About plan

Flood Risk Management Plan for Riga City

Different territories of Riga City flood for various reasons (spring spate, intense precipitation, wind surges, malfunctioning melioration and rainwater drainage systems) or for combinations of reasons, posing a threat to residential areas, manufacturing or public buildings and other forms of infrastructure. In addition, flood may cause environment pollution from manufacturing companies and present risks to monuments of architecture and culture, and it potentially endangers specially protected nature territories and sites.

The most serious flood risks that endanger Riga City are connected with wind surges in Riga Bay (as opposed to spring spate, downpours or melting snow); therefore, the most significant flood prevention measures are linked with protection against flooding caused by wind surges.

Observations so far indicate that simultaneous occurrence of spring spate and wind surges is impossible, and since the risk of spring spate is lower, then, whilst primarily protecting territories from sea water surges, they will also be protected from flooding caused by spring spate.

According to the climate change forecasts, the frequency and extent of flooding in future will grow, thus increasing the risk of flooding even more. To ensure sustainable development of the city it is necessary to reduce the flood risk endangering inhabitants and property by balancing environment, social and economic interests. The reduction of risk will considerably lessen the damage that flood could cause the owners and governments at all levels.

The aim of flood risk management is to manage the flood risk in a way that the balance is obtained among the environmental, social and economic needs that are and will be influenced by flood risk prevention measures. Flood risk management is not a one-time action, but a continuous, cyclic process, requiring regular activity. Management comprises various activities – research of the problem and study of possible solutions, planning of resources and development of the timeline, attraction of funding and implementation of measures, proper monitoring and maintenance of anti-flood constructions, progress monitoring and review of the plan, taking into account the most recent research, climate forecast and the best technologies available.

Flood Risk Management Plan for Riga City has been developed within the framework of the project, funded by Riga City Council and European Union LIFE+ programme. This is the first plan of its kind, assessing the possible flood threat to Riga City and recommending flood prevention measures that would lessen the possible flood-induced damage and loss to the inhabitants, their culture and historical values and economic activity, especially because the present climate change forecasts predict the increase in flood frequency and extent in the future.
The developed Flood Risk Management Plan is a strategic document that aims at exploring the problem, calculating the costs of possible solutions, as well as potential environment impact assessment of the flood prevention measures.

The flood prevention measures recommended in the Plan are based on modelling data that were calculated for the possible wind surges, which, as a result of modelling, are considered to be the most significant cause for flooding in future. The particularizing of the downpour hydrological model, developed within the framework of the Project, is not sufficient for detailed localization of conceptual recommendations, since the territories endangered by rain are relatively scattered.

The recommended technical solutions, that are included in the Flood Risk Management Plan, were worked out, taking into account the anticipated climate change, for the nearest future (2021-2050) climate with the likelihood of 1% (once in 100 years). This scenario is very close to our current climate with the likelihood of 0.5% (once in 200 years). According to the data obtained from the modelling, the total territory of land that may get flooded in this scenario is 3061.8 ha or 30 618 thousand m² (30.6 km²), from which 2646 ha or 26 460 thousand m² of

territory might experience economic loss. 4198 inhabitants or 0.6% of all the inhabitants of Riga reside in this territory that floods with the likelihood of 1%.

In carrying out the prioritizing and multi-criteria analysis of flood prevention constructions, the number of residents in the territories under flood risk should be clarified, taking into account the most recent available data and it should also be identified how many inhabitants will be isolated from the rest of the city as a result of flood, thus complicating their daily lives, obtaining supplies and receipt of emergency services, etc.

According to the results of modelling, flood with the likelihood of occurrence once in 100 years endangers 5 objects of social infrastructure, 3 architecture monuments of local significance and two museums. Also inundation of several other culture-historical monuments of state and local importance is possible (fortification buildings, medieval cemetery, part of the historical centre of Riga, historical buildings in Kipsala).

Flood of the same scenario also poses a threat to 20 sites listed in polluted sites register – businesses, having received permissions for A un B category polluting activity, and polluted or potentially polluted sites.

The possible flood also poses flood threat of different degree to specially protected natural territories located in Riga – Seaside Nature Park and three nature reserves (Kremeri, Vecdaugava and Jaunciems nature reserve), as well as 12 micro-reserves that have been created for the protection of certain species and habitats. However, according to the strategic environmental impact assessment statement it cannot be stated without further research that the possible flood would endanger the species and biotopes in the specially protected territories or micro-reserves. According to the nature preservation plans of specially protected natural territories, periodic flooding in these territories is desirable, thus the construction of such flood prevention infrastructure that would stop periodic flooding of these territories is inadmissible. The flood with 1% likelihood considered here are temporary (the time of wind surges normally does not exceed 10-12 hours), and for some protected species and biotopes periodic flooding is desirable or even required.

In compliance with the requirements of legislation, both the Flood Risk Management Plan project and Strategic Environmental Impact Assessment (SEIA) Environment report project were revised and commented on by Environment State Bureau (ESB). In accordance with the decision of ESB, both above-mentioned projects were sent to the responsible government and municipality institutions – Ministry of Environmental Protection and Regional development, Ministry of Interior, Lielriga Regional Environmental Board of State Environmental Service, Nature Conservation Agency, appropriate structural unit of Health Inspectorate, administration of Riga Planning Region, State Fire and Rescue Service, Freeport of Riga Authority, State Inspection for Heritage Protection, as well as to the Environmental Consulting Council, which represents public organizations.

For Flood Risk Management Plan and its Strategic Environmental Impact Assessment (Environment report) projects public deliberations were organized. Within their framework, four public deliberation meetings were held.

Based on the research data, several territories in Riga City are under the potential flood risk and need to be protected because of their inhabitants, culture-historical values, economic activity, planned territorial development or historical environmental pollution. According to the results of the research, the following territories were identified as being under flood risk:

- around Bullupe (Vakarbulli, Ritabulli, Daugavgriva, Bolderaja);
- around Vecdaugava;
- around Hapaka ditch and Bekera ditch (Kremeri, Voleri, Spilve);
- around Kisezers, Juglas channel, Juglas Lake and Baltezers;
- around Sarkandaugava;
- around Zunda channel (Kipsala, Kliversala, lower reaches of Marupite);
- around Biekengravis (Mukusala, Biekensala, Lucavsala);
- around Krasta street from Salu bridge till Dienvidu bridge.

The greatest number of inhabitants, who are under flood risk with the likelihood of 1%, reside in Bolderaja (1923 inhabitants) and around Vecdaugava (1159 inhabitants). The other inhabitants under flood threat are located in the vicinity of Kisezers, Juglas channel and Juglas Lake – 636 inhabitants (in the north and northwest part of Kisezers – 274, near Jugla channel - 246, on the coast of Juglas Lake – 102, in Saulesdarzs – 8, in Aplokciems – 6), as well as in Voleri (169), Sarkandaugava (101), Ritabulli (96), Kipsala (66), Vakarbulli (45), Biekengravis (2), Spilve (1).

Each of the above-mentioned territories was assigned the most suitable flood prevention measures, taking into account the impact (gain/ loss) that the implementation of a certain measure can have on the community, economic activity (business enterprises), nature (including specially protected natural territories) and culture-historical values. Flood prevention measures refers to various technical solutions for protecting the territory of Riga City, such as elevation of asphalted street or dirt road sections, elevation of existing dams, construction of new earth dams, construction or reconstruction of sluice and regulator gates and culvert regulators.

Flood prevention measures, proposed by the Plan, mainly involve elevation of the existing streets and roads that would serve as dams or even as evacuation routes in case of flood. In several areas construction of new dams is intended. For several territories sluice regulators or culvert regulators are proposed; they would remain open most of the time, but the regulators would have to be closed temporarily during wind surges to protect the respective territory from flooding.

For a part of the city territory two flood prevention measure alternatives have been provided, with their possible impact on the environment determined and cost-benefit analysis carried out.

The plan contains the main protection constructions necessary to protect the buildings and historical and cultural values from possible flood-induced loss. The degree of detail for flood prevention measures, developed in the framework of the Project, does not propose protection for all territories in Riga City, facing flood risk. For separate smaller territories the protection should be considered individually during the stage of designing the development proposal, weighing various options of protection and selecting the most suitable one.

To reduce the risk of flooding in the territories where no flood prevention constructions are proposed in the Plan, local flood prevention measures are recommended for protection of these territories, for example, coast strengthening, thus, preventing coastal erosion, or earthwork. Such measures can be implemented in the territories where it is allowed in compliance with the binding regulations.

The flood prevention measures proposed in the Plan and their technical parameters are based on the existing height marks in the city territory that were used in the research. Many streets in the city serve as dams already now, so they must not be lowered, dug anew and culverts beneath them must have regulators. The harbour landings and dams along Daugava, Kisezers, Juglas Lake, Baltezers, Bullupe, Vecdaugava must not be lowered. It should also be banned to dig the natural relief elevations along Daugava, Kisezers, Juglas Lake, Baltezers, Bullupe, Vecdaugava. Changes in these streets, landings, natural relief elevations and height of dams have to be carried out in compliance with the flooding model, developed as part of research within the framework of Project.

To prevent the erosion of Daugava banks and flooding of coastal territories, regular monitoring, maintenance and, if necessary, renovation of Daugava banks strengthening is crucial.

The proposed technical parameters of flood prevention constructions for the specific territories were based on the assumption that rainwater drainage/ melioration systems in the respective territory under flood threat is well functioning.

The proposed flood prevention measures in each flood risk zone, **should only be implemented alongside with the improvement, reconstruction** or, where necessary, construction of **rainwater drainage system.** Building flood prevention constructions without

proper rainwater drainage systems would potentially cause greater and more frequent flood-related problems.

For the assessment of the existing situation detailed site visits (inventory), checking rainwater drainage (melioration) systems in Riga and the analysis of the obtained results are necessary.

Based on the flood prevention solutions presented in the Plan and the assessment of the existing city rainwater drainage/ melioration system, a complex course of action should be worked out to protect the inhabitants and their values from the loss that may be caused by more frequently anticipated flood. The course of action should be implemented, considering the possibilities to put in order rainwater/ melioration systems in flood risk regions indicated in the Plan, to improve the maintenance of the existing rainwater/melioration systems and provide the maintenance of the intended flood prevention constructions and the necessary management of new melioration constructions.

A multi - criteria analysis needs to be performed for flood prevention measures that are a priority, identifying and assessing not only economic benefits but also immaterial achievements and loss. To prepare the criteria for such analysis, it is necessary to carry out a more in-depth research, and the following aspects should be taken into account in the analysis: number of working and residing people; number of inhabitants and companies, which will not get flooded in case of flood, but might get isolated from the rest of the neighbourhood (the streets and roads will flood); the possibility and consequence of environmental pollution, if the flood reaches the polluted territories or companies where certain substances might pollute the environment or properties that use individual water supply and waste water collection (well-curbs, reservoirs that need to be emptied, septics); impact on specially protected nature territories; as well as other significant criteria of assessment. It needs to be evaluated whether in areas with little construction and the likelihood of flooding 1% it is possible to implement individual protection from flood or use temporary means (sand bags or others), taking into account that costs, after letting the buildings flood and then renovating them, are much lower than building a permanent flood protection construction, the necessity for which is likely to be once in 100 years.

To implement the specific measures proposed in the Plan, the following activities will be necessary: development of technical projects for flood protection constructions (including the necessary geological and geotechnical studies and necessary approvals); recalculation of funding according to the construction costs after a year of implementation, other up-to-date financial figures and in accordance with allocated funding and terms; as well as the timeline and the assessment of the institutional capacity (resources for the introduction of the project and maintenance of the new constructions – human resources and costs of exploitation), and environmental impact assessment.

Making a decision about the implementation of flood prevention measures the entrepreneurs should be given the option to choose other effective anti-flood constructions or materials (accepted in other parts around the world) for their technical solutions. However, these constructions (or materials) should correspond to the requirements of Latvian building regulations and should provide the same or even better protection against the potential flood.

In the future preparation and implementation of the Project we will continue to keep the public informed about the course of the Project and possibilities to participate in the decision making process. In the process of making the environmental impact assessment for specific flood prevention measures, public deliberations will be announced.

During the implementation of Flood Risk Management Plan the following activities are required: regular monitoring of change of environmental conditions in territories under question, monitoring of technical condition and functionality of anti-flood constructions; and monitoring of those environmental parameters that served as basis for the decisions and process models used in the preparation of the planning document. Using the data obtained in the monitoring programmes, as well as taking into consideration the most recent climate change forecasts, the results of scientific research in other related fields, the best available methods and materials for

technical solutions, trends of territorial development and the changes in the state of existing anti - flood constructions, the planning document should be revised and updated.