

Bresle Somme Authie: long term coastal submersion and flood Management Plan

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Abstract. In 2011, the French government commissioned the SMBS-GLP (Somme Bay –Picardie Coast joint venture development authority) to implement a flood prevention action programme along the Northern Sea coast between Le Tréport and Berck, in order to provide an overall mid- and long-term intervention strategy regarding flood risks (river floods and marine submersion). The area covered by the integrated management program is about 660 square km, more than 80 km of sea coast, 3 estuaries Bresle, Authie and Somme Bay, 56 communities are concerned by the risk and covered by the management plan. The prevention strategy developed for the area is based on a solidarity principle between coastal areas and land areas. The principle is based on the fact that the territory should face the risk with and adapted redistribution of human and urban stakes. This strategy is to be initiated now but will need tens of years to be effective. That's why the process is temporally adapted in order to assure some security to the most impacted areas.

1 The schedule

In 2011, the French government commissioned the SMBS-GLP (Somme Bay –Picardie Coast joint venture development authority) to implement a flood prevention action programme along the Northern Sea coast between Le Tréport and Berck, in order to provide an overall mid- and long-term intervention strategy regarding flood risks (river floods and marine submersion).

The time process included in 2012 an “intention” Management Plan (“PAPI d’intention” in French) focussing on the main characteristics and risks of the area and aiming at describing the organisational aspects of the Plan. This leads in a cooperation and pre-organisation between Picardie Cost institution and Opale Sud community in order to proceed with the technical studies and strategy definition.

The studies started in 2013 up to November 2015. The Management Plan has been accepted by the French national Inundation Commission for the first short term step of the overall strategy on the 5th of November 2015.

2 The area covered by the Management Plan

The area covered by the integrated management program is about 660 square km, more than 80 km of sea coast, 3 river estuaries Bresle, Authie and Somme, 56 communities are concerned by the risk and covered by the management plan.



Figure 1. Map of the covered area

The topography of the region is very specific: lowlands and depressions are existing on very huge areas far behind the coastal line. The area is exposed both to coastal submersion and river flood hazards, the lowlands up to 10 km far from the coastal line are impacted. The concomitance of river floods and high sea levels is a risk increasing factor. The low hinterland is therefore exposed to huge water levels incoming and storage. Moreover,

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every breach in the coastal line leads to marine water inlets resulting in hinterland water accumulation.

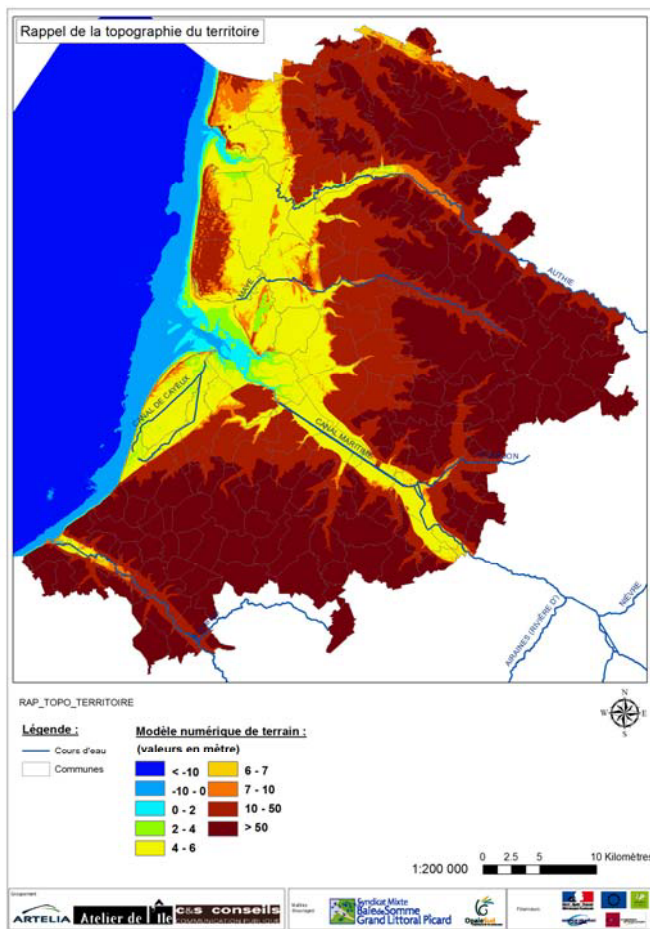


Figure 2. Topography of the covered area

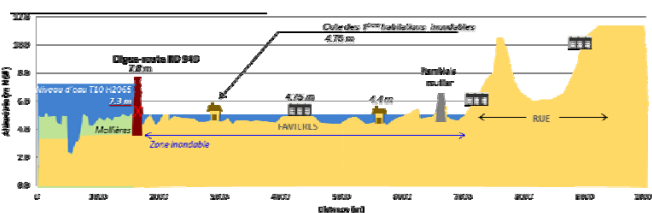


Figure 3. Example of a coastal cross section demonstrating the hinterland inundation exposure due to the specific topography – North-East of Somme Bay

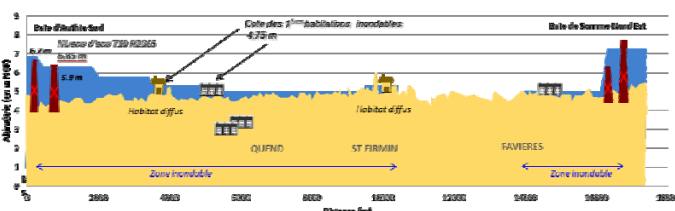


Figure 4. Example of a coastal cross section demonstrating the hinterland inundation exposure due to the specific topography – South of Authie Bay

This specificity submits the land to important inundation risks, potentially more than 30 000 inhabitants, tourists, employees and public can be affected by an inundation crisis.



Figure 5: Photography of a breach along the Cayeux coast (storm 1990) Source : Cayeux-citoyens



Figure 6: Photography of inundation in low hinterland of Somem Bay (Bas-Champs 1990 storm) Source : Cayeux-citoyens.

3 Iterative decision-making process

3.1 With the help of a protection multi-scale assessment process

The development of the actions strategy is based on a multi-thematic assessment which covers knowledge of risks, coastal dynamics and submersion, flood protection and management systems, it also includes other factors describing natural and human habitats characterised by sociological aspects, urban development, economics, ecology and the environment, hydrogeology, geology, geochemistry, hydrology, geomorphology, water quality, etc.

Moreover, the protection multi-scale assessment process, combined river (1D) and sea 2D hydrodynamic models. The results and proposed solutions are tested via multi-thematic assessment and cost-benefit analysis.

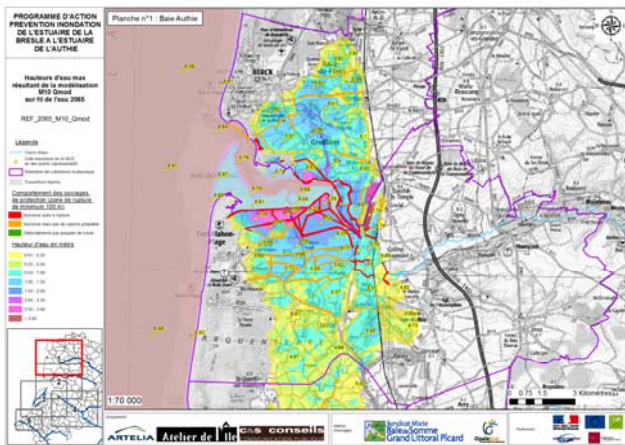


Figure 7. Example of a submersion scenario including climate change effects (sea level raise) – marine storm 10 years return period

The process should indeed insure the traceability, consistency and efficiency of the step by step decisions. The local decision makers were involved at each step of the process to provide advices, and take decisions.

Particular attention was paid for simple and pedagogical way to provide decision-aid elements.

The methodology was based on a converging iterative method, starting from global strategy to local scenarios of risk management.

The goal was to evaluate all imaginable postures for integrated management of flood risks: the most "resistant" strategy toward risk in the most "liberated" risk via an intermediate strategy.

At each stage, quantitative and qualitative assessments were shared with local actors:

- Model results,
- Economic evaluations (different project costs, residual damage values).
- Non-monetary indicators such as population affected (resident or not),
- Impacted economic activities,
- Other qualitative indicators have also been produced as the qualification of the impacts of a strategy on various themes: landscape, sociology, water quality, hydrogeology ...

The focussed strategy built on a combination of local solutions was then translated in time (short term 2021, medium term 2035, long-term 2065)

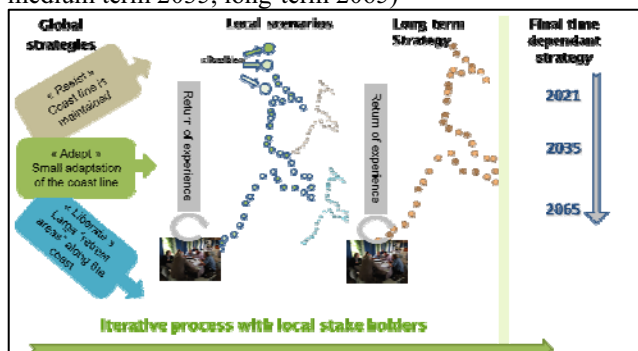


Figure 8. Schematic representation of the decision-aid process.

3.2 With the help of a cost-benefit analysis

The decision for flood protection measures must be justified with the assessment of the projected measures. The assessment should highlight the feasibility, the consistency and the efficiency of the measures.

The cost-benefit analysis (CBA) which is part of the Multi Criteria Analysis evaluates the benefits in monetary units (mainly avoided damages) and compares these benefits with the project costs in time (investment, operation, long term maintenance). The socio-economic benefits in non-monetary terms are evaluated using a score of quantitative and qualitative indicators to take into account the impacts on human health, the environment, cultural heritage and economy.

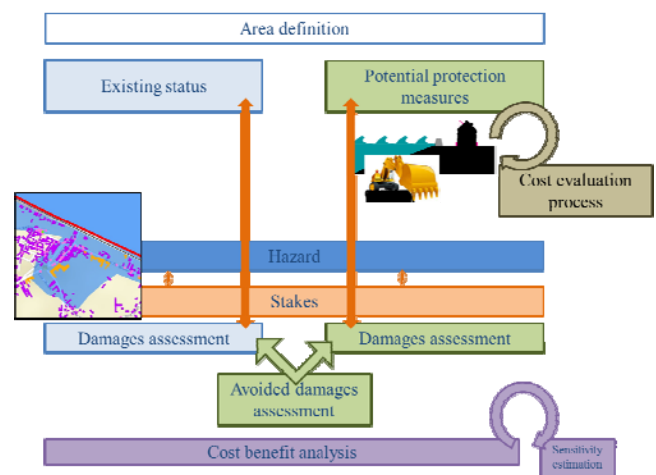


Figure 9. Methodological steps for Cost benefit analysis for inundation protection works

In the case of BSA flood prevention management plan, the inundation plain is so vast and impacts so many stakes that the expected damages even related with a moderated climatic event are very important. That's why the Cost-Benefit and the multi criteria analysis of the protection measures were highly successful.

4 The long term strategy

The prevention strategy developed for the area is based on a solidarity principle between coastal areas and land areas. The principle is based on the fact that the territory should face the risk with and adapted redistribution of human and urban stakes.

From the analysis of the urban and socio-economic issues, derived a number of strategic objectives based on a renewed vision of the territory exposed to the risk.

Objective 1: Reduction of existing vulnerability issues

First, adaptation actions to reduce the vulnerability of existing stakes (buildings...) must be undertaken in the short term, given:

- the time required for the establishment of a consistent protection system throughout the territory Bresle Somme Authie;

- the persistence of residual risk included in any system of protection;
- The large number of people affected by extreme hydro-climatic events at present and in the long term;
- The amount of potential damage to such events, with a particularly strong impact for economic activities.

This adaptation should be based on individual housing but also public buildings, farms, economic activities... Reducing the vulnerability also involves adapting activities in hazardous areas, including agriculture. The effects of salinity for marine submersion invite to renew agricultural practices on these areas. Thus, the development of extensive farming in wetlands, new salt-tolerant crops or the establishment of a land strategy of gradual relocation of some agricultural activities will fit into the medium term.

Objective 2 : Preserve and enhance the quality of existing urban, landscape and environmental heritage and invent tomorrow's heritage

Adaptation issues should be accompanied by a policy of waterfronts redevelopment, innovative resilient housing, definition of a new architectural and landscape identity of the coastal urban area.

Objective 3: Allow reasonable urban development, localized and adapted

New urbanization will be reserved in urban deserted zones mostly in higher hinterland areas. In the same time, expansion or construction will be limited or with resilient solutions . In addition, renewal of network services could be the time for a strategic relocation (out of risky areas).

Objective 4: Ensure a sustainable economic and social development

Creating new uses, new synergies : testing of new salt-tolerant crops, extensive breeding in wetlands or the touristic development of land water bodies are all paths to ensure territorial economic sustainability. Furthermore, these actions are in line with a diversification of the employment offer and the development of new courses to create the jobs of tomorrow.

Objective 5: Take advantage of the incoming changes

The submersion and inundation risk becomes a driver of innovation for the territory. Developments related to climate change require a stronger adaptability of urban systems. Thus, the strategy of fixing stakes on the territory is over and must lead to a mobile territory and better connected to its environment. What if the risk becomes an opportunity to strengthen regional competitiveness?

5 Short term trade-offs

The solidarity along the coast and hinterland is the key principle of the BSA management plan.

In compliance with this principle, it is organizing the redeployment of current and future stakes exposed to submersion and inundation risk, taking into account both

the vulnerability of low hinterland areas, but also the economic potential of coastal activities.

Organizing the redeployment of existing and future stakes requires more than 10 or 20 years at this scale. The resilient urban and land occupation planning will be probably effective in 50 years, if initiated nowadays. The BSA territory is such exposed to the risk that it cannot afford such a time without protection.

That's why the process is temporally adapted in order to assure some security to the most impacted areas. The priority is to secure the existing exposed stakes while initiating the long term changes.

The territory redeployment will require also increasing risk awareness among all land users (residents, elected officials, economic actors) today not sufficiently aware of this context through effective information and consultation procedures.

The short term action program covers a wide scope of actions from long-term urban planning to crisis management actions, coastal work rebuilding or strengthening the population awareness. The proposed multi-thematic actions are detailed and locally justified based on territorial assessment and local stakeholders' political decisions.

- Retreat of the protection along the coast line in agricultural and natural environments;
- A territorial redeployment for exposed cliffs areas;
- Adaptation of the existing environmental management plans for the areas under marine and river influence,
- Building resilient urban development, such as the creation of "buffer zones" in urban areas (runoff, inundation, sea flooding), adaptation of services networks, flood-adapted housing ...
- Consolidating and updating of crisis management documents (safety plans), risk information document (DICRIM), urban planning risk management (PPR), raising risk awareness among public ...)
- Intervention on the protection works along the current coastline or hinterland.

6 References

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