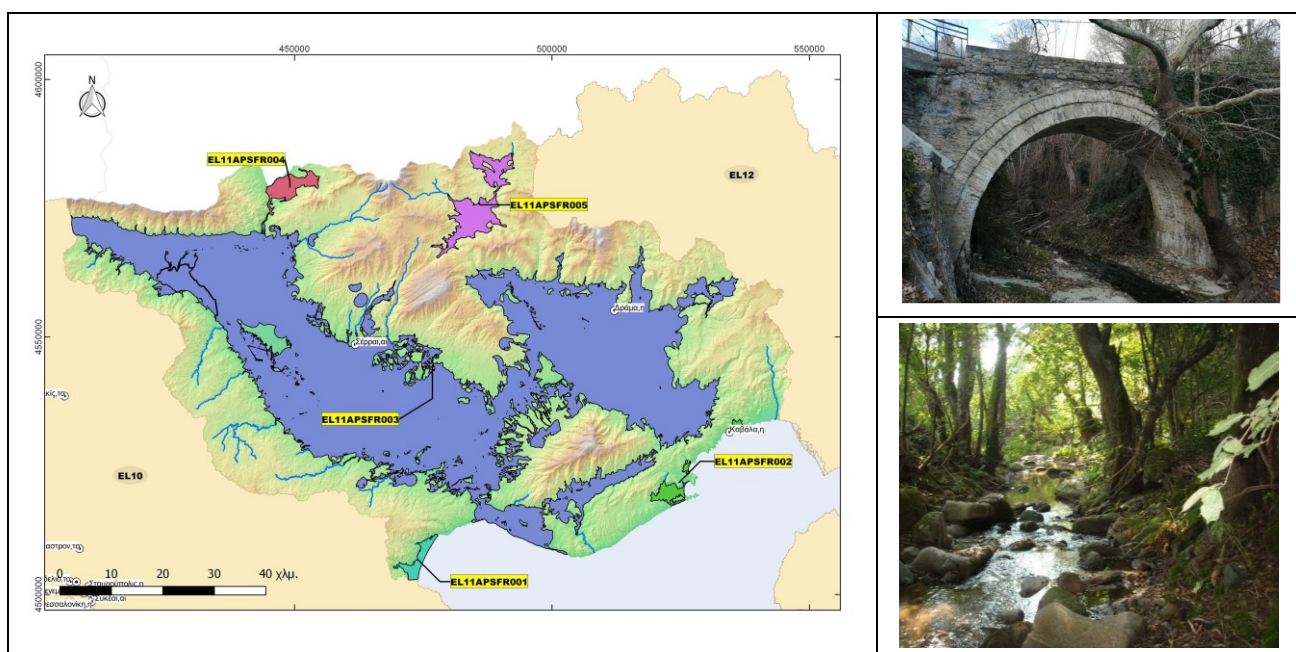




MINISTRY OF ENVIRONMENT AND ENERGY
GENERAL SECRETARIAT FOR NATURAL ENVIRONMENT AND WATER
GENERAL DIRECTORATE OF WATER



1st REVIEW of the
FLOOD RISK MANAGEMENT PLAN
for the River Basin of the
Eastern Macedonia District (EL11)

Phase 2 - Deliverable 19

TRANSLATION INTO ENGLISH OF THE DELIVERABLES' SUMMARY
METHODOLOGIES AND STUDY RESULTS



**Με τη συγχρηματοδότηση
της Ευρωπαϊκής Ένωσης**





HELLENIC REPUBLIC

MINISTRY OF ENVIRONMENT AND ENERGY

GENERAL DIRECTORATE OF WATER

This document has been prepared within the framework of the project: **1st REVIEW OF FLOOD RISK MANAGEMENT PLANS OF THE RIVER BASINS OF THE WATER DISTRICTS OF EASTERN MACEDONIA AND THRACE**

with the contribution of the Contractor: **Joint Venture "1st REVIEW OF FLOOD RISK MANAGEMENT PLANS OF THE WATER DISTRICTS OF EASTERN MACEDONIA AND THRACE"**

which consists of the following offices and Consultant Engineers:

EXARCHOU NIKOLOPOULOS BENSASSON CONSULTING ENGINEERS S.A.,

ECOS CONSULTANTS S.A,

ENVIROPLAN Consultants & Engineers

LIZA BENSASSON Abraham,

GEOSYNOLO CONSULTING ENGINEERS AND GEOLOGISTS IKE,

ANTONIOS TSINTSARIS Dimitrios

DRAFTING OF THE 1ST REVIEW OF THE FLOOD RISK MANAGEMENT PLAN FOR THE RIVER BASINS OF THE THRACE RIVER BASIN DISTRICT

PHASE 2

DELIVERABLE 19: TRANSLATION INTO ENGLISH OF THE DELIVERABLES' SUMMARY METHODOLOGIES AND STUDY RESULTS

Revisions:

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Ver. 1	27/08/2024	Original Version
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ABBREVIATIONS

APSFRR	=	Areas of Potential Significant Flood Risk
CN	=	Curve Number
DEM	=	Digital Elevation Model
DTM	=	Digital Terrain Model
EC	=	European Commission
EU	=	European Union
FHM	=	Flood Hazard Maps
FRM	=	Flood Risk Maps
FRMP	=	Flood Risk Management Plan
GD	=	Guidance Documents
GDWM	=	General Directorate of Water Management
GIS	=	Geographic Information Systems
GSCP	=	General Secretariat for Civil Protection
GSNEW	=	General Secretariat for Natural Environment and Water
HEC	=	Hydrologic Engineering Centre
HMS	=	Hydrologic Modelling System
JMD	=	Joint Ministerial Decision
MoEE	=	Ministry of Environment and Energy
NCCCAS	=	National Climate Change Adaptation Strategy
NFR	=	National Flood Register
OEFWS	=	Operational Early Flood Warning System
PFRA	=	Preliminary Flood Risk Assessment
RB	=	River Basin
RBD	=	River Basin District
RBMP	=	River Basin Management Plan
RU	=	Regional Unit
SCS	=	Soil Conservation Service
SSW	=	Special Secretariat for Waters
WFD	=	Water Framework Directive

1 INTRODUCTION - 1ST REVISION OF THE FLOOD RISK MANAGEMENT PLAN FOR THE RIVER BASINS OF THE WATER DISTRICT OF EASTERN MACEDONIA (EL11)

The European Parliament and the Council of the European Union brought into force in October 2007 Directive 2007/60/EC on the assessment and management of flood risks with the aim of reducing the negative impacts on human health, the environment, cultural heritage and economic activities associated with floods in the Community. Directive 2007/60/EC on the Assessment and Management of Flood Risks has been transposed into national law by means of K.Y.A. H.P. 31822/1542/E103/2010 (Government Gazette B' 1108/21.07.2010), as amended and in force, on the assessment and management of flood risks, in compliance with the provisions of Directive 2007/60/EC "on the assessment and management of flood risks" of the European Parliament and of the Council of 23 October 2007. The geographical unit of application of Directive 2007/60/EC in Greece is the River Basin District (Water District), the same geographical unit as that of the Water Directive 2000/60/EC.

Directive 2007/60/EC is being implemented in three (3) stages, namely:

- (a) the Preliminary Flood Risk Assessment (FRA) which identifies the Potentially High Flood Risk Zones (APSFR),
- (b) the preparation of Flood Hazard Maps (FRM) and Flood Risk Maps (FRM) for the identified ZHZs,
- (c) the preparation of Flood Risk Management Plans (FRMPs) for the FIRM based on the results of the maps. The Flood Risk Management Plan shall set objectives for the management of flood risks, focusing on reducing the potentially negative impacts of floods on human health, the environment, cultural heritage and economic activities, and shall establish a programme of measures to address them.

Flood Risk Management Plans, including Flood Risk Maps and Flood Hazard Maps, are the strategic tool for implementing policy for flood risk assessment and management across the country. The results of the Flood Hazard Maps, Flood Risk Maps and the results described in the Programme of Measures of the FRMD should be considered by any organization planning, developing and implementing flood-related projects and activities.

The Preliminary Flood Risk Assessment, Flood Hazard and Flood Risk Maps and Flood Risk Management Plans of the country's SFs shall be reviewed and, if necessary, updated every six years. The first SWMPs for all of the country's SIDs were prepared in 2018. Currently, the 1st Revision of the country's Flood Risk Management Plans is being implemented by the General Directorate for Water of the Ministry of Environment and Natural Resources. This one concerns the Hydrological Region of Eastern Macedonia (EL11).

2 BRIEF DESCRIPTION OF RBD11

The Water District of Eastern Macedonia is bounded by the mountains of Kerdilia, Vertiskos, Krušia and Beles to the west, the Falakro and the Basin Mountains to the east-southeast, the Orfanos (or Strymonikos) and Kavala bays to the south, and the Beles Mountain range to the north. The total area of the Eastern Macedonia water district is 7321 km². The Eastern Macedonia RBD consists of one (1) river basin, that of Strymon (EL1106). The total area of the Strymon River basin is 17 024 km² of which 11 035 km² (64 %) are located north of the Rupel Gorge, in the territory of Bulgaria (8 670 km²) and North Macedonia (2 365 km²). The remaining area of 5 989 km² (36 %) are located in Greece.

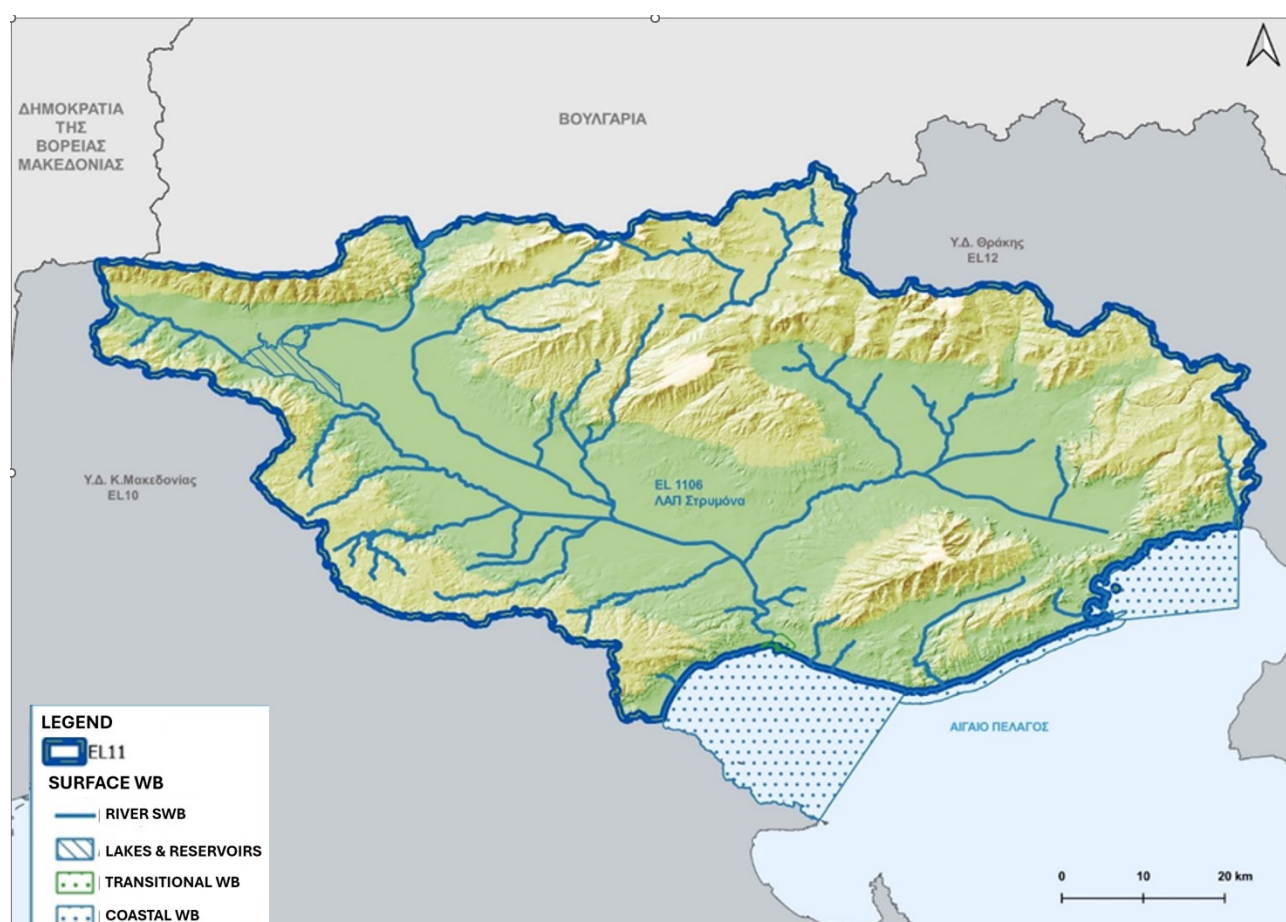


Figure 2-1: The Department of Eastern Macedonia (EL11)

The main river of the RBD of Eastern Macedonia is the Strymon with its main branch, the Aggitis. Secondary rivers of the MA are Belitsa and Krusovitis and the upstream tributaries of the Aggitis. A more detailed description of the Strymon and its tributaries follows.



Strymon river is one of the largest rivers of the Balkan Peninsula, with a total length of 315 km up to its mouth at Lake Kerkini. It originates from Mount Vitosha in Bulgaria and follows a south-eastern course (290 km) and enters the Greek territory in the vicinity of Promachonas, Prefecture of Serres. Downstream of the village of Neo Petritsio it follows a westerly course and forms the artificial lake Kerkini. From Kerkini it exits near Lithotopos village, continues south-east and, passing west of Amphipolis, flows (77 km) into the Gulf of Orfanos or Strymonikos Gulf.

The river Strymon, on Greek territory, has two branches: the main branch that enters Greek territory from Bulgaria, and the branch of the river Aggitis, which also receives the waters of the drainage ditch of the Tengiz of Philippi.

Strymon river is the largest -second to Axios- international river - in terms of length and volume of water transported - in Central Macedonia. Apart from the flood peaks of 2000-3000 m³/sec, the river carries a significant amount of sediment which contributed to the gradual blockage of its bed and the siltation of the surrounding areas. To monitor these phenomena, the artificial lake Kerkini was constructed in 1932 at the site of the former Lake Kerkinitida or Butkovo, into which the Strymons river was diverted over 15 km. This fact gave the area the possibility of stopping flood flows of up to 3000m³/sec as well as the smooth deposition of sediment mainly upstream and inside the lake.

In the southern part, near its estuary, the riverbed ended in the marshy lake Achinou, which reached an area of about 70,000 acres. Downstream of Kerkini and up to the former Lake Achinou, the Strymon was enclosed between two dikes, after the relevant alignments and adjustments had been made, for a length of about 40 km. At the same time, Lake Achinou was drained and drained. The river now flows through it to reach Orfanos Bay (Strymonikos) after about 25 km of encased bed between embankments.



Only two lake reservoirs are included in the RBD of Eastern Macedonia: Lake Kerkini and the Lefkogeia Reservoir. Lake Kerkini was created in the period 1933-36, mainly for the flood protection of the downstream riparian areas and the retention of sediment from the Strymon River. The excessive accumulation of sediment from the Strymon led to the raising of the embankments and the construction of a new dam in 1982.

Very quickly the multiple role it was destined to play in the region became apparent. Today the lake performs multiple roles, as a habitat for flora and fauna, a wetland of international importance, a reservoir of irrigation water, a fishing ground, a flood control project, a sediment retention project. In recent years, the mild tourism development of the area and the construction of a hydroelectric power plant have added two additional important functions to the multiple role of Lake Kerkini.

3 1ST REVISION OF THE PRELIMINARY FLOOD RISK ASSESSMENT

The first PAFP was completed by the former EIA of the Ministry of Environment at country level in 2012. In June 2020 the 1st Revision of the Preliminary Flood Risk Assessment (<https://floods.ypeka.gr/FRMP-lap/prelim-eval-2round/>) was completed by the GDWM (former EIA) of the Ministry of Environment, also at country level.

The revised Flood Risk Management Plans were established by combining the results from the identification of areas where flooding is likely to occur and areas with potentially significant consequences from future floods. Additionally, the potential impact of climate change on the occurrence of floods was examined according to Article 14.4 and Article 4.2.d of the Directive, as well as the impact from rising sea levels.

The Areas of Potential Significant Flood Risk in the Eastern Macedonia River Basin, defined in the frame of the 1st Revision of the FRMP, are:

1. Low basin zone of Asprovalta River (EL11APSFR001)
2. Low stream zones of the coastline of N. Kavala from Nea Peramos to Kavala (EL11APSFR002)
3. Low basin zone of Strimonas River and lakeside zone of Kerkini, low basin zone of Aggitis River, including the plains of Tenagoies Philippi, and streams of Pygadouli, Platanorema, and Marmara (EL11APSFR003)
4. Low basin zone of upper Strimonas immediately downstream of the borders (EL11APSFR004)
5. Low basin zone of the closed basin of Ochyro (EL11APSFR005)

The table and the map that follow present the identified Areas of Potential Significant Flood Risk (APSFR) in the 1st Review of the River Basin Management Plan (RBMP), along with the differences compared to the first RBMP.

PHASE 2 - DELIVERABLE 19

Translation into English of the Deliverables' summary methodologies and study results

Table 3-1: Comparison APSFRS of the initial FRMP and the 1st Revision of the PAKP in the Hydrological District of Eastern Macedonia - source: 1st Rev. Preliminary Flood Risk Assessment, (General Secretariat for Civil Protection / General Directorate for Water of the Ministry of Environment and Energy, 2019)

No.	1st REVIEW OF PRELIMINARY FLOOD RISK ASSESSMENT (2019)				PRELIMINARY FLOOD RISK ASSESSMENT (2012)		
	Code	Name	Area (km ²)	Changes in the 1 st Revision	Code	Name	Area (km ²)
1	EL11APSFR001	Low basin zone of river. Abrovalta	18	It is expanded based on the results of the 1 st FRMP for floods T1000.	GR11RAK0001	Low basin zone of the river Aprovalta	18
2	EL11APSFR002	Low river zones of the beach of N. Kavala from Nea Peramos to Kavala	21	It is expanded based on the results of the 1 st FRMP for floods T1000, including low- lying coastal zones up to Kavala where historical events have been recorded. Name Change.	GR11RAK0002	Low basin zone of the river N. Peramou	16
3	EL11APSFR003	Low basin zone of river Strymon and lakeside zone of Kerkini, low basin zone of river Aggitis, including the plain of Tena of Philippi, and rivers Pigadouli, Platanorema and Marmara	2719	It is expanded based on the results of the 1 st FRMP for floods T1000, including low- lying areas near the region where historical events have been documented.	GR11RAK0003	Low basin zone of the Strymon River and the akeside zone of Kerkini, low basin zone of the Aggitis River, including the plain of Tena grounds of Philippi, and the streams Pigadouli, Platanorema, and Marmara	2664
4	EL11APSFR004	Low zone of upstream Strymon immediately downstream of the borders	33	It is expanded based on the results of the 1 st FRMP for floods T1000	GR11RAK0004	Low zone of the upper Strymon River immediately downstream of the borders	31
5	EL11APSFR005	Low zone of the closed basin of Ohiro	87	It is expanded based on the results of the 1 st FRMP for floods T1000	GR11RAK0005	Low zone of the closed basin of Ochiro	87
TOTAL			2878		TOTAL		2817
Difference compared to Preliminary Flood Risk Assessment 2012			61				
Difference compared to Preliminary Flood Risk Assessment 2012 (%)			2.2%				

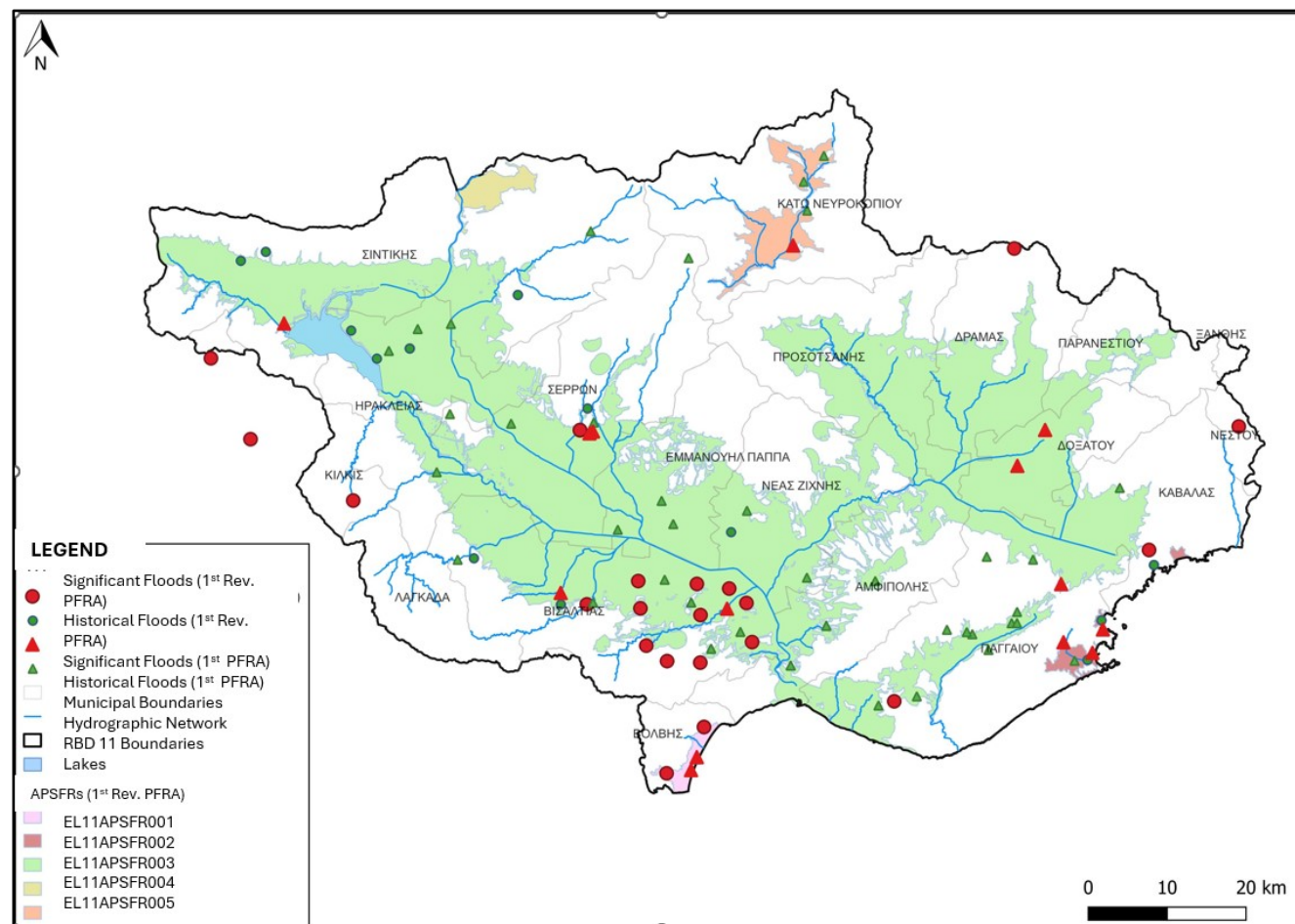


Figure 3-1: Areas of Potential Significant Flood Risk) of the Water Directorate of Eastern Macedonia (EL11).

(Source: 1st revision of ΠΑΚΠ, [ΓΦΠΥ / ΓΔΥ του ΥΠΕΝ, 2019](#))

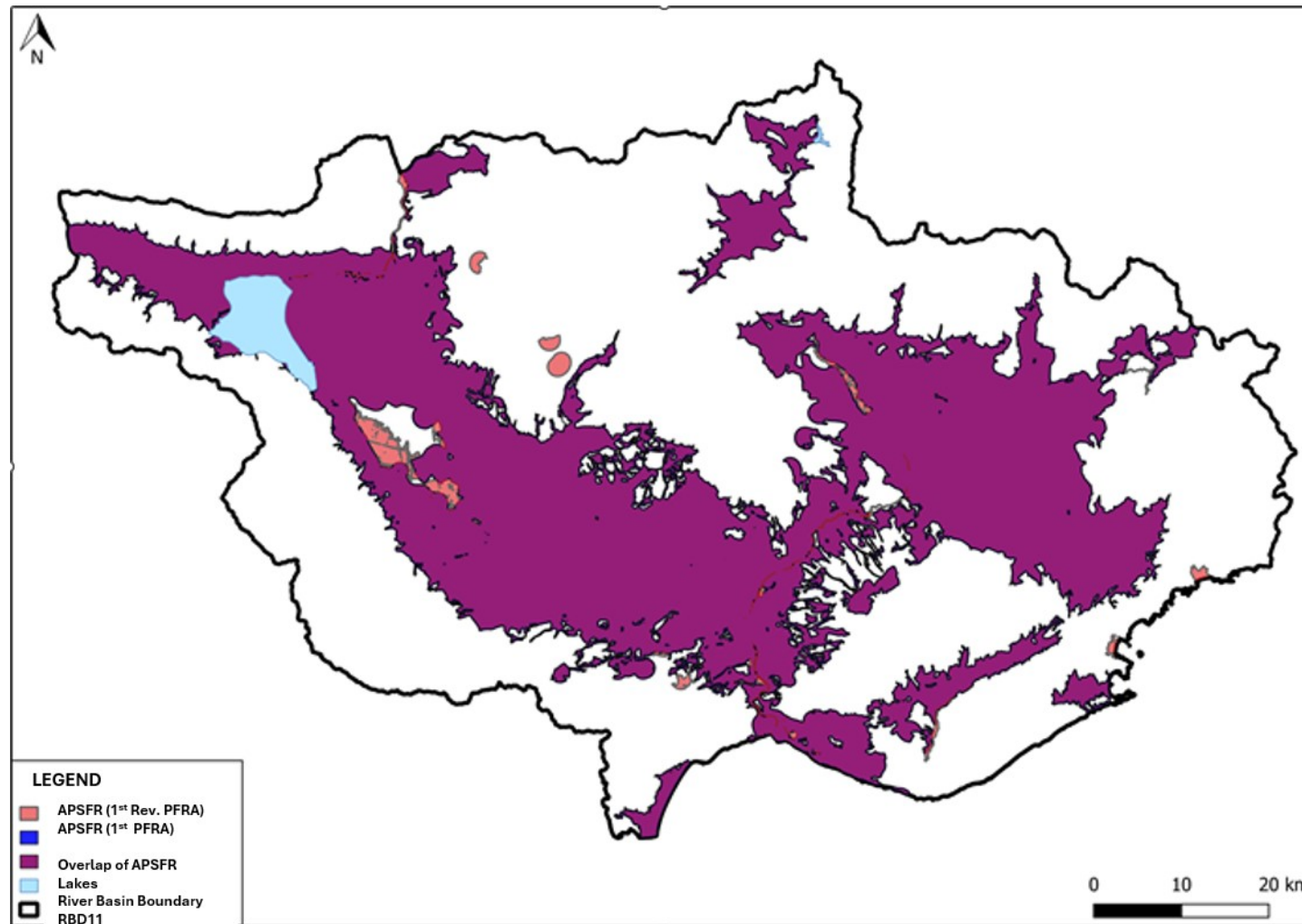


Figure 3-2: Comparison of APSFRs (1st PACP - 1st Revised PACP) of the Eastern Macedonia Water District (new areas are shown in red)

The causes and mechanisms of flooding for each WFD11 LFA have been identified as follows:

Low zone upper r. Asprovalta (EL11APSFR001)

The main cause of flood events in the EL11APSFR001 WFD is the overflow of streams (A11). Another cause is storms (A12). The main mechanism is the obstruction of flow (A24). Examples are the conversion of pits into parking areas, but also the reduction of drainage of the underground culverts of the Egnatia Odos (in Ano Vrasna) due to debris. It should be noted that downstream of the Egnatia motorway, due to steep gradients, stream flows are characterised by high velocities which are conducive to erosion.

In Asprovalta, blocked streams, but also arbitrary old constructions, mainly near the beach, exacerbate the rushing torrents, resulting in many times in disastrous floods. The problem has been reduced by the construction of a flood protection ditch. In Vrasna, as the torrent waters no longer have escape routes, they flood basements and ground floors and have swept cars parked in torrent beds into the sea. In the coastal area of Stavros (the suburbs of Stavros fall within the APSFR) the streams running down from Upper Stavros have often flooded large areas and destroyed property after prolonged downpours.

Low zones of the South Kavala beach streams from Nea Peramos to Kavala (EL11APSFR002)

The main cause of flooding is overflow (A11). The predominant flooding mechanisms are overflow of streams (A21) and flow obstruction (A24). Many streams (r. Vryssis, r. Chakalorema, r. R. Zygou-Kryoneri and r. Lefki in Eleftheres) in the area overflow during heavy storms, as they are unable to drain the volume of water due to obstruction of the flow by human interventions (confinement of the pits) and insufficient cleaning of their pits. In particular in New Peramo, the area that used to be a marsh and is located below sea level, flooding is frequent within 10 years.

Low zone of the Strymon River basin and the Kerkini coastal zone, low zone of the Aggitis river basin, including the plain of the Tenagoi Philippi, and the Pigadouli, Platanorema and Marmara streams (EL11APSFR003)

It is the most extensive WFD of the WFD. Due to its importance and extent, it is analysed separately for the main rhyme of the Strymon river. The river Strymon drains the lowland areas of the PEP Serres, while the Aggitis tributary in the southeast of the PEP Serres drains the lowland area of the neighbouring PEP Drama, while areas on the edge of the zone fall within the PEP Kavala.

Low zone of the Strymon river basin and the Kerkini coastal zone

The PIR of Serres is drained from north to south by the Strymon river after its entry into the Greek territory. Many of the floods that occur are the result of rainfall in neighbouring Bulgaria (imported floods). The flow of the river downstream of Lake Kerkini is regulated by a sluice gate. However, siltation from sediment transported by the River Strymon has limited the available suction volume of the lake and consequently its flood control role. In the eastern-northeastern area of Lake Kerkini (Megalochori, Chrysochorafo, etc.), flooding phenomena occur due to overriding of the dikes at times when the inflows from upstream (Bulgaria) exceed the suction capacity of the lake, combined with the restriction of water discharge from the sluice gates of the Lithotopos dam to avoid flooding of downstream areas. Areas downstream of Lake Kerkini are vulnerable to flooding in episodic events leading to the need to increase the outflow from the sluice gates in order to dissipate the volume of water in the lake. According to the Civil Protection Department of the Prefecture of Serres, the entire lowland area of the river Strymon

from the height of Lake Kerkini to its outlet to the sea, where historically flooding events have been recorded due to the shallow natural bed and the low morphological gradient, is vulnerable to flooding. The cause of the flooding is considered to be a cause of flooding

The Belitsa ditch receives the runoff of the Krusovitis river from the mountainous area of Sidirokastró and runs with a fully settled bed at the eastern end of the plain until its confluence with the river Strymona (near the settlement of Valtotopi). It serves as the receiving end of almost the entire network of drainage ditches of the irrigation networks in the area, the main ones being the Strymonochori, Enotic and Southern ditches. Flooding episodes in the surrounding settlements (Hortero, Kamaroto, etc.) are caused by the overflow of the Krusovitis river and/or the Belitsa ditch (A11) and overflow or failure of the dikes (mechanisms A22, A23) such as the Krusovitis dike at the farm of D. In the town of Serres flooding problem is due to the torrent of Ag. Anargyroi (event 18/06/2004 large-scale, summer 2014 small-scale). The original bed of the Ag. Anargyroi torrent, initially more than 60m wide, has narrowed considerably, while upstream, a large part of the bed has been given over to recreational uses and has been bogged down. The cause of these flooding events is considered to be the local storm (A12) which the streams failed to drain/drain due to a restricted bed and the mechanism is considered to be flow obstruction (A24).

Significant flooding problems are also faced by the riparian areas of Emmanuel Pappa, Nea Zichni and Visaltia, which are located downstream of the confluence of Krusovitis and the artificial trench Belitsa in the Strymon. From this point the bed of the Strymon is enclosed between two embankments, along a length of 40 km, until its confluence with the P. Aggitis. The areas crossed by the last part of the Strymon riverbed from the confluence of the Belitsa ditch to the straits of Amphipolis are the most frequently flooded areas, due to the small slopes and the low drainage capacity of the bed. In cases of increased flood flows, failure of the embankments (breaking) is observed, as in the episodes of March 2015, resulting in extensive flooding in the settlements of Achinos, Petelinos, Paralimnio. River overflow (A11) is considered as the cause of flooding and the main mechanism is the failure of embankments (A23).

Low zone of the basin of the river Aggitis, including the plain of the Tenagoi of Filippi.

The vulnerable area is the plain of Tenagi-Filippoi, which drains into the river Aggitis through a network of a "fishbone" and the Central Ditch of Filippoi, with a total length of 29 km, which runs through the whole plain from east to west. This is an area with very fertile soils, which, however, are subject to severe problems of co-sedimentation (from 1 m at the edges to 3.5 m in the centre of Tenagoi-Filippoi), so that, in combination with the occasional incomplete cleaning of the drainage ditches, there are serious problems of drainage in the area and the inability to drain the water into the river. The drainage network is accompanied by a large number of manual gates, many of which are decommissioned, as well as the Nikiessiani pumping station, in order to regulate the water level to achieve exsanguination and the rational management and distribution of water between the regions of Drama and Kavala. The causes of flooding are identified as overflow (A11) and local storms (A12), while the mechanisms are infrastructure failure (A23) and, secondarily, flow obstruction (A24). The Department for Structural Improvements of the Drama Region points out the need to clean the drainage ditches and to reorganise the entire irrigation and drainage network of Tenagoi-Filippoi.

Stream basins of Pigadouli, Platanorema and Marmara

Local flooding phenomena are reported in the coastal area of N. Karvali. In the Kokkinochoma area, flooding occurred in 2006 and 2009 due to interventions. The causes in these areas are the overflow of

the local streams Marmara, Vryssi, etc. (A11) due to insufficient cleaning and mainly due to man-made interventions in the streams by restricting or removing the bed.

Low zone of the upper Strymon immediately downstream of the border (EL11APSR004)

There is no record of significant historical events in this area.

Low zone of the closed basin of Ochirou (EL11APSR005)

Flood phenomena are located in the closed basin of K. Nevrokopi. Surface water is concentrated in the area of Ochyro where there are sinkholes and the area drains through them to the Maara springs where the River Aggitis starts. The drainage capacity of the sinkholes is not sufficient to receive all the water from the torrents (the main ones being Nevrokopi, Vathytopou and Vrontou) and, in combination with the periodic blockage of the sinkholes by debris, the area upstream of the sinkholes is flooded.

The flooding of fields in the area of Ochyro, in an area of about 6.5 km², is a frequent phenomenon, often lasting more than 10 days, while rarely the settlement of Ochyro is at risk. The phenomenon used to recur almost every year, but with the construction of the Lefkogeia and Kataphytou dams and the improvement of the drainage network in the basin, the situation has improved, although it does not disappear in cases of heavy rainfall. These flooding events are caused by localised storms (A12). The mechanism falls under the category (A21) of natural flooding (flooding of an area by water exceeding the carrying capacity or the ground level). The impact is mainly on economics in the agricultural sector.

Flooding from sea level rise

It is noted that according to the assessment of Potential Sea Level Rise for the assessment of potential flooding from the sea carried out within the 1st Preliminary Assessment of Flood Risks from the Sea (EY, 2014), no SSSIs of HR11 were identified that have a total sea level rise of more than 1 m.

4 HYDROLOGY

For the development of Flood Hazard Maps from river flows, hydrological models and hydraulic models were constructed. Specifically, the following methodological approach was applied:

- **Determination of Watercourses and Water Basins that supply the APSFRs**

The water bodies (rivers, streams, torrents, lakes) and their hydrological basins that supply the identified Flood Risk Management Areas (FRMAs) in the [1st Revision of the Preliminary Flood Risk Assessment](#) (Ministry of Environment and Energy, 2019 – 2nd Edition June 2020) were identified. The process was implemented using Geographic Information Systems (QGIS software) based on the 5x5 digital terrain model developed in the 1st cycle, also utilizing the 2x2 DTM from the Cadastre S.A. of the 1st revision.

For all the Water basins, calculations were made:

- their morphological characteristics,
- the geological features and hydrogeological conditions,
- the soil types with emphasis on their classification based on their permeability,

- land cover - vegetation based on the depiction of land uses according to OPEKEPE (2021) and processed with photo interpretation on orthophotos from ECHGA S.A (2007-2009) and recent satellite images from Sentinel-2 and Google Earth mosaics.

In addition, based on the study data, the existing and planned projects for sediment retention, flood protection, storage, stormwater drainage, and drainage in the water bodies, in the areas within the APSFR.

Hydrological Models - Calculation of flood flows

For the hydrological analysis and the calculation of flood flows, the Hydrologic Modeling System ([HEC-HMS](#)) software, developed by the U.S. Army Corps of Engineers, was used.

Production of flood hydrograms

A mathematical model of runoff rainfall was developed and solved using the HEC-HMS software by following the steps below:

- Shaping of sub-basins and Water basins and construction of a hydrological model. The shaping of hydrological processes is based on a semi-distributed discretization across the entire area of the Water basin within which the DYZKP is developed, where the event-based flood episode approach is applied.
- Generalization of rainfall curve parameters in each sub-basin through surface integration.
- Selection of storm duration (12 hours, 24 hours, 48 hours) depending on the size and concentration time of each basin.
- Calculation of total rainfall height for each sub-basin and conversion of point values to surface values using the surface conversion coefficient.
- Temporal distribution of total rainfall height using the alternating block method (T=50 years, T=100 years) and the method of the most unfavourable arrangement of the precipitation record (T=1000 years).
- Calculation of active rainfall according to the methodology of the U.S. Soil Conservation Service (SCS) based on the CN number. Using land cover and soil type data, maps of the geographical distribution of CN are formed, and then a weighted average curve number is calculated for each sub-basin.
- Estimation of the synthetic unit hydrograph according to the SCS methodology.
- Calculation of the concentration time for each sub-basin using the empirical Giandotti relationship, which is considered the most accurate among available empirical relationships. Additionally, the differentiation of concentration time was calculated according to the return period.
- Consideration of basic runoff.

In the following table it is shown the number of hydrological basins per APSFR and the range of their area for each APRFR separately.

Table 4-1: Statistics for Hydrological Basins per APSFR

APSFR	NUMBER OF CATCHMENTS	MIN AREA OF CATCHMENT (km ²)	MAX AREA OF CATCHMENT (km ²)
EL11APSFR001	4	0.84	346.19
EL11APSFR002	6		
EL11APSFR003	163		
EL11APSFR004	1		
EL11APSFR005	6		
TOTAL	180		

* Note that the design rainfall duration in the Strymon basin is different for the individual sub-basins.

For each sub-basin, the input data of the 3 hydrological scenarios are configured; specifically:

- ❖ the design hyetographs for the three return periods of the rainfall curves are generated;
- ❖ the maximum potential CNII-related detention is estimated, as well as the initial deficits as a 20% percentage thereof;
- ❖ the composite SCS unit hydrographs are generated based on the modified, according to the critical rainfall intensity, concentration time of the sub-basin;
- ❖ baseline runoff is estimated.

The sub-basins' design hydrographs are generated in the HEC-HMS environment, including three components:

- ❖ separation of the hydrological deficits from the overall hyetograph, using the SCS-CN method, to obtain the surface runoff of each sub-basin.
- ❖ transformation of surface runoff into a hydrograph at the sub-basin outlet, by applying the unit hydrograph theory.
- ❖ adding the baseline flow of the sub-basin.

The design hydrographs reach up to the sub-basin outlet confluence point. Obviously, if more sub-basins contribute to a confluence point, then their hydrographs are aggregated. Then, the problem of channelling the runoffs of the sub-basins into the hydrographic network is solved, which in this study is addressed with simplified hydrological approaches.

It is noted that the same process is repeated for all three scenarios under review regarding the average initial soil moisture conditions (average, favourable, unfavourable).

5 HYDRAULIC MODELLING

Hydraulic Models - Flood Routing

- 29 hydraulic models for flood hydrology routing were constructed in the watercourses within the Hydrological Management Districts of the Water Directorate of Eastern Macedonia (EL11), using the HEC-RAS 6.3.1 software from the Hydrologic Engineering Center of the U.S. Army Corps of Engineers.

- The hydraulic analysis, both in-channel and out-of-channel, was conducted using the purely two-dimensional (2D) model of HEC-RAS. Two-dimensional hydraulic analysis is suitable for simulating extensive flood areas, especially in flat terrain where the transverse component of flow velocity is significant, as is the case with most hydraulic analyses of watercourses carried out under the Hydrological Management Plan for rainfall return periods of T=50, 100, and 1000 years.
- For the rendering of the model's geometry, the following were used:
 - New high-resolution Digital Terrain Model (DTM) of the Hellenic Cadastre, with a spatial resolution of 2mX2m horizontally (elevation accuracy $\pm 0.50-0.75\text{m}$). The topographic background was complemented with on-site topographic surveys of profiles and engineering works from the 1st cycle and with new on-site topographic surveys of profiles and engineering works carried out in the 2nd cycle (both in the old and new APSFR) as well as with the design data of the engineering works.
 - The aerial photographs of the Hellenic Cadastre and Google Earth.
 - Available information, plans, studies, and topographic surveys that affect the flow in the areas under examination (embankments, transportation projects, drainage systems, etc.).
 - Available topographic data and digital terrain models at suitable scales (1:5000, 1:1000, etc.).
- For the estimation of the Manning coefficients, a literature review (domestic and international) was conducted on their variation in relation to land covers derived from Corine Land Cover.
- For the solution, flood discharges calculated from the hydrological analysis were introduced as upstream boundary conditions or as lateral inflow, as applicable.
- The time step of the calculations was taken as $\Delta t=1\div 5$ sec, and the option "Variable time step" (adaptive time step Method) was used with a maximum Courant number condition of 1 and a minimum Courant number of 0.5.

It is emphasized that the analysis of the FRM constitutes a macroscopic analysis of river / stream / creek routing, prepared for strategic planning to address flood risks in the broader area, within the framework of developing Flood Risk Management Plans for the country's River Basins in accordance with Directive 2007/60/EC. For this purpose, background data, studies, point and spatial information are utilized at the level required by the scale of a Management Plan and the specifications that accompany it. The **FRM** that have been constructed do not possess the accuracy and detail in hydraulic flood parameters that only the delineation studies of each water course can reveal and cannot be used for the planning and sizing of technical works on water courses.

6 FLOOD HAZARD MAPS

6.1 Flood Scenarios

In accordance with the 1st Revision of the Preliminary Flood Risk Assessment, the hazard maps that were prepared, as in the 1st cycle, address flooding from river overflow.

Flood Hazard Maps from river flows/lakes were prepared for the following hydrological scenarios:

- high probability floods exceeding a 50-year return period,
- medium probability floods exceeding a 100-year return period,

- low probability floods exceeding a 1000-year return period

Two (2) sets of Maps were prepared for all hydrological scenarios:

- a series with the flood extent and the maximum water depths
- a series with the flood extent and the maximum water velocities

6.2 Methodology for Developing Hazard Maps for River Floods

Flood hydrographs were produced at the entrances of the FRMP and at selected intermediate locations of the hydrological network of the study area, using the resolution of mathematical rainfall-runoff models based on the following methodology:

Ombrian (IDF) Curves

For the preparation of the flood hazard maps of the 2nd cycle, the flood discharges were initially calculated based on new ombrian curves that were developed for the entire country. A new relationship of ombrian curves was applied as provided in the project “Production of maps with updated parameters of ombrian curves at the national level (implementation of Directive (EU) 2007/60/EC in Greece)” (Koutsogiannis et al., 2023), which was commissioned by the Ministry of Environment and Energy to the National Technical University of Athens. Within the framework of this project, a consolidation of the parameters of the ombrian curves was carried out across the entire Greek territory. The aim was to produce ombrian curves (intensity-duration-return period relationships of rainfall) or intensity-duration-frequency curves (IDF) for various return periods. For this purpose, updated rainfall data from all Water Districts of the country was utilized.

6.3 Results

The total flooded areas across the entire basin, as depicted in the graph below for all hydrological scenarios and flood sources examined (river flows), do not exceed 800 km² even for the 1000-year return period flood Figure 6-2 (see that follows).

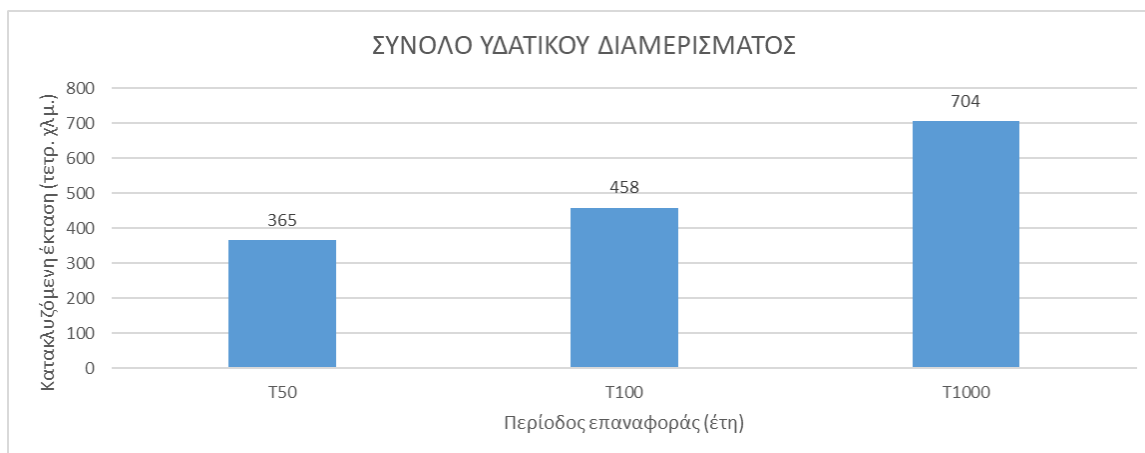


Figure 6-1: Flooded areas for return periods of 50, 100, and 1,000 years

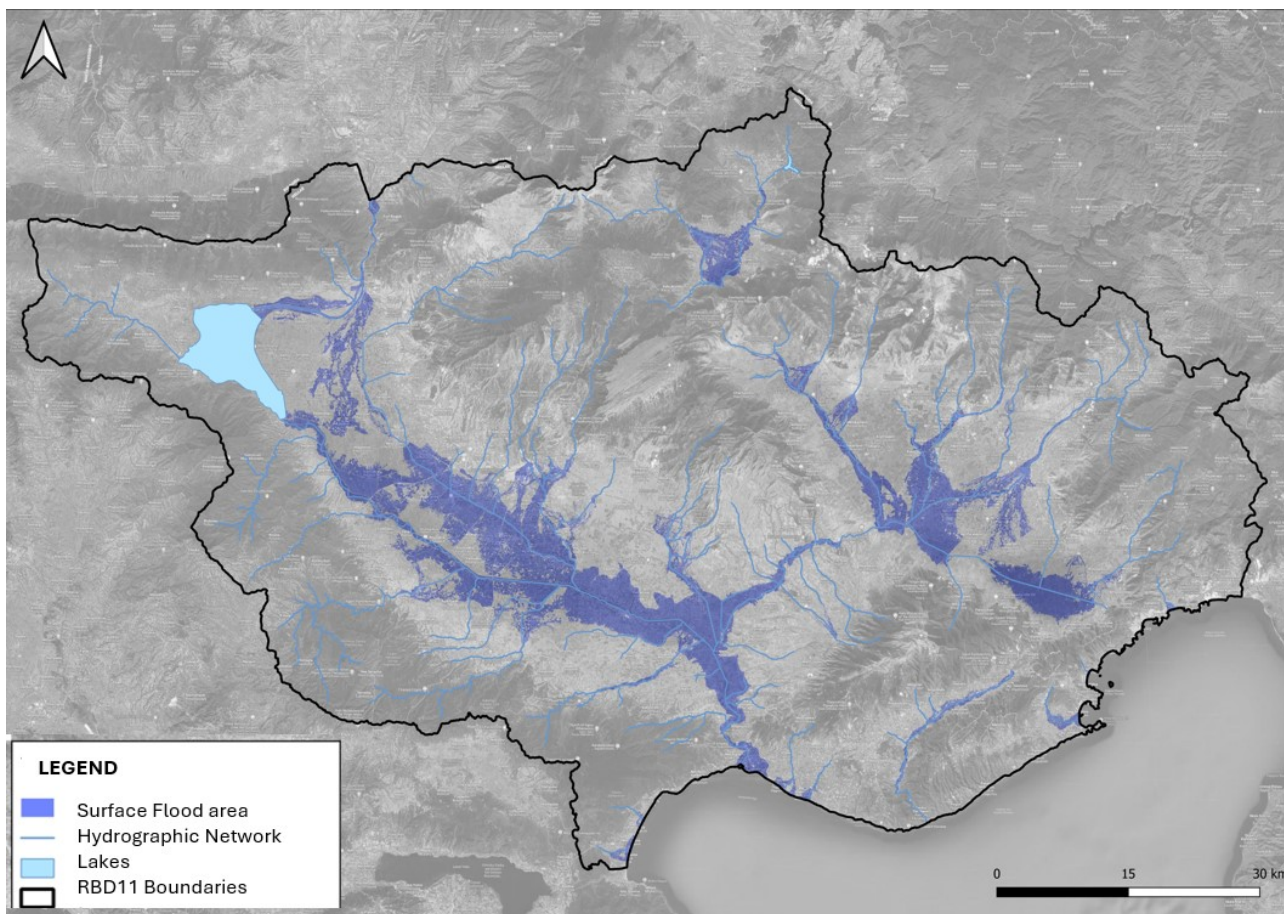


Figure 6-1: Flooded areas in the HYD EL 11 for floods from rivers/lakes with a return period $T=1000$ years.

7 FLOOD RISK MAPS 1ST REVISION OF THE FRMP

7.1 Methodology

For the assessment of flood risk, the following series of maps were prepared:

1. **Flood Risk** Maps that depict settlements, population, land uses, environmental factors, and economic activities located within the inundated areas for all examined flood sources and all probabilities of flood occurrence. The Flood Risk Maps are prepared based on the spatial distribution of flood inundation areas for all examined scenarios. Inundated zones are used as reflected in the Flood Hazard Maps.
2. **Flood Risk Assessment** Maps, where the flood risk within the floodplains depicted in the Flood Hazard Maps is evaluated. The risk assessment is categorized into 5 classes (very low, low, medium, high, and very high).
3. **Vulnerability** Maps to **soil erosion**, which were created for the entire Water District.

According to Article 2 of Directive 2007/60/EC and the Technical Report of Working Group F 'Flood Risk Management, Economics and Decision Making Support, October 2012' (http://ec.europa.eu/environment/water/flood_risk/pdf/WGF_Resource_doc.pdf), "Flood Risk" is

defined as the combination of the probability of a flood occurring and the potential negative consequences for human health, the environment, cultural heritage, and economic activities associated with that flood.

In practical terms, **Flood Risk** consists of four basic structural elements:

- The Probability of the flood
- The Exposure of receptors to risk in a flood with certain characteristics
- The Value of these at-risk receptors and
- The Vulnerability of these receptors

The combination of the first two elements gives of the **Flood (Hazard)**, while the combination of the last three elements expresses the consequences of a flood.

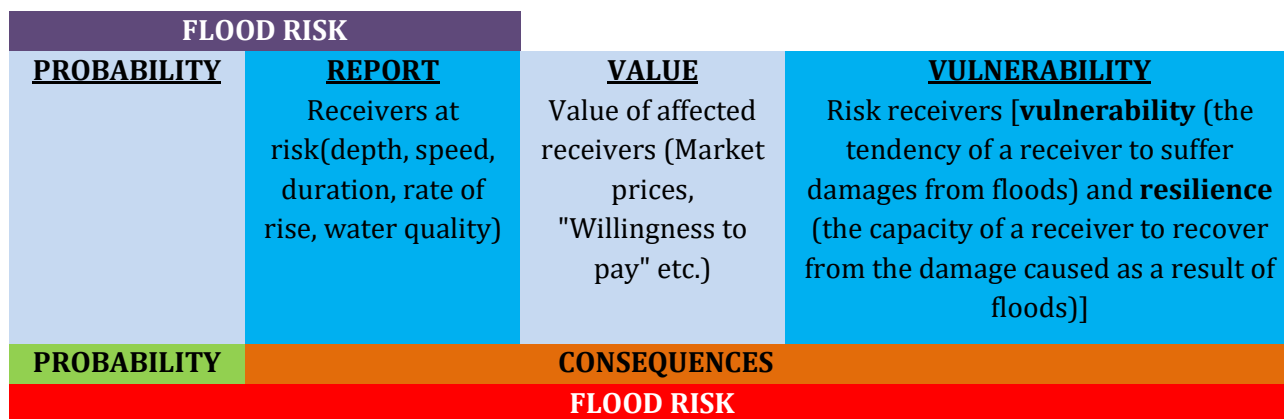


Figure 7-1: Schematic representation of the concept of flood risk (Flood Risk)

Flood Hazard is an indicator of the destructiveness of a specific flooding event. Information regarding the likelihood and exposure is incorporated into Flood Hazard Maps. Generally, the most important characteristics of floods for determining their impacts are flood depth, flow velocity, duration of water retention on inundated areas, and the time period of the flood event's occurrence.

Flood Vulnerability is an indicator of the vulnerability and resilience of people, infrastructure, economic activities, the environment, and cultural heritage within the flood zone. It depends on land use within the inundation zone.

Flood Risk (the impacts from flooding) arises from the product of the Vulnerability and Hazard indicators.







The assessment of risk in the 1st revision of the Flood Risk Management Plans, as well as in the 1st cycle of implementation of the Directive, is carried out by following the steps:

- Step 1^o : assessment of the **maximum potential impacts** from flooding
- Step 2^o: assessment of the **degree of influence** of return period p flooding, depending on the flood Hazard (intensity of natural phenomenon), as reflected in the Flood Hazard Maps.
- Step 3 : assessment of the Flood Impacts (**Flood Risk Assessment**) from the combination of maximum potential impact (vulnerability of uses) and the degree of influence of flooding.

For the assessment of flood impacts (Flood Risk Assessment), 5 classes of Risk scoring are defined with the following color gradation:

Possible impact	Risk category
<50	very low
50-125	low
125-200	average
200-4000	high
>400	very high

The **Vulnerability to soil erosion** illustrates the soil loss in t/ha in the YD, as a result of applying the RUSLE soil erosion model. The soil loss is divided into five classes using the following color scale :

	Χωρίς εδαφική απώλεια (SE = 0)
	Πολύ χαμηλή (0 < SE ≤ 5)
	Χαμηλή (5 < SE ≤ 10)
	Μέτρια (10 < SE ≤ 20)
	Υψηλή (20 < SE ≤ 50)
	Πολύ υψηλή (SE > 50)

The vulnerability map for soil erosion does not correspond to a specific return period, pertains to the entire Water District, and has been prepared at a scale of 1:400.000.

7.2 Assessment of the Impacts of the Flood (Flood Risk)

The table and the graph that follow show the areas that are flooded (surface area in km²) in the entire water district EL11 based on the Flood Risk class (Flood Impact class) for each flood scenario examined.

Table 7.1: Flooded areas by Flood Risk Class (Flood Impact Class) and by the examined scenario in the entire River Basin.

Total Water Resources of Eastern Macedonia EL11					
Flood Scenario	Flooded Area (km ²)				
	Very Low	Low	Moderate	High	Very High
T50	126.2	175.8	48.7	14.5	0.9
T100	152.4	235.7	56.4	19.2	1.2
T1000	177.3	385.2	109.0	34.0	4.6

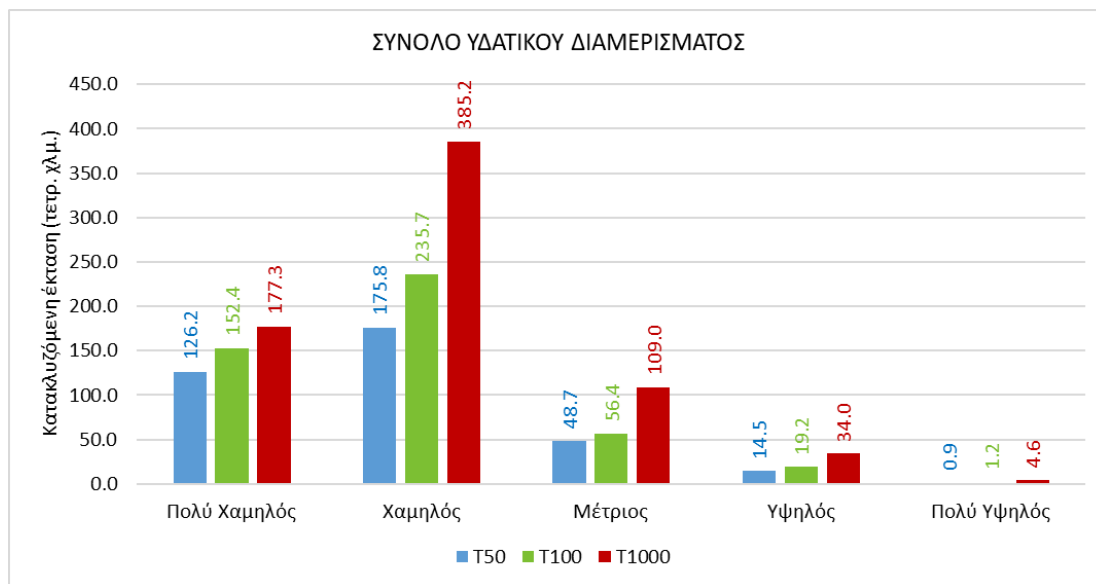


Figure 7-2: Flooded areas classified by Flood Risk Class (Flood Impact Class) and by the examined scenario (total Water Body EL11)

In total, at the level of the Water District, the assessment of flood risk is as follows:

- The area inundated by river flow flooding, for a return period **T=50 years**, within the boundaries of the FRMP of the water district EL11, amounts to 364.61 km². In the inundation area, 34.5% is characterized by very low risk, 48% by low risk, 13.3% by medium risk, 4% by high risk, and 0.3% by very high risk. 82.5% of the inundated area is characterized by low and very low risk. The high risk is primarily found in the municipalities of Amphipolis (26.84%), Nea Zichni (19.75%), Paggaiio (13.31%), and Serres (11.17%), where the reported percentages refer to the total area with **high flood risk** in the water district EL11 for T50. The very high risk is mainly found in the municipalities of Serres (67.47%) and Amphipolis (29.89%), where the reported percentages refer to the total area with a **very high flood risk** in the water district EL11 for T50.
- The size of the area affected by flooding from river flows, with a return period of **T=100 years**, within the river basin management area EL11, amounts to 458.44 km². In the flooded area, 32.8% is characterized by very low risk, 50.7% by low risk, 12.1% by moderate risk, 4.1% by high risk, and 0.3% by very high risk. 83.5% of the flooded area is characterized by low and very low risk. High risk primarily occurs in the municipalities of Amfipolis (27.02%), Pangaiou (16.53%), Serron (15.37%), and Nea Zichni (13.79%) as a percentage of the total area with **high flood risk** in the river basin EL11 for T100. **Very high risk** primarily occurs in the municipalities of Serron (58.86%) and Amfipolis (29.35%) as a percentage of the total area with very high risk for T100.
- For a return period **T=1000 years**, the flooded area within the APSFR of the hydrological district EL11, from river flows, is 704.39 km². In the flooded area, 25% is characterized by very low risk, 54.2% by low risk, 15.3% by moderate risk, 4.8% by high risk, and 0.3% by very high risk. 79.2% of the flooded area is characterized by low and very low risk. High risk is primarily found in the municipalities of Amphipolis (22.91%), Serres (16.87%), Nea Zichni (16.01%), and Paggaiio

(12.47%) as a percentage of the total area with **high flood risk** in the hydrological district EL11 for T1000. Very high risk is primarily found in the municipalities of Serres (45.81%), Paggiao (12.79%), and Drama (11.67%) as a percentage of the total area with **very high flood risk** in the hydrological district EL11 for T1000.

7.3 Vulnerability assessment in soil erosion

Based on the vulnerability analysis to soil erosion, in Groundwater Body EL11, it is concluded that:

- **For APSFR EL11APSFR001**, over much of the zone soil-erosion estimation is not feasible because, toward the coastal front, values for several controlling factors are missing—most extensively for the K factor. In reality, soil loss here is classified predominantly as very low. Within the zone, and in upstream areas, where calculation is possible, soil loss remains low. In isolated areas with steeper topography, higher values occur on lateral gullies or alluvial cones. Upstream catchments draining into this APSFR, also exhibit low soil-loss values, with locally elevated spots. Areas prone to increased transport of sediments or solids transport are identified:
 - At the settlement of Vrasna, where the Xerolaki stream crosses the northern sector, conveying soil losses from its upland reaches.
 - North of the settlement of Asprovalta, along the Serres Coast, where the Lakkos Varnava stream, can similarly transport significant sediment loads.
- **For APSFR EL11APSFR002**, much of the zone, likewise, lacks erosion estimates toward the coast due to lack of data for multiple influencing factors, again with the K factor value missing over most of the area. Practically, soil loss in this APSFR is categorized mainly as very low. Where computations are possible—within the zone and upstream—no significant erosion issues emerge, and soil loss remains overwhelmingly very low. Only in the western sector, specifically between settlements of Elaiochori and Eleftheres, does soil-loss variability increase, due to pronounced topography. In each sub-section of APSFR EL11APSFR002, areas of increased sediment load or solids transport, coincide with inflowing tributaries that traverse the zone.
- **For APSFR EL11APSFR003**, most of its surface exhibits very low soil loss. At the boundaries of the APSFR, the highest soil-loss coefficients prevail, and small patches of low to moderate loss are locally present. Upstream catchments draining into the zone predominantly show low values, though in discrete, confined areas—especially in mountainous blocks—high soil-loss values appear. Based on this spatial distribution and the local hydrographic network, areas of elevated sediment load or solids transport, are identified:
 - a. Downstream of Lake Kerkini to the Strymonas River,
 - b. On the eastern margin of the Serres plain to the Belitsa canal,
 - c. In the Prosotsani–Megalokampos sub-basin, and
 - d. In the Drama–Philippon sub-basin.

- **For APSFR EL11APSFR004**, most of the surface is characterized by low to moderate, soil loss. Locally, values fluctuate up to very high, reflecting surface-runoff incision patterns—most intensely in the southeastern sector. Upstream catchments draining into this APSFR, register very low soil loss, except for the upland area, east of the zone on Mount Agistro, where increased values are driven mainly by topography (SL) and surface cover–management (C) factors. Areas prone to elevated residual-sediment transport or solids flow occur:
 - East of the zone, at the settlement of Agistro, and
 - West of the APSFR, from Promachonas to Koulas narrow passage, where sediment discharge originates from the transboundary Strymonas headwaters, in Bulgaria.
- **For APSFR EL11APSFR005**, soil loss is generally classified as very low, with higher values recorded mainly around the perimeter, at the margins of upland blocks terminating within the zone. Across the overall area, little variability in soil loss is observed. Upstream catchments draining into the zone show generally low soil loss, with isolated high-value spots at alluvial-cone sites and fluvial-terrace deposits. A notable high value, occurs locally, on the eastern slopes of Mount Orvilos. An area likely to experience increased transport of sediment transport or solids flow is the sector drained by the Vathitopos River, whose loads derive from the eastern flanks of Mount Orvilos.

8 INVESTIGATION OF CLIMATE CHANGE 1ST REVISION OF the FRMP

The impact of climate change on flood risk assessment is done through determining the influence of climate change on the frequency of flood events. The expected change of frequency is identified for flood magnitudes corresponding to actual return periods of $T=50$ years, $T=100$ years, and $T=1000$ years, considering the climate projection scenario RCP4.5 for two future periods: (a) 2041-2070 and (b) 2071-2100.

As part of the preparation of Flood Inundation Maps for the Water District (RBD) of Eastern Macedonia (EL11), Tables 8-1 and 8-1 provide the change in the average return period of the River Basin Drainage Areas (RBDA) of RBD EL11 during future periods from 01-01-2041 to 31-12-2070 (2050s) and from 01-01-2071 to 31-12-2100 (2080s), respectively, regarding rainfall events that in the current period correspond to return periods $T = x$, where $x = 50, 100$, and 1000 years.

Table 8-1: Change in the mean return periods of the R.B. for the climate period from 01-01-2041 to 31-12-2070 (2050s), for rainfall events that during the current period correspond to return periods of T = 50, 100, and 1000 years.

α/α	RB	$T^{hist.750}$ (2050s)	$T^{hist.7100}$ (2050s)	$T^{hist.71000}$ (2050s)
1	STRYMON	31	63	933

Table 8-2: Change in the mean return periods of the R.B. for the climate period from 01-01-2071 to 31-12-2100 (2080s), for rainfall events that during the current period correspond to return periods of T = 50, 100, and 1000 years.

α/α	RB	$T^{hist.750}$ (2080s)	$T^{hist.7100}$ (2080s)	$T^{hist.71000}$ (2080s)
1	STRYMON	24	44	618

9 DIFFERENTIATIONS FROM THE 1st FRMP

The differences in the revision of the River Basin Management Plan (RBMP) from the 1st implementation cycle of Directive 2007/60/EC include:

1. Revision of all Flood Risk Maps of the 1st RBMP considering:
 - new flood hydrographs that were prepared as part of the 1st revision of the RBMP based on:
 - (a) new ombrian curves developed at the national level (YPEN 2023, Production of maps with the updated parameters of ombrian curves at the national level - implementation of EU Directive 2007/60/EC in Greece, NTUA)
 - (b) new CN values calculated within the framework of this review.
 - (c) the revision of the hydrological models of the 1st cycle conducted across all Greek watersheds
 - (d) the new data collected on flood inflows to the Strymon River from Bulgaria.
 - The new Digital Elevation Model developed based on the Digital Elevation Model (DEM) of the Greek Cadastre with a resolution of 2m X 2m horizontally for the needs of the 1st Revision of Flood Risk Management Plans (FRMP) within the implementation of Measures of the 1st cycle of the FRMP. Specifically, the new DEM pertains to the "Production of a High-Resolution and Precision Digital Elevation Model in Areas with Mild Topography as well as in Zones of High and Very High Risk".
 - The revision of the Maps is done for two-dimensional (2D) flow simulation using the HEC-RAS 6.3.1 software from the Hydrologic Engineering Center of the U.S. Army Corps of Engineers. It is noted that in the 1st cycle of application of Directive 2007/60/EC in the River Basin EL11, the two-dimensional flood routing model FLO-2D Pro of the Federal Emergency Management Agency (FEMA) was used, applying one-dimensional analysis (along the flow of the river) and two-dimensional analysis (outside the riverbed and over the floodplain).

2. Preparation of Flood Hazard Maps for the new flood-prone zones identified in the revision of the Preliminary Flood Risk Assessment.
3. Review of all Flood Risk Maps from the first cycle based on:
 - The new River Basin Management Plans (RBMPs) that were constructed in the 1st Revision (RBMPs from river flows)
 - The updated data regarding the population, land uses, and economic activities that could potentially be affected.
 - The updated data regarding the Water Bodies of Directive 2000/60/EC and the pressures as they emerge from the 2nd revision of the Flood Risk Management Plan of the Eastern Macedonia Water Directorate.
 - Construction of Flood Risk Maps for the new Flood Risk Management Zones identified in the revision of the Preliminary Flood Risk Assessment. The methodology of the 1st cycle is followed for the preparation of the FRMPs and the assessment of flood risk.
4. Specialization of the Objectives of the Flood Risk Management Plan
5. Updating the Action Program based on the progress of the implementation of the measures of the 1st Flood Risk Management Plan and based on the revised flood risk management objectives.

10 PUBLIC CONSULTATION OF THE 1ST AMENDMENT OF the FRMP

10.1 Public consultation Procedure

To inform the public and the Bodies and Institutions involved, a sufficient number of meetings were organized where the Draft Flood Risk Management Plans were published for consultation. The consultations were held both at local/regional level and at central level and aimed on the one hand at the active participation of involved parties either by attending the events or by submitting proposals on the issues in consultation.

During the implementation of the consultation and communication actions, the following was carried out:

- In the first 4 months, onsite visits to the study area were organised along with meetings with institutions and services and a report was submitted on the special areas outside the Areas of Potentially Significant Flood Risk.
- Subsequently, the Flood Hazard Maps and the corresponding accompanying Technical and Non-Technical Reports were posted on the website of the GDW of the Ministry of Environment and Energy: (<https://floods.ypeka.gr/sdkp-lap/maps-2round/sdkp-el11-2round/2round-chartes-epikin-esot-ydata-el11/>)
- Then, the Flood Risk Maps and the corresponding accompanying Technical and Non-Technical Reports were posted on the website of the GDW of the Ministry of Environment and Energy: (<https://floods.ypeka.gr/sdkp-lap/maps-2round/sdkp-el11-2round/2round-chartes-kindin-el11/>)

- The Draft Flood Risk Management Plans and the Strategic Environmental Assessments (SEA) were posted on the website of the GDW of the Ministry of Environment and Energy <https://floods.ypeka.gr/consultation/2round-consultation/>.
- A form for submitting remarks and corrections to the Draft was posted on the website of the GDW of the Ministry of Environment and Energy <https://floods.ypeka.gr/2round-consultation-el11/>.
- The Invitation and Agenda of the Consultation Day in Komotini on the 1st Review of the FRMP of the Eastern Macedonia River Basin District (EL11) were posted (<https://floods.ypeka.gr/consultation/consultation-events/>).
- The List of Social Partners for the 1st Review of the FRMP of the Eastern Macedonia River Basin District (EL11) was posted.
- Questionnaires were posted whereby stakeholders and the public could participate in the consultation, briefly expressing their views. The questionnaires were digital and available via the website of the Ministry of Environment and Energy (<https://floods.ypeka.gr/consultation/consultation-events/>). The questionnaire is also included in the Documentation text : "Report on the Consultation Results".

On Wednesday July 3rd 2024, a Consultation Day was held in Serres for the 1st Review of the FRMP of the Eastern Macedonia River Basin District (EL11) and the following was provided in printed and/or electronic form:

- ✓ Brief Draft Flood Risk Management Plan for Eastern Macedonia River Basin District.
- ✓ Questionnaire on the consultation issues of the Eastern Macedonia RBD.

The Consultation Day in Serres, Komotini was a hybrid event, with more than 142 people (38 in-person και 104 remotely), participating both in-person and remotely via live or video broadcast. ,
(https://www.youtube.com/live/tjppLW_7eQU

Overall, the consultation for both the Draft Flood Risk Management Plan and the SEA of the 1st Review of the Flood Risk Management Plan for the RBD Eastern Macedonia (EL11) lasted for more than 7 months.

The public consultation process of the 1st Revision of the FRMP of the Eastern Macedonia Water Directorate aims to inform and actively involve the stakeholders – the public and organizations – either through attendance at the organized events or through submitting their proposals on the topics up for consultation. During the implementation of the consultation and communication activities, some or all of the following actions are carried out in combination:

- Meetings with agencies and services
- Submission of inspection reports for the special areas outside Potentially High Flood Risk Zones. In the RBD11, no areas outside APSFR were identified that required inspection.
- Then, on the site of the General Directorate for Energy of the Ministry of Environment and Energy: <https://floods.ypeka.gr/> posted
 - ✓ The Flood Hazard Maps and the corresponding Technical and Non-Technical Reports that accompanied them.

- ✓ the Flood Risk Maps and the corresponding Technical and Non-Technical Reports that accompanied them
- ✓ the Draft Flood Risk Management Plans
- ✓ the form for recording comments on the Drafts
- ✓ The List of Social Partners for the 1st Revision of the FRMP of the RBD.
- ✓ The Invitation and the Program for the Consultation Day.
- Implementation of a Consultation Workshop for the 1st Revision of the FRMP of the Eastern Macedonia Water District (EL11) in Serres, on July 3, 2024, with distributed consultation material:
 - ✓ Summary Draft of Flood Risk Management for the RBD of Eastern Macedonia
 - ✓ Questionnaire on the consultation issues of the Eastern Macedonia RBD.

Upon completion of the consultation, its results are reflected in a special report that will be prepared, and any discrepancies that may arise will be incorporated into the final Flood Risk Management Plan, where necessary.

10.2 Consultation Bodies

In the consultation process, all those who influence the flow of surface water in the Eastern Macedonia Water District or are affected by flooding are invited to participate.

The list of social partners of the Eastern Macedonia River Basin District who were informed about the consultation of the 1st Review of the Flood Risk Management Plan, includes **1041** bodies, at National, Regional and Local level. Of all the bodies identified, **316** are **decision-making bodies**, **57** are **management bodies**, **60** are **Experts / Specialists**, **14** are **Flood Response Bodies**, **40** are **Users/Consumers** and **554** are **Media - News agencies**.

10.3 Results of the Consultation on the 1st Revision of the Flood Management Plan

During the consultation, interventions were made that were either discussed orally during the Workshop, and/or submitted in writing to the GDW, and/or on the website. Among others, the following topics were discussed:

- The need to support the bodies implementing the measures for application of the FRMP, as well as a meaningful assessment of the overall implementation progress of the FRMP.
- The need to coordinate the authorities and services involved in the implementation of the programme of measures.
- The need to prioritize flood defences in the context of MASTER PLANS, prioritising environmentally friendly projects, natural water retention projects and mountain water management.
- Reservations regarding the ability of the Implementing Bodies to immediately take prevention and protection actions for Rural Development.

- The need for the construction of flood defences to be implemented in a way that causes minimum environmental impact,
- The need to update mountain and lowland bed boundaries
- The need to draw up specifications (a) for clearing watercourses, and (b) for natural water retention measures in the lowlands,
- Confirmation of the need to implement land use management measures in the torrential drainage basins,
- The need to accelerate the licensing procedures that will allow the maintenance and restoration of existing training structures and flood defences and coordination of the competent bodies to identify structures in need of interventions and prioritise them.
- Confirmation of the need to identify the sites of sedimentation basins for the (temporary or permanent) deposition of sediments, to enable the performance of restoration works after flooding events (which are usually urgent) with as few obstacles as possible.
- The usefulness of locating and recording the existing pumping units and assessing their operation status.
- The need to implement a forest engineering system for mountain water management structures and to assess and maintain existing such structures,
- The need to exploit existing and new reservoirs and contain floodwater flows,
- Highlighting the flood protection, environmental and economic importance of Lake Kerkini for the region, and the need for special care in the management of structures (embankments, gates) and establishing rules for the operation of the lake

In conclusion, the opinions and comments received during the consultation of the Flood Risk Management Plan, resulted in small wording adjustments, the incorporation of institutional texts that had been omitted by mistake, and the re-wording of the measures and the competent implementing bodies incorporated in this 1st Review of the FRMP of the Eastern Macedonia River Basin District.

11 PROGRAM OF MEASURES OF THE 1ST REVISION OF THE FRMP OF RBD11

11.1 GOALS OF THE 1ST REVIEW OF THE FRMP

Considering the provisions of Directive 2007/60/EC and the Guidance Documents, as well as the results of the RBMPs and RBMPs, four (4) General Objectives were established in the 1st RBMP, common to all Water Districts of the country, as follows:

General Objectives of the 1st SDRP:

- Mitigation of flood exposure (Management Objective 01)
- Reduction of flood probability (Management Objective 02)
- Strengthening flood preparedness (Management Objective 03)
- Improving recovery mechanisms in affected areas (Management Objective 04)

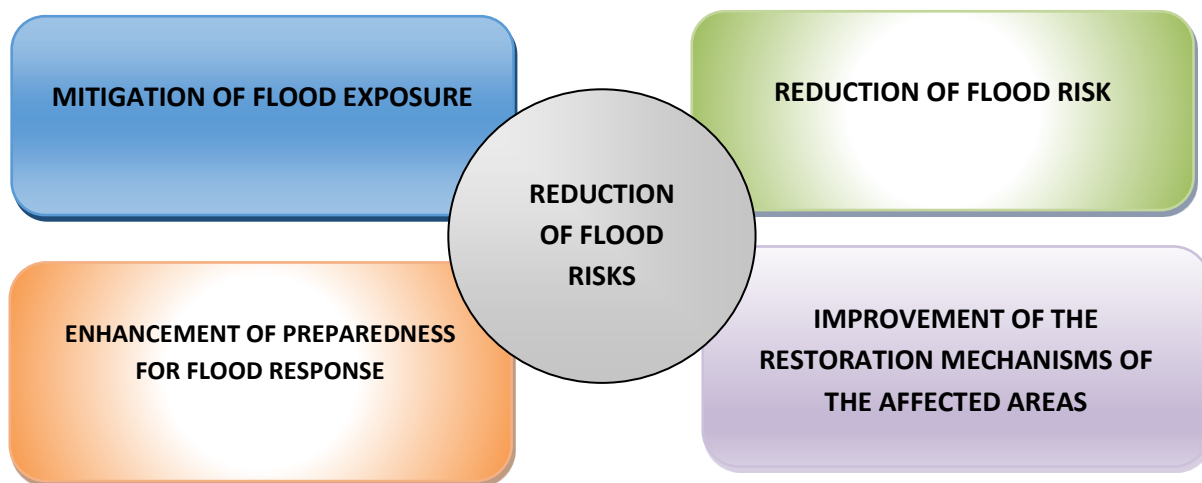


Figure 11-1: General Objectives of Flood Risk Management

The above General Objectives of the 1st Flood Risk Management Plan correspond to the four axes of actions of Flood Risk Management (Prevention, Protection, Preparedness, Rehabilitation) and are of a strategic nature with the aim of establishing a common understanding and policy on issues related to addressing flood risks.

In this 2nd cycle of the RPMP, the above General Objectives are maintained, in accordance with the provisions of Directive 2007/60/EC and the Guiding Documents. Furthermore, the four General Objectives are specialized into Specific Objectives, in order to identify, differentiate and explain the individual objectives that together will effectively cover the achievement of each general objective, in correlation with both the axes of the drawn up programme of measures and the proposed measures.

For each General Objective, three (3) Specific Objectives were defined as shown below.

To achieve General Objective **01** to mitigate the flood exposure of human health, the environment, cultural heritage and economic activities, the following specific objectives are set:

- O1.1: Organizing and improving the available information through the implementation of actions and measures for acquisition and completion, such as the creation of flood event registers and technical data for flood protection projects and demarcations, for the optimal monitoring of the Program of Measures of the RDMP.
- O1.2: Improving the level of knowledge of flood prevention through the implementation of actions and measures for training/information, modernization and organization of the meteorological and Hydrometric data network.
- O1.3: Adoption of appropriate conditions and restrictions, which will be put in agreement with the RPMP through the implementation of actions and measures, for spatial and urban planning, the relocation of activities and the protection of critical infrastructure, through appropriate legislative/administrative regulations.

In order to achieve General Objective **02** to reduce the probability of flooding and by extension increase the level of protection of human health, environment, cultural heritage and economic activities, the following specific objectives are defined:

02.1: Reduction of flood risk through natural water retention by implementing environmental actions and measures for the containment, shaping and management of the floodplain of watercourses.

02.2: Reducing flood risk by other means through the implementation of actions and measures for the development of reservoir projects, modernization, rehabilitation and construction of drainage networks, rainwater management and flood protection projects

02.3: Strengthening flood risk management practices at the protection stage through the implementation of actions and measures, strategic planning of flood protection and stormwater projects and, at the same time, through the promotion of natural containment or controlled flooding solutions to improve runoff management through appropriate legislative/administrative regulations

To achieve General Objective **03** to enhance flood preparedness and mitigate the impacts of flooding on human health, the environment, cultural heritage and economic activities, the following specific objectives are set:

03.1: Increasing the level of preparedness against flood risk through the implementation of actions and measures to develop early warning tools for floods and the organization and licensing of embankment restoration/maintenance actions.

03.2: **Improving the level of flood preparedness awareness through the implementation of non-structural interventions, actions and measures to educate/inform and raise awareness among the public and stakeholders, actions to determine in advance the alert limits and the marking/warning of areas at risk during flooding.**

03.3: **Strengthening flood risk management practices at the preparedness stage through the implementation of actions and measures for the preparation of action plans and regulations for the organization and, through appropriate non-structural interventions and legislative/administrative regulations.**

To achieve General Objective **04** for improvement of the recovery mechanisms of affected areas (people, environment, cultural heritage and economic activities), the following specific objectives are defined:

04.1: **Improvement of the mechanism for compensation valuation after a flood through the implementation of actions and measures of an economic and legislative/administrative nature to regulate actions and responsibilities for recording damage.**

04.2: **Improving the preparation of restoration works through the implementation of environmental actions and measures to determine methods and emergency restoration actions after flood events.**

04.3: Improving the recovery mechanism through the implementation of actions and measures of an economic and legislative/administrative nature to support those affected after flood events.

To achieve the **Objectives**, the revised MSDP includes a comprehensive Program of Measures as presented in the next section. The proposed program of measures is structured so that the measures of the revised MSDP correspond to specific objectives. **Thus, the achievement of the objectives can be quantified by measuring the implementation percentage (%) of the proposed Measures per category (Prevention, Protection, Preparedness, Rehabilitation).**

11.2 Preliminary Assessment of Measures

To achieve the flood risk management objectives, as revised in the context of the 1st Revision of the Flood Risk Management Plan, a superset, a "reservoir", of 40 meters, common to all the country's flood risk management areas, was established.

Within the framework of the 1st Rev. FRMP, to formulate the program of measures to manage and address flood risks in each MS, a Preliminary Assessment of the entire set of measures examined at the country level was carried out with the help of a unified multi-criteria analysis methodology.

The criteria used to evaluate the measures are effectiveness, technical feasibility, economic feasibility, social and environmental acceptance, existing maturity, synergies with other measures and objectives and synergies with RBMPs.

This evaluation for the EL11 Project led to the results summarized in the table below. In total, 31 measures qualified, while 9 measures were excluded for the following reasons:

- 6 measures were completed,
- 3 measures were continued by other measures,

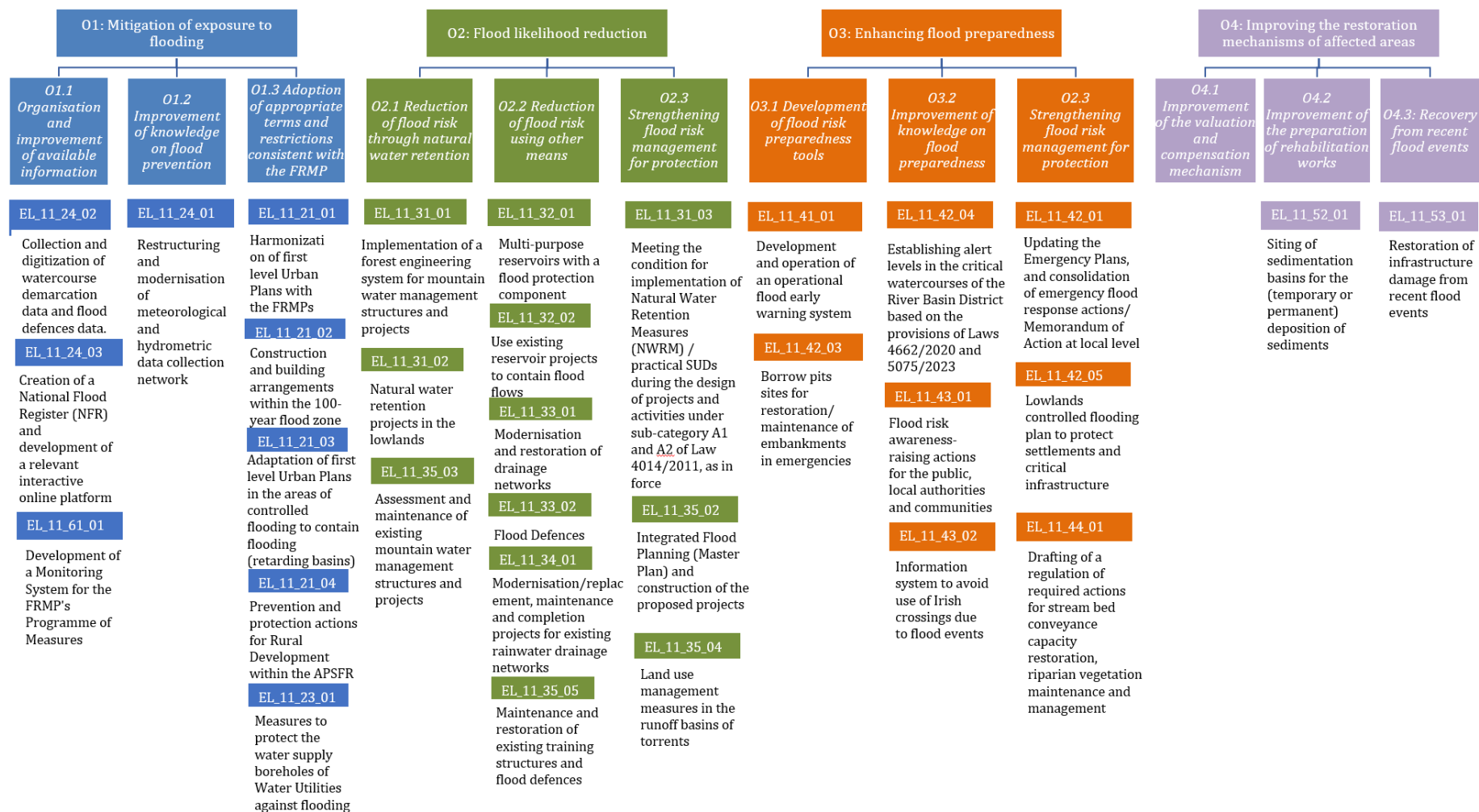
The measures that qualified are analyzed in the next section.

11.3 Measures of the 1st revision of the FRMP of RBD11

The measures that qualified for the EL11 project are summarized in the diagram and table below.

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The Presentation of the program of measures on the 1st Review FRMP is conducted according to the Special Measures Description Form.

Table 11-1: Special Measures Description Form

MEASURE TITLE	Includes the title of the measure
MEASURE CODE	The measures are numbered as follows: EL_XX (RBD number) XX (Measure Type according to WISE) _XX (Measure serial number)
CORRELATION WITH A MEASURE FROM THE FIRST CYCLE	Ongoing from the 1 st Plan or New Measure
LINE OF ACTION	Prevention, Protection, Preparedness, Restoration
GENERAL OBJECTIVE	The FRM General Objective to which the measure relates (01, 02, 03, 04)
TYPE OF FRM MEASURE	The FRM type code of the measure and its description
TYPE OF NATURAL WATER RETENTION MEASURE	The code number of the Natural Water Retention measure type and its description according to the Text "EU policy document on Natural Water Retention Measures, Technical Report", WFD CIS Working Group Programme of Measures (WG PoM), 2014 and the Catalogue of NWRM / Natural Water Retention Measures
SPECIFIC OBJECTIVE	The FRM Specific Objective to which the measure refers (01.1, 01.2, 01.3, 02.1, 02.2, 02.3, 03.1, 03.2, 03.3, 04.1, 04.2, 04.3)
TYPE OF MEASURE	<p>Legislative/ Administrative arrangements</p> <p>Measures of an economic nature</p> <p>Education/information measures</p> <p>Non-structural interventions</p> <p>Obtaining, supplementing and improving information</p> <p>Environmental measures (green infrastructure)</p> <p>Technical Flood Defences</p>
MEASURE DESCRIPTION	A detailed description of the measure
IMPLEMENTING BODIES	Reference to the Competent Authority responsible for the implementation, application and coordination of the proposed measure at national, regional, local level as well as to the other bodies involved in its implementation
AREA OF APPLICATION OF THE MEASURE	River Basin District, APSFR, Runoff Basin, Water Body, place, etc.

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MEASURE TITLE	Includes the title of the measure
MEASURE APPLICATION MONITORING INDICATOR	Varies by measure
TARGET VALUE	Varies by measure
MEASURE AREA OF IMPACT	River Basin District, APSFR, Runoff Basin, Water Body, place, etc.
MEASURE IMPACT MONITORING INDICATOR	Varies by measure
TARGET VALUE	Varies by measure
RESILIENCE TO CLIMATE CHANGE¹	The resilience of the Measure to climate change conditions. Performance is assessed as Critical, High, Medium, Low.
CORRELATION WITH CLIMATE CHANGE TARGETS AND MEASURES	The correlation of each Measure with the targets and actions of the National Climate Change Adaptation Strategy (NCCCA 2016), the EASTERN MACEDONIA AND THRACE Regional Plan for Climate Change Adaptation (2023), the Climate Law and the EU Specifications.
CORRELATION WITH RBMP OBJECTIVES AND MEASURES	Notes on how the measure relates with the objectives and measures of the RBMP
IMPLEMENTATION PHASE	<ul style="list-style-type: none"> • Maturity • No tender • To be implemented • In a tendering or procurement procedure • Implementation
IMPLEMENTATION DURATION	<p>Short-term : 0-2 years</p> <p>Medium-term : 2 - 6 years</p> <p>Long-term : > 6 years</p>

¹ Climate resilience is defined as "The ability of interrelated social, economic and ecological systems to address a dangerous event or trend or disruption, through their response or reorganization in ways that maintain their main function, identity and structure" [PROVISIONAL FRAMEWORK FOR THE ASSESSMENT OF CLIMATE RESILIENCE OF INFRASTRUCTURE PROJECTS SUBMITTED FOR CO-FINANCING IN THE NSRF 2021 – 2027 PROGRAMMES, National Coordination Authority, General Secretariat of Public Investments & NSRF, Ministry of Development & Investments, December 2022.

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MEASURE TITLE	Includes the title of the measure
PROPOSED IMPLEMENTATION TIMELINE (MILESTONES)	<ul style="list-style-type: none"> • Preparation and issuance of regulatory decision (for legislative arrangements): 6 to 12 months • Planning and implementation of educational actions : 12 to 24 months • Project dossier preparation, technical sheets and inclusion in a financing instrument – securing funding: 12 months • Tender procedure for contract award: 12 months • Preparation of designs, procurement, development of registers/systems and other plans. Varies by measure. • Licensing (if required) : 12 to 24 months • Project dossier preparation, technical sheets and inclusion in a financing instrument- securing funding for construction projects: 12 months • Tender procedure for construction project contract award: 12 months • Construction project implementation: Varies by measure.
PRIORITY RANKING ORDER	The ranking of the measure's priority based on the results of the assessment of its economic effectiveness.
ESTIMATED COST	An estimate of the cost of the measure
INDICATIVE FINANCING INSTRUMENT	The agencies/programmes that may be financing sources for the

The Flood Risk Management Plan concerns Areas of Potential High Flood Risk and is drawn up based on the results of the Flood Hazard and Risk Maps.

The following may be financed, upon submission of a documented proposal to the financial instrument projects and actions of the FRMP Measures Program in areas that do not belong to the Potentially High Flood Risk Zones of the Preliminary Flood Risk Assessment, but where a very large flood event and/or a significant forest fire has occurred in and/or downstream/upstream of these areas, provided that the compatibility of the projects/ actions with the objectives of Directive 2007/60/EC on the assessment and management of flood risks and no conditions are created that are contrary to the relevant Flood Risk Management Plan and the provisions of its Action Program.

Indicative Documentation of the Necessity of the Measure:

The necessity of adopting and implementing the measure is documented in accordance with current developments in flood risk management, as well as flood risk and climate change calculations within the framework of the present FRMP.

11.4 Specialization of the program of measures for the FRMP of the Eastern Macedonia Water District (EL11)

The Flood Risk Management Plan concerns areas that are potentially at high risk of flooding and is prepared based on the results of the Flood Hazard and Risk Maps. Projects and actions of the Measures Program of the Flood Risk Management Plan can be funded by submitting a documented proposal to the funding tool for areas that do not belong to the Potentially High Flood Risk Areas of the Preliminary Flood Risk Assessment, but where a significant flooding event and/or a major forest fire has occurred in and/or upstream/downstream of these areas, provided that the compatibility of the projects/actions with the objectives of Directive 2007/60/EC on the assessment and management of flood risks is ensured and that conditions contrary to the relevant Flood Risk Management Plan and the provisions of its Measures Program are not created

During implementation of the 1st Review of the FRMP for the Thrace River Basin District (EL11), the Programme of Measures became considerable more specific, with more detailed proposals for projects and measures at RBD or APSFR level. Apart from the requirements of Directive 2007/60 and the General and Specific Objectives of the 1st Review on the reduction of flood risks, this specification also considered other flood protection plans and studies implemented in RBD EL11.

The measures of the program are summarized below, accompanied by a brief description. The detailed description of all 31 measures of the Measures of the EL11 RBD and related information, including area of application and specific provisions per APSFR, can be found in the relative chapter of the FRMP.

Table 11-2: Relation of measures RBD11 to spatial application level

MEASURE CODE	MEASURE TITLE	Responsible Authority	RBD	EL11APSFR001	EL11APSFR002	EL11APSFR003	EL11APSFR004	EL11APSFR005
EL_11_61_01	Development of a Monitoring System for the FRMP's Programme of Measures	MACEDONIA THRACE DECENTRALIZED ADMINISTRATION (Central Macedonia & Eastern Macedonia-Thrace Water Directorates	✓					
EL_11_21_01	Harmonization of first level Urban Plans with the FRMPs	MINISTRY OF ENVIRONMENT AND ENERGY (General Secretariat for Spatial Planning and Urban Environment)	✓					
EL_11_21_02	Construction and building arrangements within the 100-year flood zone	MINISTRY OF ENVIRONMENT AND ENERGY (General Secretariat for Spatial Planning and Urban Environment)	✓					
EL_11_21_03	Adaptation of first level Urban Plans in the areas of controlled flooding to contain flooding (retarding basins)	MINISTRY OF ENVIRONMENT AND ENERGY (General Secretariat for Spatial Planning and Urban Environment)	✓					
EL_11_21_04	Prevention and actions for Rural Development within the APSFR	MINISTRY OF INFRASTRUCTURE AND TRANSPORT (Directorate for Flood Defences and Rehabilitation Projects D19), CENTRAL MACEDONIA AND EASTERN MACEDONIA-THRACE REGIONS (Directorate for Technical Projects / RU Sub-Directorates for Technical Projects), MUNICIPALITIES		✓	✓	✓		✓

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MEASURE CODE	MEASURE TITLE	Responsible Authority	RBD	EL11APSFR001	EL11APSFR002	EL11APSFR003	EL11APSFR004	EL11APSFR005
EL_11_23_01	Measures to protect the water supply boreholes of water utilities against flooding	(1) Water Utilities MACEDONIA THRACE DECENTRALIZED ADMINISTRATION (Central Macedonia & Eastern Macedonia Thrace Water Directorates)				✓		✓
EL_11_24_01	Restructuring and modernisation of meteorological and hydrometric data collection network	Developer: MINISTRY OF ENVIRONMENT AND ENERGY Operator: Ministry for Civil Protection and Civil Protection (General Secretariat for Civil Protection, Independent Directorate for Civil Protection of the relevant REGION (CENTRAL MACEDONIA AND EASTERN MACEDONIA-THRACE)	✓					
EL_11_24_02	Collection and digitization of watercourse demarcation data and flood defences data	MINISTRY OF ENVIRONMENT AND ENERGY ,(Technical Chamber of Greece) and MINISTRY OF INFRASTRUCTURE AND TRANSPORT	✓					
EL_11_24_03	Creation of a National Flood Register (NFR) and development of a relevant interactive online platform	MINISTRY OF ENVIRONMENT AND ENERGY (General Directorate for Water)	✓					
EL_11_31_01	Implementation of a forest engineering system for mountain water management structures and projects	MINISTRY OF ENVIRONMENT AND ENERGY (Directorates of Forests), Forestry Offices (RU Serres, Kavala, Drama)	✓					

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MEASURE CODE	MEASURE TITLE	Responsible Authority	RBD	EL11APSFR001	EL11APSFR002	EL11APSFR003	EL11APSFR004	EL11APSFR005
EL_11_31_02	Natural water retention projects in the lowlands	MINISTRY OF INFRASTRUCTURE AND TRANSPORT (Directorate for Flood Defences and Rehabilitation Projects D19), CENTRAL MACEDONIA AND EASTERN MACEDONIA-THRACE REGIONS (Directorate for Technical Projects / RU Sub-Directorates for Technical Projects), MUNICIPALITIES	✓					
EL_11_31_03	Implementation of Natural Water Retention Measures (NWRM) / practical SUDs during the design of projects and activities under sub-category A1 and A2 of Law 4014/2011, as in force.	Implementing Agency of each project	✓					
EL_11_32_01	Multi-purpose reservoirs with a flood protection component	Project owner	✓					
EL_11_32_02	Use existing reservoir projects to contain flood flows	(A) MINISTRY FOR CLIMATE CRISIS AND CIVIL PROTECTION (Technical Chamber of Greece) ² (B) & (C) To be determined on the basis of projects proposed in the Masterplan				✓		✓

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MEASURE CODE	MEASURE TITLE	Responsible Authority	RBD	EL11APSFR001	EL11APSFR002	EL11APSFR003	EL11APSFR004	EL11APSFR005
EL_11_33_01	Modernisation and restoration of drainage networks	MINISTRY OF INFRASTRUCTURE AND TRANSPORT (DIRECTORATE FOR FLOOD DEFENCES AND REHABILITATION PROJECTS, EASTERN MACEDONIA REGION (Directorate of Technical Projects and RU Sub-Directorates of Technical Projects), LAND RECLAMATION AGENCIES (OEB)		✓	✓	✓		✓
EL_11_33_02	Flood Defences	MINISTRY OF INFRASTRUCTURE AND TRANSPORT (Directorate for Flood Defences and Rehabilitation Projects D19), CENTRAL MACEDONIA AND EASTERN MACEDONIA-THRACE REGIONS (Directorate for Technical Projects, RU Sub-Directorates for Technical Projects), MUNICIPALITIES	✓					
EL_11_34_01	Modernisation/replacement, maintenance and completion projects for existing rainwater drainage networks	CENTRAL MACEDONIA, EASTERN MACEDONIA AND THRACE REGIONS (Directorate of Technical Projects / RU Sub-Directorates of Technical Projects), MUNICIPALITIES, Water & Sewage Companies, Road maintenance bodies	✓					
EL_11_35_02	Integrated Flood Planning (Master Plan) and construction of the proposed projects	(A) MINISTRY FOR CLIMATE CRISIS AND CIVIL PROTECTION (Technical Chamber of Greece)	✓					

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MEASURE CODE	MEASURE TITLE	Responsible Authority	RBD	EL11APSFR001	EL11APSFR002	EL11APSFR003	EL11APSFR004	EL11APSFR005
		(B) & (C) To be determined based on projects proposed in the Masterplan						
EL_11_35_03	Assessment and maintenance of existing mountain water management structures and projects	MINISTRY OF ENVIRONMENT AND ENERGY (Directorates of Forests), Forestry Offices (RU Serres)				✓		
EL_11_35_04	Land use management measures in the runoff basins of torrents.	MINISTRY OF RURAL DEVELOPMENT AND FOOD (under Law 5184/ 2025 (A 34)	✓					
EL_11_35_05	Maintenance and restoration of existing training structures and flood defences	CENTRAL MACEDONIA, EASTERN MACEDONIA AND THRACE REGION (Directorate of Technical Projects and RU Sub-Directorates of Technical Projects)	✓					
EL_11_41_01	Development and operation of an operational flood early warning system	Developer: MINISTRY OF ENVIRONMENT AND ENERGY Operator: Ministry for Civil Protection and Civil Protection (General Secretariat for Civil Protection, Independent Directorate for Civil Protection of the relevant REGION (CENTRAL MACEDONIA AND EASTERN MACEDONIA-THRACE)				✓	✓	
EL_11_42_01	Updating the Emergency Plans, and consolidation of emergency flood response actions/ Memorandum of Action at local level	CENTRAL MACEDONIA & EASTERN MACEDONIA-THRACE REGIONS (Independent Civil Protection Directorate), MUNICIPALITIES (Civil	✓					

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MEASURE CODE	MEASURE TITLE	Responsible Authority	RBD	EL11APSFR001	EL11APSFR002	EL11APSFR003	EL11APSFR004	EL11APSFR005
		Protection Offices), MACEDONIA-THRACE DECENTRALIZED ADMINISTRATION (Civil Protection Directorate),						
EL_11_42_03	Borrow pits sites for restoration/ maintenance of embankments in emergencies	CENTRAL MACEDONIA and EASTERN MACEDONIA-THRACE REGIONS (Directorates of Technical Projects / Serres, Drama and Thessaloniki RU Sub-Directorates of Technical Projects, Independent Civil Protection Directorates)				✓		
EL_11_42_04	Establishing alert levels in the critical watercourses of the River Basin District based on the provisions of Laws 4662/2020 and 5075/2023	CENTRAL MACEDONIA and EASTERN MACEDONIA-THRACE REGIONS - (Directorate of Technical Projects / RU Sub-Directorates of Technical Projects, Independent Civil Protection Directorate)				✓		
EL_11_42_05	Lowlands controlled flooding plan to protect settlements and critical infrastructure	MINISTRY OF INFRASTRUCTURE AND TRANSPORT (Directorate for Flood Defences and Rehabilitation Projects D19), EASTERN MACEDONIA AND THRACE REGION (Directorate for Technical Projects / Sub-Directorates for Technical Projects), Ministry for Climate Crisis and Civil Protection (General Secretariat for Civil Protection)		✓	✓	✓		✓

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MEASURE CODE	MEASURE TITLE	Responsible Authority	RBD	EL11APSFR001	EL11APSFR002	EL11APSFR003	EL11APSFR004	EL11APSFR005
EL_11_43_01	Flood risk awareness-raising actions for the public local authorities and communities	MINISTRY FOR CLIMATE CRISIS AND CIVIL PROTECTION, MINISTRY OF EDUCATION, MINISTRY OF ENVIRONMENT AND ENERGY, MACEDONIA - THRACE DECENTRALIZED ADMINISTRATION (Civil Protection Directorate), CENTRAL MACEDONIA & EASTERN MACEDONIA AND THRACE REGIONS (Independent Civil Protection Directorate), MUNICIPALITIES in cooperation with the administration of school units	✓					
EL_11_43_02	Information system to avoid use of Irish crossings due to flood events	The competent body of the road network, CENTRAL MACEDONIA & EASTERN MACEDONIA AND THRACE REGIONS (Independent Civil Protection Directorate, Technical Projects Directorate)	✓					
EL_11_44_01	Drafting of a regulation of required actions for stream bed conveyance capacity restoration, riparian vegetation maintenance and management	MINISTRY OF ENVIRONMENT AND ENERGY in cooperation with jointly competent bodies	✓					

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MEASURE CODE	MEASURE TITLE	Responsible Authority	RBD	EL11APSFR001	EL11APSFR002	EL11APSFR003	EL11APSFR004	EL11APSFR005
EL_11_51_01	Restoration of infrastructure damage from recent flood events	Competent bodies, depending on the type of infrastructure, for recording, designing and restoring/providing compensation, in accordance with the applicable legislation	✓					
EL_11_52_01	Siting of sedimentation basins for the (temporary or permanent) deposition of sediments	CENTRAL MACEDONIA & EASTERN MACEDONIA AND THRACE REGIONS (Directorates of Technical Projects / RU Sub-Directorates of Technical Projects, Independent Civil Protection Directorate)	✓					

EL_11_61_01: Development of a Monitoring System for the FRMP's Programme of Measures

The project concerns:

(1) the development of a database and interactive platform to collect and monitor the information required by all actors involved in the implementation of the Programme of Measures; and

(2) receiving advisory services for this purpose from qualified staff. The provision of advisory services will include but not be limited to: (a) monitoring the implementation of the River Basin District's FRMP measures, (b) preparing designs and regulatory decisions, (c) coordinating the services involved in the implementation of the measures, (d) recording and analysing data related to FRMP measures/actions, (e) preparing methodological texts and technical specifications for implementation of FRMP measures, (f) actions for the collection/ updating of key data and data used in the preparation of the FRMP, (g) support on issues of the review of the Flood Risk Management Plan and participation in working groups to be established depending on the River Basin District's needs.

In the context of this project, evaluation reports will be drawn up on the progress of the implementation of the Programme of Measures, guidance will be given on the actions required to complete implementation, and measures will be evaluated for effectiveness.

EL_11_21_01: Harmonization of first level Urban Plans with the FRMPs

The measure concerns the issuance of a Circular Directive to recommend data that should be drawn from the FRMPs during the Analysis Stage/Diagnosis Section of the designs of the first level Urban Plans (Local Urban Plans/ Special Urban Plans), to formulate substantiated disaster hazard reduction Proposals, in accordance with the qualitative urban planning guidelines by way of the new Urban Planning Standards (Ministerial Decision ΥΠΕΝ/ΔΝΕΠ/32892/1414/2024, Government Gazette D' 200/01.04.2024).

EL_11_21_02: Construction and building arrangements within the 100-year flood zone

Introduction of special provisions in the Construction and Building Regulation to reduce the vulnerability of constructions / installations and structures within the 100-year Flood Zone from their exposure to flood risk, with the aim of reducing the disaster risk.

EL_11_21_03: Adaptation of first level Urban Plans in the areas of controlled flooding to contain flooding (retarding basins)

The measure concerns the appropriate adaptation of first level Urban Plans (Local Urban Plans/ Special Urban Plans) in the areas of controlled flooding, to recommend permitted uses and restrictions therein. The controlled flooding areas are identified in the special design of measure EL_12_42_05.

EL_11_21_04 : Prevention and protection actions for Rural Development within the APSFR

The measure concerns actions such as, but not limited to, the following:

- a) Identifying crops and sites that are subject to systematic flood damage. This is mainly related to the season and duration of flooding. It is a known fact that flooding for short periods and in wintertime or springtime may even be beneficial for some crops. In these cases, no compensations are paid out from ELGA (Agricultural Insurance Organisation) so particular care is required in collecting data from various bodies (in addition to ELGA).
- b) Identifying and recording point, local or broader issues in artificial or natural drainage networks and their E/M equipment that exacerbate flood damage, and the improvement/restoration of which would reduce the losses, in order to propose restoration projects in application of measure EL_12_33_01 "Modernisation and restoration of drainage networks".
- c) Recording the positions of livestock / poultry units suffering systematic flood damage (with IACS final data). Facilities with makeshift accommodation should be inventoried separately (Law 4056/2012 as in force) from the permanent stables.
- d) Identifying crops and livestock facilities that need, as a priority and not exclusively, protection from flood.
- e) Investigating alternative crops and/or varieties, which are effective, direct and can yield in the future the same level of agricultural income as existing crops, considering the suitability of soil and climate conditions, the knowledge of local producers and the available mechanical equipment and buildings of agricultural holdings. Further investigation into the possibility of irrigating same (since they will obviously be water-intensive) through land reclamation projects (existing or to be constructed) and the provision of irrigation and/or flood water, irrigation boreholes, irrigation network, etc., especially in times of water scarcity or drought.
- f) Proposals for the use of alternative agricultural practices (sowing season, fertilization, harvesting, grazing sites, etc.), taking into account the seasonality of flood events and identifying the possible economic and other impacts of modifying agricultural practices.
- g) proposals for financial and other incentives to change crops and/or relocate livestock units.

EL_11_24_01: Restructuring and modernisation of meteorological and hydrometric data collection network

The measure concerns the upgrading and modernisation of the existing analogue network of hydrometeorological stations of the MoEE. The implementation of the measure includes, but is not limited to, the following actions:

- a) the replacement of analogue hydrometeorological stations with digital telemetry stations across the country, and expansion of the network where required
- b) the creation of a digital platform for recording and transmitting hydrometric and meteorological information.

The measure will be implemented in cooperation with the Water Directorates of the relevant Decentralised Administrations.

EL_11_24_02: Collection and digitization of watercourse demarcation data and flood defences data

The measure concerns the creation and maintenance of a database, by collecting and digitising information at APSFR level, regarding:

- Information on existing and new stream demarcation files per River Basin District and other useful information to prepare demarcation studies
- Already demarcated watercourses (geospatial elements of demarcation lines, etc.).
- Technical data of flood defences that affect water flow, including topographic surveys of existing structures conducted in the context of the FRMPs and other studies, as well as other available information on technical structures from designs and archives of other agencies

The available information will be used recording and digitization Information of existing boundaries and watercourses from the project "Information System for the Delimitation of Watercourses" of the Ministry of Environment and Energy.

EL_11_24_03: Creation of a National Flood Register (NFR) and development of a relevant interactive online platform

This is the design and development of a National Flood Register and a relevant interactive online platform, with the development of an appropriate spatial data system.

The NFR will at least include entries of flood events and their data made by competent services and involved agencies, in accordance with the General Emergency Response Plan and Immediate/ Short Term Management of Flood Consequences "DARDANOS", as applicable each time, based on guidelines to be issued by the competent service of the MoEE.

This way, the purpose is for all involved agencies to have and use uniform data to assess the damage and impact from extreme flood events, supporting management plans and flood risk assessments

EL_11_23_01: Measures to protect the water supply boreholes of Water Utilities against flooding

The measure includes:

(1) The adoption by Water Utilities of appropriate measures for the flood protection of their water supply boreholes, located within the T=100-year flood zone. Such measures can be either e.g. lifting the electromechanical systems, piping and cabin of each borehole to a higher level, or constructing a protective perimeter embankment of appropriate height using suitable materials, etc.

(2) The River Basin Districts are to introduce a term stipulating the obligation to take flood protection measures in all water usage licenses issued under Joint Ministerial Decision 146896/27.10.2014 (Government Gazette B' 2878 and B' 3142) "Categories of licenses for the use and performance of water development projects. Procedure and terms for issuing licenses, content and term thereof and other relevant provisions", as amended and in force.

EL_11_23_01: Measures to protect the water supply boreholes of Water Utilities against flooding

By taking appropriate flood protection measures, the risks inherent in a water supply borehole are avoided, and in addition to the damage to its above-ground electromechanical equipment, flood water ingress in the underground aquifer is also prevented.

EL_11_31_01: Implementation of a forest engineering system for mountain water management structures and projects

The measure concerns natural water retention projects in mountainous areas.

(A) The Forest Engineering System for Mountain Water Training, which includes three organically linked and interdependent projects and measures:

1. Horticultural projects to create normal hydrogeonomic forests and shrubs, resistant to climate change, which contribute to the prevention of surface erosion, the increase of water retention and infiltration into the soil, the conversion of surface into subsoil runoff, and the deceleration of runoff.

2. Geotechnical projects (grading, scraping of slopes, drainage, trenches, dry stone walls, wattle, log erosion barriers, etc.) for the purpose of eliminating sediment-generating source or temporarily retaining rainwater.

3. Hydraulic technical structures involving a variety of technical constructions such as :

a) low dams built in the beds of the main and smaller branches used primarily to secure the beds, contain or sort sediments, prevent slides, contain flood peaks, abstract or store water, etc.

b) structures arranged in parallel to the water flow (embankments, linings, etc.) to protect the bank of streams and prevent slope erosion, limit the flow within a defined bed and protect riparian zones or enlarge the bed to allow natural formation.

(B) Open-type dam constructions and temporary sediment containment basins in intense torrentiality mountainous river basins.

This will include open barriers for sorting and temporary retention of sediments in order to stop massive sediment transfer (debris flows & Mud flows), the containment backwater effect, the temporary retention of sediments in basins, the control of the movement of sediments by sorting.

(C) Construction of dry detention ponds to contain flooding in mild torrentiality mountainous river basins.

Construction of dry detention ponds in the mountain stream beds to contain flooding. The action is applied only to mild torrentiality river basins or river basins whose torrentiality has been greatly absorbed and show normal debris & mud flow.

The mountain water management projects will be implemented as a priority from upstream to downstream and in addition from the lower-order branches to the higher-order branches according to Strahler. Methods and materials compatible with the natural environment will be used in their construction.

In the context of the flood defences integrated design of the FRMP, it should be clarified that:

For areas where the implementation of a Masterplan is indicated as a measure (EL_12_35_02), projects falling under this measure will result from the Masterplan.

EL_11_31_01: Implementation of a forest engineering system for mountain water management structures and projects

Exceptions to the above are as per Note(i):

The areas selected for the implementation of the measure are mountainous basins/sub-basins upstream of the APSFR where mountain water management structures will be constructed in suitable locations following a relevant forest engineering study.

EL_11_31_02: Natural water retention projects in the lowlands

The measure concerns natural water retention projects at the boundaries of the lowland bed of watercourses, as defined together with the mountain bed boundaries in the decisions of the former Prefects of the country and in accordance with the legislation in force, and as a priority in the 100-year flood zones within the APSFR (or upstream thereof) and/or in locations with high and very high risk (see Flood Impact Assessment Map).

The proposals for construction of NWRP projects will be developed according to the specifications during the preparation of flood protection project designs on the specific requirements and/or the preparation of Flood Protection Plans (Master Plan), where such plans are prepared.

The measure includes:

- floodplain restoration and management projects (N03) – "make room to river" - by removing artificial embankments to increase storage capacity and accelerate restoration after flood events.
- watercourse bed re-naturalisation (N05).
- re-meandering (N04) to increase storage capacity and buffer capacity.
- construction of offline dry detention basins and online ponds (N01) in the stream beds to contain flooding and lateral runoff/ and store flood flows.
- wetland restoration and management (N02) through riparian vegetation to increase storage capacity and slow the flow.
- restoration and reconnection of seasonal streams (N06) to increase storage capacity and drainage.
- Natural bank stabilization (N10) using bioengineering materials to increase drainage and reduce sediment delivery.

In the context of the flood defences integrated design of the FRMP, it should be clarified that:

For areas where the implementation of a Masterplan is indicated as a measure (EL_12_35_02), projects falling under this measure will result from the Masterplan. Exceptions to the above are:

1. Projects for which there is approved funding may proceed.
2. Projects that have at least one of the main characteristics (A and B) of the following Table may proceed, provided that they also meet the supplementary condition.

EL_11_31_03: Implementation of Natural Water Retention Measures (NWRM) / practical SUDs during the design of projects and activities under sub-category A1 and A2 of Law 4014/2011, as in force

During the design of projects and activities under sub-category A1 and A2 of Law 4014/2011, as in force, the implementation of Natural Water Retention Measures (NWRM) / practical SUDs should be considered as a priority, when flood defences are required, to limit surface runoff and contain flood flows.

EL_11_32_01: Multi-purpose reservoirs with a flood protection component

During the preparation of designs for new large dams that fall within the definition of Large Dams of the International Commission on Large Dams (ICOLD), i.e. dams with a height of 15 metres or greater from lowest foundation to crest or dams between 5 metres and 15 metres impounding more than 3 million cubic metres, used for irrigation or other functions, it is mandatory to consider the possibility of the dams operating for flood protection purposes in basins located upstream of APSFR. Flood protection requires additional storage volume and an appropriate reservoir operation schedule. Under these conditions, the reservoir can achieve flood containment, i.e. a reduction in the duration and magnitude of the flood peak. All planning must consider the multiple feasibility and requirements of environmental legislation and the Water Framework Directive 2000/60.

The planning of the projects should also take into account the provisions of the Dam Safety Regulation (Government Gazette B'4420/30.12.2016), and provide for the continuous improvement of the safety procedures for dams subject to this Regulation, as it falls within the remit of the Dams Administrative Authority (DMA) as a Commission operating under the General Secretariat for Infrastructure of the Ministry of Infrastructure and Transport.

EL_11_32_02: Use existing reservoir projects to contain flood flows

The measure includes actions to optimize the management of existing reservoirs so that, on the one hand, they meet the needs of the uses they serve in the best possible way, and, on the other hand, they offer maximum flood protection downstream.

The reservoirs implementing the measure will be selected based on the results of the Flood Hazard and Flood Risk Maps and in particular the results of the flood risk assessment in the context of this review of the FRMP, downstream of existing or future Dams.

EL_11_33_01: Modernisation and restoration of drainage networks

The measure includes the following actions:

- Identifying problematic, in terms of drainage, lowland cultivated areas - assessment of the current situation.
- Checking the adequacy of drainage networks and E/M equipment in these areas.
- Drafting proposals and implementation of restoration projects/ upgrading of drainage works that may include:
 - clearing of existing trenches from vegetation and sediments
 - maintenance/replacement of technical structures for road crossings and flow control structures (gates, locks)
 - modernization of the existing E/M equipment (installation of an automatic adjustment and remote management system of the existing equipment for regulating the flow control structures)
- Prioritization of scheduling
- Implementation of interventions

EL_11_33_02: Flood Defences

This measure shall be implemented if it is not possible to adequately implement measure EL_11_31_02 of this 1st Review of the FRMP concerning natural water retention projects in the lowlands. The measure includes the construction of new flood defences and/or the completion/reinforcement of existing flood defences in the lowland beds of the watercourses (for restoration/ maintenance projects see measure EL_11_35_05), as a priority in the 100-year flood zones within the APSFRs and in locations with high and very high risk (see Flood Impact Assessment Map), which are

(A) Proposed in the context of this document, or

(B) planned to be studied as per the proposals for the maturation of future projects of the Flood Protection Plans (Master Plan), where these are being prepared or will be prepared (Measure EL_11_35_02).

In the context of the flood defences integrated design of the FRMP, it should be clarified that:

For areas where the implementation of a Masterplan is indicated as a measure (EL_11_35_02), projects falling under this measure will result from the Masterplan. Exceptions to the above as

1. Note 1

It should be noted that the reference to T=100 applies to the geographical impact of the measure and is not related to the design size of flood protection works, which is defined based on the regulations in force and the technical specifications of the studies for the projects under consideration.

The measure shall include, as appropriate, projects comprising one or more of the following:

1. River/torrent training projects to increase their drainage capacity and to protect the bed from erosion (shaping the cross-section with or without lining the bottom or the slopes, supporting the slopes, construction of individual groynes within watercourses).
2. Construction of terraces/cascades to reduce the longitudinal slope where required.

EL_11_33_02: Flood Defences

3. Construction or reinforcement of embankments along the watercourses
4. Replacement or construction of culverts and bridges at road crossings that interrupt the continuity of watercourses.
5. Stream confluence training and watercourse/river estuary technical structures
6. Construction of an artificial watercourse branch.
7. Silt removal from an untrained section of watercourse.

EL_11_34_01: Modernisation/replacement, maintenance and completion projects for existing rainwater drainage networks

The measure includes replacement, reinforcement and completion projects of rainwater drainage structures (rainwater collection, transport and disposal to the available recipients), affording priority to areas of high residential needs and requirements within the Areas of Potentially Significant Flood Risk.

The measure is implemented in the following phases:

1. Phase one, mapping the existing rainwater drainage networks
2. Assessment of the adequacy of the existing infrastructure by competent bodies, to determine the type of interventions required, if any, (such as: maintenance, reinforcement, replacement, extension),
3. Project preparation and implementation during this or the next management period.

EL_11_35_02: Integrated Flood Planning (Master Plan) and construction of the proposed projects

The measure includes the following actions:

(A) Implementation of Flood Protection Plans (Masterplan) for selected areas, to identify and prioritize the required Projects, in the following order of priority:

- within the APSFRs and upstream basins to mitigate the effects in the areas included in the T=100 Flood Hazard and Flood Risk Maps of this Plan.
- in the remaining part of the River Basin District where a Masterplan is required.

Notes:

- a) the necessities for Masterplans (number and spatial specialization) are defined within the framework of this measure
- b) within the framework of the Masterplan, projects of the categories included in the following measures EL_11_31_01, EL_11_31_02, EL_11_32_01, EL_11_32_02, EL_11_33_02 and EL_11_42_05, while restoration and maintenance projects are not included.

(B) Preparation of the required designs for project maturation

(C) Construction of proposed projects

EL_11_35_02: Integrated Flood Planning (Master Plan) and construction of the proposed projects

The Master Plan must be consistent with the provisions of the Management Plans of Directive 2000/60/EC (River Basin District status, exceptions, etc.) and for this purpose it must have the assent of the competent Water Directorate.

Note that the reference to T=100 concerns the implementation areas of the measure and is not related to the design dimensions of flood defences, which is defined based on the regulations applicable each time and the technical specifications of the designs of said projects.

EL_11_35_03: Assessment and maintenance of existing mountain water management structures and projects

The measure includes the assessment of the status of existing Mountain Water Management Structures in torrent and river basins and their maintenance to mitigate the effects in the areas included in T=100 flood zones. Operations will be studied and planned by the Forest Directorates and Forestry Offices responsible for the maintenance of the structures in their area of responsibility.

EL_11_35_04: Land use management measures in the runoff basins of torrents

The pasture management plans, in accordance with the requirements of Law 4351/2015 (Government Gazette A' 164) and Joint Ministerial Decision 1058/71977/2017 (Government Gazette B' 2331/07.07.2017) and in areas upstream of the APSFRs that have not been excluded from grazing land (they have not been characterized as protective), shall consider the provisions of the FRMP and RBMP and apply hydronomic criteria to determine grazing intensity (grazing capacity).

EL_11_35_05: Maintenance and restoration of existing training structures and flood defences

The measure includes the following actions that should be carried out annually:

- Performing onsite visits and recording problems after the end of the wet (winter) period (e.g.: April)
- Identifying critical positions and techniques in need of maintenance/restoration and setting priorities
- Preparation of annual maintenance/restoration work programme by the Region's competent technical services, which will include :
 - ✓ Clearing sediment and removing silt from the bed of watercourses that hinder the free runoff of the watercourse
 - ✓ Repairs of slope retaining/lining structures
 - ✓ Repairs of bed protection/lining structures
 - ✓ Embankment repairs
 - ✓ Repairs of technical structures (terraces, culverts, crossings, etc.)
- Securing funds
- Implementation of interventions

The measure is implemented at the level of the Water District and concerns all existing flood protection infrastructure and/or projects within watercourses that affect the hydraulic regime of rivers. Maintenance and restoration works are planned as a priority for projects within or upstream of APSFR that affect flood flows.

EL_11_41_01: Development and operation of an operational flood early warning system.

Development of an Operational Early Flood Warning System (OEFWS) with priority to selected T100 flood zones. The system shall include:

- (a) Design and development of an early warning system for floods, using the hydrometeorological data of the updated network specified in measure EL_12_24_01, other data/models and appropriate software, based on the specifications of the (OEFWS) implemented by the MoEE in Evros and Axios rivers and with the possibility of interconnection with their operating platform (OEFWS) developer: MoEE/GDW).
- (b) Design and development of a communication protocol between the (OEFWS) operator and the body competent for timely notifying the public and activating the competent bodies (notification process, alerts, information transmission mechanisms/tools e.g. sms), based on (OEFWS) data (OEFWS) operator: Independent Civil Protection Directorate of the relevant Region or Ministry Climate Crisis and Civil Protection/GSCP).

EL_11_42_01: Updating the Emergency Plans, and consolidation of emergency flood response actions/ Memorandum of Action at local level

According to the provisions of the General Civil Protection Plan "Xenocrates", in 2019 the Directorate of Planning and Emergency Response of the Ministry Climate Crisis and Civil Protection/GSCP, in cooperation with all involved agencies, issued the General Emergency Response Plan and Immediate/Short Term Management of Flood Consequences, which was sent to all involved agencies with document 8794/06.12.2019 of the Ministry of Climate Crisis and Civil Protection/GSCP ("DARDANOS 1").

In 2022, the Emergency Planning Directorate of the Ministry Climate Crisis and Civil Protection/GSCP, considering that the 1st version of the plan brought about administrative and organisational changes, which mainly concerned central government agencies, issued the 2nd General Emergency Response Plan and Immediate/ Short Term Management of Flood Consequences, named "DARDANOS 2".

According to this, the results of the risk analysis of the current 2nd FRMP should also be taken into account.

- by first and second degree local authorities when preparing or updating Regional or Local Emergency Plans.
- by Decentralized Administrations when preparing, updating, or upgrading Action Plans-Memoranda of Actions to address flood risks from all Municipalities – Municipal Units located within the T100 flood zone.

EL_11_42_03: Borrow pits for restoration/ maintenance of embankments in emergencies

In the T1000-year flood zone where embankments have been constructed or are about to be constructed, the following actions shall be taken :

- 1) Study for the selection and demarcation of borrow pits for prompt availability of materials for embankment restoration;
- 2) Environmental Impact Assessment and compliance with the licensing procedure of the applicable provisions. The activity is part of Group 5, Mining and Related Activities of the Joint Ministerial Decision as amended and in force, no. 5 Borrow pits for aggregates and earth or other soil materials exclusively for the needs of infrastructure projects.

If an emergency is declared in the area, the Technical Control Directorate may issue a decision on the right to grant material directly, provided steps 1 and 2 have been completed.

EL_11_42_04: Establishing alert levels in the critical watercourses of the River Basin District based on the provisions of Laws 4662/2020 and 5075/2023

According to article 6 of Law 4662/2020 "State of Preparedness Scaling" and Law 5075/2023, the National Mechanism is activated on a scale depending on the state of preparedness.

The measure includes the following actions, with a view to setting the alert limits corresponding to the four levels of mobilization defined in legislation:

EL_11_42_04: Establishing alert levels in the critical watercourses of the River Basin District based on the provisions of Laws 4662/2020 and 5075/2023

- ✓ Hydraulic control of watercourses and determination of their conveyance capacity (maximum flow rate they can safely convey - with the required margin according to the specifications).
- ✓ Identifying critical positions on watercourses where it would be possible to monitor and record the flow of the river (bridge positions, positions with accesses, linear positions suitable for water measurements)
- ✓ Identifying critical positions in relation to the progression of the flood wave routing and the position/distance of the adjacent affected uses and mainly of the settlements and road access infrastructure.
- ✓ Defining the level and flow at the above positions for the four (4) preparedness levels included in the legislation.
- ✓ Defining the water flow corresponding to all the above preparedness levels at critical selected positions of the level - absolute elevation values.

EL_11_42_05: Lowlands controlled flooding plan to protect settlements and critical infrastructure

The measure concerns planning controlled flooding of lowland areas that will be selected as a priority within or upstream of the T100 flood zones and with the aim of protecting the areas within the T100 flood zones or reducing the flood risk as a priority of areas with high flood risk (as defined in the relevant Flood Risk Assessment maps), in the context of a special design of controlled area flooding, either during the preparation of flood defences MasterPlan (see EL_12_35_02) or other relevant design.

Controlled flooding of sacrifice areas is an internationally recognized flood protection practice and Climate Change adaptation measure.

Once the boundaries of the mountainous and lowland bed of the watercourses are defined under the applicable legislation, and the boundaries of the settlements and the critical infrastructure to be protected are determined, the hydraulic behaviour of the watercourses for various flood flows shall be reviewed to identify the potential flood volume discharge sites and protect the settlements and/or critical infrastructure, checking the hydraulic behaviour of each proposal. Furthermore, it is necessary to formulate proposals and establish the positions where the existing embankments will be broken in a controlled manner and, finally, to establish a mechanism for assessing the effectiveness of the options (if they actually contributed to addressing the risk), after each flood event and updating /adjusting the plan.

The results of this measure are considered for the implementation of measure EL_11_21_03.

For the purposes of this measure, critical infrastructure means units relating to human health, the natural environment, transport networks, public interest projects (irrigation, drainage, flood defences, etc.) and cultural heritage sites, and as otherwise defined following the harmonization of Greek legislation with Directive 2022/2557/EC.

EL_11_42_05: Lowlands controlled flooding plan to protect settlements and critical infrastructure

In the context of the flood defences integrated design of the FRMP, it should be clarified that:
For areas where the implementation of a Masterplan is indicated as a measure (EL_11_35_02), projects falling under this measure will result from the Masterplan. Exceptions to the above as per **Note (i)** at the end of the section.

EL_11_43_01: Flood risk awareness-raising actions for the public, local authorities and communities

The measure includes the implementation of information and awareness-raising actions for citizens and bodies about the flood risk in their area and the precautions to take in case of flood risk. Such actions may be: television, radio and internet broadcasts, events, educational workshops, presentations in schools, etc. The above will be implemented by the Ministry of Climate Crisis and Civil Protection, the Ministry of Education, the Ministry of Environment and Energy, the Civil Protection Directorate of the relevant Decentralized Administrations, the Independent Civil Protection Directorates of the relevant Regions and the Municipalities in cooperation with schools. Actions may address subjects such as:

- ✓ information on the local Areas of Potentially Significant Flood Risk (APSFR),
- ✓ information on the provisions of the relevant FRMP and its programme of measures,
- ✓ the importance of ensuring that rainwater and watercourse drainage systems are cleared and accessible
- ✓ the possibility and need for private/community protection measures
- ✓ information on Emergency Response Plans and the importance of their observance by the competent authorities
- ✓ on existing Irish crossings, the associated hazards and actions to be taken to avoid accidents
- ✓ protection of economic activities (agriculture, livestock breeding, etc.).

EL_11_43_02: Information system to avoid use of Irish crossings due to flood events

The purpose of the measure is to enhance the preparedness of citizens and involved agencies to limit accidents during the transverse crossing of streams and rivers through Irish Crossings.

The object of the measure is the installation of a system consisting of, at least, warning signs and a level rods with depth markings at Irish Crossings within the River Basin District, in order to provide clear information and support the prevention of vehicles passing during floods.

This measure will be implemented on the one hand at all Irish Crossings within T=100-year flooding areas, according to the calculations of this 1st Review of the FRMP, and on the other hand at any other Irish Crossings that studies or data of the Competent Bodies show that they must be marked immediately.

EL_11_43_02: Information system to avoid use of Irish crossings due to flood events

The specifications of the warning system will be established by the Technical Services and the Civil Protection Directorates before tendering the projects. The specifications will cover the content and dimensions of the signs, the colours and markings of the level rods, whether the signs will provide and alternative route, whether bars will be installed to prevent passage through critical crossings, any required telemetry functionality or other bar handling devices, etc.

EL_11_44_01: Drafting of a regulation of required actions for stream bed conveyance capacity restoration, riparian vegetation maintenance and management

This measure includes the preparation of a regulation/specifications for the periodic actions of watercourse cleaning, and riparian vegetation maintenance and management. The regulation/specifications shall be formulated considering the specific characteristics of these watercourses (geomorphological and hydraulic characteristics, type of watercourse, ecological elements, etc.) as well as the protection status of the area over which they extend.

The regulation/specification(s) shall concern at least the following:

- ✓ The body responsible for cleaning operations, etc., based on the legislation applicable each time (in Natura areas, forests, etc.)
- ✓ the cleaning method applied
- ✓ the time and frequency of cleaning operations
- ✓ the position(s) to be cleaned
- ✓ the areas for disposal of cleaning materials or the recovery thereof
- ✓ the procedure to be followed such as environmental permits and/or informing authorities
- ✓ detailed instructions for the appropriate handling of riparian vegetation in the various parts of the hydrographic network (small mountain streams, tributaries, large rivers in floodplains) and the use of means that will not cause damage to the river ecosystem.
- ✓ the methodology for keeping a record of the interventions carried out

In any case, the cleaning of watercourses should be carried out where necessary, in a way that does not conflict with the objectives of the River Basin Management Plans of Directive 2000/60/EC.

Where bodies of water related to "Areas designated for the protection of habitats or species" of the Protected Areas Register of the approved RBMP fall within the area of application of the measure, ensure timely cooperation with the competent Management Unit of OFYPEKA to include terms and conditions in the proposed regulation to address their potential impact on the object meriting protection.

EL_11_51_01: Restoration of infrastructure damage from recent flood events

The measure aims to restore infrastructure damage due to intense flood events that have occurred.

This infrastructure includes, but is not limited to: Road and Railway Network, Irrigation and Drainage Projects, Flood Defences (Embankments, Trainings, Transverse Projects), Projects of cultural interest, Health Units, etc.

The project includes:

(a) recording losses,

(b) preparing relevant studies depending on the type of infrastructure, which will include, inter alia:

- Resizing of the structures according to the updated flood sizes
- Analysis of flood mechanisms that led to the failure of the infrastructure during occurrence of the flood event, to be considered during the redesign
- Proposals for alternative interventions based on milder operations. And,

(c) restoration of damaged infrastructure

EL_11_52_01: Siting of sedimentation basins for the (temporary or permanent) deposition of sediments

The scope of the measure is to determine the procedure for selecting the optimal sediment management process after each flood event. There are 2 distinct cases:

- Case 1: Sediments that contain no pollutants hazardous for public health. The measure in question establishes areas that can be used as temporary or permanent sediment deposition sites. For example but not limited to: disposal as a soil coating material in sanitary landfills or quarries for rehabilitation. The possibility of using these materials by sorting and processing will be investigated at a later stage.
- Case 2: the sediments have been contaminated by pollutants hazardous for public health (including but not limited to: sewage, petroleum products, etc.). In this case, a sediment management study is required to define the separation, transportation and deposition process (including, but not limited to: disposal to sanitary landfill, hazardous waste landfill, etc.). Cooperation with the Sanitary Landfill or Waste Treatment Unit project owner (Municipality or FODSA (Solid Waste Management Agency)) is required.

The measure will consider the flooding areas as they result from the Flood Hazard and Risk Maps as well as the soil erosion maps drawn up under this 1st Review of the FRMP, in conjunction with the lists of diffuse and point source pollution prepared under the 2nd Review of the RBMP for the River Basin District (the spatial distribution of which is available in shapefiles) to enable assessment in advance of the sediment deposition sites and the sedimentation basins, for the different flood return periods under review.

Note (i):

1. Projects for which there is approved funding may proceed.
2. Projects that have at least one of the main characteristics (A and B) of the following Table may proceed, provided that they also meet the supplementary condition.

<i>A</i>	<i>EMERGENCY SITUATIONS</i> <i>Projects covering an emergency need for the area's protection against floods, following natural disaster events (e.g. fire, significant floods, etc.) may proceed.</i>
<i>B</i>	<i>MULTIPLE FUNCTIONS</i> <i>Projects that serve multiple uses and functions may proceed.</i>
	<i>SUPPLEMENTARY CONDITION:</i> <i>The projects of the above categories A and B will proceed if there is evidence that they do not have a negative impact on the downstream, in terms of flood risk.</i>

11.5 Prioritization of the measures of the 1st FRMP Review of the RBD 11

The measures of the 1st Review of the FRMP of the Eastern Macedonia RBD (EL11) are prioritized according to their economic effectiveness. The purpose of the prioritization is to highlight the measures that achieve a flood damage reduction (benefit) at the lowest cost.

All measures are complementary to each other and there is no question of choosing a measure with high cost-effectiveness index over another with a low index. Therefore, cost-effectiveness analysis makes sense mainly as an indication of the implementation priority of measures, taking into account the scarcity of available funds which dictates that high cost-effectiveness measures are to be promoted immediately.

11.5.1 Methodology

The applied methodology for assessing the measures of the 1st Review of the FRMP of the Eastern Macedonia and Thrace RBD is a modification of the methodology applied in the 1st Implementation Cycle of the Floods Directive. The adopted steps are:

- The proposed measures are divided into two categories: the measures that indirectly contribute to the prevention of damage (Category 1) and the measures that directly contribute to the prevention/addressing of damage (Category 2).
- Assessment of the expected benefit of each measure in the two categories
- Assessment of the nature/line of action of the measure (Prevention, Protection, Preparedness, Restoration)
- Correlation with other policies (climate change, RBMP)
- Multi-criteria analysis of the overall benefit index of each measure

- Estimation of the total cost of each measure (investment cost, operating cost)
- Calculation of the cost-effectiveness index of each measure and prioritization of measures

11.5.1.1. Proposed measures are distinguished according to their contribution to addressing the damage

The measures proposed by the programme are divided into two categories depending on whether they have a direct or indirect contribution to the prevention/addressing of damage:

- **Category 1:** Measures that **indirectly contribute** to the prevention of damage. Their implementation is expected to assist the application of Category 2 measures. These include: legislative measures at no cost, most measures to acquire, supplement and improve information, as well as the implementation of the Phase (A) of measure 35_02 (Master Plan).
- **Category 2:** Measures that **directly contribute** to the prevention/addressing of damage. All construction projects are included, as well as measures relating to early warning of flood events.

The measures of each category are classified into priority groups (1, 2 or 3) as follows:

Priority Group:	Includes measures along with Mathematical equation
1 st	$\frac{RA11}{RA16} < \text{avg.}$
2 nd	$\text{avg} < \frac{RA11}{RA16} < (\text{mean} + \frac{1}{2} \text{ s.d.})$
3 rd	$\frac{RA11}{RA16} > (\text{mean} + \frac{1}{2} \text{ s.d.})$

Where:

D11 the overall benefit index of the measure, receiving values 0-100.

D16 the index of total annualized cost of the measure

RD11 the regular benefit index, receiving values 1-17 for category 1 and 1-10 for category 2. The smaller the value, the more beneficial the measure is compared to the rest of the same category.

RD16 the regular cost index, receiving values 1-17 for category 1 and 1-10 for category 2. The smaller the value, the more costly the measure is compared to the rest of the same category.

Presentation of the results of the prioritization of measures in the Eastern Macedonia RBD

30 of the 31 measures of the overall Program which are assessed in the context of prioritization in this 1st Revision of the FRMP, based on the assumptions mentioned above. Of these, 17 measures are Category 1 and 13 measures are Category 2.

The results of the implementation of the measures prioritization methodology are presented in the two tables below, by Category of measures.

Table 11-3: Prioritization of the measures of the 1st Review of the FRMP for RBD EL11 by priority group for Category 1 (indirect contribution to flood risk) based on the cost-efficiency index

CATEGORY 1					
α/α	MEASURE TITLE	TYPE OF MEASURE	MEASURE CODE	AXIS	Priority Group (1,2,3)
1	Development of a Monitoring System for the FRMP's Programme of Measures	Obtaining, supplementing and improving information	EL11_61_01	Prevention	1
2	Harmonization of first level Urban Plans with the FRMPs	Legislative/ Administrative arrangements	EL11_21_01	Prevention	1
3	Construction and building arrangements within the 100-year flood zone	Legislative/ Administrative arrangements	EL11_21_02	Prevention	1
4	Adaptation of first level Urban Plans in the areas of controlled flooding to contain flooding (retarding basins)	Legislative/ Administrative arrangements	EL11_21_03	Prevention	1
5	Prevention and protection actions for Rural Development within the APSFR	Obtaining, supplementing and improving information	EL11_21_04	Prevention	1
6	Restructuring and modernisation of meteorological and hydrometric data collection network	Obtaining, supplementing and improving information	EL11_24_01	Prevention	1
7	Creation of a National Flood Register (NFR) and development of a relevant interactive online platform	Obtaining, supplementing and improving information	EL11_24_03	Prevention	1

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CATEGORY 1					
α/α	MEASURE TITLE	TYPE OF MEASURE	MEASURE CODE	AXIS	Priority Group (1,2,3)
8	Implementation of Natural Water Retention Measures (NWRM) / practical SUDs during the design of projects and activities under sub-category A1 and A2 of Law 4014/2011, as in force.	Legislative/ Administrative arrangements	EL11_31_03	Protection	1
9	Maintenance and restoration of existing training structures and flood defences	Measures of an environmental nature	EL11_35_04	Protection	1
10	Information system to avoid use of Irish crossings due to flood events	Education/information measures	EL11_43_01	Preparedness	1
11	Restoration of infrastructure damage from recent flood events	Legislative/ Administrative arrangements	EL11_44_01	Preparedness	1
12	Borrow pits sites for restoration/ maintenance of embankments in emergencies	Obtaining, supplementing and improving information	EL11_42_01	Preparedness	1
13	Collection and digitization of watercourse demarcation data and flood defences data	Obtaining, supplementing and improving information	EL11_24_02	Prevention	3
14	Assessment and maintenance of existing mountain water management structures and projects	Technical Flood Defences	EL11_35_02	Protection	3

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CATEGORY 1

α/α	MEASURE TITLE	TYPE OF MEASURE	MEASURE CODE	AXIS	Priority Group (1,2,3)
15	Lowlands controlled flooding plan to protect settlements and critical infrastructure	Non-structural intervention	EL11_42_04	Preparedness	3
16	Establishing alert levels in the critical watercourses of the River Basin District based on the provisions of Laws 4662/2020 and 5075/2023	Measures of an environmental nature	EL11_42_03	Preparedness	3
17	Siting of sedimentation basins for the (temporary or permanent) deposition of sediments	Measures of an environmental nature	EL11_52_01	Restoration	3

Table 11-4: Prioritization of the measures of the 1st Review of the FRMP for RBD EL11 by priority group for Category 2 (direct contribution to flood risk) based on the cost efficiency index

CATEGORY 2					
α/α	MEASURE TITLE	MEASURE CODE	MEASURE TYPE	GENERAL OBJECTIVE/ MEASURE LINE OF ACTION	Ομάδα προτεραιότητας (1, 2, 3)
1	Measures to protect the water supply boreholes of water utilities against flooding	EL11_23_01	Legislative/ Administrative arrangements	Prevention	1
2	Use existing reservoir projects to contain flood flows	EL11_32_01	Technical Flood Defences	Protection	1
3	Use existing reservoir projects to contain flood flows	EL11_32_02	Technical Flood Defences	Protection	1
4	Development and operation of an operational flood early warning system	EL11_41_01	Obtaining, supplementing and improving information	Preparedness	1
5	Information system to avoid use of Irish crossings due to flood events	EL11_43_02	Non-structural intervention	Preparedness	1
6	Assessment and maintenance of existing mountain water management structures and projects	EL11_35_03	Technical Flood Defences	Protection	1
7	Maintenance and restoration of existing training structures and flood defences	EL11_35_05	Technical Flood Defences	Protection	1

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CATEGORY 2

α/α	MEASURE TITLE	MEASURE CODE	MEASURE TYPE	GENERAL OBJECTIVE/ MEASURE LINE OF ACTION	Ομάδα προτεραιότητας (1, 2, 3)
8	Natural water retention projects in the lowlands	EL11_31_02	Measures of an environmental nature	Protection	1
9	Lowlands controlled flooding plan to protect settlements and critical infrastructure	EL11_42_05	Technical Flood Defences	Preparedness	2
10	Modernisation/replacement, maintenance and completion projects for existing rainwater drainage networks	EL11_34_01	Technical Flood Defences	Protection	2
11	Modernisation and restoration of drainage networks	EL11_33_01	Technical Flood Defences	Protection	3
12	Implementation of a forest engineering system for mountain water management structures and projects	EL11_31_01	Measures of an environmental nature	Protection	3
13	Flood Defences	EL11_33_02	Technical Flood Defences	Protection	3