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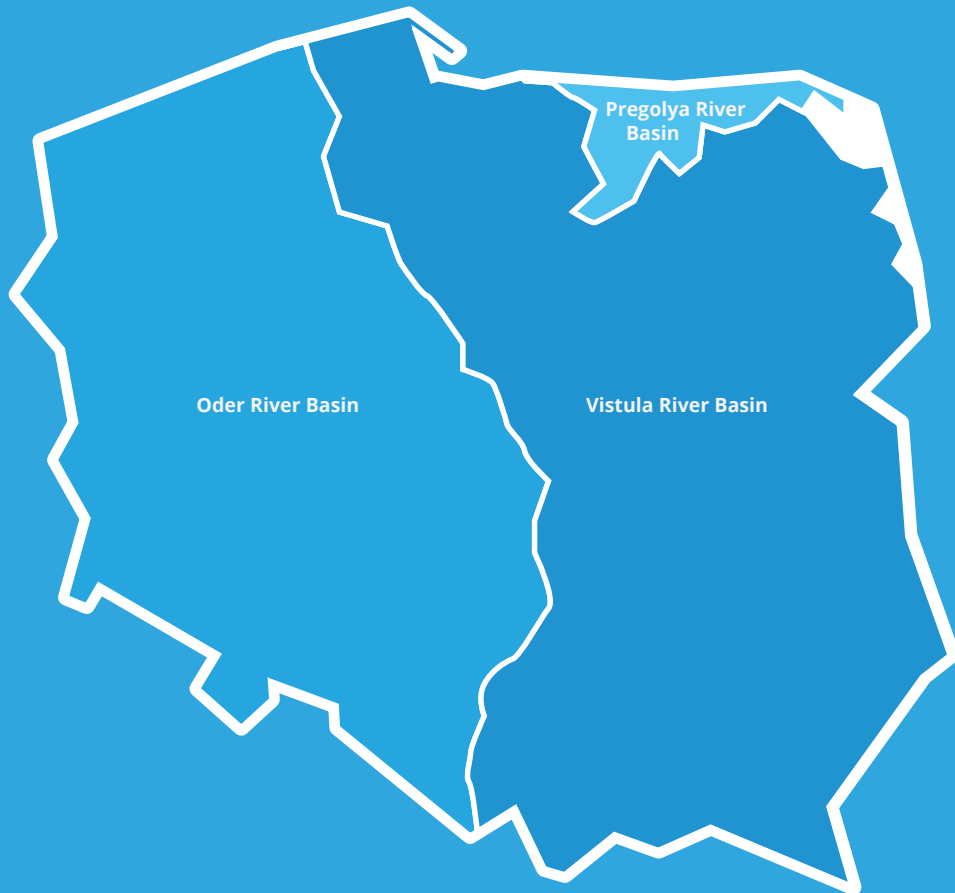
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Technical Assistance 2007-2013

**FLOOD
RISK
MANAGEMENT
PLANS**





KZGW
Krajowy Zarząd
Gospodarki Wodnej

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WITOLD SUMIŃSKI

President of the National Water
Management Authority

Ladies and Gentlemen,

Flood Risk Management Plans open a new chapter in the way flood protection is perceived in Poland. They will help us to introduce a strategic approach and thereby exercise more complex and coordinated management in the river basins. This will help to avoid accidental investments and limiting ourselves to just temporary and immediate actions.

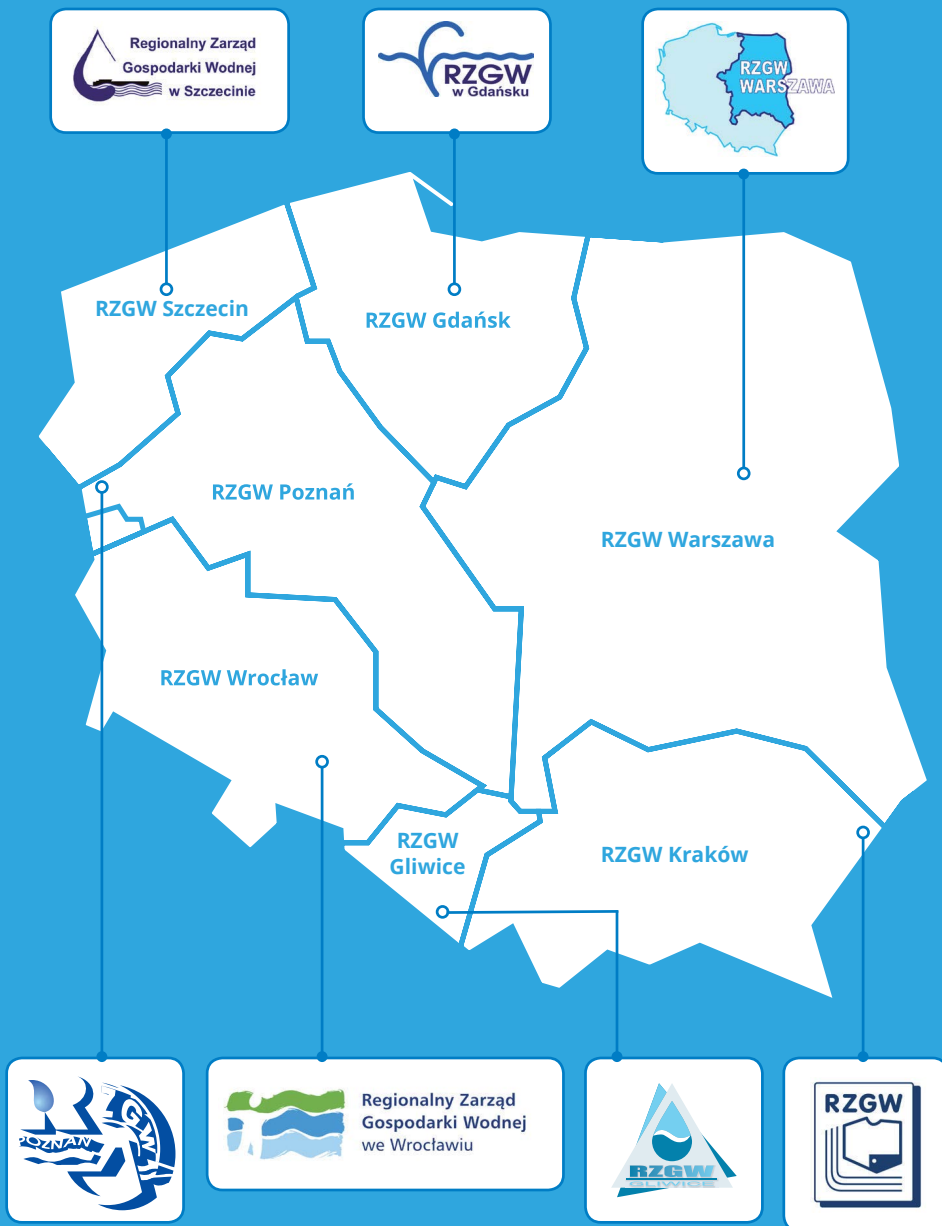
In Poland, we should change the way of thinking about flood safety. There may always come a cataclysm bigger than the one we anticipated. We must think and act towards managing the whole process of flood.

Our obligation is to educate the citizens in flood protection; hence, we created a platform offering the opportunity to share information between experts who are involved in water management in Poland and residents of the territories threatened by a flood. I would like to take this opportunity to encourage you to visit our website www.powodz.gov.pl where you will find information necessary to prepare for this dangerous phenomenon, voice your comments connected with the draft plans or ask our experts questions. Let's learn how to live with a flood.

I encourage you to familiarise with the Flood Risk Management Plans and participate actively with the public consultations process.

Witold Sumiński

A handwritten signature in blue ink, appearing to read 'W. Sumiński'.



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FLOOD RISK MANAGEMENT PLANS

You think that the flood is not your concern. It's not true. Even if you don't live near any river, flood may surprise you. It's one of the most dangerous natural phenomena that occur in our country. During the flood in 1997, the territories that were flooded included nearly 700 thousand apartments, thousands of companies, ca. 70 thousand buildings. More than 50 people lost their lives. It was said that this was "the flood of the millennium." Whereas, it wasn't long before yet another flood came. In 1998, similar catastrophe visited the areas around Kotlina Kłodzka. Each year, 20% of all losses in Polish households are caused by floods!

Remember – you're not alone during the flood.

In November 2007, the Directive of the European Parliament and the Council dedicated to assessing and managing flood risk, the so-called Flood Directive (Directive 2007/60/EC) came into force. All EU members, including Poland, have been obligated to plan the measures related with flood protection. Until the end of 2015, Poland should prepare flood risk management plans (FRMP).

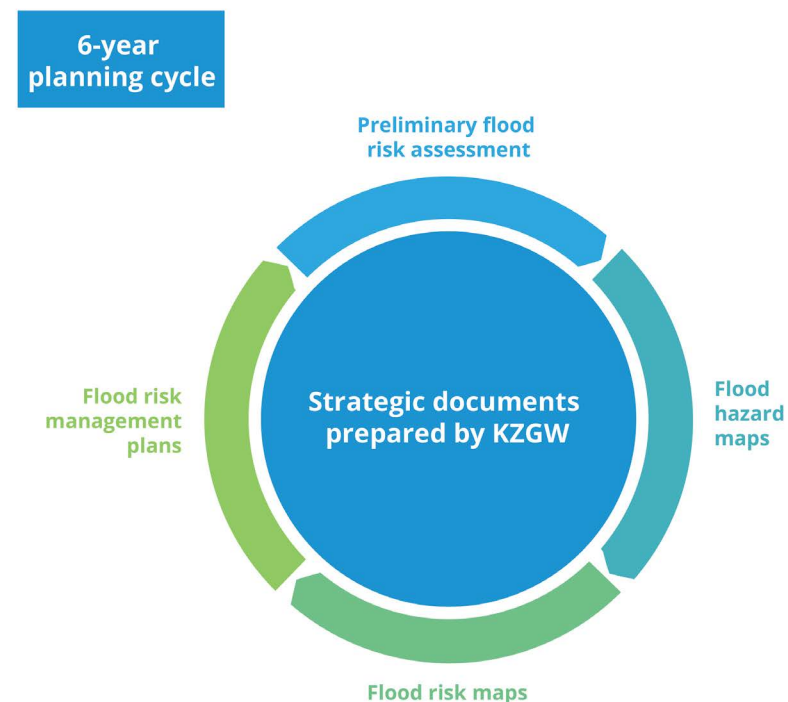
Before starting to draft the plans, a preliminary flood risk assessment was made (PFRA) followed by flood risk maps (FRM) and flood hazard maps (FHM). In December 2011, the preliminary flood risk assessment (PFRA) was published, mapping out the areas at risk of flood; that is those areas for which potential significant flood risks exist or might be considered likely to occur. For the areas indicated in the FRPA, flood hazard maps and flood risk maps have been prepared. Currently, based on the prepared planning documents and data collected, draft flood risk management plans have been prepared for the river basins and water regions. The works are conducted simultaneously for the river basins for Oder, Vistula as well as Pregolya and 9 water regions: Lower Oder and West Littoral (Przymorze Zachodnie), Warta, Central Oder, Upper Oder, Łyna and Angrapa, Lower Vistula, Central Vistula, Little Vistula and Upper Vistula.

By following carefully selected measures dedicated to minimising the identified threats, flood risk management plans aim at reducing potential negative consequences of the flood for the life

and health of people, environment, cultural heritage and business. Those measures must also lead to reducing the damages caused by the flood.

Published on 22 December 2014 on www.powodz.gov.pl, the drafts have been prepared by over 2.5 thousand experts in water management. As set out by the Water Law, preparing the plans for the river basins is the responsibility of the President of the National Water Management Authority, while the plans on the level of water regions are prepared by the directors of the

Water Directive 2007/60/EC



individual Regional Water Management Authorities. This project is co-funded by the European Union's Operational Programme Technical Assistance 2007-2013.

You can also choose to have an impact on your and your family safety.

Visit www.powodz.gov.pl and learn more about the flood risk management plans for your commune. Don't be indifferent, consult!

DICTIONARY OF BASIC TERMS

Fundamental goal of the Flood Directive – to reduce potentially negative consequences of the flood for the life and health of people, environment, cultural heritage and business, by preparing FRMP, among others.

Main goals of the FRMP – three main goals have been set out: containing the growth of flood risk (prevention stage), lowering the existing flood risk (prevention and protection stage), improving the existing flood risk management system (preparation stage, reconstruction and analyses stage, development of instruments).

River basin – the area from which the waters flow down to one river system and through one main river run off to a sea, lake or other river.

Flood Directive – Directive 2007/60/EC of the European Parliament and the Council of 23 October 2007 on the assessment and management of the flood risks; the Directive introduced the term “flood risk,” which is the basis for the actions reducing the consequences and losses caused by floods.

Flood risk reduction measures – measures that directly influence the degree of flood risk; they cover non-technical measures, such as reducing or banning constructions on the flood retention basins, methods of protecting public and private facilities, warning systems, evacuation plans and technical measures, that is all kind of hydro-technical works; they are applied subject to preparing and implementing appropriate legal, financial and information instruments.

Flood exposure – land use development status of the hazarded area covering all facilities in the area, forms of land use and the communities living or using the land.

Flood wave – it is developed in the river channel of the waterway during the rise caused by intensive rainfall, rapid thaw melt, ice jams and other kind of jams, dam failure; the wave has a distinctive beginning, rising phase, culmination point and falling phase.

Hot spot – problematic areas characterised by a high flood risk, requiring an intervention.

Informing – active and passive forms of sharing information about the process of preparing plans, including problems, goals and measures, implementation deadlines, possible impacts on the process.

Implementation instruments – legal, financial, analytical or informational instruments implementing or supporting implementation of flood risk reduction measures and stimulating R&D works related thereof.

Measures catalogue – open set of measures/groups of measures implementing detailed goals.

Goals catalogues – sets of main goals and the corresponding detailed goals connected with a river basin and water region; catalogues are an indication for the planning teams, showing them from which set they should select goals for the specific planning area.

Public consultations of the plans – the process of collecting and analysing opinions given by various circles in order to clarify the problems and needs connected with flood risk reduction and assessment of proposed solutions (measures, instruments, plans).

River channel – means the lowest part of the river valley eroded naturally by a river or shaped artificially by humans.

Flood hazard map – a map showing the borders of the areas at hazard of flood and flood depths for 3 types of likelihood of flood event: 0.2%, 1%, 10%; maps for the capitals of voivodeships, towns with the administrative rights of a poviats and those with over 100,000 residents include additional information concerning the speed and the direction of water flow.

Flood risk map – a map presenting potential negative consequences of a flood, including

information about number of residents threatened by flood and information about facilities with significant cultural, environmental and economic relevance, flooding which may cause losses.

Areas exposed to flood risk – specified in the Preliminary Flood Risk Assessment areas for which potential flood risk exists or might be likely to occur.

Significant flood risk area – one of the areas included on the flood hazard maps characterised as:

a) area where the likelihood of flood event is average being determined as once a 100 years (1%),

b) area where the likelihood of flood event is high being determined as once in every 10 years (10%),

c) area between the bank line and the levee or a natural high bank with built-in levee course as well as islands and alluvions,

d) technical zone within understanding of article 36 of the act of 21 March 1991 on the marine areas of the Republic of Poland and marine administration.

Flood Risk Management Plan (FRMP) – it is a document containing, among others, set of measures helping to achieve goals connected with flood risk management, i.e. reduction of flood risk and instruments guaranteeing their implementation (legal, financial, information, research, etc.) along with implementation schedule (six years) and necessary costs; set of measures was selected during the process of planning based on the criteria evaluating how efficient are the selected measures for reducing the effects of floods for the community, economy and environment.

Polder – natural or artificially formed flood retention area enclosed from the river channel which is a special kind of retention reservoir which may temporarily retain the excess of water flowing through the river channel.

Flood – according to the Water Law, it is a temporary covering by water of land not normally covered by water, caused by water rise in the natural courses, water reservoirs, channels and from the sea side, excluding overflow of water caused by water rise in sewage systems; floods are caused mainly by a heavy rainfall (fall), quick snowmelt (freshet), ice jamming drainage (ice jam) and the rise of waters adjacent to the sea (storm).

Likelihood of flood event – statistically determined likelihood of flood event; the higher the number determining the likelihood the more often the flood occurs; e.g. 50% likelihood of flood event means that it is statistically occurring once every two years, on average.

Valley retention – water amount occurring during the flood in the river channel and flood retention basin; on the levee areas, level of such retention is significantly reduced.

Channel retention – amount of water that may be retained by river channels during the water rise.

Flood risk – combination of likelihood of flood event and potentially negative consequences caused by flood for the health of humans, environment, cultural heritage and business. In practice, it is assumed that flood risk involves the hazard (flood range), exposure (facilities and communities on the threatened area) and sensitivity (to what extent the facilities and communities are prepared for a flood).

Flood Warning Systems – they aim at providing residents and users of floodplains with condi-

tions that enable taking actions to reduce the threat to life and health of people as well as material losses. F.W.S. include the following elements:

- estimated size of flood as well as duration and time of occurrence,
- determining areas that may be flooded,
- determining the addressees of the warnings – people and institutions at risk,
- distribution of warnings, monitoring of people's reaction to the warnings.

Participants of planning works – developed for the purpose of drafting FRMP the below-provided organisational structures:

- Water region (or river basin) planning group – is a counselling and opinion-making body appointed in order to draft flood risk management plans for the reference water region (or the reference river basin); planning group provides content-related opinions of the materials prepared; moreover, it participates in public consultations and information campaign.
- Steering committee for river basins and water regions – is a body exercising strategic management of the process of drafting and implementing flood risk management plans on the level of respectively river basins and water regions; it supports, consults and advises the President of the NWMA or directors of the RWMA in relation to approving new products drafted.
- Catchment area planning team – is a body supporting the actual water region planning group, appointed in order to involve local community in the decision-making process and cooperate on the on-going basis (supporting, consulting and advising) on the level of the catchment area with the contractor

who drafts the flood risk management plan connected with the water region.

Levees – artificial construction in the form of a long heap constructed along a river in order to protect flood retention basin.

PFRA – preliminary flood risk assessment – planning document resulting from the Flood Directive determining the areas exposed to the risk of flood, constituting the basis for the flood hazard and flood risk maps; every 6 years, PFRA is reviewed and updated.

Sensitivity – feature characterising degree of preparedness of threatened people and facilities in case of flood event; it covers vulnerability for flood of the threatened people and facilities as well as ability of local communities to prevent the hazard and remove the effects of the catastrophe; therefore, sensitivity reduction covers on the one hand decreasing the vulnerability for flood (e.g. applying protections in individual buildings) and on the other hand improving the capability to respond to a hazard (e.g. improving warning system).

Co-deciding – working out solutions (selecting criteria and measures, designing instruments, determining weights) jointly; co-deciding will be implemented mainly in relation to steering committees for the river basins and water regions as well as planning groups for the regions.

Spatial planning – process resulting with decision concerning the purpose and use of specific area consistent with the spatial planning and management law.

Flood risk management – process involving the following phases: prevention, protection, preparing, reconstruction and analyses.

Catchment area – part of the area (e.g. river basin) enclosed by an aquatic compartment in any

section (water gauge, dam, bridge, river mouth to recipient); if the catchment area covers the whole river system, i.e. the main river and its tributaries, the term catchment area shall mean the river basin.



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DRAFT FLOOD RISK MANAGEMENT PLAN FOR ODER RIVER BASIN

ODER RIVER BASIN AREA IS 118.861 SQ. KM, WHEREBY, 106,056 SQ. KM ARE LOCATED IN POLISH TERRITORY.

Oder River Basin splits into four water regions:

- water region of Upper Oder – 3.83 thousand sq. km of surface
- water region of Central Oder – 39.3 thousand sq. km of surface
- water region of Warta – 54.5 thousand sq. km of surface
- water region of Lower Oder and West Littoral – 20.4 thousand sq. km of surface.

FLOOD HAZARD AND RISK (PFRA, FHM, FRM)

Oder river basin has been outlined 101 areas exposed to the risk of flood event (AERFE) covering total area of 8,076.8 sq. km; length of rivers within the aforementioned areas is 6,578 km. Based on the analysis of flood hazard maps (FHM), it was defined that ca. 396 thousand ha is located on the areas with a low likelihood of flood event, ca. 325 thousand ha are within average likelihood of flood event and finally ca. 198 thousand ha are at high risk of flood event.

Number of residents living in the flood risk areas is respectively: ca. 325 thousand residents live in the area where the likelihood of flood event is low, ca. 149 thousand reside in the areas of average likelihood and 22 thousand people live in the areas at high risk of flood event.

It was also identified that respectively 28 thousand and 21 thousand of residents live within the areas of low and average likelihood of sea flooding. As far as Oder river basin is concerned, the biggest area and the highest number of residents at risk from flooding are located in the water region of Central Oder.

Following a five-degree scale, flood risk in relation to individual communes was determined and as a consequence, 41 communes with the highest integrated risk of flooding were indicated. The highest number of communes with very high and high level of integrated flood risk is located in the water region of Central Oder. Out of all identified communes in the Oder river basin, this region includes 70.3% of the communes at high risk and 73.2% of the communes with the very high level of risk.

Analysis conducted based on flood hazard and flood risk maps helped to calculate the values of

the average annual damage (AAD) for the catchment areas and water regions within Oder river basin. As far as Oder river basin is concerned, average annual damage amounts to 0.64 billion zloty with the water region of Central Oder that accounts for the highest amount– 0.33 billion zloty.

It was identified that there are 12 main problems connected with flood risk management in Oder river basin. They mainly concern the growing flood risk caused by the changing climate and intensified human pressure, inadequate scope and frequency of the maintenance measures dedicated to the anti-flooding infrastructure, unsatisfactory protection and safeguarding of the seashore against erosion, deficient flood retention of individual catchment areas, growing risk of floods caused by ice jams due to weather conditions and more difficult conditions in which the ice breaking operations are conducted. Threats to the seashore communes and those located around the Bay of Szczecin include storm surges. If a storm surge is combined with a snowmelt surge and ice jam by the rivers' mouths, flood risk automatically goes up.

The main strategic goal of flood risk management is to reduce flood risk in Oder river basin by undertaking non-technical measures that limit the vulnerability of the zone at particular risk from flooding and measures supporting all elements of the flood risk management system.

RECOMMENDED NON-TECHNICAL AND TECHNICAL MEASURES

- Implementation of organisational reform of units responsible for the water management, including flood security ensuring.
- Enforcement of FHM and FRM into spatial planning in order to reduce vulnerability of areas at risk from flooding by publishing them on ISOK platform as well as preparing and implementing guidelines "Location and technical aspects of land development in areas at risk from flooding."
- Implementation and drafting of construction laws regulating the rules of construction and commissioning of new facilities as well as rules connected with adjusting existing facilities to their use on the areas at risk from flooding.
- Construction and implementation of insurance system against flood damage.
- Construction and development of warning system in connection with dangerous phenomena in atmosphere and hydrosphere, in particular rainfall, snowmelt and ice jam-related floods.
- Construction and improvement of flood response system.
- Construction and improvement of flood damage reconstruction system.
- Construction and improvement of education system increasing awareness and competences of the communities living in the areas at risk from flooding.
- Developing a system financing structural and non-structural measures.
- Modification of ways of using the existing multifunctional reservoirs in order to increase flood retention.

It was planned that a package of non-technical measures will be produced involving reconstruction of sections of levee systems in order to increase space for the river, thereby ensuring higher valley retention and lower level of flood waters.

Non-technical measures should be supported by technical measures focused on reducing flood threat by constructing anti-flood retention reservoirs, reinforced valley retention and increased river flow capacity. All those measures should be conducted according to a rule that prevents "flood risk transfer." Necessary technical measures should also include investments that involve reconstruction of the functionality of anti-flood facilities. Moreover, in Oder river basin, the identified flood risk was also connected with ice jams. Implementation of the main strategic goal takes

into account measures that aim at ensuring good conditions for the process of ice breaking and safe removal of ice floe by ensuring sailing capability on the jam-exposed sections of rivers and ice breakers flotilla necessary to conduct effective campaign preventing ice and frazil-related jams.

The key element of the flood risk management strategy in the river basin is to prepare a package of non-technical solutions connected, among others, with the process of increasing natural retention of the river valleys, buying out properties or implementing legal, financial, education and information instruments. Forecasted budget that is to finance the aforementioned elements is estimated to reach over 3 billion zloty throughout the upcoming planning cycles. Key technical measures in Oder river basin include construction of anti-flood reservoirs Racibórz Dolny and Wielowieś Klasztorna and launching of a series of linear investments connected with regulation works, such as Oder river, and reduction of flood risk for Kłodzko Valley and Słubice town.

The most important investments connected with the protection of seashore will involve implementation of morphometric parameters and measures connected with reconstruction of the functionality and maintenance of infrastructure.

MAIN HOT SPOTS:

Upper Oder water region

1. Gliwice
2. Racibórz
3. Kędzierzyn-Koźle

Central Oder water region

1. Głogów
2. Oława – Jelcz-Laskowice
3. Upper Kwisa until Nowogrodziec water gauge
4. Upper Bóbr until Plichowice reservoir
5. Kąty Wrocławskie
6. Kotlina Kłodzka
7. Krapkowice
8. Krosno Odrzańskie
9. Legnica
10. Nowa Sól – Otyń
11. Opole
12. Skorogoszcz – Wronów
13. Wrocław
14. Wrocław – Długołęka – Czernica – Wisznia Mała

Warta water region

1. Częstochowa
2. Golina
3. Gorzów Wielkopolski
4. Kalisz
5. Kostrzyn, Słońsk
6. Warta

Lower Oder and West Littoral water region

1. Boleszkowice
2. Gryfino
3. Jarosławiec
4. Jezioro Dąbie
5. Liwia Łuża
6. Niechorze
7. From the mouth of Lusatian Nousse to Widuchowa
8. Słubice
9. Szczecin
10. Świnoujście
11. Ustronie Morskie
12. Widuchowa

ODER RIVER BASIN

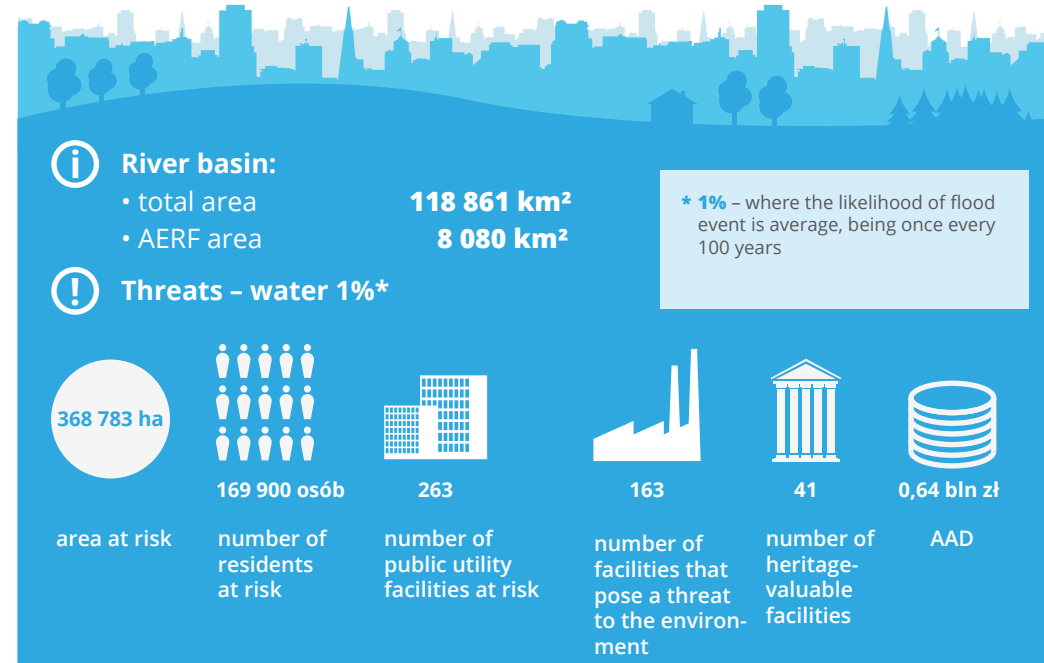


6.5 billion PLN

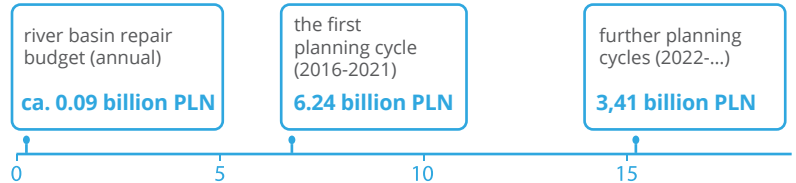
(including residential properties 3.7 billion PLN)

Potential damage – water 1%*

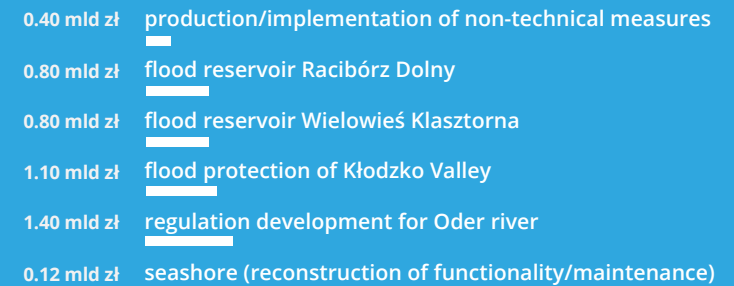
Potential total damage (residential properties, industrial and communication areas, forests and recreational areas, arable land, grasslands, other)



Proposed non-technical and technical measures:



The most important investments (2016-2021)





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DRAFT FLOOD RISK MANAGEMENT PLAN FOR UPPER ODER WATER REGION



TOMASZ CYWIŃSKI
acting Director of Regional Water
Management Authority in Gliwice

” Administered by the RWMA in Gliwice, water regions of Little Vistula and Upper Oder, in terms of their specifics, they stand out in comparison to the rest of the country. On the one hand there's this highly urbanised and industrialised Upper Silesia agglomeration and on the other hand we have Podbeskidzie area, which is full of watercourses. It all makes this region, inhabited by nearly 11% of the whole country's population, particularly demanding and significant from the point of view of water management and response to flood threat.

There are 11 water reservoirs working here under RWMA in Gliwice management with the purpose of flood retention. Another matter are the problems connected with mining activity. Therefore, the Plans that are the currently being drafted will help to better manage flood risk in our water regions, in accordance with the rule “think globally – act locally,” thereby increasing safety of the residents, industry, cultural heritage and nature.

Draft Flood Risk Management Plan (FRMP) for the water region of Upper Oder is an integral part of the FRMP draft for Oder river basin, listing measures, implementation of which, aims at reducing flood risk in the region and improving the system of managing thereof.

Water region of Upper Oder covers the land of 3,828.4 sq. km. The whole area is administered by the Regional Water Management Authority in Gliwice and includes hydrographical catchment area of the upper Oder (on the territory of Poland) from the country's border to the mouth of Gliwicki Chanel.

Water region of Upper Oder is divided into two areas because Olza catchment area – Oder tributary, is not one coherent whole within Poland's borders but is divided into two parts (a small fragment of Olza catchment area near Koniakowo and Istebna – Istebna commune – functions as a separate and independent part).

Water region of Upper Oder is spread across two voivodeships: Opolskie and Silesia. In Opolskie, it is worth noticing kędziersko-kozielski area, which covers significantly industrialised and urbanised zone as well as głubczycki area – typically agricultural area. In Silesian voivodeship, the distinguishing part includes a slice of Upper Silesia Industrial Area which is the biggest Polish agglomeration of combined urban population and industry, and Rybnicki Coal Area which covers the land located in the south-eastern part of the Upper Oder region characterised by intensive activity connected mainly with mining and electricity production.

The main reason for floods are first and foremost rainfalls that cause natural water rise in rivers, while the main reasons behind the increased flood risk are connected with the failure of levee system functionality to work and unsatisfactory number of retention reservoirs.

In the water region of Upper Oder, 13 areas have been recognised as exposed to the risk of flood event (AERF), with a total area of 298 sq. km, length of rivers within the areas exposed to the risk of flood event in the region amounts to 476 km.

Based on the analysis of flood hazard maps (FHM), as far as the water region of Upper Oder is concerned, more than 23 thousand ha of land have been defined as located on the area with a low likelihood of flood event, 17 thousand ha demonstrate an average likelihood of flood event and ca. 8 thousand ha of land are the areas where the likelihood of flood event is high.

Number of residents living in the areas at risk from flooding is respectively: ca. 43 thousand residents live in the areas where the likelihood of flood event is low, ca. 21 thousand people reside in areas with an average likelihood of flood event and finally 2.5 thousand residents remain in the areas with high likelihood of flood event.

According to a five-degree scale, flood risk in relation to individual communes was determined and as a consequence, 7 communes with the highest integrated risk of flooding were indicated (communes: Lubomia, Racibórz, Nędza, Kuźnia Raciborska, Cisek, Kędzierzyn-Koźle and Gliwice).

List of communes with the assigned flood risk in the water region of Upper Oder.

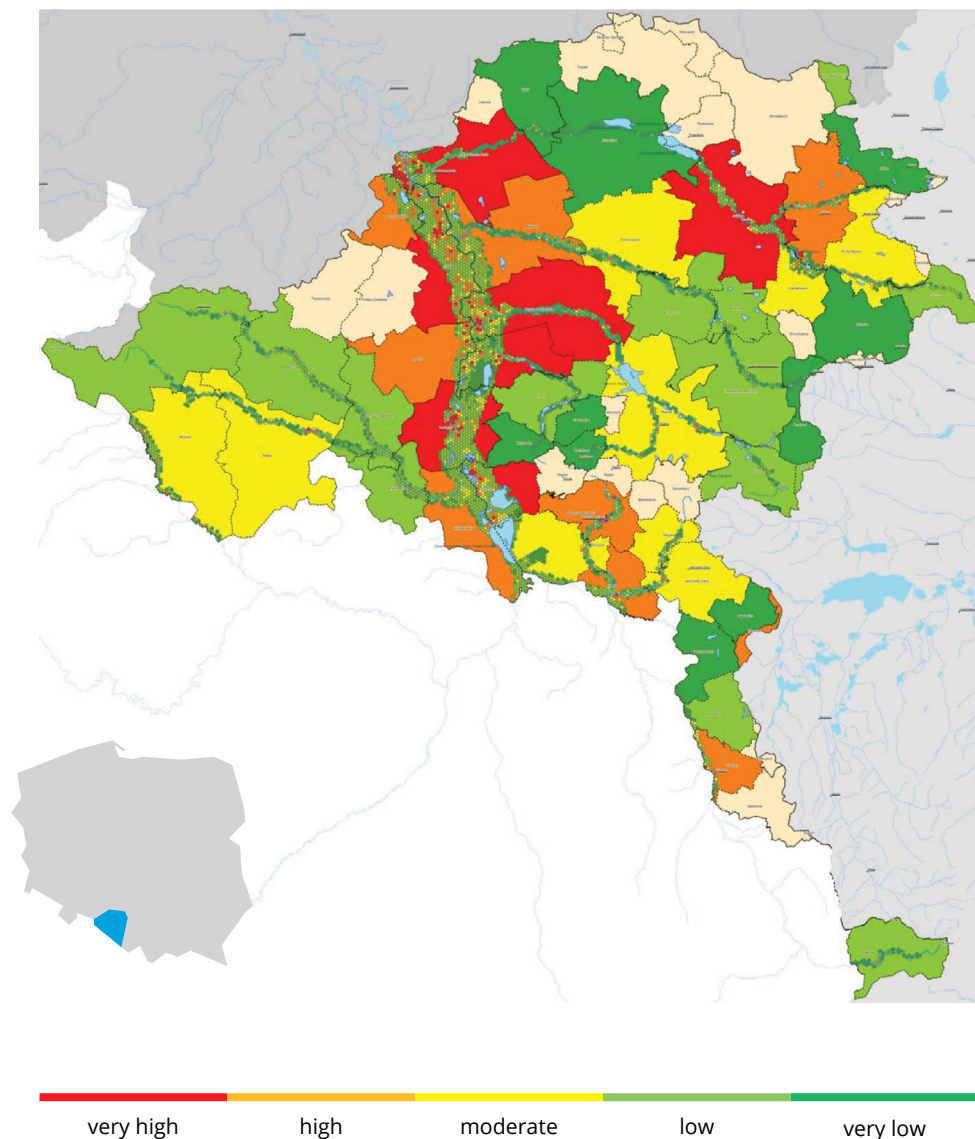
Number of communes with flood risk representing specific level						
Water region	Risk level	Integrated flood risk	Health and life of people	Environment	Cultural heritage	Business
	5	7	4	3	0	12
	4	8	7	2	0	4
	3	9	7	7	0	9
Upper Oder	2	12	11	13	0	10
	1	12	19	23	48	13

Analysis conducted based on flood hazard and flood risk maps helped to calculate the values of the average annual damage (AAD) for the catchment areas and water regions in Poland. As far as Upper Oder water region is concerned, average annual damage reaches the amount of 157.7 million zloty.

Water region has been specified the most important measures, implementation of which will help to lower the flood risk. 52 detailed measures have been itemised and divided into three groups, whereby, the most important one covers non-technical and technical measures that aim at lowering the rise wave and maintaining the existing flood infrastructure in proper condition. Among the technical measures, the prevailing number of tasks is connected with the construction and modernisation of levee systems and construction of retention facilities.

The key investment in the water region of Upper Oder has been recognised the construction of dry flood reservoir in RacibórzDolny with the cost of investment amounting to 1.2 billion zloty.

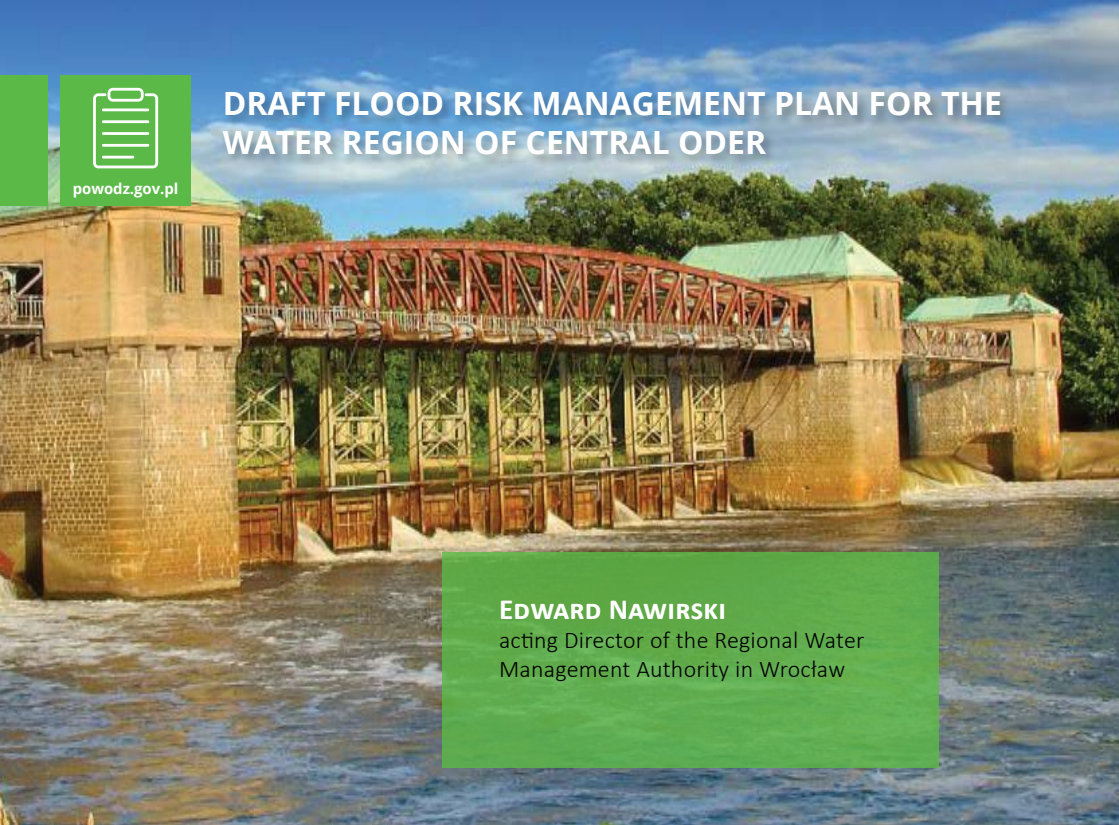
Spatial distribution of integrated flood risk for the communes located in the water region of Upper Oder.





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DRAFT FLOOD RISK MANAGEMENT PLAN FOR THE WATER REGION OF CENTRAL ODER



EDWARD NAWIRSKI

acting Director of the Regional Water Management Authority in Wrocław

“ Floods are natural phenomena which unfortunately is inevitable and which we have no other choice but to face every once in a while. The memory of the 1997 flood which was later called the millennium flood is still vivid, particularly among the residents of Lower Silesia. Nevertheless, the tragic experience has taught us quite a lot and now flood management in Poland is much more efficient.

Flood risk management plans will radically change the approach to the protecting against flood in Poland. We must remember that flood risk management is a process not a one-off event. Modern and efficient flood protection requires consequent, long-term measures implemented across the whole river basin on each stage of risk management – starting from the prevention, through the response and ending with the effects removal. The pillar of this process is the idea of a sustainable development, overcoming the conventional and complex perception of the way the rivers and their valleys are used.

Draft Flood Risk Management Plan (FRMP) for the water region of Central Oder is an integral part of the FRMP for Oder river basin and lists the measures whose implementation aims at reducing flood risk in the region and improving the management system thereof.

The whole water region of Central Oder with a total area of 39,299 sq. km is administered by the Regional Water Management Authority in Wrocław. Central section of Oder River, which is the main watercourse in the water region of Central Oder is over 433 km long and, running in the north-western direction, starts at the mouth of Gliwicki Channel and ends at the mouth of the Lusatian Neisse. In terms of hydrography, most of this area belongs to the Baltic Sea watershed. Only some small parts of the catchment areas of the following rivers: Metuje, Ostrožnica, Dzika Orlica and Jizera in Sudetes belong to the Labe river basin, which empties into the North Sea being part of that watershed. Central Oder region is quite diversified, it runs through flat river valleys, Pogórze Sudeckie and the mountainous land of Sudetes which covers several mountain ranges, such as Karkonosze Mountains, Jizera Mountains, Rudawy Janowickie, Stone Mountains, Owl Mountains, Stołowe Mountains and others.

The region is used mainly for agricultural purpose, the dominating type of land are the arable lands accounting for 60.7% of the area. 34.2% of the region's area is taken by forests, whereby urban areas occupy 4.1% of the region, these are mainly large agglomerations, such as Wrocław, Opole, Wałbrzych, Zielona Góra, Legnica and Jelenia Góra. The remaining land is occupied mainly by wetlands (0.14%) and lands under water (0.9%).

The main reason behind the floods in this area is the rainfall which causes rainfall-kind of river rises and as a consequence the flood. The rises that dominate in the region are the summer term rises (rainfall of a significant extent and long-lasting).

The Preliminary Flood Risk Assessment (PFRA) produced for the water region of Central Oder has outlined 49 areas in total which are exposed to the risk of flood event (AERF) and cover the area of 3,072 sq. km. River length within the areas exposed to the risk of flood event in the region amounts to 2,837 km.

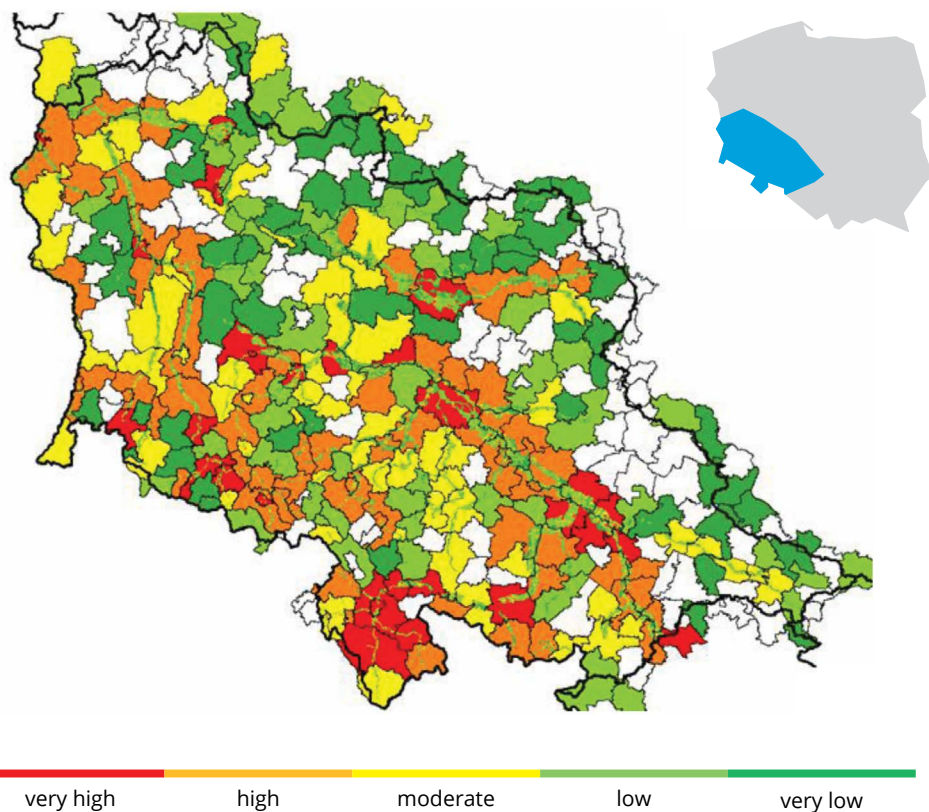
Based on the analysis of flood hazard maps (FHM), it was defined that in the water region of Central Oder, more than 200 thousand ha of land is located on the areas with low likelihood of flood event, 155 thousand ha are within the average likelihood of flood event and finally ca. 19 thousand ha are at high risk of flood event.

Number of residents living in the flood hazard areas is respectively: ca. 251.3 thousand residents live in the area where the likelihood of flood is low, ca. 111.8 thousand people inhabit the areas with average and 13.3 thousand with high likelihood of flood event.

Following a five-degree scale, flood risk in relation to individual communes was determined. As a consequence, 30 communes have been assigned high level of integrated flood risk, in 64 communes the level of integrated flood risk is high and in 62 communes it is moderate.

Number of communes with flood risk on a specific level						
Water region	Level of risk	Integrated flood risk	Health and life of people	Environment	Cultural heritage	Business
Central Oder	5	30	31	5	0	10
	4	64	33	5	0	83
	3	62	59	30	1	61
	2	52	60	54	4	52
	1	58	83	172	261	60
	TOTAL					266

Distribution of integrated flood risk in the water region of Central Oder with regard to individual communes



Analysis conducted based on flood hazard and flood risk maps helped to calculate the values of the average annual damage (AAD) for the water region of Central Oder; they amount to 328 million PLN. Catchment area in which the average annual damage (AAD) is the highest, i.e. 81.9 million PLN, is Oder's catchment area within the section that starts at Gliwicki Channel and ends at the mouth of Lusatian Neisse (Przyodrze). As far as the water region of Central Oder is concerned, the main problem areas (the so called hot spots) that have been identified include: Kędzierzyn Koźle, Krapkowice, Czarnowąsy -Żelazna -Dobrzeń Wielki, Brzeg, Oława-Jelcz Laskowice, Wrocław-Długołęka-Czernica-Wisznia Mała, Marszowice, Brzeg Dolny-Uraz, Prochowice, Nowa Sól, Krosno Odrzańskie, Wężyńska-Chlebowo, Prudnik, Głuchołazy, Kotlina Kłodzka, Bardo Przyłęk-Kamieniec Żąbkowski, Kamieniec Żąbkowski-Nysa-Skorogoszcz-Wronów, Górny Bóbr, Górna Kwisa, Szprotawa, Żagań, Bogatynia -Krzewina Zgorzelecka, Zgorzelec, Przewóz, Gubin, Chojnów, Strzegom, Świdnica, Żmigród.

During one stage of the task implementation, an attempt was made to identify major problems, followed by detailed outline of the flood protection strategy in the water region of Central Oder.

MAIN PROBLEMS CONNECTED WITH FLOOD RISK MANAGEMENT ACROSS CENTRAL ODER WATER REGION INCLUDE:

- unsatisfactory retention capacity of individual catchment areas that prevents effective reduction of flood risk,
- progressing land and building development in the areas that are at particular risk from flooding,
- lack of regulations regarding the conditions regulating potential management of land protected by levees,
- unsatisfactory scope and frequency of maintenance works with regard to rivers and gills,
- growing risk of floods caused by ice jams,
- lack of appropriately developed hydrological and meteorological shield in the
- catchment areas which would help to forecast and warn the communities against the coming threat.

On further stages, the most important measures have been defined, whereby, their implementation will help to lower the flood risk. 53 detailed measures have been itemised and divided into three groups, whereby, the most important one covers non-technical and technical measures that aim at lowering the freshet wave culmination and maintaining the existing flood infrastructure in proper condition as well as reducing potential damage in the areas at risk from flooding.

It is essential to produce a package of non-technical measures connected with, among others, improving natural retention of river valleys, buying out properties, regulating legal status of the existing polders and implementing legal, financial, information and educational instruments.

Estimated budget that should cover the process of preparing non-technical measures amounts to 185 million PLN.

KEY TECHNICAL MEASURES IN CENTRAL ODER:

- protecting Kłodzko Valley against flood (construction of 4 flood reservoirs, reconstruction of Kłodzka Neisse, Biała Łądecka, Bystrzyca Dusznicka and Ścinawka),
- preparing design documentation and the land for the purpose of constructing flood
- reservoirs in Bóbr catchment area,
- constructing „Rzymówka” reservoir on Kaczawa,
- linear investments connected with regulation works on the river Oder.



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DRAFT FLOOD RISK MANAGEMENT PLAN FOR THE WATER REGION OF WARTA



MAGDALENA ŻMUDA
Director of the Regional
Water Management Authority
in Poznań

“ Flood is unavoidable; however, it is possible to prevent its negative effects. It is a dangerous element as we saw more than once when the public and private property of our citizens suffered severe damage. It is the reduction of the aforementioned damage that became the goal of the modern flood risk management plan that is being drafted for the water region of Warta, among others.

In addition to a series of planning and supporting measures which aim at reducing flood risk and minimising damages, we must better prepare our citizens to select optimal measures in case of a flood hazard.

Draft Flood Risk Management Plan (FRMP) for the water region of Warta is an integral part of the FRMP for Oder River Basin listing the measures which should be implemented in order to reduce flood risk in the region and improve the management system thereof.

The whole water region of Warta with a total area of 54.5 thousand sq. km is administered by the Regional Water Management Authority in Poznań. The region is mostly agricultural, ca. 60% of the area consists of arable lands and grasslands. There are 170 towns in this region, whereby, 5 of them have more than 100 thousand residents (Łódź, Poznań, Częstochowa, Gorzów Wielkopolski, Kalisz). Flood hazards characteristic for this region include tempestuous and profuse rainfall as well as snowmelt-related floods during winter season.

Drawing up the Preliminary Flood Risk Assessment (PFRA), 23 areas exposed to the risk of flood event (AERF) have been outlined, with a total area of 3,323 sq. km and total rivers' length of 2,543 km.

Based on the analysis of flood hazard maps (FHM), it was defined that in the water region of Warta more than 141 thousand ha of land is located on the areas with low likelihood of flood event, 123 thousand ha are within the average likelihood of flood event and finally ca. 84 thousand ha are at high risk of flood event. Number of residents occupying the areas exposed to the flood risk is respectively: 22 thousand residents live in the areas where the likelihood of flood is low, ca. 8.5 thousand people inhabit the areas with average and 1.7 thousand with high likelihood of flood event.

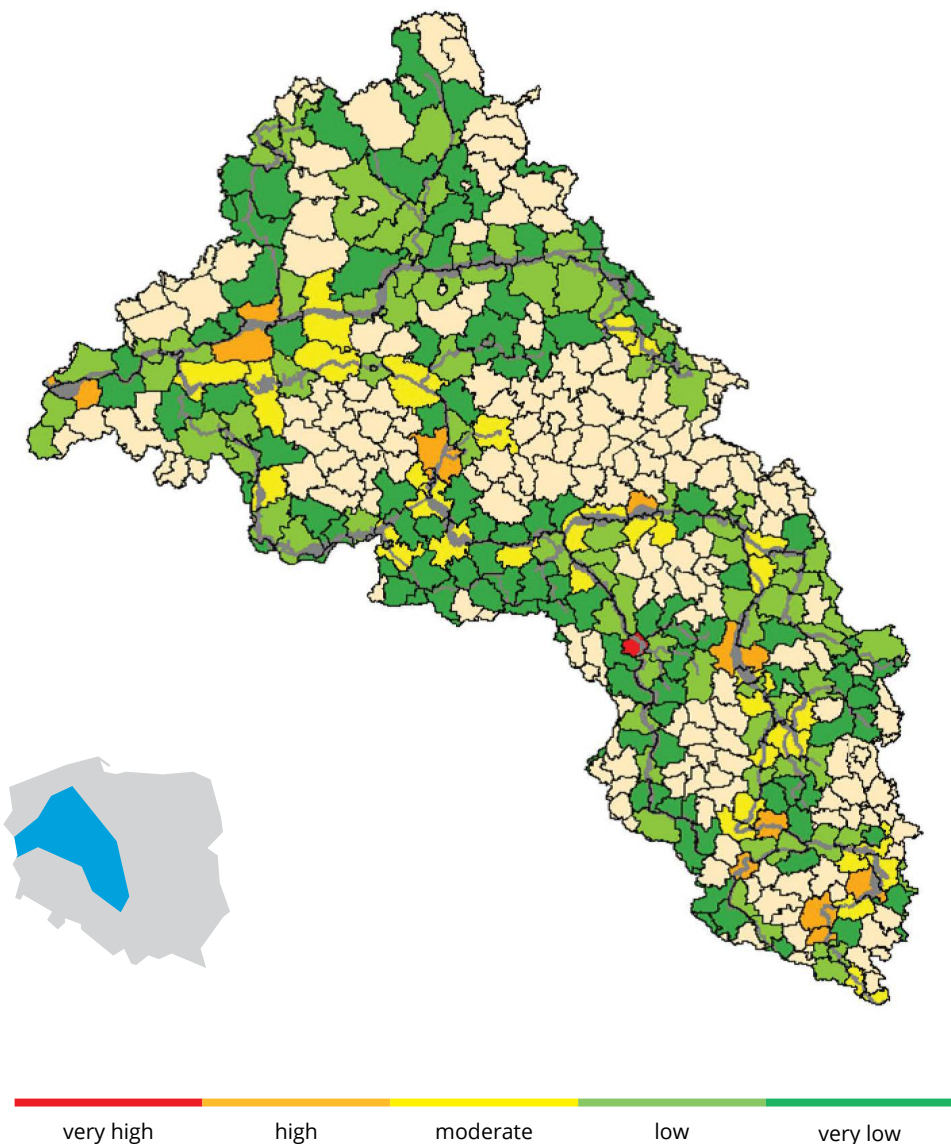
Following a five-degree scale, flood risk with regard to individual communes was determined and as a consequence, 1 commune was recognised as having the highest integrated flood risk, while 14 communes suffer from high and 32 from moderate level of risk.

Number of communes with flood risk on a specific level

Water region	Level of risk	Health and life of people	Environment	Cultural heritage	Business	Integrated flood risk
Warta	5	2	0	2	1	1
	4	2	1	0	16	14
	3	23	1	5	38	32
	2	44	25	11	83	92
	1	185	229	238	118	117

Analysis conducted based on flood hazard and flood risk maps helped to calculate the values of the average annual damage (AAD) for the water region of Warta amounting to 104.8 million PLN. The region was also defined major problematic areas (the so called hot spots) which include: Częstochowa, Działoszyn, Warta, Kalisz, Golina, Poznań and Luboń, Górna Noteć from Gopło lake until Łabiszyno, Wieleń, Kostrzyn nad Odrą and Słońsk, Gorzów Wielkopolski as well as Drezdenko.

The below map demonstrates problematic areas and the risk level in individual catchment areas.



As far as the water region is concerned, the most important measures have been defined; whereby, their implementation will help to lower the flood risk. 53 detailed measures, both technical and non-technical, have been outlined.

KEY NON-TECHNICAL MEASURES CONCERN IN PARTICULAR:

- improving natural retention of river valleys,
- buying out properties,
- developing hydrological and meteorological network,
- implementing legal and financial as well as information and education instruments.

The budget that is estimated to cover the measures has been set out to more than 1.3 billion PLN.

KEY INVESTMENTS FOR THE WATER REGION OF WARTA ARE AS FOLLOWS:

- construction of Wielowieś Klasztorna reservoir,
- creating Golina polder,
- modernisation of Jeziorsko reservoir,
- modernisation of Poraj reservoir.

Investments are strategically important in terms of lowering the existing flood risk in substantial part of the water region of Warta, including big towns, such as Poznań, Częstochowa, Kalisz, Konin. Total cost of strategic investments amounts to 1.3 billion PLN.



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DRAFT FLOOD RISK MANAGEMENT PLAN FOR THE WATER REGION OF LOWER ODER AND WEST LITTORAL



ANDRZEJ KREFT

Director of the Regional Water Management Authority in Szczecin

” Flood risk management plan changes the current approach to protecting against flood, replacing traditional strategy that focuses on technical protection measures aiming at reducing range of areas at risk from flooding by a strategy that is directed at reducing negative effects of flood. This change is connected with the acceptance of the fact that flood risk is irremovable and at the same time it is necessary to accommodate the need of safety and the need of development. It results in a different view on the problem of reducing flood consequences which emphasises not just protective measures and reduction of land and building development on the areas at risk but also how important it is for the people and the facilities at risk to be prepared for flood, including improving warning and crisis response tools.

Flood risk management must also include specific local conditions. In our region, those include storm and ice jam-related floods, which add to the threat of „typical” rainfall and snowmelt-related flooding.

Draft Flood Risk Management Plan (FRMP) for the water region of Lower Oder and West Littoral is an integral part of the FRMP draft for Oder river basin, listing measures, implementation of which, aims at reducing flood risk in the region and improving the system of managing thereof.

Water region of Lower Oder and West Littoral covers the area of 20,406 sq. km and includes part of Oder river basin below the mouth of Lusitian Neisse up until the mouth of Roztoka Odrzańska (excluding Warta’s river basin) along with the Polish part of the Szczecin Bay and the river basin of Littoral’s rivers from the western border up until Wieprza river.

The whole area is administered by the Regional Water Management Authority in Szczecin.

Two types of flood hazards exist in the region: threat posed by the rivers and the sea. Those hazards may generate river flooding (rainfall and snowmelt-related), floods caused by ice jams and ice piling during the rafting of the floe (it applies to Oder) as well as storm-related floods (caused by strong north winds which are the reason for the Baltic Sea waters to reverse into the estuarial sections of rivers). A significant danger is the simultaneous occurrence of both threats, i.e. when the river flood overlaps with the storm flood coming from the sea. Preliminary Flood Risk Assessment (PFRA) conducted in the region outlined 18 areas exposed to the risk of flood event (AERF) covering total area of 1,384.2 sq. km, which accounts for ca. 7% of the total area of the water region. Based on the analysis of flood hazard maps (FHM), it was defined that in the area of this water region more than 32 thousand ha of land are located on the areas with low likelihood of flood event, 30 thousand ha are within the average likelihood of flood event

and finally ca. 26 thousand ha are at high risk of flood event. With regard to the threat posed by the sea, the territories located within low and average likelihood of flood are respectively 45.3 thousand ha and 42.9 thousand ha.

Number of residents living in the areas threatened by flood is respectively: ca. 8.5 thousand residents live in the area of low likelihood of flood event, ca. 6.8 thousand residents live on the area of average and 4.5 thousand on the area of high risk of flood event. It was also identified that respectively 28.6 thousand and 21.1 thousand residents live in the areas of low and average

Flood risk caused by sea (table a) and rivers (table b) in the catchment areas of Lower Oder and West Littoral water region.

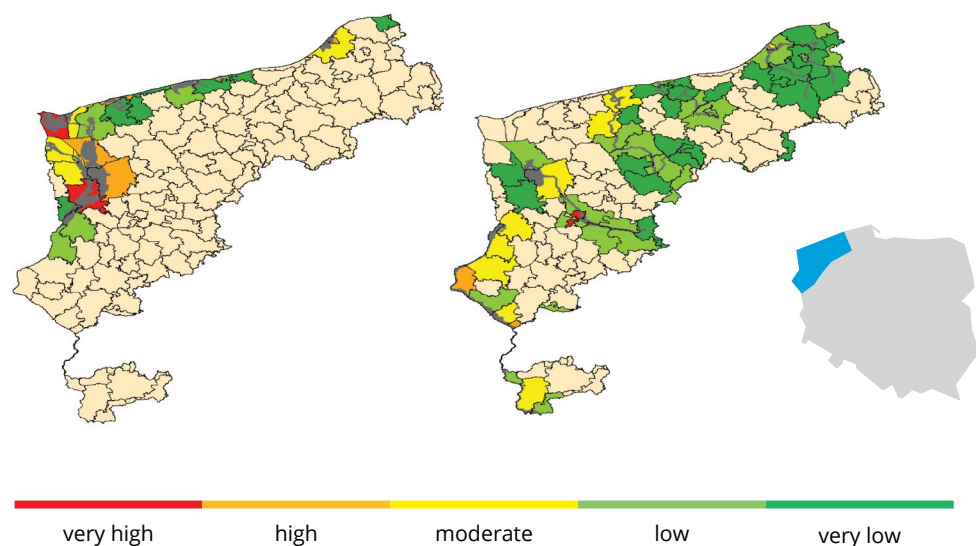
No.	Catchment area	a) Categories of flood risk				
		Health and life of people	Environment	Cultural heritage	Business	Integrated flood risk
1	Oder from Warta to Roztoka Odrzańska	1	1	1	1	1
2	Bay of Szczecin	5	5	3	4	5
3	Ina	2	3	1	3	3
4	Rega	1	1	1	2	2
5	Parsęta	1	1	1	2	2
6	Wieprza	3	1	1	3	3

No.	Catchment area	b) Categories of flood risk				
		Health and life of people	Environment	Cultural heritage	Business	Integrated flood risk
1	Oder from the mouth of Lusitian Neisse to Warta	1	1	1	1	1
2	Oder from Warta to Roztoka Odrzańska	1	2	1	2	2
3	Bay of Szczecin	1	1	1	1	1
4	Ina	3	1	2	2	3
5	Rega	1	1	1	1	1
6	Parzęta	1	1	1	1	1
7	Wieprza	1	2	1	1	2

Below presented is the spatial distribution of integrated flood risk in the communes located within the impact area of

a) sea

b) rivers



likelihood of flood event caused by the sea.

Following a five-degree scale, flood risk in relation to individual communes was determined and as a consequence, 7 communes with the highest integrated risk of flooding were indicated.

Analysis conducted based on flood hazard and flood risk maps helped to calculate the values of the average annual damage (AAD) for the water region of Lower Oder and West Littoral, amounting to 77.9 million PLN.

The water region was also defined with major problematic areas (the so called hot spots) which require implementation of flood hazard reduction measures. Problematic areas in the water region of Lower Oder and West Littoral include: Słubice, Boleszkowice, Widuchowa, Gryfino and Szczecin, Goleniów Stepnica, Nowe Warpno, Świnoujście, Dziwnów, Stargard Szczeciński, Trzebiatów, Mrzeżyno, Gryfice, Resko, Kołobrzeg, Białogard, Darłowo, Bukowo-Łazy, Sławno, Sianożęty, as well as areas located in the sea shore zone, such as: Niechorze, Liwia Łuża, Rewal, Kołobrzeg, Mierzeja Jeziora Jamno, Mierzeja Jeziora Kopań, Mierzeja Dziwnowska (both eastern and western part). In addition, a Congestion Hot Spot has been identified and analysed in connection with the winter flood risk reduction.

As far as the water region is concerned, the most important measures have been defined; hence, their implementation will help to lower the flood risk. 70 detailed measures have been itemised and divided into three groups, whereby, the most important one covers non-technical and technical measures that aim at lowering the freshet wave and maintaining the existing flood infrastructure in proper condition. Implementation of selected measures should be supported by supporting instruments, i.e. legal and financial, analytical as well as information and educational measures, thereby indirectly contributing to a lowered flood risk.

Taking into account the specifics of the Lower Oder and West Littoral water region, areas that are particularly exposed to the risk of flood event were identified, following which, individual areas (communes) were assigned technical, non-technical supporting and non-technical measures. All technical measures are estimated to be finalised by 2023.

KEY INVESTMENTS FOR THE WATER REGION INCLUDE:

- renovation and modernisation of the regulation developments on the Bordering Oder – cost ca. 218 million PLN,
- renovation and modernisation of the regulation developments on Oder river – cost ca. 202 million PLN,
- flood protection for Słubice town, cost 229 million PLN,
- measures connected with reconstruction of the functionality and maintenance of the infrastructure along the seashore – cost ca. 180 million PLN,
- acquiring ice breakers flotilla – cost 85 million PLN.

AND NON-TECHNICAL MEASURES, FORECAST TO AMOUNT TO 75 MILLION PLN:

- increasing forest retention,
- modernisation of buildings,
- implementation of the monitoring of morphometric parameters,
- running ice breaking campaign.



DRAFT FLOOD RISK MANAGEMENT PLAN FOR VISTULA RIVER BASIN

**VISTULA RIVER BASIN COVERS THE AREA OF 183,220 SQ. KM,
WHEREBY 87.5% IS LOCATED ON POLISH TERRITORY.**

Vistula river basin consists of 4 water regions:

- water region of Little Vistula (area of 3.94 thousand km²),
- water region of Upper Vistula (area of 43.11 thousand km²),
- water region of Central Vistula (area of 101.1 thousand km²),
- water region of Lower Vistula (area of 35.07 thousand km²).

Warsaw by night, photo by Kuba Bożanowski

FLOOD HAZARD AND RISK (PFRA, FHM, FRM)

During the Preliminary Flood Risk Assessment (PFRA), 166 areas exposed to the risk from flooding (AERF) have been outlined in Vistula river basin, covering in total 12,675.2 sq. km; the rivers running through the aforementioned territories are 7,521 km long.

Based on the analysis of flood hazard maps (FHM), it was defined that in the area of Vistula river basin more than 501 thousand ha of land is located on the areas with low likelihood of flood event, 411 thousand ha are within the average likelihood of flood event and finally ca. 271.7 thousand ha are at high risk of flood event.

Number of residents living in the flood hazard areas is respectively: ca. 413.4 thousand residents live in the areas where the likelihood of flood event is low, ca. 153.7 thousand live on the area of average and 29.5 thousand on the area of high risk of flood event. It was also identified that respectively 28 thousand and 21 thousand residents live in the areas of low and average likelihood of flood event caused by the sea.

Following a five-degree scale, flood risk with regard to individual communes was determined and as a consequence, high and very high level of risk was indicated within the areas of river impact affecting in total 224 communes (93 – very high, 131 – high). In the areas affected by the sea waters' impact, very high level of risk applies to 15 communes, while in 3 communes the aforesaid

level is high. 120 areas in Vistula river basin are exposed to the risk of flood (AERF). They include individual problematic areas of the water regions: Little Vistula 8, Upper Vistula 52, Central Vistula 32, Lower Vistula 28. Moreover, in addition to the AERF, 8 problematic areas have been identified and they are located in the following water regions: Upper Vistula – 5 and Lower Vistula – 3. Individual problematic areas will be drafted proper planning variants.

Analysis conducted based on flood hazard and flood risk maps helped to calculate the values of the average annual damage (AAD) for the catchment areas and water regions in Vistula river basin, amounting to 1.3 billion PLN per year.

As far as the whole area of Vistula river basin is concerned, a series of problems connected with flood risk management have been identified. They are mainly manifested in the growing flood hazard caused by the climate changes and the decreasing retention capabilities of the catchment areas, they are also related with the growing level of vulnerability of the areas at risk of flood event which is caused by the increasingly intensive land development that those territories are experiencing. In addition, other problems include: unsatisfactory level of outlays for the maintenance of brooks and rivers, limited ability to carry through flood wave in Vistula valley (which poses a serious flood threat to Kraków, Tarnobrzeg and Sandomierz), unsatisfactory technical condition of the existing levee systems and insufficient hydrological and meteorological shielding system dedicated to forecasting and warning the community against the upcoming threat. In part of the river basin area, a significant problem are the ice jam floods which, due to the limited sailing capabilities and insufficient number of units that may be used to conduct efficient ice breaking campaigns, are the reason for a serious flood threat.

Major strategic goal of the flood risk management is to first and foremost stop the growth and significantly reduce the flood risk in Vistula river basin by undertaking non-technical measures that limit the vulnerability of the particular flood risk zone as well as measures supporting all elements of the flood risk management system.

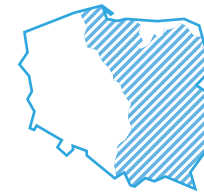
RECOMMENDED NON-TECHNICAL AND TECHNICAL MEASURES:

- Implementation of organisational reform in the units responsible for water management and flood safety.
- Enforcement of FHM and FRM into spatial planning in order to reduce vulnerability of areas at risk from flooding by publishing them on ISOK platform as well as preparing and implementing guidelines "Location and technical aspects of land development in areas at risk from flooding."
- Implementation and drafting of construction laws regulating the rules of construction and commissioning of new facilities as well as rules connected with adjusting existing facilities to their use on the areas at risk from flooding.
- Construction and implementation of insurance system against flood damage.
- Construction and development of a system warning against dangerous phenomena in atmosphere and hydrosphere, in particular rainfall, snowmelt and ice jam-related floods.
- Construction and improvement of flood response system.
- Construction and improvement of flood damage reconstruction system.
- Construction and improvement of education system increasing awareness and competences of the communities living in the areas at risk from flooding
- Developing a system financing structural and non-structural measures with special reference to ensuring sources of funds for the purpose of the keeping the flood protection system on a constant functional level.

- Modification of ways of using the existing multifunctional reservoirs in order to increase flood retention.
- Reduction of the existing flood threat which may be achieved by: running ice breaking campaigns, improving technical condition of the existing flood protection infrastructure, regulation and maintenance works in rivers and brooks.

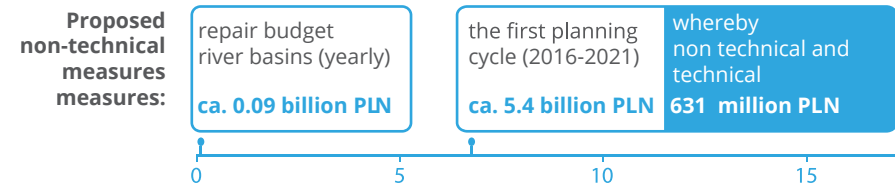
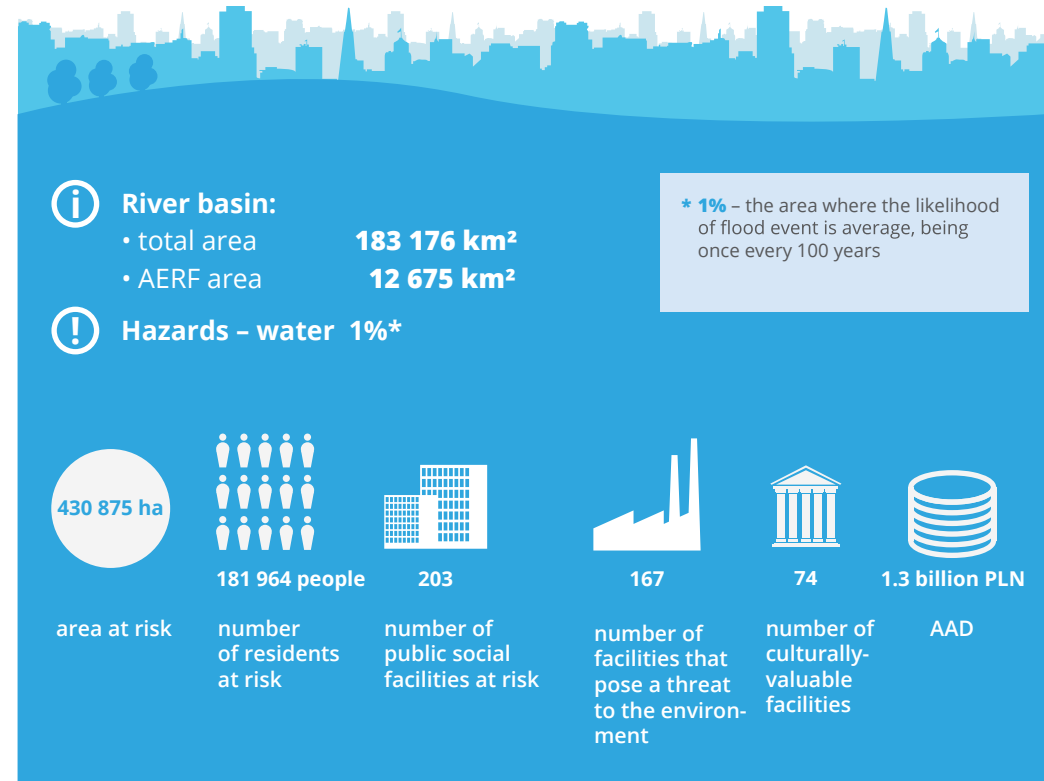
Non-technical measures should be reinforced by technical measures focused on reducing flood risk by building flood retention reservoirs, in particular in the southern part of the river basin, supported by valley retention (including polders) in the central sections of rivers where the flooding waters pose a threat caused by natural and artificial jams. All measures should be implemented according to the rule that aims to prevent „flood risk transfer.” In order to achieve the major strategic goal, that is reduction of flood risk in Vistula river basin, it is necessary to undertake measures that aim at ensuring good conditions for the ice breaking campaigns and safe removal of ice floe by ensuring sailing capability on the jam-exposed sections of rivers and ice breakers flotilla necessary to conduct effective campaign preventing ice and frazil-related jams. In Vistula river basin, there is also a high flood threat in the territory of Żuławy. It varies in terms of causes and potential consequences; therefore, it is very important to ensure a complex flood protection adjusted to the local conditions.

VISTULA RIVER BASIN



9.9 billion PLN
(including residential properties 5.637 billion PLN)

Potential damage - water 1%*
Potential total damage (residential properties, industrial and communication areas, forests and recreational areas, arable lands, grasslands, other)





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DRAFT FLOOD RISK MANAGEMENT PLAN FOR THE WATER REGION OF LITTLE VISTULA



TOMASZ CYWIŃSKI
acting Director of the Regional Water Management Authority in Gliwice

Administered by the RWMA in Gliwice, water regions of Little Vistula and Upper Oder, in terms of their specifics, they stand out in comparison to the rest of the country.

On the one hand there's this highly urbanised and industrialised Upper Silesia agglomeration and on the other hand we have Podbeskidzie area, which is full of watercourses. It all makes this region, inhabited by nearly 11% of the whole country's population, particularly demanding and significant from the point of view of water management and response to the threat from flooding. There are 11 water reservoirs working here under RWMA in Gliwice management with the purpose of flood retention. Different kinds of issues are the problems connected with mining activity. Therefore, the Plans that are currently being drafted will help to better manage flood risk in our water regions, in accordance with the rule "think globally – act locally," thereby increasing safety of the residents, industry, cultural heritage and nature.

Draft Flood Risk Management Plan (FRMP) for the water region of Little Vistula is an integral part of the FRMP for the area of Vistula River Basin and lists the measures that should be implemented in order to reduce flood risk in the region and improve the system managing thereof.

The whole water region of Little Vistula with a total area of 3,942 sq. km is administered by the Regional Water Management Authority in Gliwice. This water region is quite diversified when it comes to the landform – Little Vistula's catchment area drains the mountainous and sub-mountainous territories, whereby Przemsza's catchment area covers urbanised and industrialised areas where the effects of mining activity are a serious challenge in terms of the water management. The region is occupied by: agricultural land (47%), forests (33%), urbanised areas (18%) and water and wetlands (2%).

Characteristic for the water region in Little Vistula, summer surges are caused by heavy tempestuous and profuse rainfall. Whereby, winter floods are caused by snowmelt as well as ice and frazil-related jams.

The Preliminary Flood Risk Assessment (PFRA) offered the opportunity to outline the areas exposed to the risk from flooding (AERF) in the water region of Little Vistula. They are concentrated in the valleys of the major rivers in the region: Little Vistula and Przemsza, and their total area is 184.7 sq. km.

Based on the analysis of flood hazard maps (FHM), it was defined that in this water region more than 5,200 ha of land is located on the areas with low likelihood of flood event, 4,121 ha are within the average likelihood of flood event and finally ca. 2,400 ha are at high risk of flood event.

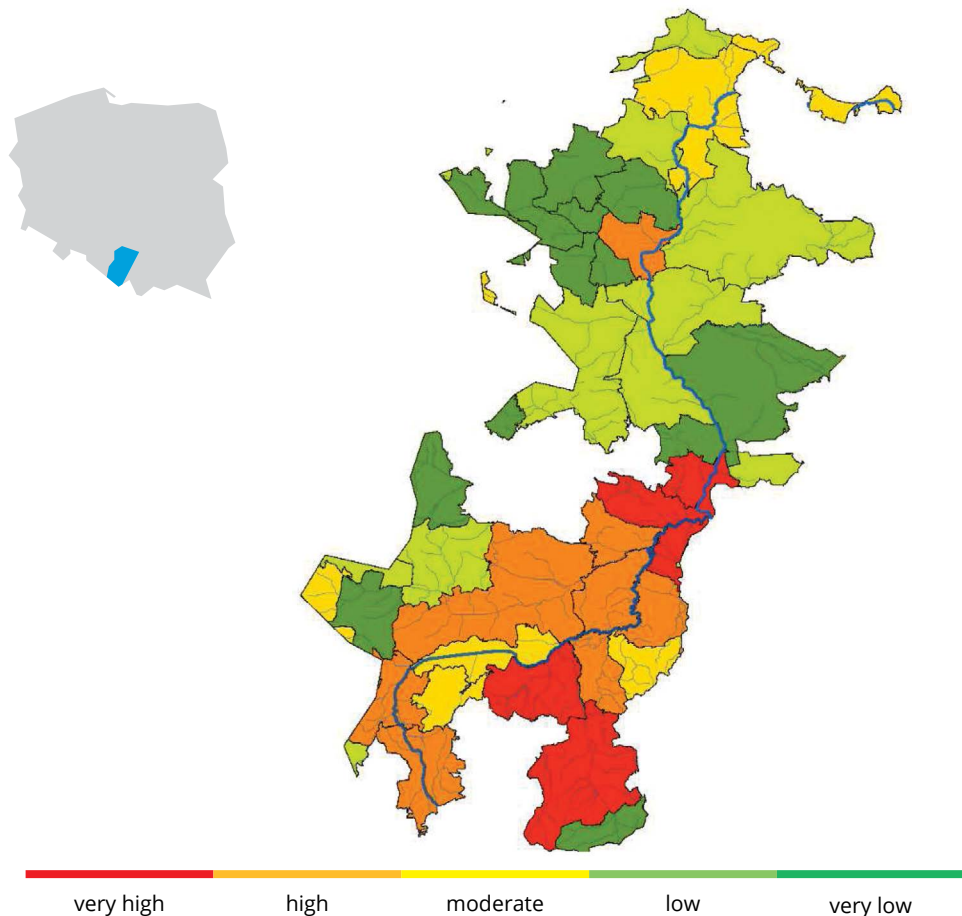
Number of residents occupying the areas exposed to the flood risk is respectively: 13.5 thousand residents live in the areas where the likelihood of flood is low, ca. 5.2 thousand people inhabit the areas with the average and 831 thousand with high likelihood of flood event. According to a five-degree scale, flood risk with regard to individual communes was determined and as a consequence, 6 communes with the highest integrated risk of flooding were indicated (Bielsko-Biała, Oświęcim, Czechowice-Dziedzice, Bieruń, Chełm Śląski, Chełmek).

Below presented is the flood risk for the communes located in the water region of Little Vistula.

Water Region	Number of communes with flood risk on a specific level					
	Level of risk	Integrated flood risk	Health and life of people	Environment	Cultural heritage	Business
Little Vistula	5	6	3	1	2	3
	4	8	3	1	0	6
	3	3	6	3	1	8
	2	6	4	3	0	5
	1	11	18	26	31	12

Analysis conducted based on flood hazard and flood risk maps helped to calculate the values of the average annual damage (AAD) for the water region of Little Vistula amounting to 43 million PLN.

Spatial distribution of the integrated flood risk.



RECOMMENDED MEASURES:

Major goal of the Flood Risk Management Plan is to reduce flood risk and hazard to the acceptable level by implementing proper measures, including non-technical measures. Draft FRMP for the water region of Little Vistula includes recommended measures, such as:

- maintaining and increasing the existing retention capability of the catchment areas in the water region,
- eliminating/avoiding growth of land development in the areas that are at particular risk of flood event,

- determining regulations regarding the conditions for the potential management of land protected by levee systems,
- avoiding further growth and determining the conditions for land development on the areas under low likelihood of flood event ($I=0.2\%$) by introducing laws that limit investments on the threatened areas
- specifying detailed conditions regulating construction of facilities with considerable significance for the economy as well as facilities that may pose a significant threat for people and environment, should a flooding occur,
- construction of facilities retaining water, flood channels and melioration systems,
- modernisation of the stripes between the levee and the river bank and maintaining wetlands,
- naturalization of river beds and their proper maintenance,
- construction of levee systems and the technical stripe facilities,
- protection and increasing forest retention by increasing the woodland and slowing down surface runoff,
- enforcement, in towns and urbanised areas, the obligatory use of mobile warning systems against the so called 100 years flood,
- improvement of the rules of controlling technical flood protection devices and facilities,
- removal or amendment of the functions of facilities used by people with limited mobility as well as facilities that pose a threat to the natural environment,
- modernisation of the existing buildings as well as construction of new, flooding-resistant buildings,
- improved forecasting and warning against meteorological and hydrological events,
- improved efficacy of reconstruction and recovery to pre-flood condition,
- implementation and improved reliability of post-flooding analyses,
- development of legal and financial instruments improving flood safety,
- drafting laws that introduce rules of land development on the territories at risk of flood which will help to protect the community against excessive risk,
- developing rules of funding programmes supporting new rules of managing areas at risk,
- developing education programmes aiming at increasing awareness and knowledge about the sources of flood risk and hazard.

Based on a series of analysis, problematic areas in the water region of Little Vistula were specified and thus, investment measures planned. Basic investment plans recommended for the water region of Little Vistula along with forecast cost up to 2021 include:

- Modernisation and reconstruction of functionality of 102 km of levees; cost 83,836 thousand PLN
- Modernisation of 4 reservoirs; cost 61,650 thousand PLN
- Construction and reconstruction of ca. 30 km of regulation development water facilities; cost 36,725 thousand PLN
- Implementation of 4 monitoring and flood forecasting systems; cost 14 million PLN
- Analysis and guidelines; cost 9,500 thousand PLN
- Other measures; cost 10,903 thousand PLN
- Project management; cost 8,020 thousand PLN

In total, the expected cost of investment measures is 224,634 thousand PLN.



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DRAFT FLOOD RISK MANAGEMENT PLAN FOR THE WATER REGION OF UPPER VISTULA

MAŁGORZATA OWSIANY

Director of the Regional
Water Management Authority
in Kraków

” Subjects connected with flood risk are one of the key areas of focus of the Regional Water Management Authority in Kraków. The process of producing information concerning flood hazard with regard to flood zones has started 10 years ago, when the RWMA in Kraków began to produce flood protection studies with the purpose of issuing opinions with regard to planning documents and informing the community about the level of risk. Scope of information has been successively expanded under the Flood Protection Programme in the Upper Vistula River Basin. With regard to this subject, the RWMA in Kraków has been pursuing studies aiming at developing a list of investment tasks, which will contribute to risk reduction in the most technically, economically, environmentally and socially-related way. The drafted Flood Risk Management Plan consumes several years of knowledge and experience at the disposal of the RWMA in Kraków guaranteeing high standard of flood risk level mapping as well as selection of the most justified measures aiming at reducing it.

Draft Flood Risk Management Plan (FRMP) for the water region of Upper Vistula is an integral part of the FRMP for the area of Vistula River Basin and lists the measures that should be implemented in order to reduce flood risk in the region and improve the management system thereof.

Upper Vistula water region covers the area of 47.515 thousand sq. km accounting for 25% of the Vistula river basin. It has been divided into the following planning catchment areas: krakowska Vistula, sandomierska Vistula (including Nida and Czarna Staszowska), Sola and Skawa, Raba, Dunajec, Wisłoka and San (including Wiśłok). This area is administered by the Regional Water Management Authority in Kraków. It is a very diversified region in terms of the landform – catchment areas of the southern tributaries to Vistula occupy mainly mountainous and sub-mountainous areas, whereby the catchment areas of the northern tributaries to Vistula run through uplands.

Agricultural lands account for 58% of the region's area, 32% are the forests and 5% urbanised areas. Surges constituting flood hazard are divided into the summer and winter ones. Characteristic for the mountains and uplands in the water region in Upper Vistula, summer surges are caused by heavy tempestuous and profuse rainfall. Whereby winter surges although characteristic for the lowlands, they are a threat also in the water region of the Upper Vistula. Winter floods are caused by snowmelt and ice jams.

During the studies produced under the Upper Vistula River Basin Flood Protection Programme, flood hazard was defined for total 8,637 km of rivers, whereby, on the sections of rivers covered by the studies ordered by the RWMA in Kraków (6,211 km), flood zones for the water with the likelihood of expanding 1% occupy the area of ca. 1,600 sq. km.

Based on the analyses of the flood risk and investment programmes pursued under the aforementioned Programme, the area of Upper Vistula water region was defined 1,577 sq. km of territories located within the areas where the likelihood of flood event is low and 1,244 sq. km occupy the areas with an average likelihood of flood. Number of residents living in the flood risk areas is respectively: ca. 137 thousand residents live on the areas where the likelihood of flood event is low and ca. 59 thousand residents occupy the area of average likelihood of flood event.

SCOPE OF MEASUREMENTS RECOMMENDED FOR THE WATER REGION OF UPPER VISTULA UNTIL 2021:

Major goal of the Flood Risk Management Plan in the region of Upper Vistula is the reduction of flood hazard and risk down to the acceptable level, by:

- Maintaining good technical status of the existing infrastructure,
- Construction of new elements of flood protection,
- Reducing development on the areas at risk,
- Preparing future investments,
- Decreasing vulnerability of the communities and their property to the flood event.

Under the FRMP for the water region of Upper Vistula (2021 perspective) it is planned to implement the following measures with an aim of reducing the flood risk:

- Construction and reconstruction of levee systems' functionality – over 500 km,
- Construction of new levees and boulevards – over 1,000 km,
- Construction of dry reservoirs and polders – ca. 40,
- Construction and modernisation of pump station – ca. 30.

The listed measures that are expected to be implemented include, among others, several dozens of investments that involve reconstruction or modernisation of the existing levees. However, their scope fails to fulfil all the needs. Studies on the technical condition of levee system in the voivodeships located in the water region of Upper Vistula demonstrate that only 17% of the levees are in good technical condition, while the remaining 83%, i.e. 1,593 km of levees are at risk or potentially at risk. That means that following the implementation of the scope provided by the FRMP, in the perspective of the next 6 years, there will still be ca. 1,000 km of levees that require additional reconstruction actions. Since, in the current perspective, the selected sections require immediate intervention, it is assumed that reinforcement of the remaining sections will not require as high unit outlays, currently it is expected that the cost of levee system modernisation in the new 6-year cycle will be ca. 1 billion PLN.

Number of communes with flood risk on a specific level							
Water region	of Upper Vistula	Health and life of people	Environment	Cultural heritage	Business	Integrated flood risk	Integrated flood risk (POPGW)
	5	34	30	4	34	39	264
of Upper Vistula	4	53	12	6	77	70	17
	3	58	29	10	62	60	55
	2	45	62	22	36	40	38
	1	51	108	199	32	32	59

Identified flood risk in the water region of Upper Vistula.

In the water region of Upper Vistula, the purpose of non-technical measures is mainly supportive, that is, in many cases, their implementation fails to satisfactorily reduce the flood risk. Nevertheless, their implementation is recommended as these are the activities that are beneficial both for the purpose of reducing flood risk and the environment.

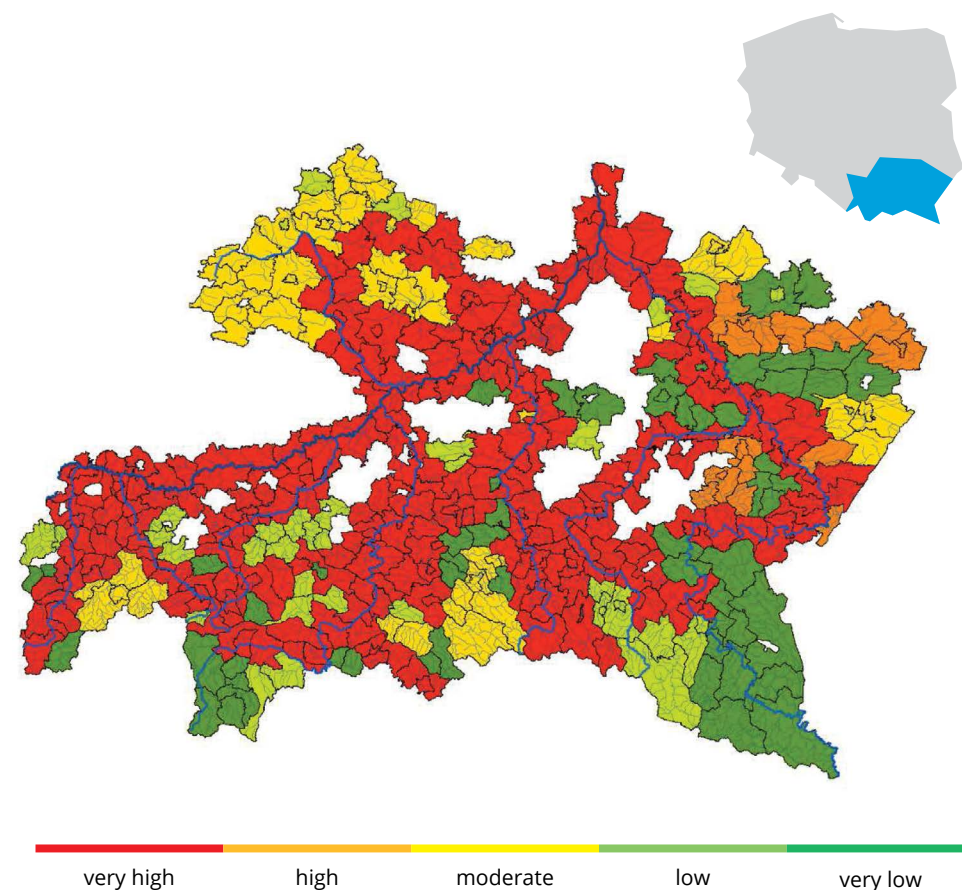
Therefore, technical measures should be treated as necessary for the implementation and ensuring proper protection of the territories that are at the highest risk in terms of health and life of people. From among the analysed communes that are located in the water region of Upper Vistula, 61% units is characterised by a very high level of flood risk, 3.9% are the communes with a high risk from flooding and 12.7% of communes enjoy moderate level of risk.

The communes with a very high flood risk are located within the following poviats: bielski, bieruńsko-łędziński, bocheński, brzeski, brzozowski, buski, chrzanowski, dąbrowski, dębicki, gorlicki, jarosławski, jasielski, jędrzejowski, kazimierski, kielecki, krakowski, kraśnicki, krośnieński, leżajski, limanowski, łańcucki, mielecki, myślenicki, niżański, nowosądecki, nowotarski, opatowski, oświęcimski, pińczowski, proszowicki, przemyski, przeworski, ropczycko-sędziszowski,

rzeszowski, sandomierski, sanocki, stalowowolski, staszowski, strzyżowski, suski, tarnobrzski, tarnowski, wadowicki, wielicki, żywiecki and within the cities of Kraków, Nowy Sącz, Tarnów.

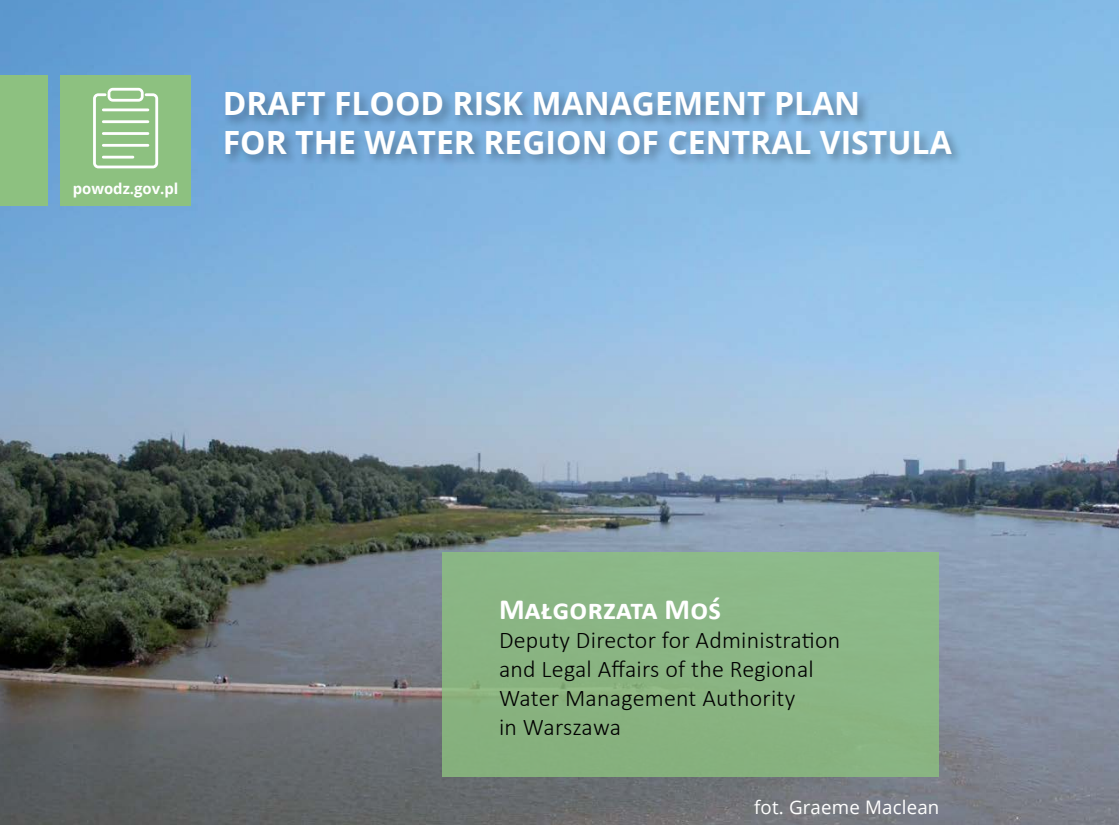
Flood risk manifests mostly in the areas located along the Vistula River and its main tributaries, where, in particular within the mouth sections of rivers, freshet waves cumulate. Vistula valley in the water region of Upper Vistula has been embanked along nearly the whole length, which results in the lack of opportunity for natural floodplains to develop and contributes to the water rising. As a consequence, this situation poses a serious threat in case the levee system fails.

On the current stage of works implementation, the flood risk with regard to the individual communes in the water region of Upper Vistula has been defined according to a five-degree scale. Below, the spatial distribution of integrated flood risk has been provided based on the analysis of the Upper Vistula River Basin Flood Protection Programme.





DRAFT FLOOD RISK MANAGEMENT PLAN FOR THE WATER REGION OF CENTRAL VISTULA



MAŁGORZATA MOŚ

Deputy Director for Administration and Legal Affairs of the Regional Water Management Authority in Warszawa

foto. Graeme Maclean

” Flood is a natural event which cannot be prevented. For years, people believed that the measures connected with flood protection should provide them with 100% safety. Needless to say, as the experience of the previous floods has shown, it is impossible to eliminate that phenomenon completely. Floods have always been and they will always be happening. Climate changes behind intensification of the extreme phenomena indicate the increasing role of the broadly understood planning. Our measures should be addressed at producing a joint document which would become the basis for unification of rules and measures aimed at preventing, protecting and minimising flood consequences. Hence, the Flood Risk Management Plan is the key element that should help us in this respect.

Draft Flood Risk Management Plan (FRMP) for the water region of Central Vistula is an integral part of the FRMP for Vistula river basin and lists the measures that should be implemented in order to reduce flood risk in the region and improve the management system thereof.

Water region of Central Vistula covers the area of 111,470 sq. km and includes the catchment area of Vistula River from the mouth of Sanna until Korabniki town (presently part of Włocławek). The main river in this region is the Vistula River. The biggest right-side tributaries to Vistula in this region include: Wieprz, Świder, Narew, Skrwa, and the left-side ones: Kamienna, Iłżanka, Radomka, Pilica and Bzura. Total length of hydrographic network in the water region of Central Vistula is 40,700 km.

This region is mainly used for the agricultural purposes – utilised agricultural land account for ca. 70% of the area and are spread pretty evenly. 25% of the area is occupied by forests, while urbanised areas cover less than 3% of the area and concentrate in the biggest cities: Warszawa, Puławy, Płock, Włocławek, Ostrołęka, Łomża, Biała Podlaska, Ostrowiec Świętokrzyski, Starachowice and Tomaszów Mazowiecki.

Major causes of flooding include rainfall which is behind natural surges in rivers, snowmelt and simultaneously occurring rainfall and snowmelt resulting in rainfall-snowmelt-related floods. Taking into account the mechanism behind the flood occurrence, in many cases, the areas located in direct proximity of rivers were flooded because the water poured over the levee crown or because of the ice jams.

FLOOD HAZARD AND RISK (PFRA, FHM, FRM)

The Preliminary Flood Risk Assessment (PFRA) in the water region of Central Vistula enabled to outline 56 areas exposed to the risk of flood (AERF), covering in total 5,078 sq. km; total length of rivers running through those territories is 3,182 km.

Based on the analysis of flood hazard maps (FHM), it was defined that in the water region of Central Vistula more than 301.5 thousand ha of land is located on the areas with low likelihood of flood event, 250.3 thousand ha are within the average likelihood of flood event and finally ca. 172.2 thousand ha are at high risk of flood event.

Number of residents occupying the areas exposed to the flood risk is respectively: ca. 192 thousand residents live in the areas where the likelihood of flood is low, ca. 48 thousand people inhabit the areas with the average and 9.6 thousand with high likelihood of flood event.

In addition, following a five-degree scale, the flood risk was defined with regard to the planning area. As a consequence, over 90% of the analysed territory is under low or very low level of flood risk, while the risk on less than 10% of the territory reaches dangerously alleviated level; however, 1% of the territory was diagnosed as suffering from a very high level of risk. In total, 64 communes were recognised as the area where the level of flood risk is high or very high (17 very high, 47 high).

Analyses conducted based on flood hazard and flood risk maps helped to calculate the value of average annual damage (AAD) and thus, in the water region of Central Vistula they amount to 404.46 million PLN per year.

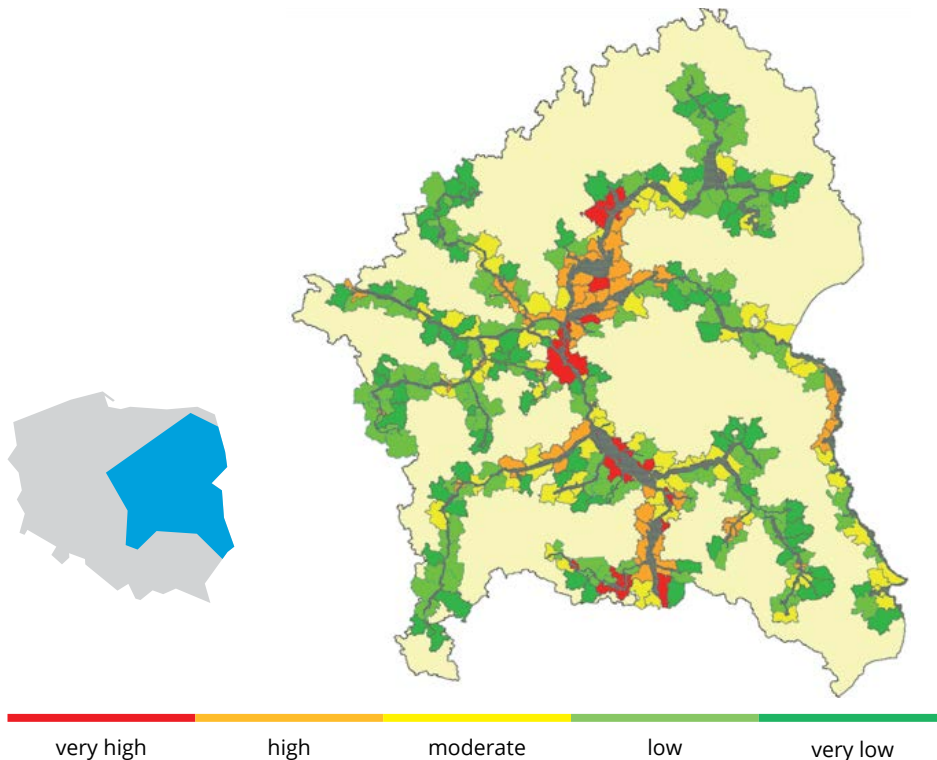
Finally, careful selection proved that the problematic areas identified as the first in line to be implemented flood risk reduction measures are 42 out of 56 AERF identified in the preliminary flood risk assessment. With regard to the remaining AERF, despite low level of flood risk, non-technical measures have been considered as they should influence locally individual areas and also support

the undertakings provided for the whole planning catchment area.

Major strategic goal of the flood risk management is to first and foremost stop the growth and significantly reduce the flood risk by undertaking non-technical measures that limit vulnerability of the particular flood risk zone as well as measures supporting all elements of the flood risk management system.

Below presented is the spatial distribution of integrated flood risk in the communes

Number of communes with flood risk on a specific level						
Water region	Level of risk	Health and life of people	Environment	Cultural heritage	Business	Integrated flood risk
Central Vistula	5	2	7	5	32	17
	4	32	4	2	41	47
	3	49	17	7	67	68
	2	86	43	31	100	110
	1	155	253	279	84	82



RECOMMENDED NON-TECHNICAL AND TECHNICAL MEASURES:

- No construction in the hazardous zones:
 - of facilities for people with limited mobility or ability to take decisions,
 - of facilities that pose a threat to the environment,
 - of infrastructural facilities,
 - of the remaining kinds of private and public facilities.
- Restricted construction or construction subject to specific conditions in the hazardous zones:
 - of facilities for people with limited mobility or ability to take decisions,
 - of facilities that pose a threat to the environment,
 - of the remaining kinds of private and public facilities.
- Producing technical conditions that need to be met in order to locate or construct facilities in the areas at risk due to levee system failure.
- Producing recommendations addressed at the existing facilities with regard to available ways of protecting against damages caused by the flooding of the areas protected by the levee system.
- Protection/increased retention in urbanised areas.
- Construction and modernisation levee systems as well as protective facilities of the technical stripe.
- Maintenance works in rivers and brooks.
- Improving technical condition of the existing flood infrastructure.
- Running ice breaking campaigns.
- Modernising constructions of the existing buildings and constructing new, flooding-resistant ones.
- Sealing buildings, using water-resistant materials.
- Securing the areas surrounding the buildings permanently.
- Producing laws that introduce ways of land development on the territories at risk from flooding which will protect the community against excessive risk and reduce future damages, submitting the drafts for the legislation.
- Designing rules of financing programmes supporting economically the new ways of land development in the areas at risk, launching such programmes, finding sources of funding.
- Designing educational programmes addressed at various recipients (kindergartens, primary schools, middle schools, high schools, universities and colleges) aiming at changing the awareness of the local communities in order to reduce the expansion onto the areas at risk and the way the inhabited areas at risk are developed.
- Producing educational programmes addressed at media and other bodies aiming at changing the awareness of the local communities in order to reduce the expansion onto the areas at risk and the way the inhabited areas at risk are developed.



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DRAFT FLOOD RISK MANAGEMENT PLAN FOR THE WATER REGION OF LOWER VISTULA



HALINA CZARNECKA
Director of the Regional
Water Management Authority
in Gdańsk

” Major threat in the water region of Lower Vistula manifests in the planning catchment areas covering Vistula River, Żuławy Wiślane and estuarial sections of coastal rivers.

Flood threats in Żuławy are quite specific mainly due to the depressions and near-depressions covering 120,000 ha and situated 2.1 m below the sea level. The functioning of the polderised Żuławy system is directly correlated and depends on the correct operation of flood protection infrastructure.

Nonetheless, Lower Vistula has been identified with three major threats: lack of correct navigational depth for the operation of ice breakers, need to ensure permeability of the route used by the huge flooding waters and the security of the barrage in Włocławek. Another threat is the impact of the sea in Żuławy and estuarial sections of rivers causing storm surges and the phenomenon of reverse flow of sea waters entering the land. Those floods are threatening the sea coast and the valley of Littoral's rivers.

Currently drafted Flood Risk Management Plan is an important strategic document that shall increase efficiency and reliability of the flood protection in the Vistula river basin, including Lower Vistula water region.

Draft Flood Risk Management Plan (FRMP) for the water region of Lower Vistula is an integral part of the FRMP for the area of Vistula river basin and lists the measures that should be implemented in order to reduce flood risk in the region and improve the management system thereof.

Water region of Lower Vistula spread across the area of 35.07 thousand sq. km, covering the northern part of the Vistula river basin below Włocławek from Korabniki to the mouth to the Baltic Sea (Bay of Gdańsk) along with the catchment areas of Littoral's rivers west of the mouth of Vistula (Łupawa, Łeba, Piaśnica, Reda and Słupia that flow directly to the sea) as far as Pasłęka river east of Vistula's mouth.

The prevailing part of the water region is occupied by utilised agricultural areas (ca. 62.1%), while urbanised areas account for just ca. 2.3% of the land concentrating mainly in Trójmiasto and the neighbouring smaller towns as well as Słupsk, Elbląg, Bydgoszcz and Toruń. The most characteristic areas in the water region of Lower Vistula are the polder depressions of Żuławy Wiślane and the lake Drużno as well as the dynamically changing sea coast.

Water region of Lower Vistula is threatened by floods caused by various factors: rainfall, snow-melt, ice jams, storms (Bay of Gdańsk and Vistula Lagoon) and river polder kind of floods as well as intrapolder rainfall-related floods. This region also happens to experience mixed surges caused by the reversing sea which are the reason for the water surging in the estuarial sections of rivers and hampering free flow of waters through Vistula River.

FLOOD HAZARD AND RISK (PFRA, FHM, FRM)

Flood hazard and risk in the region was based on the flood hazard (FHM) and flood risk (FRM) maps detecting the threat posed by rivers and the sea as well as expert assessment. Map analysis shows that rivers pose a threat to more than 49 thousand ha of land (low likelihood of flood event), 41 thousand ha (average likelihood of flood event) and ca. 30 thousand ha (high likelihood of flood event). With regard to the sea threat, the areas are as follows: more than 28 thousand ha (low likelihood of flood event) and more than 19 thousand ha (average likelihood of flood event).

Number of residents occupying the areas exposed to the river-related flood risk is respectively: ca. 26 thousand residents live in the areas where the likelihood of flood is low, ca. 14 thousand people inhabit the areas with the average and 6 thousand with high likelihood of flood event. Whereby, as far as the sea impact is concerned, the numbers are as follows: 48 thousand and 28 thousand people live on the areas with low and average likelihood of flood event.

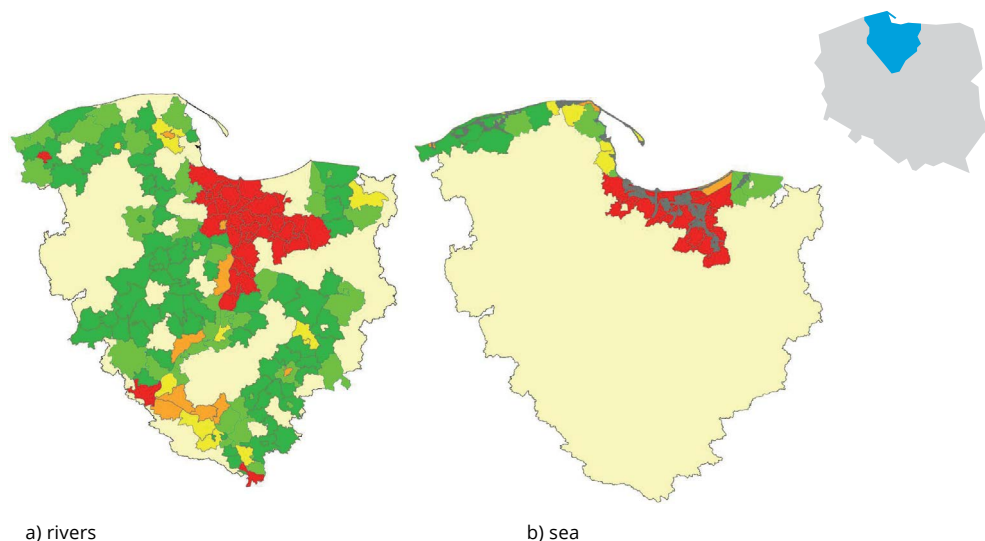
Flood hazard maps became the source of various kinds of data used to outline problematic areas in the water region of Lower Vistula. However, the aforementioned data was not sufficient enough to produce comprehensive diagnosis of the problems because the maps failed to include factors such as: specifics of flood risks in depressions and near-depressions as well as intrapolder rainfall-related and river floods (taking into account potential failure of drainage facilities and the process of aging of the levee system). Therefore, during the works on the FRMP, a series of additional analysis was used in order to obtain a full picture of flood risk in the water region of Lower Vistula.

So, with their help and the help of the expert method, it was possible to determine the risk across ca. 120 thousand ha of polder territories in Żuławy connected with flood that occurs in case technical flood infrastructure stops to operate (scenario of potential river polder flood). It poses a threat to ca. 64 thousand people. Taking into account all kind of threats, material damages are estimated to be ca. 9 million PLN.

In the water region of Lower Vistula, flood risk based on a five-degree scale was determined

for 158 communes which are under rivers' influence and 33 threatened by the sea and internal sea waters. In total, 5 and 2 communes were indicated as experiencing the highest integrated flood risk, and they are respectively the areas under rivers' influence and sea impact. As a result of an expert assessment, those numbers have been increased, and now 30 communes are recognised as threatened by rivers and 15 as threatened by the sea and internal sea waters. In the water region of Lower Vistula, the purpose of non-technical measures is mainly to support, that is, in many cases, their implementation fails to satisfactorily reduce the flood risk. Nevertheless, their implementation is recommended as it is beneficial both for the purpose of reducing flood

Below presented is the flood risk in the water region of Lower Vistula – rivers and sea impact with additional expert assessment (table a and b). The maps present the spatial distribution of the integrated flood risk with regard to communes located in the area under rivers and sea impact in the water region of Lower Vistula with additional expert assessment (map a and b).



a) Number of communes with flood risk on a specific level						
Water region	Level of risk	Health and life of people	Environment	Cultural heritage	Business	Integrated flood risk
Lower Vistula flood risk caused by rivers	5	5	0	2	2	30
	4	8	2	3	11	8
	3	7	2	1	15	11
	2	18	11	1	44	39
	1	120	143	151	86	70

b) Number of communes with flood risk on a specific level						
Water region	Level of risk	Health and life of people	Environment	Cultural heritage	Business	Integrated flood risk
Lower Vistula flood risk caused by the sea	5	3	0	1	1	15
	4	1	1	1	7	3
	3	7	2	1	7	5
	2	10	4	4	8	6
	1	12	26	26	10	4

risk and the environment. Therefore, technical measures should be treated as necessary for the implementation and ensuring proper protection of the territories that are at the highest risk in terms of health and life of people.

The principal goal of the Flood Risk Management Plan in Lower Vistula region is to reduce flood hazard and risk down to the acceptable level by implementing proper measures, such as:

- Reduction of the existing flood risk implemented through various measures, depending on the problems diagnosed in individual planning catchment areas, in particular: running ice breaking campaigns, improving technical condition of the existing flood infrastructure, measures and activities protecting depressed areas of Żuławy Wiślane against flood,
- Eliminating/avoiding growth of land development in the areas that are at particular risk of flood event,
- Maintaining and increasing the existing retention capability of the catchment areas in the water region.

As far as the water region of Lower Vistula is concerned, a series of analyses conducted in the planning catchment areas served as the foundation for the process of outlining problematic areas, which have been planned implementation of investment measures, both technical and non-technical, which should take place during the first planning period. Below presented are the estimated investment outlays proposed for each planning catchment area:

RIVERS' IMPACT:

- Planning catchment area: Littoral's rivers – ca. 6 million PLN
- Planning catchment area: Vistula Lagoon and Bays – ca. 500 million PLN
- Planning catchment area: Lower Vistula – ca. 500 million PLN
- Planning catchment area: Brda, Wda and Wierzyca – ca. 26 million PLN
- Planning catchment area: Drwęca and Osa – ca. 9 million PLN

SEA WATERS' IMPACT:

- Planning catchment area: Littoral's rivers / Vistula Lagoon and Bays – ca. 108 million PLN

Total amount for the water region – ca 1.25 million PLN



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DRAFT FLOOD RISK MANAGEMENT PLAN FOR PREGOLYA RIVER BASIN

PREGOLYA RIVER BASIN IN POLAND IN SQ. KM.

In our country, Pregolya river basin is represented by one water region – Łyna and Węgorapa

foto by Katarzyna Jodko

FLOOD HAZARD AND RISK (PFRA, FHM, FRM)

Performing the Preliminary Flood Risk Assessment (PFRA) in Pregolya river basin, it was determined that 1 area is exposed to the risk from flooding (AERF) and it covers the area of 20.2 sq. km; the rivers running through the area are 166 km long.

Based on the analyses of flood hazard maps (FHM), it was defined that ca. 16.7 sq. km of the territories are located within the areas where the likelihood of flood event is low, ca. 15 sq. km occupy the areas with an average likelihood of flood and finally ca. 10 sq. km are the areas where the likelihood of flood event is high.

Number of residents living in the flood risk areas is respectively: 284 residents live on the areas where the likelihood of flood event is low, 188 people live within average likelihood of flood event and 29 people reside in the areas where the likelihood of flood event is high.

In addition, following a five-degree scale, the flood risk was defined with regard to the individual communes in the river basin of Pregolya. The risk level was analysed with regard to 10 communes located in the planning catchment area of Łyna and Węgorapa: the city of Lidzbark Warmiński, the city of Bartoszyce, Dobre Miasto, Dywity, Sępólno, Olsztyn, Stawiguda, Bartoszyce commune, Kiwity, Lidzbark Warmiński commune. The highest integrated flood risk occurs in the communes: the city of Lidzbark Warmiński (4) and the city of Bartoszyce (3).

In general, potential damages caused by a flood with a high potential of occurrence have been estimated to 3.1 million PLN, whereby damage caused by flood with an average potential of occurrence are 7.7 million PLN and finally, low potential occurrence floods may be responsible for the damages amounting to 10.1 million PLN. Average annual damage (AAD) caused by floods estimated base on the aforementioned data amount to 0.77 million PLN.



Łyna River, photo by Marcin Polak

Major problems connected with flood risk management in Pregolya river basin are caused by unsatisfactory flow capacity of the river Łyna which crosses major cities in the river basin. Flood risk is also present during the winter season and it is connected with the flow direction in the river (early defrosting and melting in the upper course).

Major strategic goal of the flood risk management is to stop the growth and significantly reduce the flood risk in Pregolya river basin by undertaking, among others, non-technical measures that limit the vulnerability of the particular flood risk zone as well as measures supporting all elements of the flood risk management system.

PROPOSED NON-TECHNICAL MEASURES

- enforcement, in towns and urbanised areas (if reasonable), the obligatory use of mobile warning systems against the flood for water with p=1%,
- Implementation and drafting of construction laws regulating the rules of construction and commissioning of new facilities as well as rules connected with adjusting existing facilities to their use on the areas at risk from flooding.
- Construction and development of a system warning against dangerous phenomena in atmosphere and hydrosphere, in particular rainfall, snowmelt and ice jam-related floods.
- Construction and improvement of flood response system.
- Construction and improvement of education system increasing awareness and competences of the communities living in the areas at risk from flooding.
- Developing a system financing structural and non-structural measures with special reference to ensuring sources of funds for the purpose of the keeping the flood protection system on a constant functional level.

Major focus of the measures implemented in the river basin of Pregolya is to stop further land development on the areas at risk and if possible reduce the current use. Because the flood risk in Pregolya river basin concentrates in the cities, it is necessary to focus on non-technical measures which help to forecast early enough, recognise and thereby prepare for the flood, here, mobile flood protection systems are particularly important, and they include: barriers, dams or bulk-heads.

PREGOLYA RIVER BASIN



7,712 thousand PLN
(including residential properties 2,279 thousand PLN)

Potential damage - water 1%*
Potential total damage (residential properties, industrial and communication areas, forests and recreational areas, arable lands, grasslands, other)



Proposed non-technical measures:





DRAFT FLOOD RISK MANAGEMENT PLAN FOR THE WATER REGION OF ŁYNA AND WĘGORAPA

MAŁGORZATA MOŚ

Deputy Director for Administration
and Legal Affairs of the Regional
Water Management Authority in
Warszawa

photo by Katarzyna Jodko

” Flood is a natural event which cannot be prevented. For years, people believed that the measures connected with flood protection should provide them with 100% safety. Needless to say, as the experience of the previous floods has shown, it is impossible to eliminate that phenomenon completely. Floods have always been and they will always be happening. Climate changes behind intensification of the extreme phenomena indicate the increasing role of the broadly understood planning. Our measures should be addressed at producing a joint document which would become a basis for unification of rules and measures aimed at preventing, protecting and minimising flood consequences. The Flood Risk Management Plans should be the key element to help us in this respect.

Draft Flood Risk Management Plan (FRMP) for the water region of Łyna and Węgorapa is an integral part of the FRMP for the area of Pregolya River Basin and lists the measures that should be implemented in order to reduce flood risk in the region and improve the management system thereof.

The whole water region of Łyna and Węgorapa with a total area of 7,522 sq. km is administered by the Regional Water Management Authority in Warszawa.

This region is prevalently agricultural – utilised agricultural area accounts for ca. 68% of the total area. More than 26% of the region’s area is occupied by forests and semi-natural ecosystems. The surface water bodies account for ca. 4% of the area. Urbanised areas occupy 1.6% of the region.

Major cause of floods in the region is the rainfall which causes river floods. There are also floods caused by the melting snow – snowmelt-related floods.

FLOOD HAZARD AND RISK (PFRA, FHM, FRM)

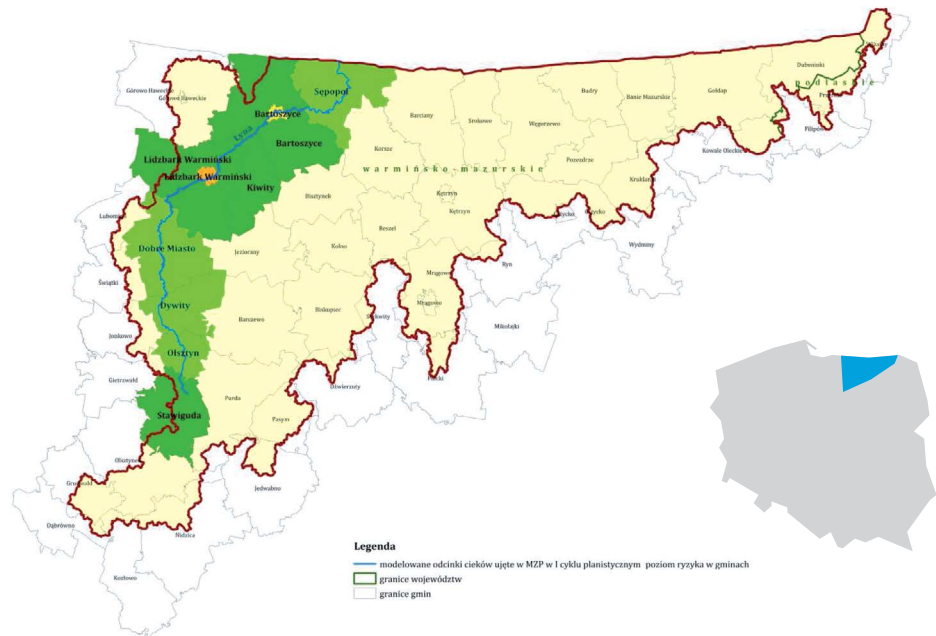
Drawing up the Preliminary Flood Risk Assessment (PFRA), 1 area exposed to the risk of flood event (AERF) has been outlined, with a total area of 20.2 sq. km and the total rivers’ length of 166 km.

Based on the analysis of flood hazard maps (FHM), it was defined that in this water region 1,672 ha of land is located on the areas with low likelihood of flood event, 1,517 ha are within the average likelihood of flood event and finally more than 1,071 ha are at high risk of flood event.

Number of residents living in the flood risk areas is respectively: 284 residents live on the areas where the likelihood of flood event is low, 188 people live within average likelihood of flood event and 29 people reside in the areas where the likelihood of flood event is high. Following a five degree scale, flood risk with regard to individual communes was determined and as a consequence, 1 communes with the highest integrated risk of flooding was indicated, and 1 commune experiences moderate level of flood risk.

Below presented is the spatial distribution of integrated flood risk in the communes.

Number of communes with flood risk on a specific level						
Water Region	Level of risk	Integrated flood	Health and life of people	Environment	Cultural heritage	Business
Łyna and Węgorapa	5	0	0	0	0	0
	4	1	1	0	0	0
	3	1	1	0	0	1
	2	4	0	1	1	4
	1	4	8	9	9	5



- avoiding growth and determining land development conditions in the areas with low ($I=0,2\%$) likelihood of flood event,
- reducing the existing land development,
- reducing vulnerability of facilities and communities,
- improved forecasting and warning against meteorological and hydrological events,
- improved reliability of people, companies, public institutions' response,
- development of legal and financial instruments improving flood safety,
- developing education programmes aiming at increasing awareness and knowledge about the sources of flood risk.

Non-technical methods may, in some cases, become more effective than the technical ones, at the same time they are less invasive for the environment and do not require huge one-off financial outlays. Non-technical variant includes only non-investment measures relating to construction of water facilities, such as: improvement of catchment areas' retention, buying out land, moving the properties, persuading residents to implement individual safeguards, etc.

Analysis conducted based on flood hazard and flood risk maps helped to calculate the values of the average annual damage (AAD) for the water region of Łyna and Węgorapa, amounting to 0.77 million PLN. A long term strategic goal of flood risk management is to reduce the damages down to a level justified by the expenses paid. At the same time, the goal is to reduce risk level across the whole region by undertaking measures that limit the vulnerability of the particular flood risk zone and measures that support all elements of the flood risk management system.

As far as the water region is concerned, the most important measures have been defined, whereby, their implementation will help to lower the flood risk. It is essential to produce a package of non-technical measures connected with, among others, improving the natural retention of river valleys, buying out properties and implementing legal, financial, information and educational measures.

A DECISION WAS MADE WITH REGARD TO MEASURES THAT SHOULD BE IMPLEMENTED AT FIRST IN ORDER TO MINIMISE FLOOD RISK BY:

- maintaining and increasing the existing retention capability of the catchment areas in the water region,
- eliminating/avoiding growth of land development in the areas that are at particular risk of flood event,



Implementation structure of the Flood Risk Management Plans

1. Implementation of strategic investments in 2016-2021 cycle:

ODER RIVER BASIN



- Technical development investments and non-technical investments [35]
- Reconstruction of infrastructure's functionality [23]
- Effective for 40 problematic areas [out of 88 identified]

VISTULA RIVER BASIN



- Technical development investments and non-technical investments [427]
- Reconstruction of infrastructure's functionality [120]
- Effective for 75 problematic areas [out of 124 identified]

- **Combination under WFD mode, Habitats Directive, SEA Directive based on hydraulic modelling;**

- **Implementation consistent with guidelines relating to environmental protection (Appendix 3 of the FRMP supporting Instruments, available at www.powodz.gov.pl)**



2. Implementation of non-technical supportive measures in the following areas:

- forests (including location guidelines with regard to afforestation),
 - agricultural areas,
 - urbanised areas,
- consistent with methodological guidelines of FRMP.**

3. Implementation of the policy aiming at decreasing the vulnerability of flood risk areas:

- Guidelines Rules of managing areas at risk from flooding (Appendix 2 of the FRMP supporting Instruments, available at www.powodz.gov.pl)
- Developing commune plans aiming at decreasing vulnerability of the areas at risk from flooding (including recommendations with regard to changing the function of construction facilities and land properties),
- Adjusting facilities to the new technical conditions (Appendix 2 of the FRMP supporting Instruments, available at www.powodz.gov.pl),
- Implementation of the assumptions of educational supportive instruments.

4. Guidelines with regard to analyses conducted for 2022-27 cycle:

- Developing optimum investment solutions with regard to problematic areas that have not been covered by the effect of 2016-2021 strategic investments,
- Continued concept and design works with regard to strategic non-technical measures (foundation: location recommendations of 2016-2021 FRMP: EcoFlood guidelines, amendment of the Water Law).

5. Development of the following systems:

- Financing flood risk management,
- Catastrophic risk insurances,
- Analyses covering flood risks and damages,

based on the legislation and organisational proposals recommended under 2016-2021 FRMP.

A large, stylized graphic of a human eye, rendered in various shades of blue. The eye is positioned on the right side of the page, with its iris and pupil clearly defined. The surrounding areas are filled with abstract, flowing blue shapes that suggest movement and focus.

DON'T BE INDIFFERENT, CONSULT!

(fill in the form provided further
or at www.powodz.gov.pl)

FORM DESIGNED FOR THE PURPOSE OF PUTTING FORWARD COMMENTS TO THE DRAFT FLOOD RISK MANAGEMENT PLANS

We kindly inform you that according to the Flood Directive and the Water Law, the President of the National Water Management Authority and the Directors of the Regional Water Management Authorities have produced draft Flood Risk Management Plans (FRMP) for the areas covered by river basins and water regions.

Production of FRMP aims at reducing potentially negative consequences of the flood for the life and health of people, environment, cultural heritage and economy.

Draft plans have been published at www.powodz.gov.pl We encourage you to familiarise with the documents and use this form to put forward your comments.

Your opinions will be analysed and the reasonable ones will be taken into account during the process of preparing the final version of the flood risk management plans. Expert commentary to the reported issues will be published on www.powodz.gov.pl

This form provides 9 questions and the estimated time necessary to fill it is 5 minutes.

NOTE: This form enables you to put forward your comments to only one selected draft Flood Risk Management Plan (FRMP). In order to comment on other drafts, please fill in additional forms (1 form = 1 FRMP)

1.

Published on www.powodz.gov.pl draft Flood Risk Management Plans have been developed with regard to 3 river basins and 9 water regions. Please, indicate the plan you wish to comment on.

(please indicate 1 document only)

- a) FRMP for the water region of Little Vistula
- b) FRMP for the water region of Upper Vistula
- c) FRMP for the water region of Central Vistula
- d) FRMP for the water region of Lower Vistula
- e) FRMP for the water region of Upper Oder
- f) FRMP for the water region of Central Oder
- g) FRMP for the water region of Lower Oder and West Littoral
- h) FRMP for the water region of Warta
- i) FRMP for the water region of Łyna and Węgorapa
- j) FRMP for Oder river basin
- k) FRMP for Vistula river basin
- l) FRMP for Pregolya river basin

2.

In your opinion, is the draft Flood Risk Management Plan (FRMP) that you have selected clear and comprehensible? **(please check 1 answer only)**

- a) I definitely agree
- b) I rather agree
- c) I rather don't agree
- d) Completely don't agree

If you selected answer a or b, please go to question 4.

3.

Please outline the elements of the Flood Risk Management Plan (FRMP) that are not clear. **(you may check several answers)**

- a) Summary in non-technical language
- b) Introduction
- c) Description of the planning area
- d) Partners of the planning process and rules applying to public participation
- e) Summary of the preliminary flood risk assessment
- f) Flood hazard assessment
- g) Flood risk assessment
- h) Analysis of the current flood risk management system
- i) Problem diagnosis
- j) Goals of the flood risk management
- k) Instruments supporting measures implementation
- l) Summary of measures and their priorities
- m) Description of the scope and the way of coordination mode in line with the Framework Water Directive and other Environmental Directives
- n) Other (which?)

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4.

Do you think that the draft Flood Risk Management Plan FRMP you selected covers all necessary measures aimed at minimising identified threats and risk and reducing flood damage?

(please check 1 answer)

- a) I definitely agree
- b) I rather agree
- c) I rather don't agree
- d) I completely don't agree
- e) I don't know, it's hard to say

5.

Please indicate in the below-provided catalogue the group of measures that you believe are essential for the selected draft Flood Risk Management Plan with regard to reducing negative consequences of flood. **(you may check more than one answer)**

- a) Protection and increasing the natural retention as well as reconstruction of natural conditions of water flow
- b) Rules concerning land management in areas exposed to the risk of flood event (reducing land development / changing the functions of the buildings / development conditions)
- c) Implementation and use of technical infrastructure protecting against flooding
- d) Improvement of the flood risk management system, including data collection systems, monitoring and warning
- e) Removal and preparing for flood damage
- f) Educational and information instruments
- g) I don't know / hard to say
- h) Other (which?)

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6.

In your opinion, does the selected draft Flood Risk Management Plan require additional information or changes? **(please check 1 answer only)**

- a) No, I don't have any further comments
- b) Yes, it should be complemented or changed with respect to the following elements (please provide)

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7.

Please tell us in what capacity do you submit your comments: **(please check 1 answer only)**

- a) Natural person
- b) Institution representative

please go to question 8

please go to question 9

8.

Please tell us where you live:

- a) Voivedeship
- b) Poviatic
- c) Commune
- d) Post code

please go to the end of form

9.

Please provide contact details of the institution/company you represent.

NOTE: this question applies ONLY to a person representing institution/company!

- a) Name of the institution.....
- b) Address of the institution.....
- c) *Organisational unit
- d) *First name.....
- e) *Last name
- f) *Email

*** non-obligatory fields**

Thank you for filling in the form. Summary information with regard to the comments submitted will be published on www.powodz.gov.pl

- a) Natural person
- b) Institution representative

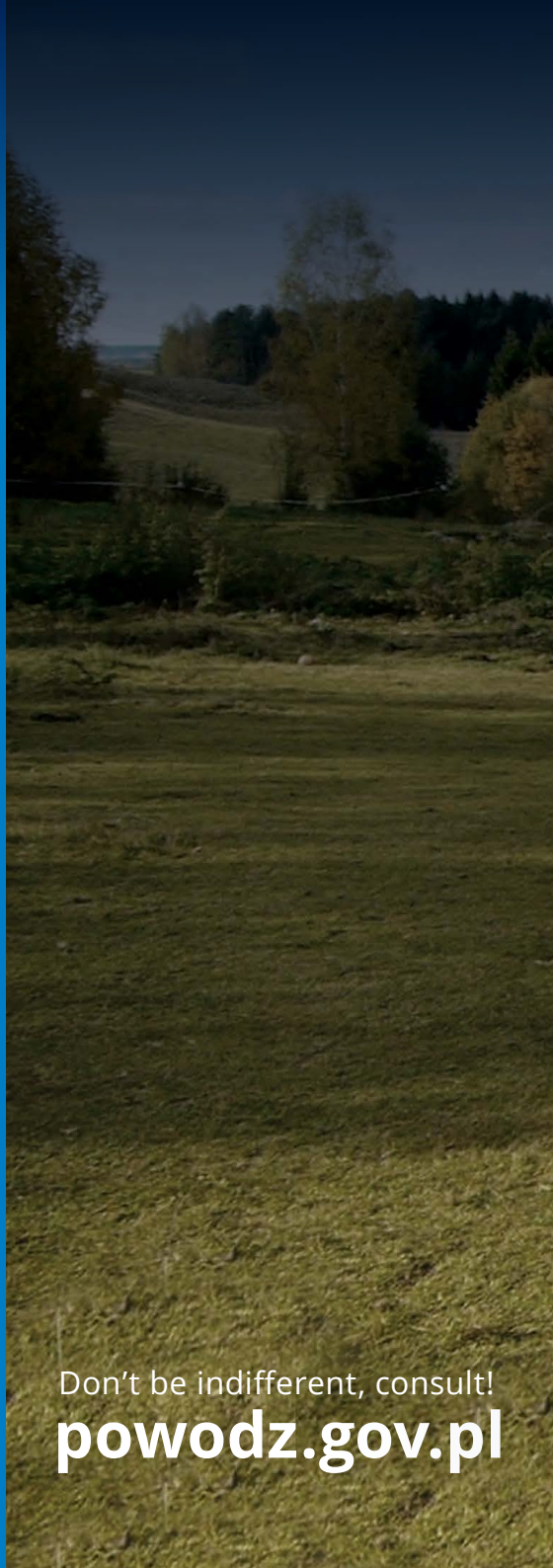
please go to question 8

please go to question 9





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Don't be indifferent, consult!
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