIEE)* and local public river basin authority *(Établissement Public Territorial de Bassin Seine Grands Lacs, EPTB)* sought anew to mobilise the OECD's expertise to track the progress made since 2014 and the remaining challenges. This analysis is the result of extensive participation of all state stakeholders, local authorities, enterprises and network operators, the scientific community and civil society, through a survey, targeted interviews with major actors and a focus group.

This work finds that, since 2014, the mechanisms aimed at improving public policies on flood risk management have enabled widespread mobilisation of public and private actors, especially following the floods of May-June 2016. However, these dynamics still fall short when compared to the challenges associated with this major risk, especially with respect to urban development policy, territorial management and prevention funding.

Along with ongoing institutional changes, this creates a window of opportunity to perpetuate and reinforce these dynamics for the future. Urban infrastructure, development and renewal projects of the Greater Paris initiative, reinforced by the hosting of the Olympic Games, can help create a resilient capital city and environs. This would make the Paris region an innovative model of adaptation to climate change at international level, while also reinforcing its economic attractiveness.



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Key messages

The Seine Basin in the Ile de France continues to be highly vulnerable to flooding, with much at stake, as illustrated by the May-June 2016 floods. These floods, which were locally significant but relatively average at the level of the entire basin – with a 20-year return period - caused damages of more than a billion euros. The floods led to the interruption of several transportation networks and also put into question the ability of the crisis management system to respond to an event of a higher magnitude. This fully confirms the analysis made by the OECD in 2014 on the socio-economic impact of flooding similar to that of 1910: 3 to 30 billion euros of direct damages, 5 million directly or indirectly affected citizens, with significant economic repercussions at national level. The fact that the 2016 flood differed so greatly from the 1910 in nature, intensity and time of year also demonstrates the importance of being prepared for a wide range of diverse events.

Undeniably, efforts to improve public policies for preventing this risk have been under way since 2014. These efforts, which are also part of the implementation of the European Flood Directive, helped mobilise all stakeholders. They have also improved following the May-June 2016 floods. Nevertheless, these efforts remain insufficient, given the scale of the challenges. The progress made to strengthen the governance, resilience measures and increased funding have to continue in order to be fully in line with the recommendations of the 2014 OECD High Level Risk Forum. In particular, the following observations can be made:



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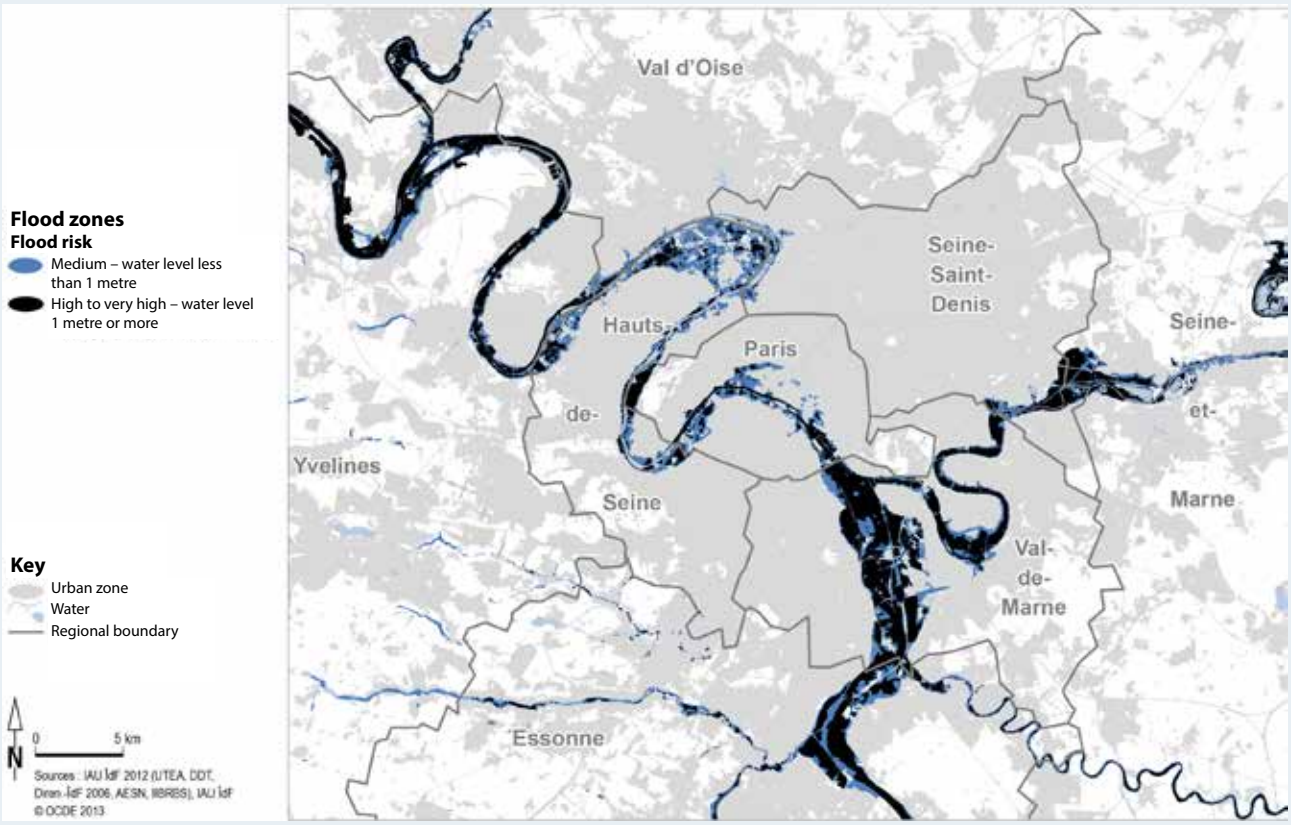


- **As highlighted by most stakeholders, significant progress has been made in terms of governance, although the persisting fragmentation and complexity remains challenging.** The adoption of the Local Strategy for Flood Risk Management in the Paris metropolitan area was a concrete step forward. Improved organisation of these efforts and raising the level of ambition and commitment with specific long-term objectives, is hampered by the institutional fragmentation of the Ile de France region and the complexity of existing tools – generating a lack of clarity, notably linked to the implementation of the last decentralisation reforms.

- **Measures have been taken to strengthen resilience and reduce the risk of flooding in the long term, within the framework of the local strategy and its action plan, but progress is still uneven.** A better risk knowledge and a more widespread risk culture are increasingly evident. While remarkable efforts have been made to reinforce critical network resilience, flood risks are not always taken into account in urban management and development policies. Regarding structural risk prevention measures, it is essential to maintain protection and storage infrastructures while investment choices for new infrastructure projects are slow in materialising. Since the effects of all these prevention measures will only be felt in the long term, it is important to improve crisis management capacities and resources, and accelerate procedures for ensuring businesses and public services continuity.

- **Despite the mobilisation of additional financial resources, the current flood prevention funding strategy is not commensurate with the economic stakes involved.** All risk prevention funding mechanisms are now mobilised (Barnier fund, CPER, FEDER, water agency and local authorities). However, the amounts involved, the themes covered, and uncertainty over the sustainability of some funding sources clearly point to a need to develop a more ambitious and long-term funding strategy. This could include better co-ordination among providers, raising the Flood prevention tax *(Gestion des millieux aquatiques et prevention des inondations, GEMAPI)* and creating complementary incentive mechanisms.

- **The situation offers an opportunity to sustain and reinforce the current momentum in the long term.** The recent experiences of the May-June 2016 floods, the emergence of the Grand Paris Metropolitan Authority, urban infrastructure, development and renewal projects, and the hosting of the Olympic Games in Paris, all present opportunities to build on this momentum. Building a region that is resilient to this major risk will improve both the wellbeing of its citizens and its attractiveness to investors.



The May-June 2016 flood in the Seine Basin

From late May to early June 2016, the south-eastern half of the Ile de France - as well as the Centre region - witnessed episodes of intense and continuous rainfall over several days, with record-breaking totals locally, reaching more than 100mm over four days. This led to serious, once-in-a-century flooding in the Loing Basin, as well as the other tributaries of the Seine and the Marne rivers, where known maximum levels were surpassed. In the Seine, the flood extended over one week, reaching 6.07 metres on the Austerlitz scale on the night of 3 June, following a rapid rise of the river height at a rate of 1 metre per day. These levels are equivalent to those of 1982, and two and a half metres below the level reached in 1910. This event occurs roughly every 20 years.

The crisis management mechanism was activated, following the orange alert launched by the flood prediction service for the *départements* concerned and the Paris defence zone. As the crisis evolved, this mechanism progressively gained strength. It helped co-ordinate rescue efforts, which amounted to 8,000 interventions that mobilised 1,000 rescue workers per day, and ensured the evacuation of 17,500 people. Traffic was disrupted on several roads, public transportation was seriously interrupted and river transport prohibited. Almost 17,000 people faced power outages. All major network operators activated their crisis management units and decided on preventive interruptions of gas, urban heating and sanitation services. Schools, high schools and cultural establishments were closed for preventive reasons and health institutions were evacuated.

This episode of flooding caused the death of two people in the Ile de France and injured a dozen. It is estimated economic repercussions amounted to about 1.42 billion euros for the Loire and Seine Basins, while 545 communes in the Ile de France were recognised as having undergone a natural disaster. The majority of damages occurred in the Seine et Marne, Essonne and in the south of the Val de Marne *départements*.

The OECD Secretariat considers the French authorities and stakeholders have made progress in the implementation of 10 of the 14 recommendations made in 2014 (Figure 1). Based on the results of the survey, (Figure 2) and our own analysis, significant progress has been made in the implementation of two recommendations (14%), partial progress in eight recommendations (57%), and very little progress in four recommendations (29%).

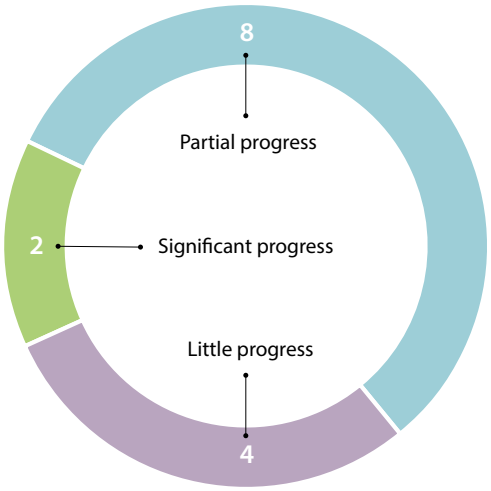


Figure 1: **Progress in the implementation of the 14 OECD recommendations**

Figure 2: **Results of the survey conducted by the OECD on progress made**



Note: Figures based on 54 responses to the OECD survey.



Recommendations

The efforts initiated since 2014 and strengthened since 2016 to improve this public policy should be further enhanced, focusing on the following points:

1. **Ensure political support for risk management policy by leveraging collective governance**
   The decentralisation reforms offer a window of opportunity to ensure clearer political leadership for the upcoming local flood risk management strategy. The responsibilities of the Grand Paris Metropolitan Authority on flood prevention within the framework of the new decentralisation laws require shared commitment and a shared vision with all the local authorities and the state. Partnerships with upstream communities based on basin solidarity and local engagement and empowerment will be critical for implementation.

2. **Implement risk reduction measures based on an established level of protection that will allow coherence and prioritisation.** It will be important to set up a timeline for upgrading flood protections, by ensuring the protection infrastructures in Paris metropolitan area are discussed by the Grand Paris Metropolitan Council. It will be equally important to make progress on the la Bassée water storage pilot project following the planned start of work in 2021.

3. **Improve emergency management capacities and resources to enable a response to a hundred-year cycle flood of the Seine in the Ile de France.** The May-June 2016 flood proved the efficacy of the crisis management structures in place but also highlighted certain shortcomings. The adequacy of current crisis management in a crisis of centennial magnitude affecting the entire agglomeration of the Paris region needs to be analysed. Examples from other OECD countries, especially with respect to large scale evacuations, and partnerships with the private sector, can provide guidance.

4. **Reinforce the economic resilience of the Ile de France in partnership with the private sector and network operators.** To support the implementation of the Declaration of Intent on the resilience of critical networks, the formulation of result indicators would enable measurement of progress. Significant reinforcement of business continuity measures, including in small enterprises, should also be a priority, alongside improvement in emergency response.

5. **Improve the resilience of urban areas to flooding, by seizing the opportunity offered by development projects of the Grand Paris projects.**
   The Paris metropolitan area can position itself as an innovative metropolis and a climate change adaptation model, by fully integrating flood resilience in the design of Grand Paris and other related urban renewal projects. The development of the metropolitan territorial plan, the hosting of the Olympic Games in Paris, the new Ardoines neighbourhood, the ZAC Paris-Charenton, and the *"Inventons la Métropole du Grand Paris"* consultation project are opportunities to demonstrate such a resilient approach is economically relevant and should incite urban development actors to draw inspiration from this, and not be limited to regulatory approaches.

6. **Increase and sustain funding for financing flood resilience over the long term by developing an ambitious financing strategy commensurate to the level of the risk. Such a strategy should be based on common objectives, both at the level of the Paris metropolitan area and the Seine river basin.** This will require mobilising not only all the existing mechanisms to finance risk prevention and restructuring them where necessary, but also the financing of the water policy at the basin level through the Seine-Normandy Water Agency (Agence de l'Eau Seine Normandie). This could subsequently be complemented by resources raised through the flood prevention tax for financing protective infrastructures. Furthermore, this requires the implementation of incentive mechanisms to encourage whole-of-society efforts towards greater resilience, and the exploration of innovative financial mechanisms, such as green bonds.



Progress in terms of risk governance

In 2014, the OECD highlighted several shortcomings with respect to governance and recommended the development of an ambitious and coherent Seine flood prevention strategy in the Ile de France, in coordination with related policies. Institutional fragmentation, the lack of coordination between policies and different levels of action, and the multiplicity of actors, were serious constraints to the development of any public action commensurate with the stakes. The survey showed the OECD's recommendations on governance were considered the most important, especially those related to stakeholder engagement, the coordination between the levels of action and the development of a long term strategic vision.

Table 1: **OECD recommendations on governance made in 2014**

1. Ensure coordination between the different levels of flood prevention - from the metropolitan area exposed to the flood to the Seine river basin.
2. Define a global, ambitious and motivating long term strategy accompanied with necessary action.
3. Break down this global strategy into precise objectives and empower stakeholders.
4. Create effective pathways between the flooding risk prevention management strategy and related public policies (water, urban management and development, crisis management, etc.).

Momentum driven by the State and the local public river basin authority Seine Grands Lacs has improved the governance of this flood risk. The large scale engagement of stakeholders, noted by 75% of respondents in the survey (Figure 3), makes clear the efforts made in the past three years as part of the implementation of the Flood prevention action programme *(Programme d'Actions de Prévention des Inondations, PAPI)*, and the development of the Local flood risk management strategy (*Stratégie Locale de Gestion des Risques, SLGRI*). The SLGRI was provided by the European Flood Directive adopted in December 2016. This improvement trend is most evident in a number of best practices identified by stakeholders (Table 2).

Table 2: **Good governance practices identified**

- The steering of the SLGRI by a Strategic Committee jointly constituted by the Prefecture of the Region and the Police Prefecture.
- The large scale engagement of stakeholders within the framework of Flood prevention action programme activities and the consultative design of the flood management strategy.
- The assumption of the Flood prevention jurisdiction by the Grand Paris Metropolitan Authority, which seems to be the appropriate level for action on the High Flooding Risk Territory (TRI).
- The consultative design of major strategic plans at the level of the basin on policies related to water, risk and climate change adaptation: Flood Risk Management Plan (*Plan de Gestion des Risques d'Inondation, PGRI*), Water Development and Management Master *Plan (Schéma Directeur d'Aménagement et de Gestion des Eaux, SDAGE*), Climate Change Adaptation Strategy (*Stratégie d'Adaptation au Changement Climatique, SACC*) and CARENCO report.

Progress is being made on the governance structures for flood risk prevention, despite complexity and a lack of political support. The Prefecture of the Region and the Police Prefecture have set up a dedicated joint governance structure since 2014, which has improved the organisation of the State's actions and clarified their coordination with those led by local authorities. The local public



Local Flooding Risk Management Strategy, which was approved on 2 December, 2016 by the Prefet of the Ile de France Region and the Police Prefet of Paris, covers 160 communes in the high flooding risk territory.

river basin authority *(Établissement Public Territorial de Bassin Seine Grands Lacs, EPTB)* saw its prevention action, coordination and implementation role in the territory reinforced by the implementation of the Flood prevention action programme and the Local Flooding Risk Management Strategy *(Stratégie locale de Gestion des Risques d'Inondation,* SLGRI*)* in the upstream Seine territory. This improved coordination is acknowledged by 53% of respondents.

However, the emergence of the Grand Paris Metropolitan Authority, which has been given jurisdiction over the prevention of floods in recent laws on decentralisation, challenges the future coordination of responsibilities between various structures. Beyond legal and territorial questions, it also poses the question of the political leadership of the Local Flooding Risk Management Strategy. It seems important to prioritise reflection on this point, considering deadlines provided by the law for the effective exercise of this new jurisdiction fall between now and the end of 2019. Lastly, concerning the reinforcement of upstream-downstream solidarity, which is a guarantor of efficient action, little progress has been noted by the stakeholders. On-going discussions to better involve upstream territories at risk of flooding in the governance of the local public river basin authority seem promising however, and the same goes for an increased consideration of this theme by the Seine-Normandy River Agency.



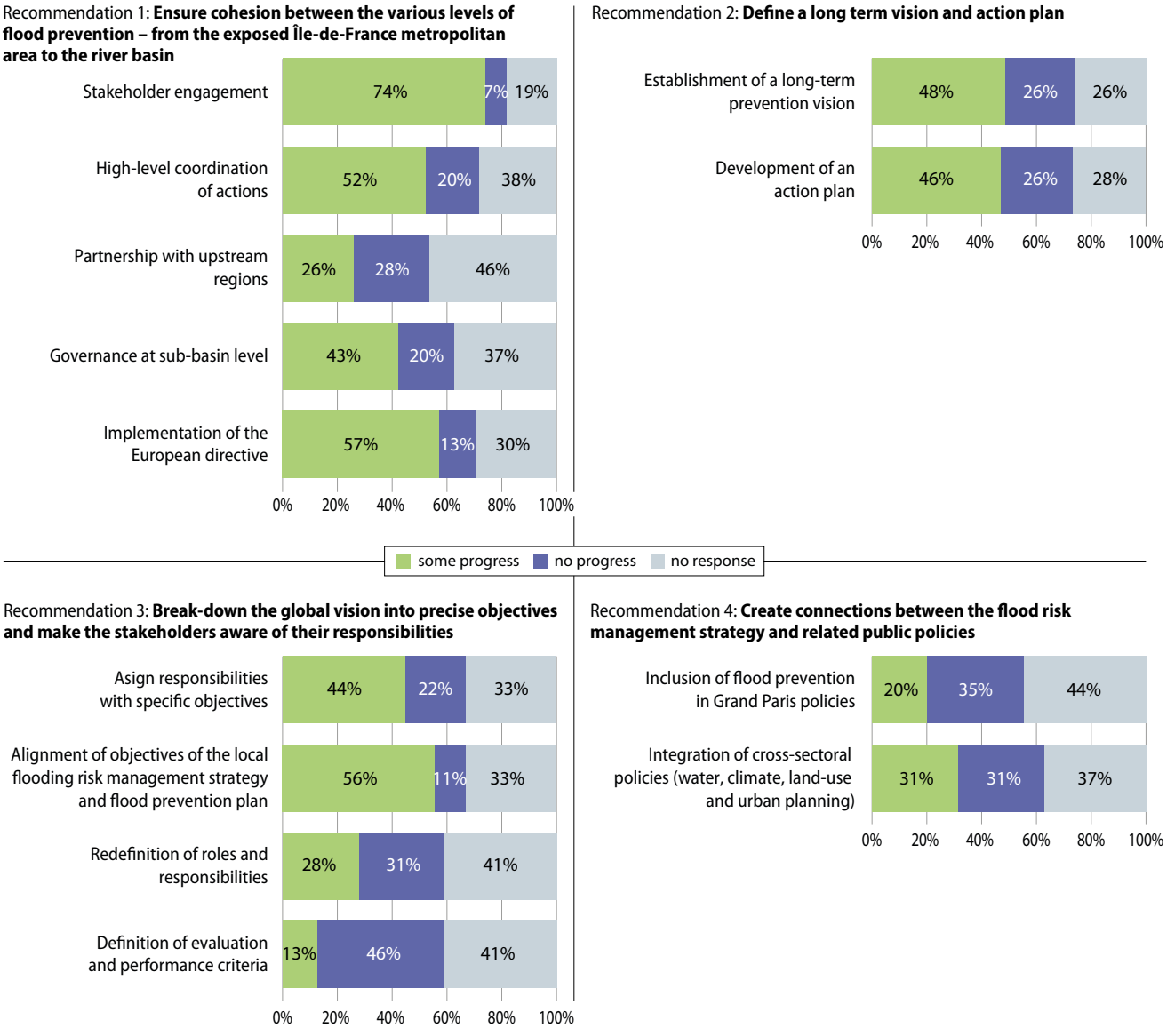
The Flood Prevention Action Programme has enabled large scale engagement of actors through the organisation of four Flood prevention action programme workshops and a Stakeholders' Conference.

The adoption of the Local Flooding Risk Management Strategy (SLGRI) marks an important step, but a more ambitious, long term strategy and improved accountability framework will be necessary to sustain these efforts in the long term.

Built through a broad consultation, the Local Flooding Risk Management Strategy of the Grand Paris Metropolitan Area has strong founding principles - ambition, attractiveness, coherence and inclusion - and implements the governance led by the State. It is accompanied by a programme of 112 –measures centred on eight main objectives closely associated with the Flood Prevention Action Programme coordinated by the local public river basin authority



Figure 3: **Evaluation of progress in terms of governance**



Seine Grands Lacs with 20 contracting authorities in the Paris area. The Local Flooding Risk Management Strategy also defines the roles and responsibilities of various stakeholders in the implementation of the measures. However, as noted in the *lessons learned report* following the 2016 floods, this strategy does not set a long term vision over 20-30 years with operational and numerical objectives, such as the choice of a maximum level of protection or of socio-economic impact - although some measures extend beyond the six-year cycle perspective provided by the European Directive. Lastly, as highlighted in the survey, the strategy did not lead to the definition of evaluation and performance criteria that can improve accountability of stakeholders and empower them in the territories.

Greater consideration of the Seine flooding risk is visible in certain public policies, especially in water and climate policies, but the link with urban development still falls short. Clear progress has been made in designing major strategic plans at the level of the region or the basin, with better consideration of the flooding risk. This demonstrates greater coordination between various administrations, especially the Prefecture of the Region, the Police Prefecture and the Seine-Normandy Water Agency. As such, the water or climate change adaptation policy documents adopted by Seine Normandie Basin Committee are coherent and well-coordinated with the flood risk management plan of the basin (PGRI). Considerations about flooding risks take drought risks into consideration and vice versa – the CARENCO



Préfet's report to the Prime Minister on the hydrology of the Seine Basin is an example. Prevention and crisis management stakeholders now work in close collaboration. This is also evident at the level of the city of Paris which initiated a broad reflection on its resilience as part of the global network of 100 Resilient Cities. However, efforts need to continue with respect to territorial management and urban development, where strategic documents still do not sufficiently take into account the flooding risk. The design of the Territorial Consistency Scheme of Grand Paris Metropolitan area (*Schéma de Cohérence territorial métropolitain du Grand Paris*) lists resilience as one of its strategic axis and, as such, presents an opportunity to be seized.

In the end, this momentum represents an important achievement and numerous stakeholders have underscored the significant efforts made in terms of governance. However, persistent fragmentation and complexity result in a lack of clarity. While the institutional framework is still evolving, and with the ongoing application of recently introduced laws on decentralisation, much of the accomplished progress risks not providing results in the absence of more clearly defined leadership.

IMPLEMENTATION OF RECOMMENDATIONS			
PROGRESS	SIGNIFICANT	PARTIAL	LIMITED
Rec. 1: Coordination between levels of action		✓	
Rec. 2: Long term vision		✓	
Rec. 3: Objectives and empowerment		✓	
Rec. 4: Connections with other policies		✓	





Progress in implementing resilience measures

The 2014 OECD review identified several synergies that could be used to strengthen coherence in structural and non-structural prevention measures. The development of the Local Flood Risk Management Strategy appeared as an opportunity to put all these measures in order while prioritising the most effective ones, ranging from risk knowledge and culture, the resilience of territories, networks, public services and business units, to risk control options using protection or storage infrastructures.

Table 3: **OECD recommendations on resilience made in 2014**

5. Continue to improve and align risk knowledge and ensure risk information is made available
6. Reinforce the risk culture of citizens, decision makers and enterprises
7. Improve territorial resilience, by capitalising on the opportunities offered by Grand Paris Metropolitan area
8. Gradually improve the resilience level of critical networks and act to ensure continuity of business units and public services
9. Place protection infrastructures under the responsibility of a single contracting authority.
10. Foster experimentation on the La Bassée storage project

Reflections linked to the strategy and action programme set a clear programme of resilience measures that need to be implemented in the short and medium term, in line with these recommendations, although progress is uneven. The survey showed a high variability in the importance of resilience measures in the eyes of stakeholders, with a high preference for non-structural measures against structural measures. Tangible progress is also uneven (Figure 4), with certain best practices distinguishing themselves and persistent difficulties remaining with respect to urbanisation or the alignment of protection levels.

Table 4: **Best resilience practices**

- Capitalisation on the May-June 2016 floods to improve risk knowledge
- The EU Sequana crisis management exercise.
- The declaration of intent on the resilience of infrastructural networks
- The assessment of all risk reduction options in the post-2016 floods CARENCO report

The development of risk knowledge and culture has made clear progress, as observed respectively by 81% and 72% of respondents. The production and availability of precise mapping and the detailed analysis of the May-June 2016 flood by the Regional and Inter-departmental Directorate for the Environment and Energy, the new numerical model developed through the Flood prevention action programme, and the study on groundwater flooding are all projects that have been completed or are in progress and demonstrate the improvement of risk knowledge. The provision of risk information through a dedicated server is appreciated by the many stakeholders who can access it.

While last year's floods certainly helped strengthen risk culture, the organisation of the EU Sequana crisis management exercise by the Police Prefecture, two months before the May-June 2016 floods demonstrated the value of such measures to reduce the impacts: all emergency response actors proved to be ready. However, some actors observe that the May-June 2016 flood, which had lesser effects than were projected for a major flood in the metropolitan area, led to stalling the momentum. Maintaining awareness of this major risk and its memory when it does not manifest itself will require long term investment and support through animation mechanisms with different audiences, including businesses and decision makers. The Episiene resource centre of the local public river basin authority Seine Grands Lacs, as part of the Local flood risk management strategy, is a good initiative in this sense. Conducting regular evaluation of the flooding risk perception could be part of its mission in the future.





The EU Sequana exercise, organised by the Paris Police Prefecture, mobilised almost 100 institutions and enterprises in the simulation of a major flood of the Seine for a two-week period, in partnership with the European Union.

As concerns territorial resilience, particularly urban development and the development of the Grand Paris metropolitan area, stakeholders agree progress since 2014 is limited. This is the recommendation on which the least improvement has been made, which highlights the complexity of this issue. Today, despite the sometime manifest political commitment, no neighbourhood in the *Petite Couronne* area is resilient to flooding, although several areas earmarked designated for urban densification within the Grand Paris project are situated within the flood plain. Support of planning actors, the development of a charter to design resilient neighbourhoods, and the on-going studies about the benefits of resilience are all promising initiatives likely to enable progress on this important topic. Furthermore, the integration of flood resilience in the terms of reference for ecological neighbourhoods and "High Environmental Quality" certifications are also likely to constitute pertinent incentives. If such approaches are not enough to overcome reluctance to integrate resilience in urban development, because of its short term costs, lessons will have to be learned and the regulatory framework of Risk Prevention Plans (*Plans de Prévention des Risques, PPR*) in the Ile de France Region should be reviewed to include higher standards. The Ardoines neighbourhood in Vitry-sur-Seine, the Bercy-Charenton Integrated Development Zone (ZAC), the Paris 2024 Olympic Village Project, and the "*Inventons la Métropole Grand Paris*" urban design competition could serve as strong indicators of the political will to foster resilience while demonstrating cost control and innovation potential.



Signing of the declaration of intent on network resilience in the face of Seine floods on 20 April 2016 by the State, 14 network operators, 14 local authorities and groups thereof.

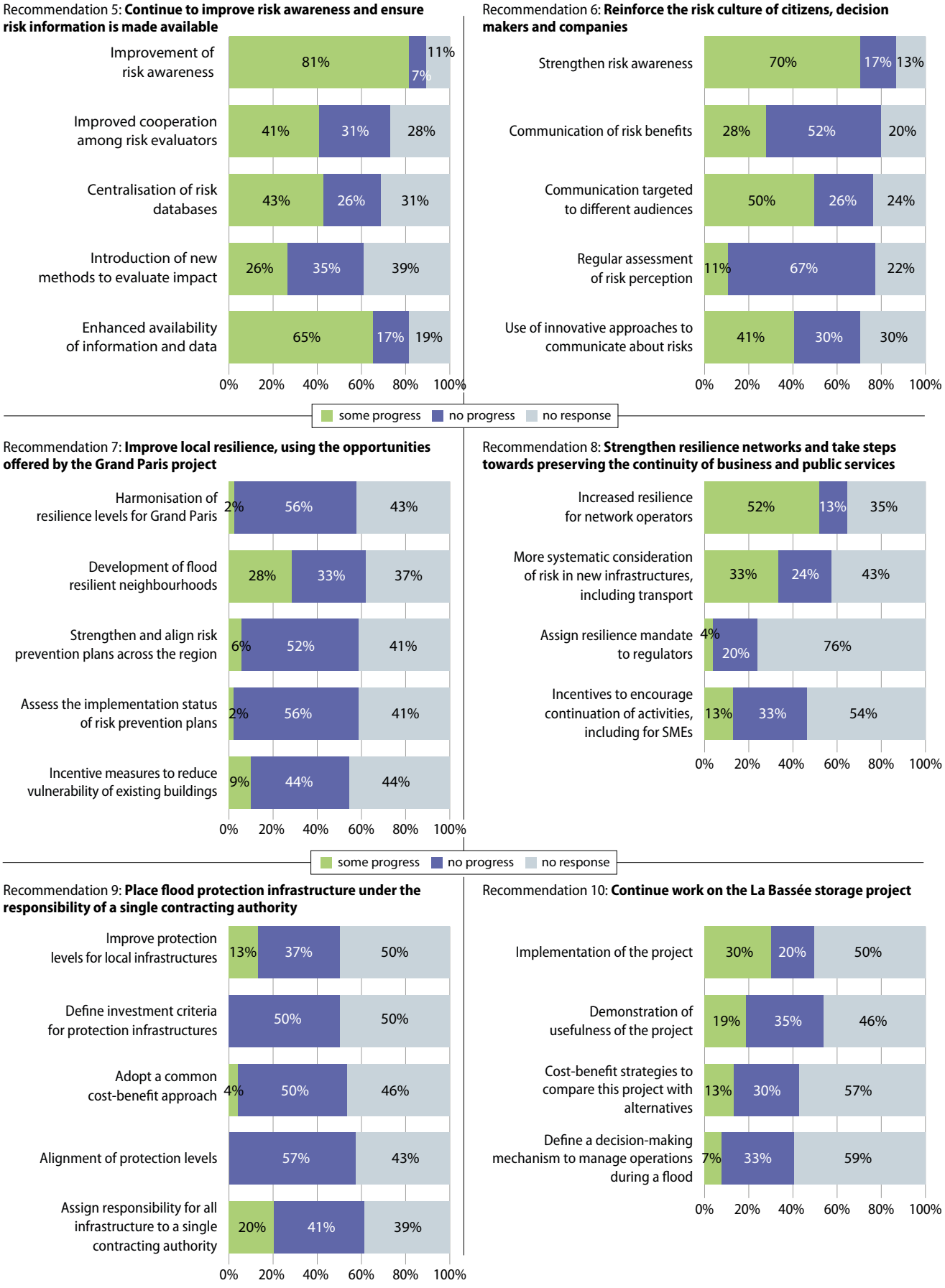
At the same time, greater awareness of the importance of critical infrastructure resilience in reducing the socio-economic impact of flooding also led to remarkable progress. Reinforcing network resilience and business continuity is considered the most relevant OECD recommendation as it highlights the cascade effect caused by network interruptions in large cities. Network operators have been working towards reinforcing resilience in their infrastructures for some years now, with the General Secretariat of the defence and security zone and within the framework of the Risk Prevention Plans rules and regulations for the City of Paris. This theme is a strong focus of the Local Flooding Risk Management Strategy and led to the signing, in 2016, of a voluntary framework between the State, local authorities and network operators: the declaration of intention for network resilience in the face of Seine floods in the Ile de France region. This, non-binding document promotes the sharing of information on network vulnerability and measures that reduce this vulnerability. It represents a remarkable example of partnership between state authorities and public and private network operators. Regarding new infrastructures, the recent adoption of a flood response strategy that proposes a higher level of protection than that of the Risk Prevention Plans by the Greater Paris Society *(Société du Grand Paris)*, which serves as a reference point for the *Grand Paris Express* public transportation network and its stations currently under construction, constitute another example of good practice. It will be desirable to develop equally ambitious mechanisms towards businesses, especially small and medium sized enterprises, to foster resilience and business continuity procedures, and to encourage sharing of best practices.

Structural prevention measures have recorded unequal progress. Limited progress has been made regarding local protection infrastructures, although some improvements can be seen regarding the La Bassée project. The structural prevention measures recommendation was for a series of local protection measures to be placed under the responsibility of a single contracting authority - which corresponds to the philosophy of the new Flood prevention tax jurisdiction the Grand Paris Metropolitan Authority employs, which in the past was under the responsibility of the "*départements*". This institutional transition, and the related uncertainty, raises questions about the conditions under which discussions will continue on the level(s) of protection planned from now until 2019 by the "dykes" decree. The issue of protection structure maintenance along the river (dykes and quay walls), which are unequal and have several weaknesses at local level, is also still to be addressed.



La Bassée site, the largest flood plan upstream of Paris, where the overall management project provides for the temporal storage of flood waters and ecological valuation of marshlands.

Figure 4: **Progress with respect to resilience measures**

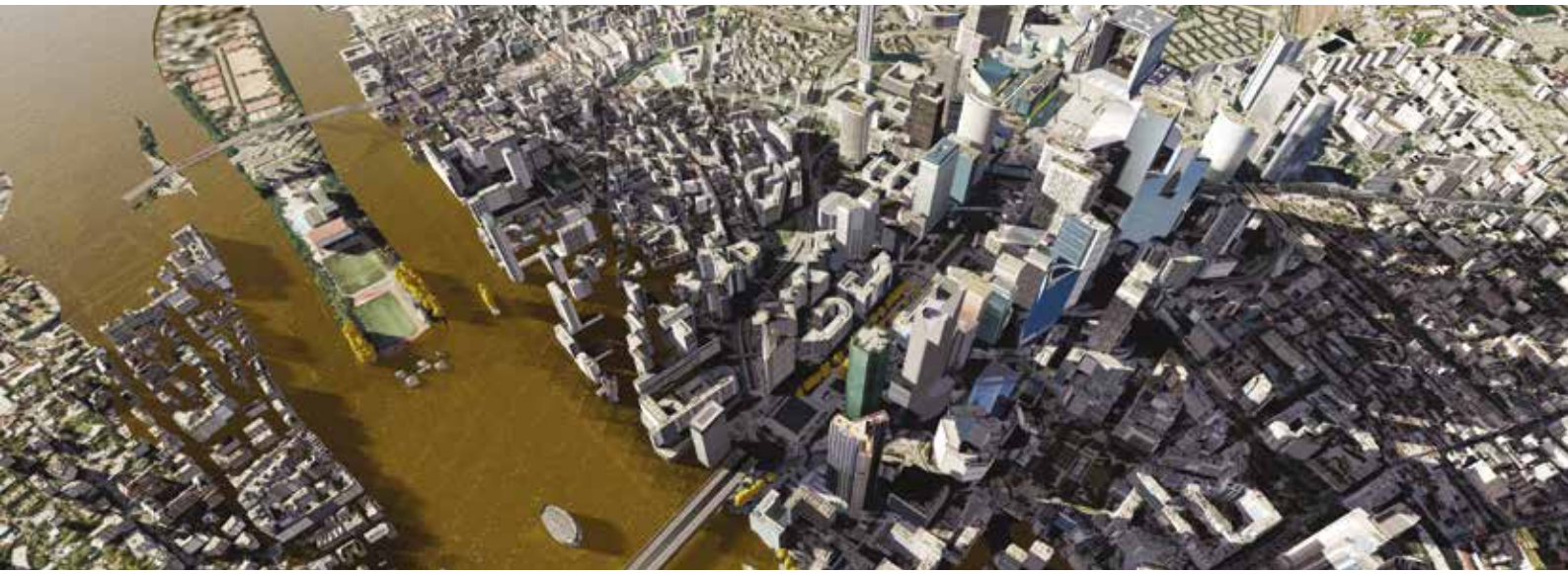


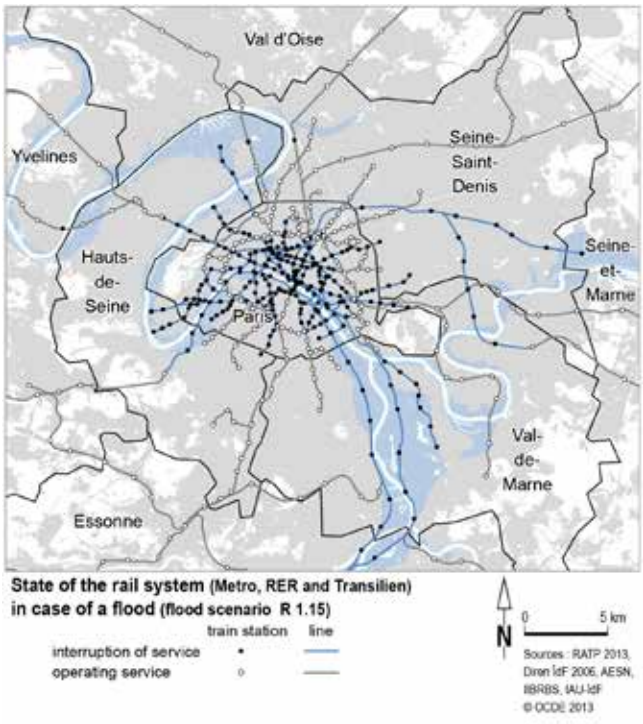
Regarding the La Bassée storage project, which has been the subject of studies and consultation for the last 20 years, work is planned to start on a pilot site in 2021. The timing of this pilot development and its feasibility has been confirmed by recent studies, pending an update of the cost-benefit analysis by 2019, in order to obtain the State's co-funding agreement. The 2016 floods demonstrated that the presence of full storage in La Bassée would have, under optimum conditions, enabled the flood level at the maximum water height to be brought below 5.8 m instead of 6.1 m in Paris. The "CARENCO" report on the hydrology of the Seine, made at the request of the Prime Minister following the 2016 floods, made it possible to review all the structural options using a comparative approach, with solutions related to land development or management, such as restoration of flood zones on the basin and natural infiltration capacities. It particularly emphasised the need to prioritise two structural projects: upgrading local protections in Paris and the *Petite Couronne* area, and the project of La Bassée.

Reinforcing crisis management capacities and resources is very important, as recalled by several stakeholders during interviews. The value of the serious efforts made over more than 10 years by the General Secretariat of the Paris Defence and Security Zone *(Prefecture de Police)* to develop a response mechanism to different flood scenarios was demonstrated during the May-June 2016 floods. All emergency response actors were fully mobilised and coordination mechanisms enabled the effective engagement of the available resources. Yet, while the mechanism functioned well, several stakeholders still raised questions regarding the ability to maintain the system over the long term and to coordinate the scaling up of the emergency response in the event of a bigger flood, of centennial frequency for example, with far greater effects and crisis management needs.

Ultimately, this uneven progress to improve the resilience of the Île de France region in the face of the Seine's floods reflects the difficulty in obtaining concrete vulnerability reduction results in a city where the flood plain is already largely built up. While it is essential to reduce risks in the long term through urban renewal and structural measures, it is also important to pursue activities to reinforce crisis management policies and accelerate efforts to support business continuity.

IMPLEMENTATION OF RECOMMENDATIONS			
PROGRESS	SIGNIFICANT	PARTIAL	LIMITED
Rec. 5: Risk awareness	✓		
Rec. 6: Risk culture	✓		
Rec. 7: Territorial resilience			✓
Rec. 8: Resilience of networks and business units		✓	
Rec. 9: Protection infrastructures			✓
Rec. 10: La Bassée project		✓	



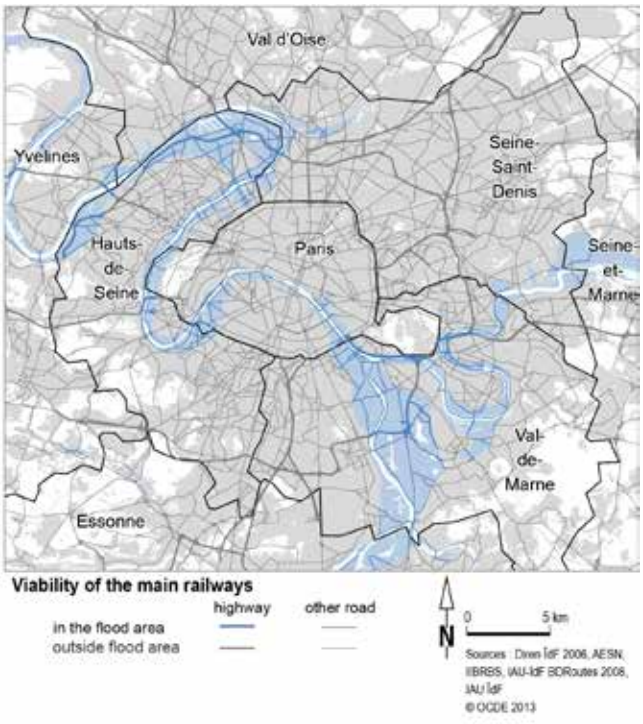


State of the rail system (Metro, RER and Transilien) in case of a flood (flood scenario R 1.15)

	train station	line
interruption of service	•	
operating service	○	

N 0 5 km

Sources : RATP 2013, Diren IdF 2006, AESN, IBRBS, IAU-IdF
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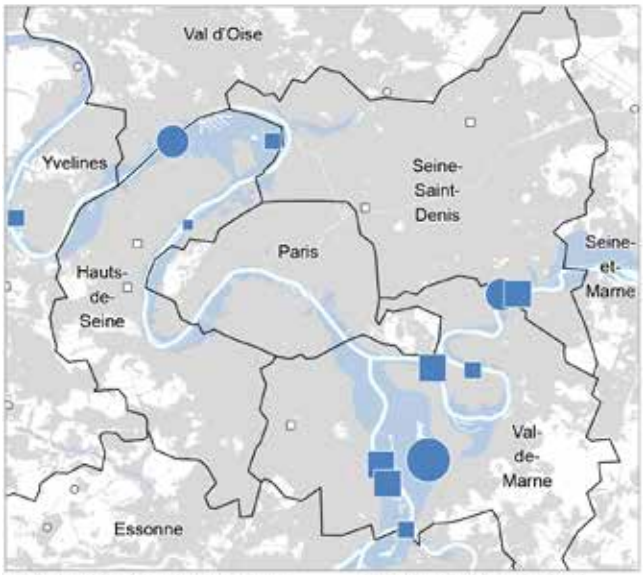


Viability of the main railways

	highway	other road
in the flood area		
outside flood area		

N 0 5 km

Sources : Diren IdF 2006, AESN, IBRBS, IAU-IdF BDRoutes 2008, IAU IdF
© OCDE 2013



Water treatment plant in flood area
Treatment Capacity
(Number of inhabitants)

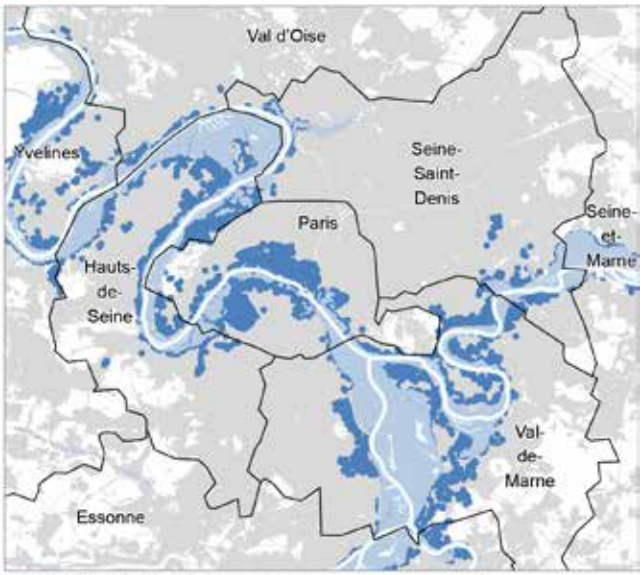
- < 2 000
- 2 000 - 100 000
- 100 000 - 2 000 000
- > 2 000 000
- ○ plant outside flood area

Water production plant in flood area
Production Capacity in m³/day

- < 10 000
- 10 000 - 100 000
- > 100 000
- □ plant outside flood area

N 0 5 km

Sources : IAU IdF Densimos 2006 , Satese 77, Satese 78-91, Satese 95, SIAAP, IAU IDF Assainissement 2008, Diren IdF 2006, AESN, IBRBS, IAU IdF
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Electric grid vulnerability area
(flood scenario R 1.15)

N 0 5 km

Sources : ERDF 2010, Diren IdF 2006, AESN, IBRBS, IAU-IdF
© OCDE 2013

Elements of background

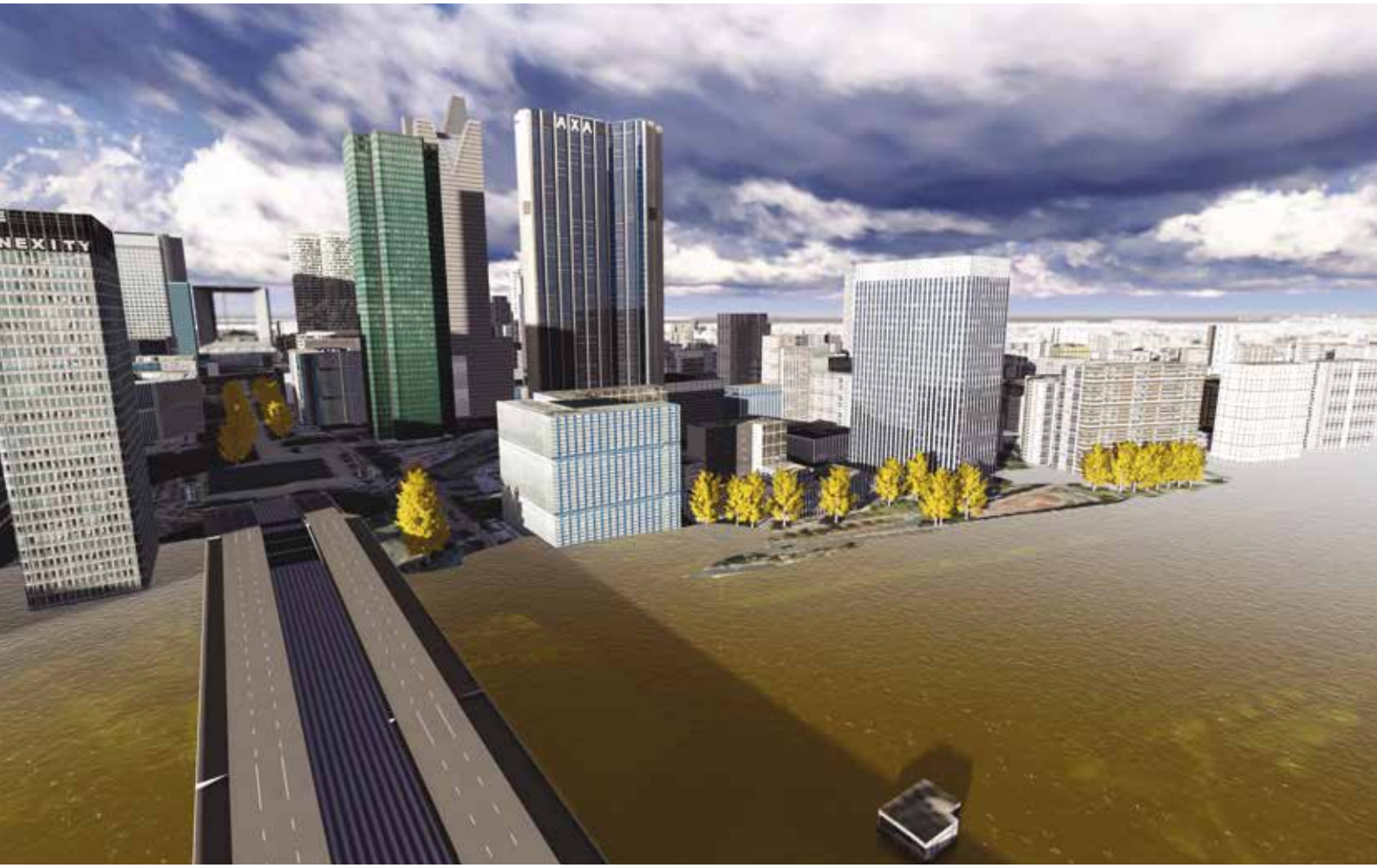
- urban area
- flood area
- hydrography
- district border

Progress in financing prevention

In 2014, the OECD noted delays in funding and therefore the implementation of an ambitious Seine flood risk prevention policy, and limited progress has been made since then. Financial instruments for risk prevention in France have been targeting other regions or other risks during recent decades. With the memory of the risk having faded away, the Seine no longer appeared to be a strategic priority. In this context marked by a certain degree of under-investment, the OECD proposed the development of a holistic financial strategy mobilising resources from all the beneficiaries of these prevention measures: State, local authorities, network operators, enterprises, and citizens around principles of action (Table 5). An update of prevention funding mechanisms at the national level was also proposed, as they had not made it possible to prioritise investments in preventing this major national risk. Overall, stakeholders agree there has been little progress on these four recommendations relating to funding (Figure 5).

Table 5: **OECD recommendations on funding made in 2014**

11. Support the local flooding risk management strategy of the Seine in the Ile de France with a clear financial strategy taking national specificities into consideration.
12. Mobilise all beneficiaries of prevention measures by following a multi-level approach that will combine local authorities and State funding, as well as various network operators, the private sector and citizens through targeted incentives.
13. Continue efforts to clarify criteria to prioritise state investments in risk prevention.
14. Review the impact of the CATNAT compensation scheme for flood risk prevention.

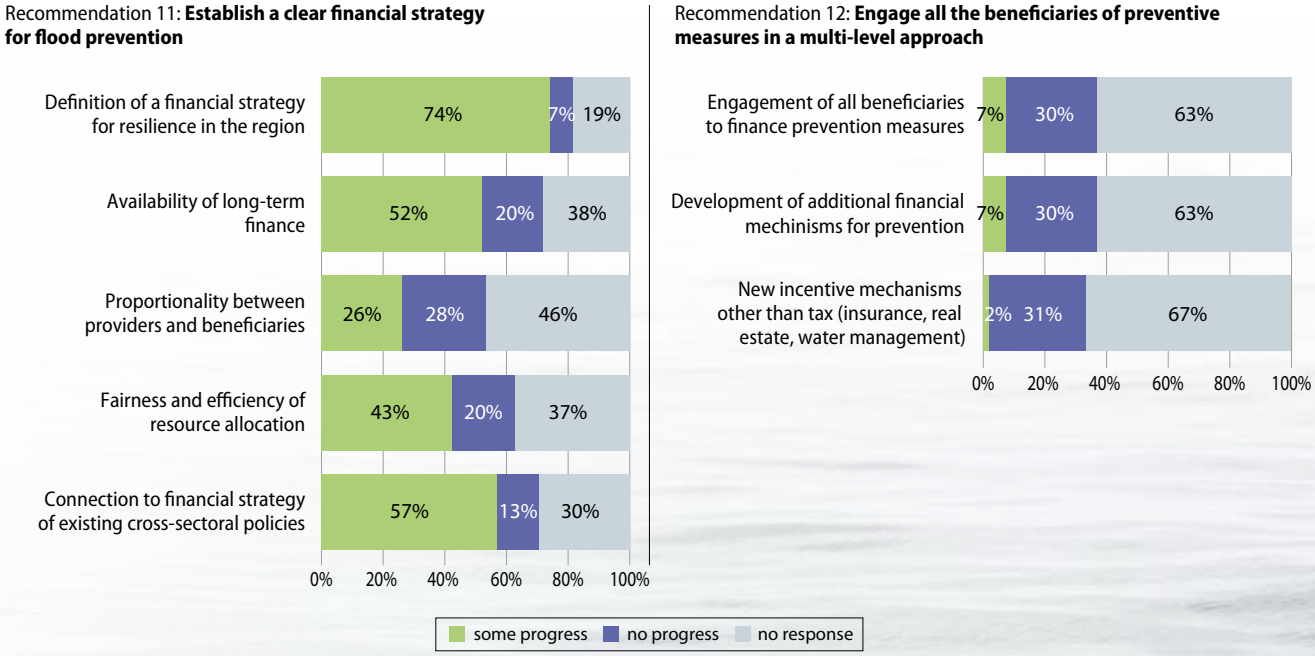


The development of the Local flood risk management strategy (SLGRI) has not led stakeholders to any agreement on a long term funding strategy dedicated to strengthening resilience in the Ile de France region. With the exception of the principle of synergies with sectoral strategies, stipulated in the Local Flooding Risk Management Strategy, the principles proposed by the OECD to feed such a strategy: long term vision, empowerment and proportionality between measure beneficiaries and donors, seeking efficacy and considering equity in resource allocation – have not guided discussions at the level of the area at risk.

Funding for the Flood prevention action programme (PAPI) of the Seine et Marne Franciliennes has been largely mobilised through the engagement of all available instruments but this does not seem, at this stage, to be commensurate with the risk level. The Barnier Prevention Fund, the State-Region contract plan, the Plan Seine, the European Development Fund (FEDER), Seine-Normany Water Agency, the *départements*, and the Grand Paris Metropolitan area – through co-funding for a main valve of the Saint Maur watergate – contributed to funding the Flood Prevention Action Programme in its mid-term reviewed version. Resources allocated to this programme, amounting to a total of 89 million euros for the period 2014 - 2019, correspond to less than 20 million euros per year, without any guarantees of longer term sustainability. This does not align with potential damages caused by a centennial flood (3 to 30 billion euros) or with the estimates of the CARENCO Report for priority infrastructure projects, which were estimated at 600 million euros for the complete La Bassée project and around 2 billion euros for upgrading local protection systems.

Uncertainty over the sustainability of funding sources and projected amounts of future prevention funds poses the question of developing a more ambitious funding strategy, including the introduction of the Flood prevention tax, as well as complementary incentives and innovative funding mechanisms. The deadlines set by the most recent decentralisation laws are fast approaching: the Grand Paris Metropolitan Authority plans to position itself within the framework of its next budget to decide on any eventual tax deduction. This tax could represent a significant source of funding to finance new structural protection and storage measures or to strengthen existing infrastructure. However, this possibility cannot be the only prospect of long-term funding and the role of the State in the face of this nationwide risk remains highly important. Many stakeholders also note the lack of on-going reflections on complementary mechanisms that solicit other protection measure beneficiaries, apart from citizens of the metropolitan area. Yet, some stakeholders such as network operators or the *Société du Grand Paris* have shown openness on this matter.

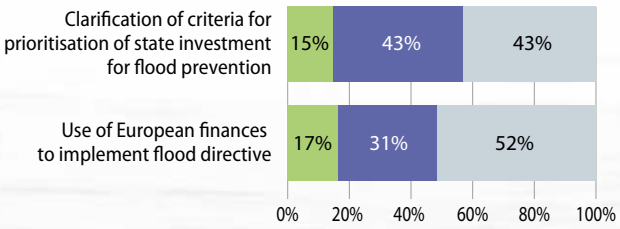
Figure 5: **Evaluation of progress in terms of funding**



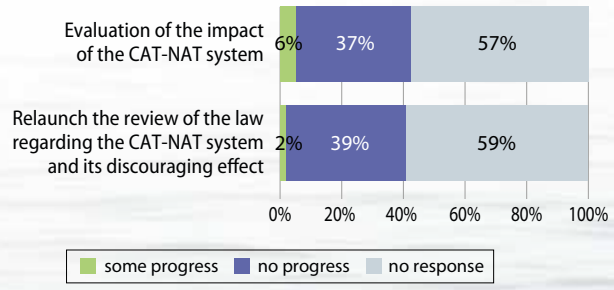
The clarification of prioritisation criteria for investments related to risk prevention has not seen much progress, although pressure on available funds is increasing. In 2014, the OECD estimated the national level of investment in prevention could be deemed satisfactory considering public expenditure effectiveness criteria if it could be demonstrated that these funds are allocated in a way that prioritises the most beneficial or effective prevention actions. Conscious of these stakes, the Directorate-General for Risk Prevention (*Direction Générale de la Prévention des Risques, DGPR*) set up a working group on this theme, although this did not lead to the use of the momentum of the European Flood Directive that led to defining High Flooding Risk Territories (*Territoires à Risques Importants d'Inondation, TRI*) to prioritise prevention funding in these territories. The choice to favour the most complete action programmes in the terms of references of the new Flood Prevention Action Programme will end up granting financing on a priority basis to the most competent contracting authority. This is certainly proof of efficiency, but will not necessarily deliver optimal risk reduction at the national level. With 122 High Flooding Risk Territories defined at national level today and an important number of these areas booked for state-funded action programs, grant applications through the Barnier Fund and the Joint Flood Commission (*Commission Mixte Inondations*) which instructs them, are likely to increase significantly in the coming years. Calling into question the Barnier Fund's own financing in the Court of Auditors' summary judgement of December 2016 also raises the question of how to continue this partnership approach between the State and local authorities to finance risk prevention.

Finally, with respect to the CAT-NAT compensation scheme for natural hazards, the reform project initiated in 2008 aiming to encourage better prevention efforts by individuals, corporations and local authorities has not yet been completed. A draft law introduced in the Senate in 2012 by the Ministry of Finance aimed to achieve a better definition of hazard events that give rise to compensation and to reduce certain perverse effects of the system by using insurance premiums as leverage to further encourage prevention efforts. The French compensation and prevention funding system, which is based on solidarity among insured entities and guaranteed by the State, depends on a delicate balance which is the result of a collective choice. Considering the probable increase in damages caused by natural hazards in the context of climate change, adjustments will be necessary to maintain the balance of this system and they deserve a transparent and responsible debate on the level of risk the French society is ready to accept and the funds it will be willing to devote to this. It is therefore worth recalling that the May-June 2016 floods, which caused insured damages (excluding agricultural losses) estimated at 1.1 billion euros for the Loire and Seine Basins, were the most expensive floods since the creation of the CAT-NAT insurance scheme in 1982.

Recommendation 13: **Clarify the priority criteria for prevention funding from state resources**



Recommendation 14: **Re-examine the impact of the CAT-NAT compensation scheme on flood risk prevention**



Allocated financial resources remain insufficient to ensure the resilience in the Paris Metropolitan area. The likely reduction of prevention funds in the future clearly raises the question of the development of an ambitious and long term funding strategy, including the raising of the Flood prevention tax and complementary incentive mechanisms. Governance efforts can also be capitalised on to include more partners in financing prevention measures.

IMPLEMENTATION OF RECOMMENDATIONS			
PROGRESS	SIGNIFICANT	PARTIAL	LIMITED
Rec. 11: funding strategy			✓
Rec. 12: mobilising beneficiaries		✓	
Rec. 13: prioritising investments in prevention		✓	
Rec. 14: reforming CAT-NAT			✓



Appendix 1: Recommendations of the OECD review on the prevention of the flooding risk of the Seine in the Ile de France (2014)

1. Ensure coordination between the different levels of flood prevention - from the susceptible part of the Paris Metropolis to the drainage basin. Effecting a differentiated engagement of stakeholders both at the local level in the flood plain in the Ile de France and those in upstream territories creates a partnership in which the latter will also benefit from the implementation of the EU directive on flooding. The governance structure envisaged between the State and local contracting authorities at the level of sub-basins, and the benefits of decentralisation reform, will have to be clarified with the local authorities.

2. Define a global, ambitious and motivating long term vision alongside principles for action. This long term global vision shall be consistent with the ambitions of the Grand Paris project and enable mobilisation of public decision makers and citizens beyond their regulatory obligations in the directive and the risk management policy. Action principles of the national flooding risk management strategy could be adapted and stated at the level of the flood plain (mutualisation of risk, minimisation of moral risk, proportionality in burden and benefits, subsidiarity of the State's role, adaptability).

3. Break down this global vision into precise objectives and empower stakeholders. The operational objectives of the local strategy and Flood Prevention Action Programme should be aligned with each other and with the long term vision. Economies of scale and better efficacy could be attained through a redefinition of stakeholders' roles and responsibilities, as their number and diversity make coordination and efficacy complex. The definition of evaluation and performance criteria should help analyse the contributions made by the various stakeholders in flooding risk prevention, monitoring the performance of various initiatives and rational distribution of responsibilities and resources.

4. Create effective connections between the flooding risk prevention management strategy and related public policies. This requires the question of floods be integrated and made visible in a multi-risk approach that integrates other aspects of resilience in the development of Grand Paris (environment, green economy, wellbeing). Similarly, it will be a question of ensuring various sectoral initiatives and policies (water management, territorial development) truly incorporate the issue of flooding risk management with a view to creating synergy and sharing benefits.

5. Continue to improve and align the knowledge of risks and ensure availability of information on risks. The collaboration between the Police Prefecture and the Regional and Inter-departmental Directorate for the Environment and Energy could be extended to other stakeholders such as the insurance sector, in a coherent global risk assessment approach, especially in the economic respect. All information on risks could be centralised while respecting confidentiality, security and fair competition. This could accompany the proposal of modelling tools and data depending on needs, and could draw inspiration from the Observatory created at national level.

6. Reinforce risk culture among citizens, decision makers and enterprises. New communication approaches stressing the positive benefits of greater resilience must aim at increasing risk awareness at all levels. Regular updates, based on the best knowledge available and following a common strategy could accompany the Local Flooding Risk Management Strategy. The communication strategy should use new technologies (3D visualisation, virtual animation, social networks), target specific audiences (enterprises, citizens, decision makers, developers and architects) and be evaluated based on results through regular surveys of risk perception.

7. Improve territorial resilience, on the basis of opportunities offered by Grand Paris. The definition of a level of resilience for Grand Paris, especially through territorial development contracts, could enable the emergence of model resilient neighbourhoods such as the Ardoines. The alignment and reinforcement of the Risk Prevention Plans at the regional level will enable resilience to be improved towards this predefined level in the long term: these plans should use the latest risk assessments as a basis and their control should be improved. Incentives aiming to reduce the vulnerability of existing constructions could also be envisaged, by using opportunities such as the replacement of electricity meters.

8. Progressively improve the level of resilience of critical networks and act to ensure continuity of business units and public services. A predefined level of resilience should also apply progressively for network operators so as to reinforce requirements. New infrastructures, including transport, should aim for the greatest resilience to floods. Establishing requirement levels and controlling them may become the responsibility of the sectoral regulator. A mechanism supporting companies in their business continuity approach, and particularly SMEs, could also be developed, for instance the establishment of a risk-diagnosis service, of a dedicated label or the development of risk awareness guides.

9. Place high flood protection infrastructures under the responsibility of a single contracting authority that shall be responsible for applying a predetermined safety standard for all the contracting authorities, following a common cost/benefit approach to all of them within an appropriate institutional structure. The management and organisation of maintenance, replacement and work requirements could be assessed following the same criteria and compared to potential new infrastructures. The feasibility of aligning the protection levels for the whole urban area should be assessed by planning the work over time giving priority to the most beneficial measures.

10. Encourage experimentation at the Bassée storage project Rolling out the La Bassée project stage by stage should make it possible to adapt the approach through a process of learning by practice and to demonstrate its operational utility, beyond the theoretical cost-benefit studies. The question of governance of such a structure should also be raised beforehand, particularly regarding decision-making in a time of crisis to guarantee its effectiveness.

11. Support the local flooding risk management strategy of the Seine in the Ile de France through a clear financial strategy taking national specificities into consideration. This could focus on the following elements: perpetuation and long term vision; the principle of empowerment and proportionality between beneficiaries from measures taken and donors; the search for greater efficacy and inclusion of equity in resource allocation; and synergies with other sectoral strategies (drought, water, development, and crisis management).

12. Mobilise all prevention measure beneficiaries by following a multi-level approach that brings together local authorities and state funding, as well as various network operators, the private sector and citizens through targeted incentives. Additional funding could come from positive incentive mechanisms in existing tax deduction systems, particularly by bringing together the insurance, real estate and water management sectors.

13. Strengthen efforts to clarify criteria and prioritise state investments in risk prevention. This can take temporary European funding prospects into account for the implementation of the European Directive on flooding in high flooding risk territories like those in the Ile de France.

14. Review the impact of the CAT-NAT insurance scheme in terms of flooding risk prevention. The draft law aimed at reducing disincentives in the system could be relaunched. This could be the opportunity to reflect more widely on funding prevention.

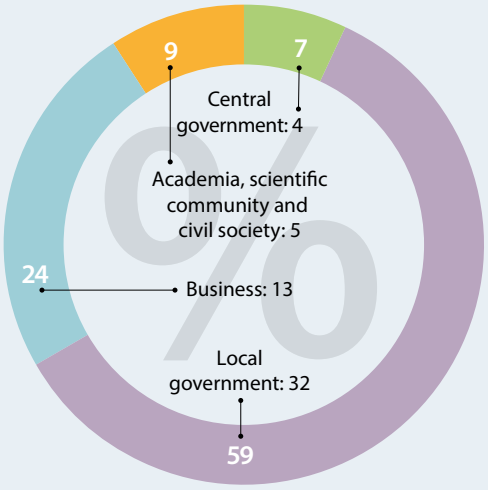
Appendix 2: Methodology of the survey

In order to evaluate the implementation of the 14 recommendations, estimate the respective contributions of each, and measure the progress made since 2014, the OECD conducted a survey through a self-assessment questionnaire to which 54 stakeholders responded.

The OECD also conducted a series of targeted interviews with key stakeholders regarding inclusive dialogue on resilience in the Grand Paris Metropolitan area, particularly addressing issues of governance, risk knowledge and assessment, risk culture, structural and non-structural prevention measures, and the funding of measures that prevent this risk.

Preliminary results were discussed during a meeting held at the OECD in June 2017.

Respondents to the OECD's questionnaire



State	Local authority Stakeholders			Network Operators and Private Sector	Academia, Scientific and Civil Society Community
	Municipalities	Departments	Others		
Seine-Normandy Water Agency (AESN), Central Reinsurance Fund (CCR), Regional and Inter-departmental Directorate for the Environment and Energy Regional and Inter-departmental Directorate for the Environment and Energy (DRIEE), Directorate-General for Risk Prevention (DGPR), General Secretariat of the defence and security zone(SGZDSP)	Athis-Mons Alfortville Boulogne-Billancourt Champs sur Marne Chennevières Corbeil-Essonnes Courbevoie Draveil Frette sur Seine Joinville-le-Pont Neuilly sur Marne Neuilly-Plaisance Neuilly sur Seine Paris Rueil-Malmaison Saint-Maur-des-Fossés Saint-Ouen Villemoisson	Hauts-de-Seine Seine-Saint-Denis Val d'Oise Val-de-Marne Seine-et-Marne	AITF local public river basin authority Seine-Grands-Lacs Grand Paris Sud Métropole du Grand Paris SAGE Croult Enghien Vieille Mer Institute for Urban Planning and Development (IAU) SyAGE	Artelia CCI Paris Île-de-France Eau de Paris EDF Generali France Mission Risques Naturels Orange Port Autonome de Paris RATP SEDIF SNCF Société du Grand Paris Veolia	CEPRI European Rivers Network Haut Comité Français pour la Défense Civile Laboratoire CEMOTEV Université de Cergy-Pontoise

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Ensuring the resilience of large cities against major risks is a fundamental responsibility of public authorities, who have to ensure the safety and well-being of their citizens and maintain confidence in government. Serious floods, such as those that recently affected the cities of Houston in the United States, Bombay in India, or the Seine Basin in France in June 2016, are reminders of the vulnerability of major urban settlements and the fragility of critical systems in a context of climate change.

In the face of such challenges, there is a need for risk management policies to help reduce these risks in the long term, increase the level of preparedness against any likely crises, and mobilise public authorities, business and civil society to improve resilience. This is the message of the main recommendation of the OECD on the Governance of Critical Risks.

The risk of the Seine flooding the Ile de France is a major one. In 2014, the OECD estimated that a flood comparable to the historic flood of 1910 could pose an unprecedented challenge for public authorities. According to projections, such a shock could affect up to 5 million citizens and cause damage costing between 3 and 30 billion euros. This could have significant repercussions in terms of employment, economic growth and state finances.



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