



FLOOD RISK MANAGEMENT PLAN

Evros River Basin (GR1210)

Thracian River Basin District (GR12)

HELLENIC REPUBLIC

HELLENIC MINISTRY OF THE ENVIRONMENT AND ENERGY
SPECIAL SECRETARIAT FOR WATER

FLOOD RISK MANAGEMENT PLAN FOR THE EVROS RIVER BASIN

Verified

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The Special Secretariat for Water

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**PROJECT: FLOOD RISK MANAGEMENT PLAN FOR THE EVROS RIVER BASIN -
IMPLEMENTATION OF DIRECTIVE 2007/60/EC**

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TABLE OF CONTENTS

LIST OF ABBREVIATIONS	IX
LIST OF FIGURES AND DIAGRAMS	XII
LIST OF TABLES	XIII
INTRODUCTION	1
STUDY TEAM	2
MONITORING TEAM	2
1. DIRECTIVE 2007/60/EC AND THE FLOOD RISK MANAGEMENT PLANS	4
1.1. GENERAL	4
1.2. TRANSPOSITION OF DIRECTIVE 2007/60/EC TO NATIONAL LAW - DEFINITIONS.	5
1.3. IMPLEMENTATION OF THE DIRECTIVE 2007/60/EC IN GREECE - COMPETENT AUTHORITIES.....	9
1.4. LEGISLATIVE AND INSTITUTIONAL FRAMEWORK FOR PROTECTION AGAINST FLOODS IN THE GREEK STATE	11
2. INTERNATIONAL COOPERATION AGREEMENT FOR THE TRANSBOUNDARY EVROS RIVER BASIN	20
2.1. GREECE’S TRANSBOUNDARY WATERS – GENERAL INFORMATION.	20
2.2. COOPERATION FRAMEWORK WITH NEIGHBOURING COUNTRIES OF THE EVROS RIVER BASIN.....	20
2.2.1. <i>Cooperation with Bulgaria</i>	21
2.2.2. <i>Cooperation with Turkey</i>	22
2.3. ARDAFORECAST PROJECT	23
3. SHORT DESCRIPTION OF THE STUDY AREA	24
3.1. GEOGRAPHICAL LOCATION - ADMINISTRATIVE AFFILIATION	24
3.2. MAIN TRIBUTARIES AND HYDROGRAPHIC NETWORK	24
3.3. ADMINISTRATIVE AFFILIATION	26
4. PRELIMINARY FLOOD RISK ASSESSMENT	29
4.1. FLOOD RISK ASSESSMENT.	29
4.1.1. <i>Natural environment</i>	29
4.1.2. <i>Anthropogenic environment</i>	29
4.2. IDENTIFICATION OF AREAS OF POTENTIAL SIGNIFICANT FLOOD RISK.....	31
5. PREPARATION OF FLOOD HAZARD MAPS	35
5.1. FLOOD HAZARD MAP PREPARATION METHOD.....	35
5.1.1. <i>Map features</i>	35
5.1.2. <i>Hydrological modelling scenarios</i>	36
5.1.3. <i>Hydraulic modelling</i>	37
5.2. COMMENTS ON FINDINGS	41
5.2.1. <i>Baseline scenario Scla</i>	41
5.2.2. <i>Sclb scenario</i>	42
5.2.3. <i>Scll scenario</i>	42
5.2.4. <i>Sclll scenario</i>	43
5.2.5. <i>Flood from MSL rise</i>	43
5.3. STRATEGIC CONCLUSIONS FROM THE FLOOD HAZARD MAP PREPARATION PROCEDURE	43
6. PREPARATION OF FLOOD RISK MAPS	46
6.1. FLOOD RISK MAP PREPARATION METHOD.....	46
6.2. COMMENTS ON RESULTS.....	47
6.2.1. <i>Influence on population</i>	47
6.2.2. <i>Influence on economic activities</i>	50
6.2.3. <i>Impact on installations likely to cause accidental pollution</i>	59

6.2.4.	<i>Impact on protected areas</i>	59
7.	FLOOD RISK MANAGEMENT OBJECTIVES OF THE FRMP	61
7.1.	FLOOD RISK MANAGEMENT OBJECTIVES	61
7.2.	DESCRIPTION OF FLOOD RISK MANAGEMENT OBJECTIVES	63
7.2.1.	<i>Management objective O1</i>	63
7.2.2.	<i>Management objective O2</i>	63
7.2.3.	<i>Management objective O3</i>	64
7.2.4.	<i>Management objective O4</i>	65
7.2.5.	<i>Management objective O5</i>	65
7.3.	SPECIALISATION AND HIERARCHISATION OF MANAGEMENT OBJECTIVES PER APSFR	65
7.3.1.	<i>APSFR GR12RAK0002 "Riparian areas south of Nea Vyssa and delta of Evros river"</i>	65
7.3.2.	<i>APSFR GR12RAK0003 "Areas west of Loutro torrent"</i>	66
7.3.3.	<i>APSFR GR12RAK0004 "Areas of north Evros and Arda"</i>	66
8.	PROPOSED MANAGEMENT PLAN MEASURES	68
8.1.	INTRODUCTION - GENERAL DESCRIPTION OF MEASURES	68
8.2.	PRIORITISATION AND HIERARCHISATION OF FRMP MEASURES	68
8.3.	PROPOSED MANAGEMENT MEASURES	69
8.4.	MONITORING OF THE IMPLEMENTATION OF THE FRMP MEASURES	97
8.5.	BRIEF DESCRIPTION OF THE MEASURES	99
8.5.1.	<i>Acquisition, supplementation, and improvement of information for flood defence infrastructure</i>	99
8.5.2.	<i>Technical flood protection measures</i>	99
8.5.3.	<i>Administrative regulations</i>	101
8.5.4.	<i>Non-structural interventions</i>	102
8.5.5.	<i>Measures of a financial nature</i>	103
8.5.6.	<i>Environmental measures</i>	106
8.5.7.	<i>Other guidelines</i>	107
9.	PUBLIC INFORMATION AND PUBLIC CONSULTATION	109
9.1.	PUBLIC CONSULTATION ACCORDING TO DIRECTIVE 2007/60/EC	109
9.2.	PREPARATION OF LIST OF SOCIAL PARTNERS	110
9.2.1.	<i>Relevant definitions</i>	110
9.2.2.	<i>Social partners</i>	111
9.3.	PROPOSED CONSULTATION ACTIONS FOR THE FRMP OF THE EVROS RB	111
9.4.	CONSULTATION ACTIONS FOR THE FRMP OF THE EVROS RB THAT WERE REALISED	112
9.5.	CONSULTATION ON THE STRATEGIC ENVIRONMENTAL IMPACT ASSESSMENT (SEIA) OF THE FRMP	113
10.	SYNERGIES WITH THE RIVER BASIN MANAGEMENT PLAN OF GR12	117
11.	BIBLIOGRAPHY	120

LIST OF ABBREVIATIONS

GDP	Gross Domestic Product
AEC	Approval of Environmental Conditions
EMTH	Eastern Macedonia and Thrace
GVA	Gross Value Added
MSW	Municipal solid waste
VEPE	Industrial and Business Areas
BIOPA	Biotechnology Park
VIPA	Industrial Park
VIPE	Industrial Zone
GS	General Secretariat
GSPR	General Secretariat of Public Revenue
HAGS	Hellenic Army General Staff
GZP	General Zoning Plans
D7	Directorate of Land Reclamation Works (falls under the GSPR/YPOMEDI)
MR	Municipal Region
MU	Municipal Units
DEKE	Directorate of Construction Project Control
DEYA	Municipal Water Supply and Sewerage Company
DIAAMATH	Waste Management (Company) of Eastern Macedonia and Thrace
MC	Municipal Communities
DUTH	Democritus University of Thrace
CPI	Consumer Price Index
HGRS	Hellenic Geodetic Reference System
SSW	Special Secretariat for Water
EU/EC	European Union/European Commission (as applicable)
WWTP	Wastewater Treatment Plant
GCLD	Greek Committee on Large Dams
NCW	National Committee on Water
SAC	Special Area for Conservation
EC	European Community
ELGA	Hellenic Organisation of Agricultural Insurances
ELSTAT	Hellenic Statistical Authority
EMY	Hellenic National Meteorological Service
NR	National Road
EEC	European Economic Community
EOT	Greek National Tourism Organisation
NP	National Park
EPAE	Town Planning and Architectural Control Committee
NFRMP	National Flood Risk Management Programme
PR	Provincial Road
AEC	Approval of Environmental Conditions
EPPERAA	Operational Programme “Environment and Sustainable Development”
HIDB	Hellenic Industrial Development Bank
SWB	Surface Water Body
SSS	Special Spatial Study
SPA	Special Protection Areas

UCZ	Urban Control Zone
IGME	National Institute of Geology and Mineral Exploration
PE	Population Equivalent
MSP	Main Sewer Pipe
WS	Wildlife Sanctuaries
WSRC	Waste Separation and Recovery Centre
KEGE	Centre for Agricultural Education
CM	Central Macedonia
J/V	Joint Venture
JMD	Joint Ministerial Decision
RB	River basin
MoS	Master of Science
WTP	Waste Treatment Plant
AARC	Average Annual Rate of Change
EIA	Environmental Impact Assessment
RPA	Register of Protected Areas
PSG	Prefectural Self Government
IWMF	Integrated Waste Management Facility
OPVAOP	Integrated Plan for the Sustainable Development of the Rhodope Mountain Range
LG	Local Government
PFRA	Preliminary Flood Risk Assessment
REMTH	Region of Eastern Macedonia– Thrace
PD	Presidential Decree
PIP	Public Investment Programme
RU	Regional Unit
RSWP	Regional Solid Waste Plan
ASSI	Areas of Specific Spatial Intervention
RBD	River Basin District
BWA	Bathing Water Area
ODAPA	Organised Development Areas in Productive Activities
RFSPSD	Regional Framework of Spatial Planning and Sustainable Development
FD	Fire Department
FRMP	Flood Risk Management Plan
WRL	Waste Reloading Station
SEIA	Strategic Environmental Impact Assessment
IBAG	Important Bird Areas of Greece
ADP	Area Development Plan
OCHOP	Open City Spatial and Housing Organisation Plan
LR	Local Region
LC	Local Communities
SCI	Sites of Community Importance
CV	Current Values
PERS	Post-Earthquake Recovery Service
YBET	Ministry of Industry, Energy and Technology
WD	Water District
YPAAT	Ministry of Rural Development and Food
YPAN	Ministry of Development
ΥΠΕΕΝ	Ministry of the Environment and Energy
YPEX	Ministry of Foreign Affairs
YPECHODE	Ministry for the Environment, Spatial Planning and Public Works

YPOMEDI	Ministry of Infrastructure, Transport and Networks
WB	Water Body
GWB	Groundwater Body
MB	Management Body
GG	Government Gazette
SWMB	Solid Waste Management Body
UWDS	Uncontrolled Waste Disposal Site
SPSD	Spatial Planning and Sustainable Development
SL	Sanitary Landfill
SRL	Sanitary Residue Landfill
cms	cubic metres per second (m ³ /sec)
D&C	Dams and Cascades Enterprise (Bulgaria)
DIC	Diploma of Imperial College London
DS	Dissolved Solids
DMI	Turkish State Meteorological Service (TSMS)
DSI	General Directory of State Hydraulic Works (Turkey)
EFAS	European Flood Awareness System
FAO	Food and Agriculture Organisation
HP	Hydropower
IPPC	Integrated Pollution Prevention Control
IUCN	International Union for Conservation of Nature
km	Kilometre
km ²	Square kilometres
km ³	Cubic kilometres
m	Metres
M ²	Square kilometres
MCM	Million cubic metres
MM	Million metres (megametres)
MSc	Master of Science
NCDC	National Climatic Data Centre
NEK	Natsionalna Elektricheska Kompania (Bulgaria)
NOAA	National Oceanic and Atmospheric Administration, USA
SCI	Site of Community Interest
SPA	Special Protection Area
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USA	United States of America
WRI	World Resources Institute
WSEAS	World Scientific and Engineering Academy and Society
WSS	Water supply system (Bulgaria)
WWF	Worldwide Fund for Nature

LIST OF FIGURES AND DIAGRAMS

FIGURE 2.1. LOGOTYPE OF THE GREEK-BULGARIAN ADRAFORECAST PROJECT	23
FIGURE 3.1. THE TOTAL EVROS RIVER BASIN.....	28
FIGURE 4.1: AREAS OF POTENTIALLY HIGH FLOOD RISK OF THE EVROS RIVER BASIN DISTRICT.....	34
FIGURE 5.1: SURROUNDING FLOOD AREA AND APSFR OF EVROS RIVER BASIN	40
DIAGRAM 7.1. DISCHARGE CAPACITY OF MAIN EVROS RIVERBED	64

LIST OF TABLES

TABLE 1.1 NATIONAL AUTHORITY	10
TABLE 1.2 REGIONAL AUTHORITY.....	11
TABLE 1.3 INVOLVED BODIES IN THE PREVENTION, PREPAREDNESS, AND FLOOD MANAGEMENT STAGES.....	18
TABLE 3.1. EVROS AND MAIN TRIBUTARIES ON GREEK TERRITORY.....	26
TABLE 3.2 WD RIVER BASINS THRACE [GR12]	26
TABLE 4.1. NATURAL ENVIRONMENTS THAT ARE AFFECTED	29
TABLE 4.2. INSTALLATIONS THAT ARE AFFECTED BY POTENTIAL FLOODS.....	29
TABLE 4.3. WASTE DISPOSAL SITES THAT ARE AFFECTED	30
TABLE 4.4. LOCAL DISTRICTS WHOSE AREAS ARE POTENTIALLY AFFECTED BY FLOODS.....	30
TABLE 4.5. AREAS OF POTENTIALLY HIGH FLOOD RISK OF THE EVROS RBD (GR1210)	33
TABLE 5.1. SCENARIO OF FLUVIAL FLOODING	36
TABLE 5.2. MEAN SEA LEVEL (MSL) RISE	37
TABLE 5.3. FLOOD CAUSES AND APSFR.....	37
TABLE 5.4. FLOOD AREAS PER APSFR AND HYDROLOGICAL SCENARIO	43
TABLE 5.5. STRATEGIC CONCLUSIONS OF THE FLOOD HAZARD ANALYSIS	44
TABLE 6.1 POTENTIAL IMPACT ON POPULATION (NUMBER OF PERSONS)	49
TABLE 6.2. GROUPING OF CORINE LAND COVER INVENTORY LAND USES FOR THE PREPARATION OF FLOOD RISK MAPS.....	50
TABLE 6.3. EXTENT OF ECONOMIC ACTIVITIES IS A POTENTIAL FLOOD RISK, APSFR GR12RAK0004.....	51
TABLE 6.4. EXTENT OF ECONOMIC ACTIVITIES IS A POTENTIAL FLOOD RISK, APSFR GR12RAK0002.....	52
TABLE 6.5. EXTENT OF ECONOMIC ACTIVITIES IS A POTENTIAL FLOOD RISK, APSFR GR12RAK0003.....	52
TABLE 6.6 POTENTIAL FLOOD IMPACT ON THE MAIN ROAD NETWORK (KM NETWORK)	55
TABLE 6.7 POTENTIAL IMPACT OF FLOODS ON THE UPGRADED (FUTURE) RAILWAY LINE (NETWORK SECTIONS).....	56
TABLE 6.8. FLOOD RISK ASSESSMENT FOR DRAINAGE AND IRRIGATION PUMP STATIONS, SCENARIO SCIA (AND SCII).....	57
TABLE 6.9. FLOOD RISK ASSESSMENT FOR DRAINAGE AND IRRIGATION PUMP STATIONS, SCENARIOS SCIB AND SCII.....	58
TABLE 7.1. MANAGEMENT OBJECTIVES AND THE PROBABILITY OF FLOODS.....	61
TABLE 7.2. MANAGEMENT OBJECTIVES AND APSFR OF IMPLEMENTATION.....	62
TABLE 8.1. CATEGORIES AND TYPES OF MEASURES BASED ON GUIDANCE DOCUMENT NO. 29.	69
TABLE 8.2. PROPOSED MEASURES FOR THE EVROS RIVER BASIN FLOOD RISK MANAGEMENT PLAN.....	71
TABLE 8.3. GROUPS OF MEASURES FOR MONITORING THE IMPLEMENTATION OF THE FRMP	97
TABLE 8.4. CORRELATION OF CATEGORY OF MEASURES WITH MONITORING GROUPS.	98

Introduction

With the contract dated 28.09.2012, the Special Secretariat for Water (SSW) awarded the study "Flood Risk Management Plan for the Evros River Basin - Implementation of Directive 2007/60/EC" to the following engineering firms:

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According to the signed Contract, the study is completed in three stages and the works that are to be conducted in each implementation stage are summarised below:

- STAGE I six (6) months
Preliminary flood risk assessment for the part of the Evros river basin that is located on Greek territory; identification of Areas of Potential Significant Flood Risk (APSEFR), and publication of this data.
- STAGE II eleven (11) months
Development of Flood Hazard Maps (FHM) and Flood Risk Maps (FRM) for the part of the Evros river basin that is located on Greek territory and publication of this data.
- STAGE III nine (9) months
Flood Risk Management Plans (FRMP) for the part of the Evros river basin that is located on Greek territory, preparation of relevant Strategic Environmental Impact Assessments that are required for the finalisation of the Flood Risk Management Plans (JMD oik.107017/05.09.2006, Directive 2001/42/EC) as amended by JMD no. oik. 40238 (GG 3759/series II/25.10.2017) and in force and public consultation for the information of the public and interested parties regarding the Flood Risk Management Plans

Stage I, II and III of the Study were approved by the SSW decision nos. oik.191757/12.12.2013, 100445/17.04.2015 and 142170/30.10.2017.

The individual scopes of the Stage II of the study include:

1. Development of the Preliminary Flood Risk Management Plans (PFRMP) for the Greek part of the Evros river basin.
2. Development of the Strategic Environmental Impact Assessment (SEIA) of the flood for the Greek part of the Evros river basin.
3. Elaboration of the study for the consultation regarding the PFRMPs and SEIAs.
4. Conduct of the consultation regarding the PFRMPs and SEIAs.
5. Development of a Consultation Assessment Report
6. Finalisation of the PFRMPs and SEIAs.
7. Preparation of the relevant folder (documents and maps) for communication to the European Commission and completion of the databases of the European Environment Agency (EEA).

This Document comprises of the deliverable no. 6 of Stage III as above, with respect to the finalisation of the FRMP. The project's SEIA was initially submitted on 5.11.2015 and again

after the consultation of the Draft Flood Risk and the incorporation of respective results on 14.6.2016.

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The following experts participated in the drafting of this document:

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Monitoring Team

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The members of the study's monitoring team include: "Flood Risk Management Plan for the Evros River Basin. Implementation of Directive 2007/60/EC" as stipulated by the decision under ref. no. 100410/5.10.2012 by the Special Secretariat for Water (ADA: B4TZ0-HΦO) include:

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1. Directive 2007/60/EC and the Flood Risk Management Plans

1.1. General

The European Commission, recognising, inter alia, that:

- Floods have the potential to cause fatalities, displacement of people and damage to the environment, to severely compromise economic development and to undermine the economic activities of the Community.
- Floods are natural phenomena which cannot be prevented
- some human activities (such as increasing human settlements and economic assets in floodplains and the reduction of the natural water retention by land use) and climate change contribute to an increase in the likelihood and adverse impacts of flood events

Adopted Directive 2007/60/EC (hereinafter the Directive) for the assessment and management of flood risks.

The purpose of this Directive is to establish a framework for the assessment and management of flood risks, aiming at the reduction of the adverse consequences for human health, the environment, cultural heritage, and economic activity.

According to the Directive, Member State shall carry out the following:

- (a) Undertake a **Preliminary Flood Risk Assessment** (hereinafter **PFRA**) for each River Basin District (**RBD**)¹ or the portion of an international river basin district lying within their territory. On the basis of a PFRA **areas** are identified for which they conclude that **potential significant flood risks exist** or **might be considered likely to occur**. The PFRA shall be completed by **22nd December 2011**. The PFRA shall be reviewed by 22/12/2018 for the first time and every six years thereafter.
- (b) Develop **flood hazard maps** and **flood risks maps** at RBD level for the above areas, pursuant to Article 6 of the Directive. These maps shall be completed by **22nd December 2013**. The maps shall show the potential adverse consequences associated with flood scenarios as well as information on **potential sources of environmental pollution** (e.g., IPPC facilities) as a consequence of floods. The maps shall be reviewed by 22/12/2019 for the first time and every six years thereafter.
- (c) Establish **Flood Risk Management Plans (FRMP)** level of the river basin district for areas where **a potential significant flood risk exists** or **might be considered likely to occur** pursuant to the provisions of Article 7 of Directive 2007/60/EC, which should be completed and published by **22nd December 2015**. The FRMPs should focus on prevention, protection, and preparedness. With a view to giving rivers more space, they should consider where possible the maintenance and/or restoration of floodplains, as well as measures to prevent and reduce damage to human health, the environment, cultural heritage, economic activity, and infrastructures.

FRMPs should therefore consider the particular characteristics of the areas they cover and customise solutions according to the needs and priorities of those areas, whilst ensuring relevant coordination within river basin districts and promoting the achievement of environmental objectives laid down in Directive 2000/60/EC for groundwater and surface water bodies. It is pointed out that the implementation of these 2 Directives needs to be

¹ According to the provisions of Directive 2000/60/EC.

coordinated since the development of river basin management plans, in the context of 2000/60/EC, and **RBMP**, in the context of 2007/60/EC, are components of the **integrated river basin management**. Thus, the two processes should mutually exploit the potential for mutual synergies and mutual benefit, having regard to the environmental objectives of Directive 2000/60/EC, in order to ensure the efficient and reasonable use of resources. The **FRMP** data should be reviewed periodically and updated if needed, considering the likely impacts of climate change impacts with the occurrence of floods. The FRMPs shall be reviewed by 22/12/2021 for the first time and every six years thereafter.

1.2. Transposition of Directive 2007/60/EC to National Law - Definitions.

Directive 2007/60/EC was transposed into national law with JMD HP 31822/1542/E103 (GG series II 1108/21.07.2010 as amended and in force by JMD 177772/924 (GG series II 2140/22.06.2017) The Directive in implemented in the RBDs of Directive 2000/60/EC which constitute the country's Water Districts (WDs).

According to JMD **Flood** means *“the temporary covering by water of land not normally covered by water. This shall include floods from rivers, mountain torrents, ephemeral water courses, lake overflows and floods from groundwater and the sea in coastal areas. It may also include floods from damages to hydraulic technical projects such as embankment and dam failures”*.

Flood risk means *“the combination of the probability of a flood event and of the potential adverse consequences for human health, the environment, cultural heritage and economic activity associated with a flood event”* Finally, the JMD - in addition to the provision of the Directive - defines **flood hazard** as the *“probability of a flood occurring in a specific area (quantified by water depth, flow velocity, or other hydrological or hydraulic magnitude) which corresponds to the probability of exceedance”*.

The competent Authorities for implementing the provisions of JMD HP 31822/1542/E103 (GG series II 1108/21.07.2010 as amended and in force by JMD 177772/924 (GG series II 2140/22.06.2017) shall be the **Special Secretariat for Water (SSW)** and the **Water Directorates of the Decentralised Administrations (Article 3)**.

The SSW formulates the **National Flood Risk Management Program (NFRMP)** and monitors, evaluates, and controls its implementation. It also coordinates the agencies and state-run bodies and participates in the competent state-run flood risk management bodies. It represents the country and participates in the competent community flood risk management bodies. It develops annual reports in relation to the implementation, assessment, and control of the National Flood Risk Management Programme (NFRMP) of the previous period based on the annual reports by the Water Directorates and submits these to the National Committee for Water.

The Water Directorates of the Decentralised Administrations ought to carry out the PFRA, develop the flood hazard and flood risk maps, to develop and implement the FRMPs, to take the necessary measures to coordinate the implementation of Directives 2000/60/EC and 2007/60/EC, as these have been transposed to national law and encourage the substantial involvement of the public. Finally, they prepare annual reports regarding the implementation of JMD HP 31822/1542/E103 (GG series II 1108/21.07.2010) as amended and in force by JMD 177772/924 (GG series II 2140/22.06.2017) which they forward to the SSW. The responsibilities of the Water Directorates of the Decentralised Administrations² must be exercised pursuant to the NFRMP, where applicable.

² The PFRA, the flood hazard maps (FHM), the flood risk maps (FRMs) and the FRMP may be developed by the SSW pursuant to Article 3 of JMD HP 31822/1542/E103 (GG series II 1108/21.07.2010) as

Pursuant to *Article 4* of the JMD, for every WD or every part of the international RBD that is located in Greek territory, a **PFRA** is conducted based on which **the areas of potential significant flood risk** (areas for which it is ascertained that there is a potential significant flood risk or that it is possible for a flood to occur) are subsequently designated.

With reference to the **areas of potential significant flood risk** flood hazard maps (FHM) and flood risk maps (FRM) are developed pursuant to *Article 5* of the JMD. Both the FHM and the FRM are prepared using the appropriate scale, geographic information systems (GIS) and suitable topographic backgrounds. In both cases, competent authorities and the public are the recipients of the information contained in these maps.

The **flood hazard maps** provide, based on the appropriate scale, the flood extent; water depths or water level, as appropriate; and, where appropriate, the flow velocity or the relevant water flow. The flood hazard maps aim the representation of the characteristics of each flood in the geographical flood-prone areas based on the hydraulic calculations for the following scenarios:

- floods with a low probability, or extreme event scenarios;
- floods with a medium probability (likely return period ≥ 100 years);
- floods with a high probability, where appropriate.

Moreover, various maps are developed for various flood causes, such as floods from fluvial flows, from mean sea level (MSL) rise, from groundwaters or from water entrapment in low-lying areas of the terrain due to rainfall. In the case of the study area, the flood causes that are being examined are fluvial flows and MSL rise, as this arose from the results of the Preliminary Flood Risk Assessment. Further information and commentary about the FHM are provided in Chapter 5.

The **flood risk maps** are also developed for the three flood scenarios (low, medium, and high probability of return), and describe the potential adverse consequences associated with these floods. Their purpose is, via the assessment of potential consequences of the phenomena, to identify the areas where measures need to be taken, thereby facilitating the preparation of the FRMP which will be targeted per areas and activities. The maps also facilitate the consultation of the FRMPs by informing the public of potential consequences of the phenomena. The FRMs consist of:

- the indicative number of inhabitants potentially affected.
- type of economic activity of the area potentially affected.
- installations likely to cause accidental pollution in case of flooding (Annex II of Article 5 of JMD 15393/2332/2002 (Series II, 1022) and potentially affected protected areas (Annex V (para. A, case 1, 3 and 5) of Article 19 of PD 51/2007).
- other information which the Member State considers useful such as the indication of areas where floods with a high content of transported sediments and debris floods can occur and information on other significant sources of pollution.

More information and commentary on the results of the flood modelling for the Greek part of the Evros RB is provided in Chapter 6.

amended and in force by JMD 177772/924 (GG series II 2140/22.06.2017)). In this phase, the FHM, the FRM and the FRMPs for all the WDs are prepared by the SSW further to the request of the General Secretariats of the Decentralised Administrations.

The **FRMPs** (*Article 6*) are prepared for the areas of Potential Significant Flood Risk based on the above maps. Only one (1) FRMP per WD or a set of management plans that refer to individual river basins are prepared, which are coordinated at WD level.

In case of an international river basin all of which is located with the Greek State and in the state of a member state or more than one member states, only 1 international FRMP or 1 set of FRMPs is prepared at international river basin level (*Article 7*). If this is not feasible, FRMPs are prepared that cover at least the parts of the international river basin that belong to the Greek administrative limits. If the international river basin is located beyond the limits of the European Community, the National Committee for Water ensures for the preparation of only one international FRMP or one set of FRMPs. If this is not feasible, FRMPs are prepared that cover at least the parts of the international river basin that belong to the Greek administrative limits. In the case of the Evros river basin, the FRMP which covers the parts of the river basin within the Greek administrative limits is being prepared for the time being, the draft of which constitutes this Document.

The **FRMPs** include:

- a) **the basic objectives** for flood risk management focusing on: i) The reduction of potential adverse consequences that flood have on human health, environment, cultural heritage, and economic activities; and ii) if deemed appropriate, in initiatives that do not concern structural projects and actions for the management of flood risks and/or the reduction of the probability of floods occurring (See Chapter 7).
- b) **the required measures** to achieve the above objectives (See Chapter 8), and
- c) **the PFRA findings** in map form with the areas of potential significant flood risk and the flood hazard and flood risk maps.

The **FRMPs** take into account related parameters, such as the cost and benefits, the extent and drainage channels of the flood, the flood retention zones (such as natural flood management areas), the environmental objectives of Article 4 of PD 51/2007, soil and water management, according to Law 3199/2003 and PD 51/2007, spatial planning and land uses, and in particular the Regional Frameworks of Spatial Planning and Sustainable Development that are drafted based on Law 2742/1999, the need to protect and conserve nature and especially protected areas and to safeguard navigation and port infrastructures.

The **FRMP** consider the characteristics of the specific basin or sub river basin and cover all the management aspects, including flood prognosis and early warning systems, by focusing on prevention, protection, and preparedness. The flood risk management plans may include actions that promote sustainable land use practices, improve flood control and the controlled flooding of certain areas in case of flood.

The finalisation of the **FRMP** approval procedure requires the preparation of the respective Strategic Environmental Impact Assessments (SEIA) (JMD oik 107017/05.09.2006, Directive 2001/42/EC) as amended by JMD no. oik. 40238 (GG 3759/Series II/25.10.2017) and in force.

Pursuant to *Article 8* of the JMD coordination is required with the provisions of **PD 51/2007** "Determination of the measures and procedures for the comprehensive protection and management of waters in compliance with the provisions of Directive 2000/60/EC" In essence, these are measures to coordinate the implementation of Directives 2000/60/EC and 2007/60/EC, focusing on opportunities for improving efficiency, information exchange and for achieving common synergies and benefits having regard to the environmental objectives laid down in Article 4 of Directive 2000/60/EC and PD 51/2007. In particular:

- the development of the first flood hazard maps and flood risk maps and their subsequent reviews as referred to in Article 5 of the JMD shall be carried out in such a way that they

contain information that is consistent with relevant information presented according to PD 51/2007. They are further coordinated with the reviews that are provided in Article 5 (para. 2) of PD 51/2007 and can be incorporated therein

- the flood risk management plans supplement the river basin management plans, in accordance to Article 10 (para. 6) of PD 51/2007.
- The development of the first flood risk management plans and their subsequent reviews which are provided by Article 6 of JMD 31822, as amended and in force by JMD 17772/924 (GG/Series II/2140/22.06.2017) are conducted in sync with the reviews of the river basin management plans which are provided by Article 10 (para. 3) of PD 51/2007 and can incorporate
- the active involvement of all interested parties under Article 9 of this decision shall be coordinated, as appropriate, with the active involvement of interested parties under Article 15 of PD 51/2007.

The Special Secretariat for Water has created a special-designed website <http://floods.ypeka.gr> which presents the actions and the progress of implementing EU Directive 2007/60/EC on the assessment and management of flood risks. In particular, it has published all relevant information about Directive 2007/60/EC, on the progress of the actions undertaken for its implementation in Greece and the progress on implementing the Flood Risk Management Plans throughout the country's water and river basin districts.

Posted to the website <http://floods.ypeka.gr> is:

- Information on the contents of Directive 2007/60/EC and the Flood Risk Management Plans
- Information about the Preliminary Flood Risk Assessment (PFRA) and the determination of Areas of Potential Significant Flood Risk (APsFR)
- Information about the Flood Hazard Maps and Flood Risk Maps for APsFR throughout the country's Water Districts and River Basin Districts and their relevant technical reports
- The full texts of Directive 2007/60/EC and JMD 31822/2010 which transposed the Directive to Greek law.
- The course of implementation of the actions undertaken by the Special Secretariat for Water for adoption of Directive 2007/60/EC.
- The methodologies and tools used for the assessment and management of flood risk.
- The time schedule and the ways of participating in the Public Consultation of the Flood Risk Management Plan for all the country's Water Districts and River Basins.

The **FRMPs**, including the Flood Hazard and Flood Risk Maps, constitute the strategic tool for implementing the assessment and management of flood risk policy throughout the country. The FRMPs consist of a Programme of Measures for the proper management of flood risks at all the flood risk phases that are set by Directive 2007/60/EC (Prevention, Protection, Preparedness, Recovery). Thus, they do not constitute technical studies for the construction works, but tools for exercising the policy and the programming of actions, which are being developed in Greece for the first time. They contribute to the better understanding flood risks and identification of areas with a high flood risk, by using a single methodology and scientific verification at country-level for the first time, in accordance with the requirements of Directive 2007/60/EC. They serve competent agencies as a first tool for assessing the adverse

effects of floods, with aimed at defining an effective flood risk management strategy, but also the design of appropriate protection measures.

In addition, flood hazard and risk analyses have been carried out as part of the **FRMPs**, aimed at making informed decisions for the setting of priorities. These decisions must be taken into consideration by the competent bodies during the detailed technical design of infrastructures/works for flood protection measures, should the need arise.

Therefore, the results of the flood hazard maps, the flood risk maps and contents of the FRMP's Programme of Measures should be taken into consideration by each body that plans, develops, and implements projects and activities located within the flood zones. Thus, during the licencing process of projects / infrastructures / activities, each body shall be required to determine the flood risk within the limits of the developing activity or infrastructure that it plans to implement in greater detail in order to take any additional flood protection measures to reduce the negative effects on its infrastructure from the occurrence of a flood.

In any event, it is clarified that reference to 50-, 100-, and 1000-year return periods that are mentioned in the FRMP are not related to the size of the plan flood protection works and implementation of the delineations, which are defined based on the applicable regulations and the technical specifications of the studies of the projects in question.

1.3. Implementation of the Directive 2007/60/EC in Greece - Competent Authorities

With respect to the implementation of the Directive to date, the following actions have been completed:

- The Preliminary Flood Risk Assessment Report has been completed and submitted to the EU (23.03.2012)
- The Identification of Areas of Potential Significant Flood Risk in the country's 14 Water Districts have been completed and the update of the Preliminary Flood Risk Assessment Report has been submitted to the EU (22.11.2012).
- The development of the Flood Hazard and Risk Maps have been completed for the Greek part of the Evros river basin and were initially submitted to the EU on 14 November 2014, and supplemental submissions were made by 7 May 2015.

With the present project "Flood Risk Management Plan for the Evros River Basin - Implementation of Directive 2007/60/EC" the PFRA and the identification of areas of potential significant flood risk for the Greek part of the Evros river basin were updated in greater detail, while at the same time, for the same basin, all the activities that are provided in Articles 6, 7, 8 and 9 of Directive 2007/60/EC are being prepared.

Lastly, in order for the Directive to be implemented for the entire country, five (5) studies have been included in the EPPEPAA and awarded by the Special Secretariat for Water, at Water District level, which will cover the entire country and include the designated Areas of Potential Significant Flood Risk, the Flood Risk Maps, Flood Hazard Maps and the Flood Risk Management Maps. These studies include:

1. Flood Risk Management Plans for the Eastern Macedonian and Thracian River Basins Districts except the Evros river basin.
2. Flood Risk Management Plans for the Epirus, Western Central Greece, and Thessaly River Basin Districts.
3. Flood Risk Management Plans for the River Basin Districts of Western, Northern and Eastern Peloponnese and Crete.

4. Flood Risk Management Plans for the River Basin Districts of Central and Western Macedonia.
5. Flood Risk Management Plans for the River Basin Districts of Attica, Eastern Central Greece, and the Aegean Islands.

The above studies include, inter alia, the flood hazard and flood risk maps in the areas of potential significant flood risk, the flood risk management plans, and the strategic environmental impact assessments (SEIAs).

With respect to the Thracian WD, Stage 1 of the study has been approved (SSW Decision under ref. no. 140454/ 26-4-2017) while the preparation of the Flood Risk Management Plan and the elaboration of the Strategic Environmental Impact Assessment are in progress.

The development of the Flood Risk Management Plan for the Thracian WD will be completed once the data is posted to the Water Information System for Europe (WISE) pursuant to the requirements set out by the European Environment Agency.

Pursuant to JMD HP 31822/1542/E103 (GG/Series II/1108/21.07.2010) for 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” as amended and in force with JMD 177772/924 (GG series II/2140/22.06.2017), “Amendment under JMD HP 31822/1542/E103/2010 (Series II/1108), and the “New Architecture of Local Government and Decentralised Administration. – The Kallikratis Plan” (Law 3852/2010), the competent authorities for 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” are the Special Secretariat for Water of the Ministry of the Environment and Energy (YPEN) and the Water Directorates of the Decentralised Administration.

It is noted that with the amendment of HP 31822/1542/2010 with JMD under no. 177772/924/2017 (series II, 2140) “Amendment of joint ministerial decision under no. 31822/1542/2010 (series II, 1108)”, paragraph 2.2 of Article 3 of JMD 31822/1542/2010 is replaced and states “2.2. Further to a request made by the Decentralised Administration Coordinator, it is possible for the preliminary flood risk assessment, the flood hazard maps, the flood risk maps and the flood risk management plan to be developed, reviewed, or revised by the Special Secretariat for Water of the Ministry of the Environment and Energy” and added to Article 6 of JMD 31822/1542/2010, following paragraph 2, is a new paragraph 3, which states: “3. In the event that the flood risk management plan is prepared by the Special Secretariat for Water in accordance with the new para. 2.2 of Article 3, the management plan in question is approved by the National Committee on Water following the recommendation by the Special Secretariat for Water of the Ministry of the Environment and Energy, provided the consultation process of Article 9 has been observed, as amended by Article 1, paragraph 4 of this Article. During the development, final processing, review or revision of the flood risk management plan, the Special Secretariat for Water collaborates with the competent Water Directorate of the relevant Decentralised Administration and with the co-responsible Ministries which are represented by the National Committee on Water.

The details of the authorities that are responsible for the implementation of Directive 2007/60/EC in the Thracian WD are presented in the following tables.

Table 1.1 National Authority

National Authority - Central Administration
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Official name of Competent Authority	Hellenic Ministry of the Environment and Energy – Special Secretariat for Water
Abbreviation/Acronym	YPEN/SSW
Member-State Code	GR
Number/Street	17 Amaliados Street
City	Athens
Country	Greece
Post code	11523
Website	Http://www.ypeka.gr/
Telephone	210 6475101 / 213 1515410
Email	info.egy@prv.ypeka.gr

Table 1.2 Regional Authority

Decentralised Administration of Macedonia-Thrace– Water Directorate of Eastern Macedonia & Thrace	
Official name of Competent Authority	Water Directorate of Eastern Macedonia & Thrace
Abbreviation/Acronym	WDEMTH
Member-State Code	GR
Number/Street	58 Tenedou Street
City	Kavala
Country	Greece
Post code	65110
Website	www.damt.gov.gr
Telephone/fax	2313 309810- 15 / 2510 837173
Email	dy-amt@damt.gov.gr

1.4. Legislative and institutional framework for protection against floods in the Greek state

As a phenomena floods are classified as natural disasters, as defined in Annex A-1-1 of MD 1299/2003 “Xenokrates” because that can put human lives and property at risk and cause destructions to the country’s economy and infrastructures. As the Central Administration body whose primary mission is to coordinate the stakeholders throughout the entire risk management spectrum from the occurrence of the disasters, in the context of implementing Article 6, paragraph 1 of Law 3013/2002 (as amended and in force based on Article 104, para. 2 of Law 4249/2014) and the General Plan for Civil Protection under the code name “Xenokrates” (MD 1299/07.04.2003), the General Secretariat for Civil Protection (GSCP), has issued document under no. 7742/1.11.2017, a document of strategic level and options, by combining all the provisions that are related to the roles and actions of Civil Protection bodies who are involved in the management of flood risks. Pursuant to the above Circular, the institutional framework for the management of floods is codified as follows:

1. Law 998/1973 “On the protection of forests and forestal areas” (GG 289/series I/1973)
2. Law 272/1976 “On the establishment of the National Institute of Geology and Mineral Exploration (IGME).” (GG 50/A/1976)
3. Law 776/1978 (GG 68/series I/1978) “Assistance to homeless families in the Prefecture of Attica due to the 1977-1978 natural disasters”

4. Law 1068/1980 (GG 190/series I/1980) on the "Incorporation of a Single Water Supply and Sewerage Company for Greater Athens",
5. Law 1190/1981 (GG 203/series I/1981) on the "Ratification of the Hellenic Republic President's Act of Legislative Content dated on the 26.3.1981 'on the restoration of damages caused by the 1981 earthquakes" and the regulation of related issues".
6. Law 1579/1985 "Regulations for the implementation and development of the National Health System and other provisions" (GG 217/series I/1985)
7. Law 2190/1994 "Incorporation of an independent authority for personnel selection and the regulation of administrative matters" (GG 28/series I/1994)
8. Law 2445/1996 (GG 274/series I/1996) "Ratification of the concession agreement for the design, construction, financing, and operation of the Elefsina - Stavros - Spata & Imittos Western Peripheral Motorways (Athens Ring Road), regulation of related issues and other provisions".
9. Law 2503/1997 (GG 107/series I/1997) on the administration, organisation, recruitment of regional authorities.
10. Law 2459/1997 (GG 17/series I/1997) on the "Abolition of tax exemptions and other provisions".
11. Law 2646/1998 (GG 236/series I/1998) on the "Establishment of the National System of Social Care and other provisions".
12. Law 2576/1998 (GG 25/series I/1998) "Improvement of review procedures for public works constructions and other provisions".
13. Law 2696/1999 (GG 57/series I/1999) "Ratification of the road traffic code".
14. Law 2738/1999 "Collective bargaining in public administration, permanent status for workers employed under open-ended contracts and other provisions." (GG 180/A/1999)
15. Law 2768/1999 "Regulating pension issues, establishing a body governed by public law called the "Civil Servants Healthcare Insurance (OPAD)", establishing a company with the corporate name "Special Capital Management Fund TAP - OTE (EDEKT – OTE SA)" and other provisions." (GG 273/A/1999)
16. Law 2800/2000 (GG 41/series I/2000) "Reorganisation of the Services of the Ministry of Public Order, establishment of the Hellenic Police Headquarters and other provisions".
17. Law 2937/2001 (GG 169/series I/2001) on the "Amendment..., regulation of the Thessaloniki Water Supply company and other provisions".
18. Law 3010/2002 (GG 91/series I/2002) "Harmonisation of Law 1650/1986 with Directives 97/11/EU and 96/61/EU, demarcation process and setting of issues for watercourses and other provisions".
19. Law 3013/2002 (GG 102/series I/2002) on the "Upgrade of the role of Civil Protection in Greece and other provisions",
20. Law 3106/2003 (GG 30/series I/2003) on the "Reorganisation of the National System of Social Care and other provisions".
21. Law 3212/2003 (GG 308 /series I/2003) "Building licence, Urban and Other Decisions under the Responsibility of the Ministry of Environment, Spatial Planning and Public Works".
22. Law 3370/2005 (GG 176/series I/2005) on the "Organisation and operation of public health services and other provisions".

23. Law 3481/2006 (GG 162/series I/2006) "Amendment to the law on the Hellenic Cadastre, the awarding and performance of project and design contracts and other provisions".
24. Law 3511/2006 (GG 258/series I/2006) on the "Reorganisation of the Hellenic Fire Department, mission upgrade and other provisions".
25. Law 3613/2007 (GG 263/series I/2007) "Regulations of issues of Independent Authorities, Body of Inspectors of Public Administration and other issues within the competence of the Ministry of Interior".
26. Law 3542/2007 (GG 50/series I/2007) "Amendments to the Road Traffic Code" (Law 2696/1999- GG 57/series I/1999)
27. Law 3536/2007 (ΦΕΚ 42/series I/2007) on "Special regulations on migration policy and other issues of the Ministry of Interior, Public Administration and Decentralisation".
28. Law 3527/2007 "Ratification of contract in favour of legal persons supervised by the Ministry of Health and Social Solidarity and other provisions (GG 25/series I/2007)
29. Law 3536/2007 on "Special regulations on migration policy and other issues of the Ministry of Interior, Public Administration and Decentralisation." (GG 42/Series I/2007)
30. Law 3584/2007 on the "Ratification of the Municipal and. Community Employees' Status Code" (GG 143/series I/2007)
31. Law 3852/2010 "New Architecture of Local Government and Decentralised Administration – The Kallikratis Plan" (GG 87, series I)
32. Law 4018/2011 (GG 215/series I/2011) on the "Restructuring of the residence permit for foreigners under increased security conditions, issues of local administration organisations and other provisions concerning competence of the Ministry of Interior.
33. Law 4071/2012 "Provisions for local development, local government and Decentralised administration – Transposition of Directive 2009/50/EC. "(GG 85/series I/2012)
34. Law 4249/2014 "Reorganisation of Greek Police, Fire Department and the General Secretariat for Civil Protection, upgrade of the Services of the Ministry of Public Order and Citizen Protection and regulation of other matters concerning the Ministry of Public Order and Citizen Protection." (GG 73/series I/2014)
35. Law 4313/2014 «Regulation of Transport, Telecommunications and Public Works issues and other provisions (GG 261/series I/2014)
36. Law 4258/2014 on the "Delineation procedure and regulation of watercourse issues - Town planning regulations and other provisions" (GG 94/series I/2014).
37. Law 4325/2015 on the "Democratisation of Administration, on combating bureaucracy, the E-Governance. The reparation of injustice and other provisions. (GG 47/A/2015)
38. Law 4412/2016 on "Public Contracts of Works, Supplies and Services (transposition of Directives 2014/24/EU and 2014/25/EU" (GG 147/series I, 2016)
39. Law 4456/2017 on "Additional measures implementing Regulation (EU, Euratom) 1141/2014 on the European political parties and foundations, acceleration measures the government competence of the Ministry of Interior project and other provisions." (GG 24/series I/2017)
40. Law 4257/2017 on "Emergency regulations under the competence of the Ministry of Interior. "(GG 93/series I/2014)
41. Law 4472/2017 Public Pension provisions and amendment of Law 4387/2016, application measures of budgetary targets and reforms, social support measures and labour regulations. Mid-term Financial Strategy Framework." (GG 74/series I/2017)

42. LD 57/1973 (GG 149/series I/1973) "Regarding the adoption of social protection measures for financially weak persons and abolition of the provisions governing poverty".
43. LD 17/1974 (GG 236/series I/1974) "Regarding civil emergency planning".
44. PD 210/1992 (GG 99/series I/1992) "Codification of Presidential Decree provisions of the Fire Department's Internal Service Regulation".
45. PD 93/1993 (GG 39/series I/1993) "Retained responsibilities of the Minister of Health, Welfare and Social Insurance".
46. PD 161/1997 (GG 142/series I/1997) "Organisation, Regulation of the Hellenic National Meteorological Service (EMY), which is under the auspices of the Ministry of Defence".
47. PD 22/2006 (GG 18/series I/2006) on the "Organisation of the National Centre for Social Solidarity (EKKA)".
48. PD 30/2007 (GG 28/series I/2007) "Amendment to the provisions concerning the Special Agency for Public Works (EYDE) for the performance of the sewerage and wastewater treatment project in the greater Thessaloniki area".
49. PD 4/2008 (GG 13/series I/2008) "Establishment of Special Agencies for Public Works for the Designs - Constructions, Operation and Maintenance of Concession Projects".
50. PD 35/2008 (GG 60/series I/2008) "Amendment of Presidential Decree 166/1996 (series I/125) "Establishment of the General Secretariat of Co-financed Public Works at YPECHODE, specification of responsibilities and amendment and supplementation of PDs 69/1988 and 91/1991".
51. PD 99/2009 (GG 125/series I/2009) "Regulation of Hellenic Police organisation issues"
52. PD 184/2009 (GG 213/series I/2009) "Establishment of the Ministry of Civil Protection and the determination of its competences"
53. PD 123/2017 "Organisation of the Ministry of Infrastructure and Transport" (GG 151/series I/2017)
54. PD 97/2017 "Organisation of the Ministry of Rural Development and Food" (GG 1389/series I/2017)
55. JMD D14a/02/69/FN380/10-11-1994 (GG 846/series II/1994) "Incorporation of the construction company called Egnatia Odos Société Anonyme".
56. MD 2025/19-01-1998 (GG 12/series II/1998) "Minister of Interior approval of the General Plan for Civil Protection dated 30.12.1997 under the code name "Xenokrates".
57. JMD 2673P2/oik.2673/29-8-2001 (GG 1185/series II/2001) "Amendment and supplementation of programmatic decisions regarding the provision of social protection".
58. JMD P2a/oik. 2673/29-8-2011 "Amendment and supplementation of programmatic decisions regarding the provision of social protection". (GG 1185/series II/2001)
59. JMD HP 31822/1542/E103/20-07-2010 (GG 1108/series II/2010) 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"" as amended and in force with JMD 17772/924 (GG series II 2140/22.06.2017).
60. JMD D28/9570/694/24-4-2014 "Amendment of joint ministerial decision under no. P2/oik2673/29-8-2001 (GG 1185/series II/11-9-2001)." (GG 1317/series II/ 2014)
61. JMD 619/146296/2016 "State aid regulation" (GG 4562/series II/2016)
62. 1299/7-4-2003 (GG 423/series II/2003) Minister of Interior approval of the General Plan for Civil Protection under the code name "Xenokrates".

63. MD 3384/28-06-2006 (GG 776/series II/2006) "Supplementation of the General Plan for Civil Protection under the code name "Xenokrates" with the special "Management of Human Losses" plan".
64. MD 20725/B.979/10-5-2011 "Determination of procedures for implementation of the provision of Article 36 of Law 2459/1997." (GG 1207/B/2011)
65. MD D17a/06/52/FN443/20-03-2007 (GG 398/series II/2007) "Determination of the roads of the Attica Prefecture and the completed motorway sections, the maintenance of which belongs to the competence of the services of the GSPW/YPECHODE".
66. MD D17a/06/19/FN443/06-02-2009 by the Minister of Infrastructure and Transport (GG 299/series II/2009)
67. Law 4483/2017 (GG 107/Series I/2017) Regulations for the modernisation of the institutional framework concerning the organisation and operation of the Municipal Water Supply and Sewerage Companies (DEYA) - Regulations relating to the Local Government organisation, operation, finances, and personnel.
68. MD 44403/2011 (GG 2492/series II/2011) "Approval of amendment of the Internal Service Organisation of the Prefecture of Attica"
69. MD 1958/2012 "Classification of public and private works into categories and subcategories according to Article 1, paragraph 4 of Law 4014/21.09.2011 (GG Series I, 209/2011)" GG 21/series II/2012)
70. MD 3648/387/30-3-2012 "Transfer of responsibilities for the project "Subsidy to companies affected by floods and other natural disasters other than earthquakes" Article 36 of Law 2459 (GG 17/A/18-2-1997)." (GG 985/B/2012)
71. The decision dated 18-4-2008 by the Minister of Interior under ref. no. 9702/200772. MD 157501/2011 "Approval of the Livestock Insurance Regulation by the Hellenic Agricultural Insurance Organisation (ELGA) - Legal Person under Private Law" by the Minister of Rural Development and Food (GG 1669/series II/2011)
72. MD 7791/A314/14/8-10-2014 "Determination of the building inspection procedure, review of building Repair and Reconstruction files as well as the adjudication of objections, after Natural Disasters" (GG 2658/series II/2014)
73. MD 5423/A314/3-6-2014 by the Minister of Environment, Spatial Planning and Public Works
74. MD DAEFK/oik.3645/D.B10/28-8-2015 "Determination of the minimum requirements for preparing restoration designs of buildings that have sustained damages due to floods and the issuance of the relevant repair permits." (GG 1894/series II/2015)
75. MD 3252/99092/22-09-2017 "Responsibilities exercised by the Regions regarding land reclamation works and Land Reclamation Organisations and the determination of cases for which the Regional Advisory Councils on Land reclamation Projects give opinions" (GG 3452/series II/2017)
76. Decision 4422/E.O./06-09-2007 (GG 1787/series II/2007) by the General Secretariat of the Attica Region "Determination of the roads of the Attica Prefecture, the maintenance of which belongs to the competence of the services of Attica, Piraeus, Eastern Attica and Western Attica Prefects".
77. Circular no. 33/3147/12-10-1998 by the Directorate of Land Reclamation Works (D7) of the General Secretariat of Public Works under YPECHODE.
78. Circular no. 938/AZ11/15-04-1998 by the PECHODE Deputy Minister in relation to the restoration of damages to buildings that were affected by floods, fires, and landslides.

79. Document no. D7c/1607/F.E33/14-9-2005 by the Directorate of Land Reclamation Works (D7) of the General Secretariat of Public Works under YPECHODE.
80. Document no. 12815/08-09-2006 by the Directorate of Utilisation of Land Reclamation Works and Machinery of the Ministry of Rural Development and Food.
81. Document no. 5301/4/16-Id/20-06-2006 by ELAS/AEA.
82. Document no. 4096/12-07-2006 by the General Secretariat for Civil Protection.
83. Document no. 1764/12-03-2009 by the General Secretariat for Civil Protection in relation to an Exercise Policy manual entitled "Planning, Conduct and Valuation of Protection Policy Exercises in the context of the General Plan for Civil Protection under the code name "Xenokrates".
84. YYKA Circular no. 109259/28-08-2007 on "Taking measures to ensure public health in the event of natural disasters"
85. Document no. P2α/G.P.oik.94064/19-08-2011 by the Directorate of Social Perception & Solidarity of the YYKA "On social protection programmes"
86. Document no. DYG2/49487/5-8-2011 by the Directorate of Sanitary Engineering and Environmental Hygiene of the YKKA "Circular on taking measures to ensure public health in the event of natural disasters"
87. Document no. D7c/1220/F.Circ. 33/29-08-2011 by the Directorate of Land Reclamation Works (D7) of the GSPW "Policing of streams and maintenance of flood-relief works"
88. Document no. 4524/A42/26-08-2011 by the post-Earthquake recovery Service (PERS) of the GSPW "Damage restoration procedure of buildings that were affected by disasters after the implementation of the 'Kallikratis' programme.
89. Document no. D7c/1220/F.Circ.33/29-08-2011 by the Directorate of Land Reclamation Works (D7) of the GSPW.
90. Document no. D7c/1202/F.Circ.33/1998/30-8-2013 by the Directorate of Land Reclamation Works (D7) of the GSPW.
91. Document no. 8284/3-4-2013 by the Technical Services Directorate of YPES.
92. Document no. 34021/16-9-2014 by the OTA Organisation and Operation Directorate of YPES.
93. MD 29310 oik. F.109.1/27-6-2014 "Organisation, structure and operation of the single operations coordination centre (SOCC)" (GG 1869/B/2014)
94. Document no. 6372/9-10-2014 by the General Secretariat for Civil Protection
95. Legislative Decree 3881/58 "On land improvement works" (GG 181/series I/1958)
96. Joint circular no. BYE/35081/6-4-1983 by the Ministries of Public Works and Agriculture
97. Circular no. 33/3147/12-10-1998 by the Ministry of Infrastructure, Transport and Networks
98. Document no. 130938/2294/22-5-2013 by the Directorate of Afforestation and Mountain Hydrometry of the Special Secretariat for Forests of the Ministry of the Environment and Energy
99. Document no. D17/81/4/F2,2,1/24-5-2007 by the PECHODE Minister.
100. Document no. 160596/4511/30-08-2017 by the Directorate of Forest Works and Infrastructures of the Ministry of the Environment ΑΔΑ 7ΑΑ4653Π8-ΠΞΛ
101. Document no. 1348/140676/7-11-2014 by the Directorate of Utilisation of Land Reclamation Works and Machinery of the Ministry of Rural Development and Food
102. Decision no. DAEE/OIK2287/22-12-2016 by the Minister of Infrastructure and Transport (GG 4420/series II/2016)
103. Document no. 1484/20-02-2017 by the General Secretariat for Civil Protection

104. Document no. 4526/22-06-2017 by the General Secretariat for Civil Protection
105. Document no. 6748/09-10-2017 by the General Secretariat for Civil Protection
106. Ministerial Decision 7575/18-10-2016 "Operating regulations of Civil Protection Coordination Authorities (CPOAs) of local authorities within the country's regions pursuant to Article 12 of Law 3013/2002 and Article 160 of Law 3852/2010, as in force." (GG 3591/series II/ 4- 11- 2016)
107. Document no. 8332/21-11-2016 by the General Secretariat for Civil Protection
108. Document no. 2110/17-04-2013 by the General Secretariat for Civil Protection
109. Document no. 9032/14-12-2016 by the General Secretariat for Civil Protection
110. Legislative Decree 444/1970 "On the competences of the Port Authority and relations with the competences of the Security Forces (GG 39/series I/2014)
111. Document no. 2/52145/0026/1-7-2014 by the General Accounting Office (ΑΔΑ: 7ΡΝΩΗ-ΨΟ2)
112. Ministerial Decision 57654/23-5-2017 "Regulation of specific operating and management issues of the Central Electronic Public Procurement Registry (CEPPR) of the Ministry of Economy and Development" (GG 1781/series II/2017)
114. PD 376/1988 "Organisation of the National Centre of Emergency Care (EKAV)" (GG 169/series I/1988)
113. Document nos. 4927/5-7-2016 and 6044/25-8-2016 by the General Secretariat for Civil Protection
114. Ministry of Health circular no. C1d/ G.P. oik.59565/4-8-2015 on "Taking measures to ensure public health in the event of natural disasters" ADA: 6MAY465ΦΥΟ-Φ25
115. Legislative Decree 17/1971 "On emergency planning policy." (GG 236/A/1974)
116. Document no. 3854/10-6-2015 by the General Secretariat for Civil Protection
117. Document no. 2300/29-3-2016 by the General Secretariat for Civil Protection ADA: ΩΜΣΚ465ΦΘΕ-7ΒΞ
118. Decision no. 8149/16-12-2014 by the General Secretariat for Civil Protection ADA: ΩΘΟΨΙ-ΛΧΦ
119. Circular no. 10 Ref. No. 7207/7-3-2017 of the Ministry of Interior ADA: Ψ65Π465ΧΘ7-4Ε8
120. Document no. 17939/30-5-2017 by the Ministry of Interior ADA: 7ΖΜΥ465ΧΘ7-ΙΥΜ
121. Document nos. 6776/5-10-2015 and 7026/14-10-2015 by the General Secretariat for Civil Protection
122. Document no. D28/GP25803/1457/27-3-2013 by the Ministry of Labour, Social Security and Welfare
123. LD 57/1973 "Regarding the adoption of social protection measures for financially weak persons and abolition of the provisions governing poverty" (GG 149/series I/1973)
124. Decision no. GDOP/0000811/EX2017/17 by the Ministry of Finance (GG 1972/series II/2017)
125. Document no. 10466/DBP108/6-3-2015 by the Directorate of Industrial Policy

According to the above institutional framework, the document under ref. no. 7742/1.11.2017 clearly determines the roles and responsibilities of all involved civil protection bodies in prevention, preparedness and flood management projects and actions. The involvement of various bodies in the above stages is summarised in Table 1.3.

Table 1.3 Involved bodies in the prevention, preparedness, and flood management stages

S/N	Prevention / preparedness / response stages pursuant to GSCP document no. 7742/1.11.2017	Stakeholders
1.	Maintenance of flood defence works	YPEN, YPYMEDI, PAMTH, Decentralised Administration of Macedonia-Thrace, Regional Units (RUs), Forest Authorities, Municipalities
2.	Prevention of flood phenomena and adversities on the road network	REMTH, Egnatia Odos SA
3.	Risk management associated with the occurrence of floods	Civil Protection Coordination Authorities (CPCA) of the RUs, ELAS, FD, EKAV, the Municipalities' Local Civil Protection Coordination Authorities (LCPCA)
4.	Public information on taking flood risk self-protection measures	GSCP, Decentralised Administration of Macedonia-Thrace (DAMTH) Civil Protection Directorate, PAMTH, Regional Units, Municipalities
5.	Assessment and Management of Flood Risks	SSW, Water Directorates, DAMTH Civil Protection Directorate
6.	Hazardous weather outlook - increased preparedness	National Meteorological Service (EMY), GSCP Operations Centre (CPOC/ERCC), DAMTH Civil Protection Directorate, PAMTH, Municipalities
7.	Public information and provision of instruction of potential risks	GSCP, DAMTH Civil Protection Directorate, ELAS, PAMTH, Central Regional Protection Coordination Body (CRPCB), Ministry of Health
8.	Initial warning - First flood impact assessment	ELAS, FD, EKAV, Municipalities, PAMTH, AMTH Civil Protection Directorate, CPOC/ERCC
9.	Emergency response and management of the consequences of flooding	ELAS, FD, EKAV, National Health Operations Centre (NHOC), Municipalities, Regional Units, PAMTH, DAMTH Civil Protection Directorate.
10.	Search-rescue operations	FD, ELAS, EKAV facilitated by Municipalities, PAMTH, DEYA, DEDDIE, DEPA, DESFA.
11.	Emergency response and management of the consequences of flooding ^(*)	ELAS, FD, Public Utility Companies, Municipalities, PAMTH, DAMTH Civil Protection Directorate
12.	Declaration of areas as a state of emergency / Coordination of bodies	GSCP, CPOC/ERCC, PAMTH
13.	Organised removal of citizens	Municipalities, REMTH, Decentralised Administration, GSCP
14.	Involvement of volunteer organisations	CPCA, LCPCA, GSCP
15.	International involvement	GSCP
16.	Social benefits and aid to affected persons	Municipalities, National Center for Social Solidarity (NCSS), YPYMEDI, YPAN, ELGA, GSCP

S/N	Prevention / preparedness / response stages pursuant to GSCP document no. 7742/1.11.2017	Stakeholders
17.	Keeping of special disaster file	GSCP, AMTH Civil Protection Directorate and the involvement of all stakeholders

(*) The term induced phenomena means natural or technological disasters that may be caused by floods, such as landslides, dam failures, leakage of hazardous materials, etc.

2. International cooperation agreement for the transboundary Evros river basin

2.1. Greece's transboundary waters – general information.

The overall water balance of Greece with neighbouring countries makes it a water resources recipient - country to a significant degree in relation to its total water potential.

The basins that Greece shares with its neighbouring countries to the north are the Axios river basin (with the former Yugoslav Republic of Macedonia - RYROM), the Strymonas river basin (with Bulgaria), the Nestos river basin (with Bulgaria) and the Evros river basin (Arda and Erythrotamos with Bulgaria and Evros river itself with Bulgaria and Turkey). Many lakes also have transboundary basins (Little and Great Lake Prespa with Albania and FYROM, Doirani with FYROM). Greece also shares the Aoös river basin with Albania, however, in the opposite direction with the previous cases (two separate sub-basins of this river basin belong on Greek territory, those of the main Aoös river and Drinos river). Moreover, an upstream part of the wider Axios basin (Sakoulevas river or Lygkos river) belongs to the Greek state in the Regional Unit of Florina.

The estimations in relation to the balance of transboundary waters vary and originate from various source; however, the total inflow into the country from transboundary rivers is calculated at 14-16 cubic kilometres per year (km³). According to the AQUASTAT database of the UN Food and Agriculture Organisation (FAO, 2001), Greece receives about 16 km³ per year from neighbouring countries, and about 1.8 km³ exits the country towards third countries (Albania). Similarly, the assessment of the World Resources Institute (WRI, 2003) is that the inflow from third countries is estimated at 15 km³, although an assessment is not provided on the runoff to third countries. The same sources estimate that the total runoff into the country is 74 km³ (including inflows from third countries). Thus, the percentage of the inflows from transboundary basin is estimated at about 20% or 1/5 of the total available quantity per year.

This percentage is quite significant in terms of the country's water resources and thus cooperation in terms of managing this water potential is of strategic importance.

Until recently, the most serious action in the transnational co-operation for managing the transboundary water resources was the transnational agreement between Bulgaria and Greece on the waters of the Nestos (1995) which provides that Greece ensures 29% of the river's annual runoff as measured at the borders of the two countries.

Of the transboundary basins of Greece, the most flood prone are the Strymonas basin WD 11 and the Evros basin WD 12, which is being examined here. However, the Evros basin has the uniqueness that it is the only transboundary basin in which the flood problem originates almost exclusively from the parts of the basin that are located outside the Greek territory.

Of late, from mid-2010 until today, great progress has been made in the active collaboration between Greece - Bulgaria and Greece - Turkey with respect to the management of transboundary waters. Presented below is the cooperation framework between the countries with respect to this issue, the joint bodies, groups, and committees that have been established and their responsibilities with respect to the management of transboundary waters.

2.2. Cooperation framework with neighbouring countries of the Evros river basin

The international cooperation framework for the management of transboundary waters shared with neighbouring countries is affected by the different regime in relation to the

European Union and the obligation that Bulgaria and Turkey have to implement European law.

As an EU member since 2007, Bulgaria is obligated to fully implement Directive 60/2007. Turkey on the hand is not an EU member and is therefore not obligated to implement the Directive. It is worth noting that both the Greek and Turkish sides place great emphasis on the joint management of the Evros flood problems.

The Evros transboundary basin concerns both Greece and Bulgaria, with which it shares Arda river and Erythrophotamos, as well as Greece and Turkey where the river constitutes the border line with the exception of a small part around Adrianoupoli, where the river, in its entirety, flows on Turkish soil.

2.2.1. Cooperation with Bulgaria

On 27 July 2010, a Joint Declaration was signed between the (then) Hellenic Minister of Environment, Energy and Climate Change and the Bulgarian Minister of Environment and Water, "On the understanding and cooperation in the field of use of water resources on the respective territories of the shared river basins between the Republic of Bulgaria and the Hellenic Republic". On 16 May 2011, based on this Joint Declaration, a meeting was held in Drama between the national delegates, at which time the Joint Expert Working Group (JG) was established.

The Joint Expert Working Group comprise of:

Bulgarian side:

- The Director of the Eastern Aegean RBD as the National Representative
- The Director of the Western Aegean RBD as the National Representative
- One (1) substitute National Representative position, which in this phase comes from the National Institute of Hydrology and Meteorology.
- and six (6) more ordinary members

Greek side:

- The Special Secretariat for Water, as the National Representative,
- One (1) substitute National Representative position
- Three (3) members from the Ministry of Productive Reconstruction, Environment and Energy (YPAPEEN)
- One (1) member from the General Secretariat of Civil Protection
- One (1) member from the Water Directorate, Eastern Macedonia-Thrace,
- One (1) member from the Water Directorate, Central Macedonia,
- One (1) member from the Ministry of Foreign Affairs (YPEX)

The possibility is also provided for experts on various issues related to the subject of the Working Group to assist the work of the Group on a case-by-case basis when deemed necessary.

The Joint Working Group met for the first time in Drama on 16 May 2011 and held its second meeting in Sofia on 12 October 2011. The third Joint Working Group meeting was held in Thessaloniki on 23 April 2013, the fourth was in Athens on 8 May 2015 and the fifth in Sandanski on 13 May 2016. The sixth and last Joint Working Group meeting took place in Kavala on 21 June 2017.

Three sub-working groups were established for: a) invoicing policies; b) administrative and legislative issues and c) technical data. The sub-group on the technical data has since met three times: in Kavala on 26 April 2012, in Blagoevgrad on 25 and 26 July 2013, in Athens on 23 June 2015.

At the meetings of the sub-group for technical data, discussions were held on issues pertaining to the Preliminary Flood Risk Assessment, and information was exchanged on the methodology, the criteria spatial files that each country identified. A comparison was also made of the designated Areas of Potential Significant Flood Risk (APSF), from which it arose that:

- Bulgaria has not designated an APSF in the part of the Arda river upstream of the Greek-Bulgarian border, with the justification that there is no flood risk in the area, whereas Greece has designated APSF downstream of the border due to flood risk,
- both sides have designated APSFs along the Greek-Bulgarian border for a 12 km long section where Evros river constitutes the border.

With respect to the preparation of Flood Hazard and Risk Maps, the coordination actions that have been taken to date include:

- Both sides coordinated the hazard analysis return periods (RPs) considering the RP for floods with a high probability have been set at 20 years for Bulgaria and 50 years for Greece. It was agreed that both sides will include their analysis and both RPs for the border area of Evros river.
- Information was exchanged with respect to the flood hazard and risk methodology assessments.
- Greece informed the Bulgarian side about (a) the available topographic data for the border area of Evros river and the methodology concerning the production of the digital terrain model and the river cross-sections, and b) the hydraulic modelling data (roughness coefficients, borderline conditions, etc.). This data was forwarded to the Bulgarian side in July 2014.
- Bulgaria informed Greece of the peak discharges at 20, 50, 100 and 1,000-year return periods for the rivers Evros, Arda, Strymonas and Nestos (without hydrographs) which were forwarded to the Greek side in February 2015.

2.2.2. Cooperation with Turkey

On 14 May 2010, a Joint Declaration was signed between the Minister for Environment, Energy and Climate Change of the Hellenic Republic and the Minister for Environment and Forestry of the Republic of Turkey “to establish and operate a system of permanent cooperation for the sustainable development of the Evros basin”. Based on this Joint Declaration, a Joint Committee was established for the Evros river which held its first meeting on 30 May 2010 and established a Joint Working Group for the exchange of information on the quality and quantity of waters of the river and data and assessments on the flood risk management of the river. The WG has met twice, in Adrianoupoli on 24 June 2011 and in Alexandroupoli on 8 September 2011.

To date, information has been exchanged in relation to the available monitoring stations (meteorological, rain gauges and hydrometric) in each of the two countries. They agreed on the use of uniform coordinates, the reconciliation of the stations' altitudes due to different reporting systems and the installation an online information exchange platform.

2.3. ARDAFORECAST Project

Collaboration also existed in the context of the Greek-Bulgarian project “Flood warning system establishment in Arda river basin for minimising the risk in the cross-border area” also known as “ARDAFORECAST”, on creating an early warning flood system at Arda river.

In the context of the European Territorial Cooperation Programme, Greece – Bulgaria 2007-2013, the Regional Development Fund of the Region of Eastern Macedonia-Thrace in cooperation with the National Institute Meteorology and Hydrology (Lead Partner), East Aegean River Basin Directorate, and the Democritus University of Thrace (Department of Civil Engineering), the project entitled “Flood warning system establishment in Arda River Basin minimising the risk in the cross border area” (ARDAFORECAST) with a total investment of € 823,220.50 was implemented.

Arda is a river that creates the most hazardous floods in the south-eastern Balkans, which produce a multiplier effect downstream to Maritza / Evros causing severe damage to the BG-GR CBC area. The project is dedicated to the creation, installation, and preparation of a real-time flood warning system, to flood prevention and to the determination of flood mitigation measures. The project development technical strategy is to take advantage of all the information about the river basin in flood forecasting computer tools.

The project aims to improve flood risk management at the border area, support the efficiency of flood mitigation measures and define flood prevention policies or measures to improve safety and quality of life.



Figure 2.1. Logotype of the Greek-Bulgarian ADRAFORECAST project

Data that was developed in the context of the ARDAFORECAST project were utilised in the present study, with the most important being the greatly improved DTM for the Greek part of the Arda river basin, which was based on the enrichment of existing backgrounds with digitised data from small-scale maps and on-site critical capture data. This work was conducted in the context of the ARDAFORECAST project by the Mountainous Water Management and Control Laboratory team of the Democritus University of Thrace (DUTH) in Orestiada that was led by Assistant Professor Fotis P Maris.

It should also be noted that for the project’s work, hydrometric data were provided by Turkey from 2005 onwards for various locations of Evros river and its tributaries. This data was utilised in the hydrological analysis for the development of the Flood Hazard and Risk Maps of the Evros river basin.

3. Short description of the study area

3.1. Geographical location - Administrative affiliation

The Evros river basin, which has a total area of 53,000 km², occupies part of the eastern Balkan Peninsula and is shared between Bulgaria, Turkey, and Greece. To the north and west the basin develops on Bulgarian soil, in the southeast mainly on Turkish soil and in the southwest on Greek territory. Parts of Evros river constitute the national border between Greece - Bulgaria and Greece - Turkey. The entire basin is presented in Figure 3.1 at the end of Chapter.

The river runs for a total of 528 km, of which 310 km belong to Bulgaria, whereas 208 km define the border between Greece with Bulgaria and Turkey. The river basin is shared among the three countries which it crosses as follows:

- 35,085 km² (66.2%) belong to Bulgaria,
- 14,575 km² (27.5%) belong to Turkey, and
- 3,340 km² (6.3%) belong to Greece.

The Bulgarian part of the Evros (Maritsa) basin administratively belongs to the Provinces of Sofia, Plovdiv, Khaskovo and Burgas. The main cities/town in the Bulgarian part of the Evros basin are Pazardik (130,000 inhabitants), Plovdiv (340,000 inhabitants), Stara Zagora (150,000 inhabitants) and Khaskovo (80,000 inhabitants) The Turkish part of the Evros basin administratively belongs to the Provinces of Adrianoupoli (Edirne), Kirklareli and Tekirdag. The main city/town in the Turkish part of the Evros river basin is Adrianoupoli (Edirne, 120,000 inhabitants) Based on the latest administrative reform, in its entirety the Greek part of the basin administratively belongs to the Decentralised Administration of Macedonia - Thrace and to the Region of Eastern Macedonia and Thrace. At local government level, it is shared among four Municipalities and 12 Municipal Units. On the Greek side, the main cities/towns are Orestiada, Didymoteicho, Soufli, Feres and Alexandroupoli.

Evros is the second largest river in the Balkans (after the Danube River) and is characterised by the transport sediments that it transfers and deposits between Alexandroupoli and Ainos. It originates from the Rila mountain range of western Bulgaria to the south of Sofia and flows southeast on Bulgarian soil forming a valley between the Rhodope and Ainos mountain ranges and running through the towns of Plovdiv (Filippoupoli), Harmanli, and Svilengrad and is the recipient numerous tributaries. From Ormenio, Evros constitutes the Greek-Bulgarian border until the area of the “triethnes” i.e., where the three countries meet, and then constitutes the Greek-Turkish border until the confluence of Arda river close to the Kastanies village. It then enters Turkish soil for a few kilometres forming the Karagatch Triangle close to Adrianoupoli where it is the recipient to its main tributaries Tountza from the north and Arda from the west.

It then turns to the south and constitutes the Greek - Turkish border by geographically dividing western Thrace from eastern Thrace, whereas close to Didymoteicho it receives the waters of the Erythropotamos river from the west and further south, at the height of Tycheron, Ergene from the east. It flows close to the Greek towns of Nea Vyssa, Pythio, Didymoteicho, Soufli, Lavara, Tycheron, Feres and the Turkish towns of Meriç, Ipsala, Doyran and Enez and pours into the north Aegean Sea (Thracian Sea). The mean longitudinal inclination from the estuaries up to 200 km upstream is 0.25%.

3.2. Main tributaries and hydrographic network

The main tributaries of Evros river are Arda, Tundjha and Ergene. In the Greek part the main tributaries are Arda and Erythropotamos (See Fig. 3.1).

Arda river (which in ancient times was called Arpissos) originates from the Bulgarian side of the Koula mountains and has a river basin that measures approximately 5,644 km², of which about 5,300 km² is located in Bulgaria and about 344 km² is located in Greece. After a 216 km route on Bulgarian soil, it enters Greek territory close to Milea village. After running for 43 kilometres on Greek territory, in the province of Orestiada it meets Evros river in the area of Kastanies village, close to Adrianoupoli. Arda river constitutes a significant ecosystem for the area and the forest that develops along the riverbed is a habitat of exceptional national importance. The entire area belongs to the NATURA 2000 Program. The Arda dam, which is located 8 km from Kyprino, was constructed in 1969 and has a length of 350 metres.

Tountzas has a river basin that measures approximately 8,000 km² of which about 7,900 km² are located in Bulgaria and about 100 km² are located in Turkey. It originates in Central Bulgaria and after travelling a distance of about 300 km on Bulgarian soil from west to east and then from north to south, it enters Turkish soil and after 50 km on Turkish soil it contributes to Evros river at Adrianoupoli level, across from Kastanies.

Ergene is entirely located in Turkey and its river basin measures approximately 11,300 km². It originates from the Istranca mountains in eastern Thrace and after travelling a distance of about 280 km on Turkish soil heading west and then south, it contributes to Evros river at Ibriktepe, across from Tychero.

Erythrotamos river, an important tributary of Evros river, which has a river basin that measures approximately 1,570 km² of which 970 km² is on Greek territory, contributes to Evros river close to Didymoteicho. Part of its basin belongs to Bulgaria (upstream of Metaxades) At Mikro Dereio level, Erythrotamos river leaves the Greek territory for a bit and travels on Bulgarian soil only to constitute the natural border between the two countries until it re-enters Greek territory at Metaxades level.

About 100 smaller watercourses, distributed symmetrically on the northern and southern sides, contribute to the Bulgarian part of Evros river. The mean altitude of the part of the Evros River basin on Bulgarian soil is 580 m and the mean bed slope 0.7%. On the Turkish side, with the exception of Ergene, no significant watercourses contribute to Evros river. Sazlıdere, which contributes to Evros river in the area across from Orestiada, could be considered the most important.

In the Greek part, there are three individual drainage sub-basins: Arda, which enters the Greek part from the northwest; Erythrotamos a little further to the south and Evros in the remaining part. At the upstream part of the contribution with Arda, Evros is the recipient of smaller stream from the Greek side, with most important are the streams Skoteino, Achladera, Galazio, Vlachou, Perdikorema, and Agapi.

Crossing the Nea Vyssa - Orestiada area are smaller watercourses which contribute to Evros river. The most significant are: A) Palaiomaritsa stream, or Berdemeno stream, travelling almost parallel to Evros river from the northern Greek-Turkish border, it contributes to Evros river close to Pythio; b) Tartara stream, starts from the north-western end of the basin and heading east with the name Manna stream meets Palaiomaritsa south east of Kavylis; c) Platyrema stream which also starts from the north-western end of the basin and heading south east it meets Berdemeno stream close to Palaia Sagini; and d) Gourounorema or Platanos stream, which flows parallel to the south western margin of the basin and meets Evros river east of Pythio.

After the confluence with Erythrotamos, Evros river travels about 120 km until its delta, where it is the recipient of smaller streams from the Greek side, the most important being

Potistiko stream in the Mandras area, Kamilipotamo stream and Diavolorema stream in the Lykofis area, Mavrorema stream in the Kypoi area and Mega stream in the Feres area.

It computed that the minimum discharge from Evros river is about 8 m³/s, whereas its normal discharge is between 50-100 m³/s (former YPAN, 2008). Peak discharge appears between March and May and the minimum between July and September. Evros is a non-navigable river with a large volume of its waters being used for power production (mainly in Bulgaria) and irrigation.

The topographic terrain in the wider water basin reaches 2,915 m, with a mean altitude of 411 m and a mean slope of 11% The topographic terrain in the Greek part of the water basin reaches 1,202 m, with a mean altitude of 175 m and a mean slope of 7% The maximum altitude in the Arda basin reaches 405 m, with a mean altitude of 98 m and a mean slope of 10% The maximum altitude in the Erythrotamos basin reaches 1,127 m, with a mean altitude of 276 m and a mean slope of 18%

Table 3.1 summarises the attributes of Evros river and the main tributaries on Greek territory. The stated length and area of the sub basin corresponds to the Greek part of the rivers (See also para. 3.2)

Table 3.1. Evros and main tributaries on Greek territory.

Basin Code	Name of river	Length (km)	Area of Drainage Sub-basin (km ²)
GR1210	EVROS	208.2	2,030
GR1210	ARDAS	42.6	344
GR1210	RYTHROPOTAMOS	170.9	971

3.3. Administrative affiliation

The study area of this project is the administrative basin of Evros river, which includes the Greek part of the Evros river basin, as well as some smaller local basins. Based in the division of the Greek state into 14 Water Districts (WD) and 46 administrative river basins (RBs), the above administrative basin belongs to the Thracian Water District (WD 12), it bears the code GR1210 and is called Evros River Basin.

The above hydrological division of the Greek state was ratified by the National Committee for water with decision no. 706/16.7.2010 (GG/Series II/1383/2.9.2010) as revised with GG/Series II/1572/28.02.2010. The Thracian WD comprises of a total of **five** (5) river basins. These basins and their physical attributes are presented in Table 3.2 below.

Table 3.2 WD River Basins Thrace [GR12]

Basin code	Basin name	Area (km ²)	Altitude (m)		
			Mean	Maximum	Minimum
GR1207	NESTOS	2975.5	606	2200	0
GR1208	XANTHI - XIROREMA STREAM	1663.6	363	1822	0
GR1209	KOMOTINI– LOUTRA EVROS STREAM	1958.4	289	1459	0
GR1210	EVROS	4080.9	175	1202	0
GR1242	THASOS– SAMOTHRACE	564.3	347	1600	0

The geographic position of the Evros river basin in relation to both the limits of WD 12 and the wider limits of the transboundary Evros river basin, which is shared by Bulgaria, Turkey, and Greece, is presented in Figure 3.1 on the following page.

The key units of management which must implement Directive 2007/60 are the River Basin Districts or the Water Districts (WD) as defined in the Greece based on the previously

mentioned NCW decisions. With respect to the management of floods, Article 3(2) allows the appointment of a different unit of management for individual river basins and coastal areas.

According to Commission's Guidance Document No. 29, the presentation of the conclusions and provisions of the FRMP is based on the Areas of Potential Significant Flood Risk (APSFRR) that have been identified in the study area. Three (3) APSFRRs have been identified in the study area which area briefly presented below.

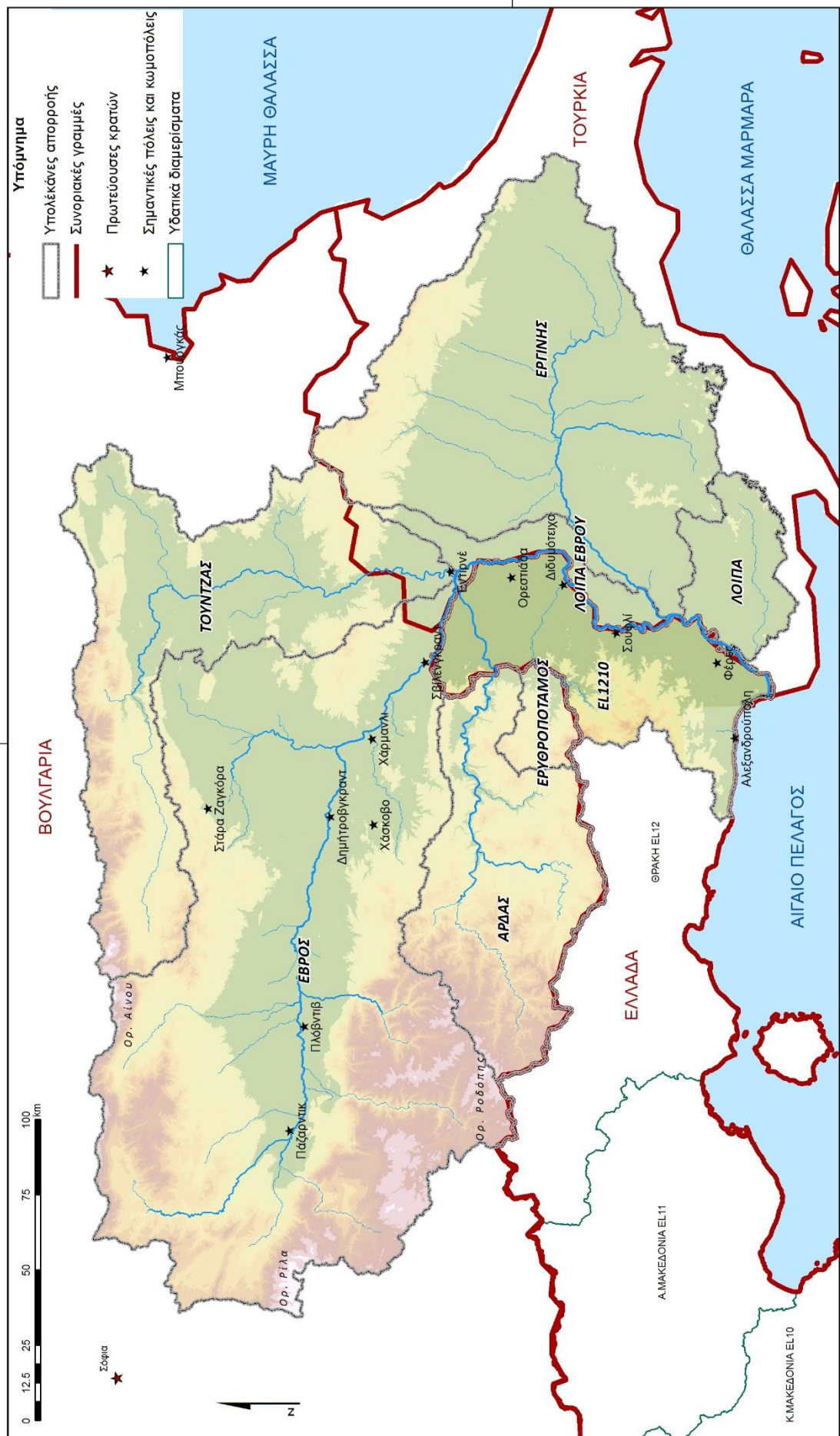


Figure 3.1. The total Evros river basin.

4. Preliminary Flood Risk Assessment

The Preliminary Flood Risk Assessment (PFRA) was the object of Stage I of this project. This work had already been prepared at country level as part of an Engineering contract for the implementation of Directive 2007/60/EC in Greece, which the Special Secretariat for Water had concluded with a partnership of engineering firms. As part of this contract and in light of the submission deadline of the PFRA results to the European Union, which was set for March 2012, the preliminary flood risk assessment was prepared for the entire Greek state and its results were submitted to the Commission in a timely fashion.

In the context of this project, the PFRA was elaborated and focused on the study area, namely the Evros River Basin (GR1210), by updating the data that had been collected up to 2012 and by taking advantage of more detailed sources of information regarding the extent and intensity of floods in the area.

4.1. Flood risk assessment.

4.1.1. Natural environment

Table 4.1 below presents the protected areas of the study environment that may be affected by floods in the future:

Table 4.1. Natural environments that are affected

Type of area	Number of areas	Remarks
NATURA nature protection areas (SCI)	2	These are the areas GR1110005 (Evros mountains) and GR1110007 (Evros Delta and Dytikos Vrachionas)
NATURA nature protection areas (SPA)	2	These are the areas GR1110006 (Evros Delta) and GR1110008 (Tributary Forest of northern Evros and Arda)
National Parks	2	All areas of the Evros Delta National Park are affected except for areas B and D Areas B1 and B2b of the Dadia-Lefkimi-Soufli Forest National Park are in contact with the flood areas.

The NATURA (SCI) “Evros Mountains” area and the affected areas of the Dadia-Lefkimi-Soufli Forest National Park are practically identical. They are included in the above Table for reasons of completeness, although their involvement with areas that is subject to future flood risks is limited to the contact of the foothills of the hilly elevation above Soufli and Kornofolia with the lowland areas to the east which are located within the flood areas.

4.1.2. Anthropogenic environment

The following tables present the results of the flood risk analysis report for the various categories of land use and activities of the anthropogenic environment in the study area.

Table 4.2. Installations that are affected by potential floods

Type of facility	Number	Remarks
Industrial/Handicraft and Rural facilities	3	These are three rural product packaging facilities that belong to associations

Type of facility	Number	Remarks
Wastewater Treatment Plant (WWTP)	3	These include the WWTP of Orestiada, Didymoteicho and Soufli
Pig farming units	1	This is a unit with a capacity of > 50 positions
Irrigation pump stations and water intake	11	These are collective irrigation pump stations of the LLRO that are located alongside Evros river and Arda River
Drainage pump stations	19	These are drainage pumping stations of the riparian rural areas
Isolated irrigation boreholes	> 250	These are pumping installations of isolated irrigation boreholes (collective and private)

Table 4.3. Waste disposal sites that are affected

Type of facility	Number	Remarks
UWDS	2	These are two closed UWDS, namely in Nea Vyssa and Lavara

Table 4.4. Local Districts whose areas are potentially affected by floods

Local District /PC	Municipal Unit	Municipality	Local District Seat /PC	Area (stremma)
Loutro	Traianoupoli	ALEXANDROUPOLI	Loutro	13,691
Ardanio	Feres	ALEXANDROUPOLI	Ardanio	300
Dorisko	Feres	ALEXANDROUPOLI	Dorisko	71,096
Peplo	Feres	ALEXANDROUPOLI	Peplo	25,718
Feres	Feres	ALEXANDROUPOLI	Feres	46,078
Didymoteicho	Didymoteicho	DIDYMOTEICHO	Didymoteicho	7,696
Isaakio	Didymoteicho	DIDYMOTEICHO	Isaakio	2,534
Petrades	Didymoteicho	DIDYMOTEICHO	Petrades	1,682
Praggi	Didymoteicho	DIDYMOTEICHO	Praggi	6,738
Pythio	Didymoteicho	DIDYMOTEICHO	Pythio	11,418
Sofiko	Didymoteicho	DIDYMOTEICHO	Sofiko	10,694
Kavyli	Vyssa	ORESTIADA	Kavyli	300
Kastanies	Vyssa	ORESTIADA	Kastanies	60
Nea Vyssa	Vyssa	ORESTIADA	Nea Vyssa	24,962
Rizia	Vyssa	ORESTIADA	Rizia	5,942
Kyprino	Kyprino	ORESTIADA	Kyprino	1,365
Fylakio	Kyprino	ORESTIADA	Fylakio	2,047
Thourio	Orestiada	ORESTIADA	Thourio	4,998
Neo Cheimonio	Orestiada	ORESTIADA	Neo Cheimonio	11,435
Orestiada	Orestiada	ORESTIADA	Orestia	33,650
Arzo	Trigono	ORESTIADA	Arzo	768
Dikea	Trigono	ORESTIADA	Dikea	3,268
Elaias	Trigono	ORESTIADA	Elaias	1,720
Therapeio	Trigono	ORESTIADA	Therapeio	2,026
Komara	Trigono	ORESTIADA	Komara	6,299
Marasia	Trigono	ORESTIADA	Marasia	4,365
Milea	Trigono	ORESTIADA	Milea	1,465
Ormenio	Trigono	ORESTIADA	Ormenio	4,739
Plati	Trigono	ORESTIADA	Plati	3,488
Ptelea	Trigono	ORESTIADA	Ptelea	1,966
Amori	Orfanos	SOUFLI	Amori	5,259

Local District /PC	Municipal Unit	Municipality	Local District Seat /PC	Area (stromma)
Lavara	Orfea	SOUFLI	Lavara	11,711
Mandra	Orfea	SOUFLI	Mandra	2,155
Kornofolea	Soufli	SOUFLI	Kornofolea	5,621
Lykofotos	Soufli	SOUFLI	Lykofotos	4,319
Lagyna	Soufli	Soufli	Lagyna	6,708
Soufli	Soufli	SOUFLI	Soufli	6,617
Lyra	Tychero	SOUFLI	Lyra	2,233
Tychero	Tychero	SOUFLI	Tychero	24,268
Fylakto	Tychero	SOUFLI	Fylakto	5,774

It is noted that the areas that are reported as being affected in the forty (40) Local Districts of Table 4.4, mainly concern rural and land areas. Of the riparian settlements with established settlement boundaries, only the settlement of Poros is wholly located within the potential flood zone. Many of the riparian settlements are in contact with the flood zone (e.g., Tychero, Fylakto, Soufli, Lykofi, Lavara, Lagyna, Praggi, etc.). In the past, the low-lying areas of these settlements have been inundated by floods, with the worst flood occurring in Lavara in the 2010 floods, which also flooded many residences. In most cases, ancillary rural buildings, and other similar structures within the limits of the settlement were flooded. Although the majority of the settlements were not flooded, the fact that their limits are so close to the flood zone creates risks for the riparian settlements.

4.2. Identification of Areas of Potential Significant Flood Risk

The identification of areas of potential significant flood risk considered all the aforementioned information and data analyses that were gathered for significant floods in the past. Given that the designation is also based on the projection of the impacts of the significant floods that occurred in the study area, information on the spatial area of past significant floods was used. Other information regarding past significant floods was also used as described below.

Overall, it was possible to collect the past significant flood spatial data information for the following years: 1998, 2003, 2005, 2006 and 2010. Historically speaking, these floods rank among the most intense to hit the study area and are definitely among the widespread in the last 15 years. The fact that mapping is available (even large-scale) of the spatial area of these floods is extremely important for the reliability of the final designation of the areas of potential significant flood risk.

The spatial imaging of the floods that were considered for the designation of the areas of potential significant flood risk included:

- Satellite imagery of the spatial area associated with the 1998, 2003 and 2005 floods from the Dartmouth College Flood Observatory USA.
- Imagery of the spatial area associated with the 2006 floods from the processing of satellite data.
- Satellite map of the spatial area associated with the 2010 floods (source: Mountainous Water Management and Control Laboratory, DUTH, Orestiada).
- Map of the spatial area associated with the 2010 floods (source: Civil Protection Department, Evros Regional Unit).

The following information sources were also used:

- One hundred and fifteen (115) aerial photos of the flood area associated with the 2010 floods, which were captured with low-flying devices used the Alexandroupoli Aeroclub (source: G. Tsesmelis). The photos were used to identify landmarks and

identifying features on the ground in order to map the flood areas on satellite photographs.

- Photographic documentation on the impacts of the February 2012 flood on the Ormenio settlement (source: G. Tsesmelis)

The processing of the above information in comparison with the evaluation of the study area data and mainly regarding the layout and operation of the flood defence works, led to the final identification of areas of potential significant flood risk.

The high-resolution satellite images were processed using the Google Earth environment so that characteristic features and landmarks in the area, the horizontal layout of flood defence works (embankments, drainage works) and other works that contribute to the formation of the flood-prone zones (e.g., Egnatia Odos motorway, railway line), to be identified in great detail. Then, the outline of the areas was transferred to a GIS environment.

Finally, the areas of potential significant flood risk were adapted to also include - in addition to the areas actually flooded by the aforementioned significant historical floods - those areas where floods could most likely spread under exceptional circumstances, considering soil and flood defence work data. Areas that can potentially be flooded after the deliberate failure of the embankments and flood defence works due to an artificial flood and the limitation of the flood area flood time were also included. The latter arose based on information that was provided by the competent employees of local authorities that carry out the artificial floods.

During the designation of the areas, the following assumptions were made regarding the farthest limits of potentially flooded areas:

- Based on all the information that was analysed and the available mapping, it arose that the flood never reaches the limit of Dytikos Vrachionas, even in the largest floods. Due to the significant extent of this project, which is not expected to exceed its ability to drain flood waters that would potentially reach this point, Dytikos Vrachionas was the farthest western limit of the areas of potentially significant flood risk.
- The southern part of the wetlands of the Delta, between the Drana river and lagoon is an exception. It is possible that a large part of this area may be flooded as a result of the artificial failure of the river's embankments for the quick release of the flood from the Delta, as was the case during the 2010 floods. In this case, the farthest western limit of the areas of potential flooding was Sarantametros and the arranged part of the Loutro torrent to the west of the Drana lagoon.
- No historical floods have been reported in the coastal zone to the west of Loutro torrent up to the Alexandroupoli limits (approximately at airport level). However, due to the low altitude of the area, it was estimated that it should be included in the area of potential significant flood risk, with the farthest western limit being the drainage ditch that pours into the sea, south of the Apalos settlement.
- The area of potential significant flood risk around Arda river includes the area between the river's embankments. Up until the recent flood in spring of 2015, there was no information or indications that floods had exceeded the embankments. It should be noted that the PFRA procedure had been finalised prior to the recent 2015 flood, during which embankment exceedance was noted at Rizia and Kastanies settlement level.
- Finally, it should be clarified that the areas of potentially significant floor risk essentially encompass all the settlements riparian to the flood zones. From time to time some of these areas (Lavara, Mandra, Praggi, etc.) have been partially flooded

due to local exceedance of the railway embankment or due to water penetration from underpasses, etc.

Ultimately, three (3) areas of potential significant flood risk (APSFs) were designated in the Greek part of the Evros RB (GR1210). The APSFRs are presented in the map of Fig 4.1.

Their total area amounts to 426,470 stremmas, of which 369,410 stremmas concern the area south of Nea Vyssa until its estuaries, 44,440 stremma concern the areas of North Evros (north of the Arda confluence) and around Arda river, and 12,160 stremma concern the coastal zone to the west of the Loutro torrent.

Table 4.5. Areas of Potentially High Flood Risk of the Evros RBD (GR1210)

Code	Description	Area (stremmas)
GR12RAK0002	Riparian areas south of Nea Vyssa and delta of Evros river	369,410
GR12RAK0003	Areas west of Loutro torrent	12,160
GR12RAK0004	Areas of north Evros and Arda	44,440

APSF GR12RAK0001, which concerns the Xanthi - Komotini flatlands (low-lying areas of the river Nestos, Kosythos, Kosmpatos, Aspropotamos Bosmozi, Filiouri rivers and riparian areas of Vistonida lagoon) and is outside the Evros RB which is being examined here, was also designated in the Thracian WD during the update of the Preliminary Flood Risk Assessment Report which was submitted to the EU on 22.11.2012.

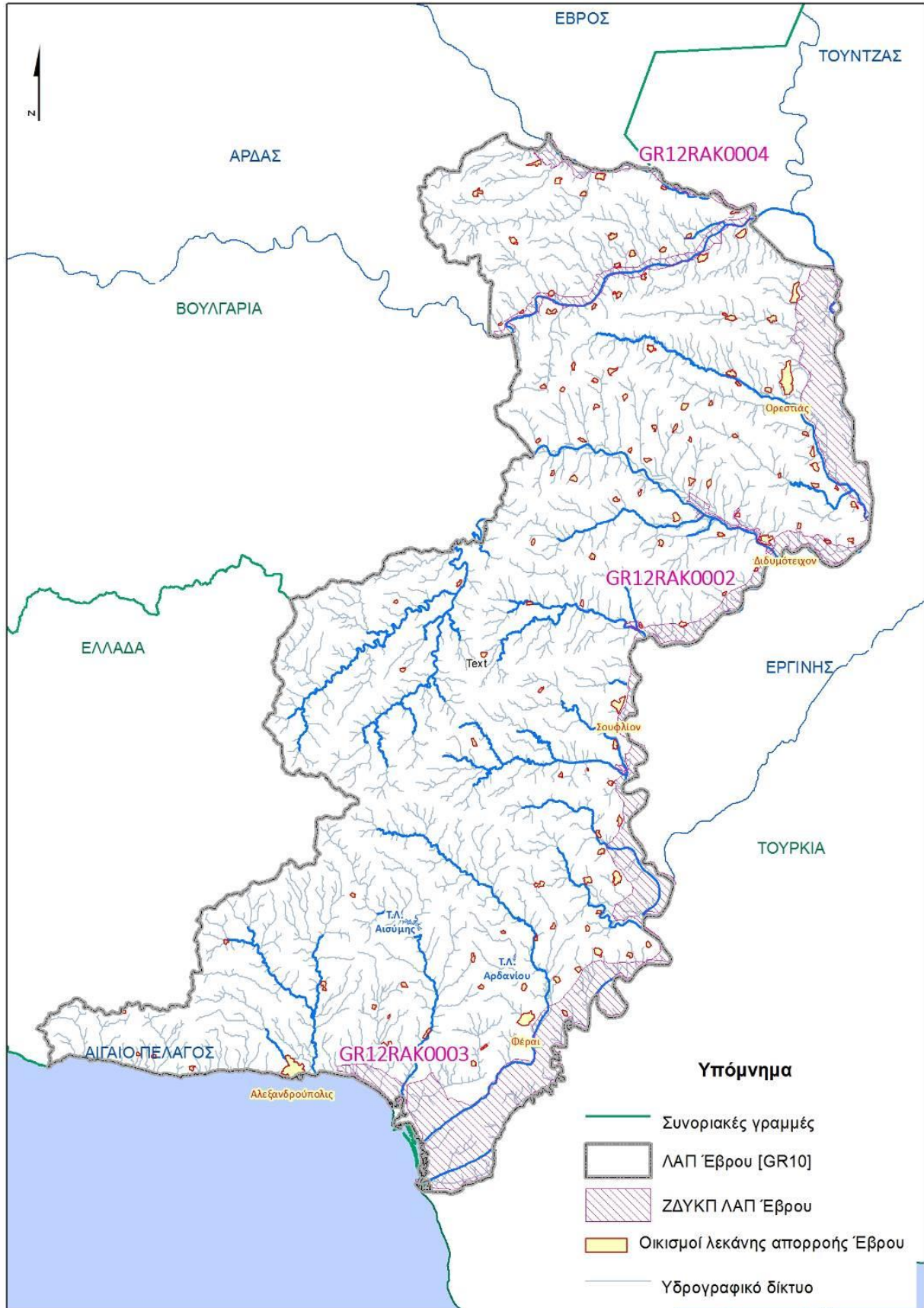


Figure 4.1: Areas of Potentially High Flood Risk of the Evros River Basin District

5. Preparation of Flood Hazard Maps

5.1. Flood Hazard Map preparation method

5.1.1. Map features

As summarised in Chapter 1.2, the Flood Hazard Maps aim at the representation of the characteristics of each flood in the study area based on the hydraulic calculations (See para. 5.1.3) for the various hydrological scenarios (See para. 5.1.2) that are being examined:

The maps have been prepared on the European Terrestrial Reference System 1989 (ETRS89) using the Transverse Mercator Projection TM07 which applies to all of Greece, so that the uploading of spatial data on the Inspire platform is possible. The maps have been posted to the specially designed YPEEN/SSW web page, namely floods.ypeka.gr.

The scale that has been selected for all the return periods, flood scenarios and flood causes is 1:25,000. Every map consists of four (4) sheets for the following sections:

- Sheet 1: Feres - Estuary section (APSFR GR12RAK0002 and GR12RAK0003)
- Sheet 2: Lavara - Feres section (APDFR GR12RAK0002)
- Sheet 3: Nea Vyssa - Lavara section (APSFR GR12RAK0002)
- Sheet 4: Ormenio - Kastanies and Arda section (APSFR GR12RAK0002 and GR12RAK0004).

The flood map due to fluvial flows for the alternative scenario III, which relates to the combination of a 100-year return period flood and the failure of a small reservoir in the Bulgarian part of the basin, is only presented for the Ormenio - Kastanies section of north Evros (APSFR GR12RAK0004), in which its impact differs from the baseline Scla scenario of the corresponding return period. Correspondingly, the flood hazard map due to MSL rise, is only presented for the Feres - Estuary section, because the flood only affects the Evros Delta and the coastal zone of Alexandroupoli (APSFR GR12RAK0002 and GR12RAK0003).

With respect to the background of the maps, the ESRI Topographic Map which is available from the Internet has been selected according to the instructions of the Department and the Technical Advisor. This map depicts the residential areas, the transport infrastructure and the border lines while including the topographic terrain in the form of equal heights with an equal dimension of 20 m. The main disadvantage of this background is the English nomenclature; however, this has been partially removed with the addition of the names of the settlements in Greek. In order to improve the accuracy of the available information, the established limits of settlements and the approved GIS have been marked on the map with a dotted line, while in terms of infrastructure, the main flood defence works of the Evros and Arda rivers and the upgraded railway line are depicted. At the same time, the limits of the APSFRs for which the analysis takes place, are marked.

The water depth for fluvial floods is represented by a blue scale, in five levels: 0.0 – 0.5 m; 0.5 – 1.0 m; 1.0 – 1.5 m; 1.5 – 2.0 m and > 2.0 m. Floods due to MSL rise use the blue scale in three level: 0.0 – 0.5 m; 0.5 – 1.0 m and > 1.0 m, since the maximum flood level does not exceed +1.23 m for the 100-year return period.

Given the extremely slow development of the phenomenon, under no circumstances do the flow velocities in the floodplain exceed 1.0 m/s, thus no cartographic information is required.

It is difficult to simulate the pooling of the waters in the present phase given that there is a dense network of drainage ditches in the area which is the main route for removing the water. Its modelling, even if it is approximate, requires a topographical background with greater

accuracy that the one that is currently available. In addition, topographic profiles of the vertical watercourses where the drainage ditches end up would be required.

A total of nine (9) flood hazard maps have been prepared, as follows:

- Four (4) flood hazard maps were prepared for the baseline scenario Ia, which correspond to the 20-, 50-, 100-, and 1000-year return periods with a high, medium, and low exceedance probability
- One (1) map for the alternative scenario Ib, which corresponds to a 50-year return period (high exceedance probability)
- One (1) map for the alternative scenario II, which corresponds to a 100-year return period (medium exceedance probability)
- One (1) map for the alternative scenario III, which corresponds to a 100-year return period (medium exceedance probability)
- Two (2) flood hazard maps due to MSL rise, which correspond to 50-, and 100-year return periods with a high and medium exceedance probability

5.1.2. Hydrological modelling scenarios

According to Directive requirements, fluvial flood modelling is required for low, medium, and high recurrence, which in Greece were quantified into floods over 1000, 100 and 50-year return periods. Especially for the Evros river basin, consideration is given to the 20-year return period, which has a high recurrence value according to the Bulgarian side.

Due to the side of the river basin, the existence of large tributaries that contribute at various locations of the river (Tountzas, Arda, Erythropotamos, Ergene) and the complexity of the flood generation mechanisms which has been occurred in the past, each occurrence probability has been examined based on one or more “flood scenarios”, which are combinations of occurrences of the different components that compose the flood response of the basin. The following Table summarises the flood scenarios for fluvial floods. It is noted that the scenarios that are considered do not concern all the APSFRs of the study area (See relevant Table 5.3)

It is noted that due to Arda river falling under the regulation regime of the Bulgarian dams, the river’s peak flood discharges at the point of entry into the Greek territory, which are used to create the flood scenarios, are divided into hypothetical “regulated discharges”, namely controlled so that they remain below the “low nuisance” threshold and flood discharges with controlled exceedance. The first range from 300 to 700 m³/s for return periods of up to 100 years (the baseline scenario), while the second are used for the 1000-year return period (1000 m³/s) as well as for a specific flood scenario that examines the impacts from a significant exceedance of Arda river (1,500 m³/s). The “low nuisance” threshold was set at 700 m³/s based on the analysis of observed hydrological data of past years during the development of flood hazard and risk maps, with the criterion of finding the discharge beyond the one whose occurrence of peak flood discharges downstream of the Arda confluence is increasing.

Table 5.1. Scenario of fluvial flooding

River	Scenario Scl, main (*)				Scenario Scll (*)	Scenario Sclll (*)
	Scla		Sclb	Downstream flood	Failure of technical infrastructures	
	Return periods (years) / Peak Discharges					
Evros	T=20	T=50	T=100	T=1000	T=50	T=100 + failure
Arda	300 m ³ /s	500 m ³ /s	700 m ³ /s	1,000 m ³ /s	1,500 m³/s	700 m ³ /s
Tountzas	T=10	T=20	T=50	T=100	T=20	T=10

Erythropotamos	T=20	T=50	T=100	T=1000	T=50	T=100	T=20
Ergene	T=10	T=20	T=50	T=100	T=20	T=100	T=20
Contributors to Greek part	T=20	T=50	T=100	T=1000	T=50	T=100	T=20

Note: The baseline return or peak flood period for each scenario is marked in bold.

(*) Scenario explanations:

Scl: Baseline scenarios for fluvial floods, with the main volume of water flowing into the country via Evros and Arda rivers. The tributaries Tountzas, Erythropotamos and Ergene participate to a lesser degree. It is divided into two sub-cases:

- Scla: The main water volume ends up in the study area via Evros river. Arda river is under complete regulation. The Arda discharge values are selected based on the threshold analysis, due to the flood flow control from the Bulgarian dams. The main Evros river flood discharges concern all the return periods under consideration.
- Sclb: The main water volume ends up in the study area due to the exceedance of very high discharges from the Arda river dams. The Evros river flood corresponds to high exceedance probability (T = 50 years).

Scll: Scenario according to which the main flood volume does not originate from the main Evros river, but rather from the tributaries Ergene and Erythropotamos. Evros river presents floods with a high probability of exceedance (T = 20 years), whereas Arda river is regulated (discharge of 700m³/sec, low nuisance threshold).

Sclll: Scenario which investigates the increase in flood discharges and the potential effects of floods with a medium probability of exceedance in the main Evros river (T = 100 years), for the simultaneous collapse of a small dam in the Bulgarian part of the basin. Arda river is regulated (discharge of 700m³/sec, low nuisance threshold).

With respect to floods due to MSL rise, the Flood Risk Management Consultant estimated the expected MSL rise, considering the astronomical tide, the meteorological flood and the MSL rise due to wave setup, for 50 and 100-year return periods, corresponding to floods of high and medium probability of recurrence. The final rises that were estimated for the study area were:

Table 5.2. Mean Sea Level (MSL) rise

APSFR Code	Description	T=50 years	T=100 years
GR12RAK0002	Riparian areas south of Nea Vyssa and delta of Evros river	1.17 m	1.23 m
GR12RAK0003	Areas west of Loutro torrent	1.18 m	1.29 m

Table 5.3 below codifies the hydrological scenarios, and the flood causes per APSFR in the study area.

Table 5.3. Flood causes and APSFR.

APSFR Code	Flood causes being examined	Scenarios (*)
GR12RAK0002	Fluvial flows - MSL rise	Scla, Sclb, Scll
GR12RAK0003	MSL rise	
GR12RAK0004	Fluvial flows - Failure of technical infrastructures	Scla, Sclb – Sclll

(*) The scenario code refers to fluvial flows and failure of technical infrastructures.

5.1.3. Hydraulic modelling

With respect to the hydraulic flood modelling, MIKE FLOOD, which is an integrated modelling package of the Danish Hydraulic Institute (DHI) was used, which is a set of computational tools for one-dimensional (along the flow of Evros and Arda rivers) and two-dimensional (outside the bed and on the floodplain) modelling of flood flows. The model that has been created runs along the length of two of the three APSFRs which were designated for the Evros RB (GR1210) during Stage I of this study and in the upstream to downstream direction these are

GR12RAK0004 (Areas of north Evros and Arda) and GR12RAK0002 (Riparian areas south of Nea Vyssa and delta of Evros river).

The river axes were digitised with the most recent available satellite images by Google Earth to reflect the current position of the higher and lower bed, considering the meandering and formation of islets along the course of the flow.

The one-dimensional flow model of Evros river between the over-topped embankments, which have a total length of 202 km, was based on 250 cross-sections which had a 1,000 m distance between one another from the Greek-Bulgarian border to Feres (~177 km) and 500 m from Feres to the estuary. The available geometric data of the river included a longitudinal section with the riverbed elevation, the altitude of the over-topped embankment at each kilometre position and the upper width of the riverbed as published in studies and research programs (PAMTH, 1999). Other geometric data that was necessary for the composition of the geometry of the cross-sections (e.g., islet dimensions of transport sediments that have developed in the riverbed) were digitised by Google Earth satellite imagery. With respect to the international part of the basin, the horizontal position of the embankments on the Turkish and Bulgarian sides was also identified by Google Earth.

In the case of Arda river, the one-dimensional flow, which was simulated in a single file with a total length of about 32.7 km, is based on 64 cross-sections with distances ranging from about 200 m to about 1,500 m between one another, with an average distance of 500 m. The cross-sections are taken between the banks in the upstream section (from Therapeio to Komara), and between the flood defences from Komara to the confluence with Evros river. It was estimated that the main riverbed has a steady longitudinal slope, determined by available data on the height of the inlet cross-sections (downstream of the Therapeio irrigation dam spillway) and outlet cross-sections (at the confluence with Evros river). The data of the digital terrain model (DTM) of the ARDAFORECAST research programme was used for the horizontal and elevation position of the flood defences, in which the embankments have been included supported by on-site topographic mapping of selected cross-sections, with reasonable assumptions in case of topographic ambiguity.

The topographic data on which the hydraulic modelling of the floodplain was based for the construction of the two-dimensional MIKE21 model was the digital terrain model (DTM) provided by the National Cadastre and Mapping Agency S.A., with a 5m x 5m grid from the Greek part of the basin and the ASTER GDEM V3.5 model with a 30 x 30 grid for the international parts of the basin. At the river zone, and at some parts of the Greek basin close to the riverbed which are not covered by the DTM provided by the National Cadastre and Mapping Agency, the two topographic backgrounds were joined. In addition, an effort was made to remove the impact of vegetation and building infrastructures from the National Cadastre and Mapping Agency background. The Greek side's main flood defences, data regarding the route and elevation, which were taken from existing studies and confirmed by partial on-site elevation mapping that was conducted by the local authorities for the Feres-Peplo embankment, were then added to the MIKE21 model. Although the embankment along the vertical axis of the Egnatia Odos motorway which crosses the study area is usually significantly higher than the natural ground level, it has not been included in the analysis, mainly because the underpasses and culverts restore flood continuity on either side, and consequently can act protectively for the western areas of APSFRs. Similarly, the embankment of the railway line, which is lower than the embankment of the Egnatia Odos motorway, has not been added to the terrain model. The calculation of the effect of the railway line on the flood protection of lowland settlements to the west was made by comparing its elevation with the flood level, as provided by ERGA OSE SA.

With reference to the limit conditions at confluence points (lateral inflows), the inflow hydrographs for the sub-basins of the Greek part have emerged from hydrological analysis,

whereas for the inflows from international parts, previously recorded, dimensionless, historical flood hydrographs have been used, with alternating assumptions per scenario regarding their timing. The analysis does not include the effect of wind on the flow and any water exchanges with the groundwater aquifers, given that these two phenomena have a very limited effect on the floods recorded in the Evros RB. In addition, the analysis only examines floods that are caused by exceedance of the main flood defences. Embankment failure, which in some cases causes significant floods in areas, is associated with cross-sectional weaknesses or unfavourable flow conditions at specific locations and can be avoided by taking appropriate embankment strengthening measures, which are identified in this FRMP.

The model was calibrated to properly reflect the extent of the significant historical February 2010 flood, which started on 12 February and lasted 25 days. The event was chosen for the calibration given that discharge fluctuations had been recorded and were available for all locations of interest and the extent of the flood both for the Greek and the international parts of the river had been captured by aerial images.

The Figure on the next page shows the area surrounding the flood, namely the maximum limit of the flood, regardless of the hydrological scenario or cause of the flood, in comparison with the APSFRs. It is observed that the flood affects all the areas of potentially significant flood risk; however, in some cases it is quite significant. Detailed commentary on the results is provided in the following paragraph.

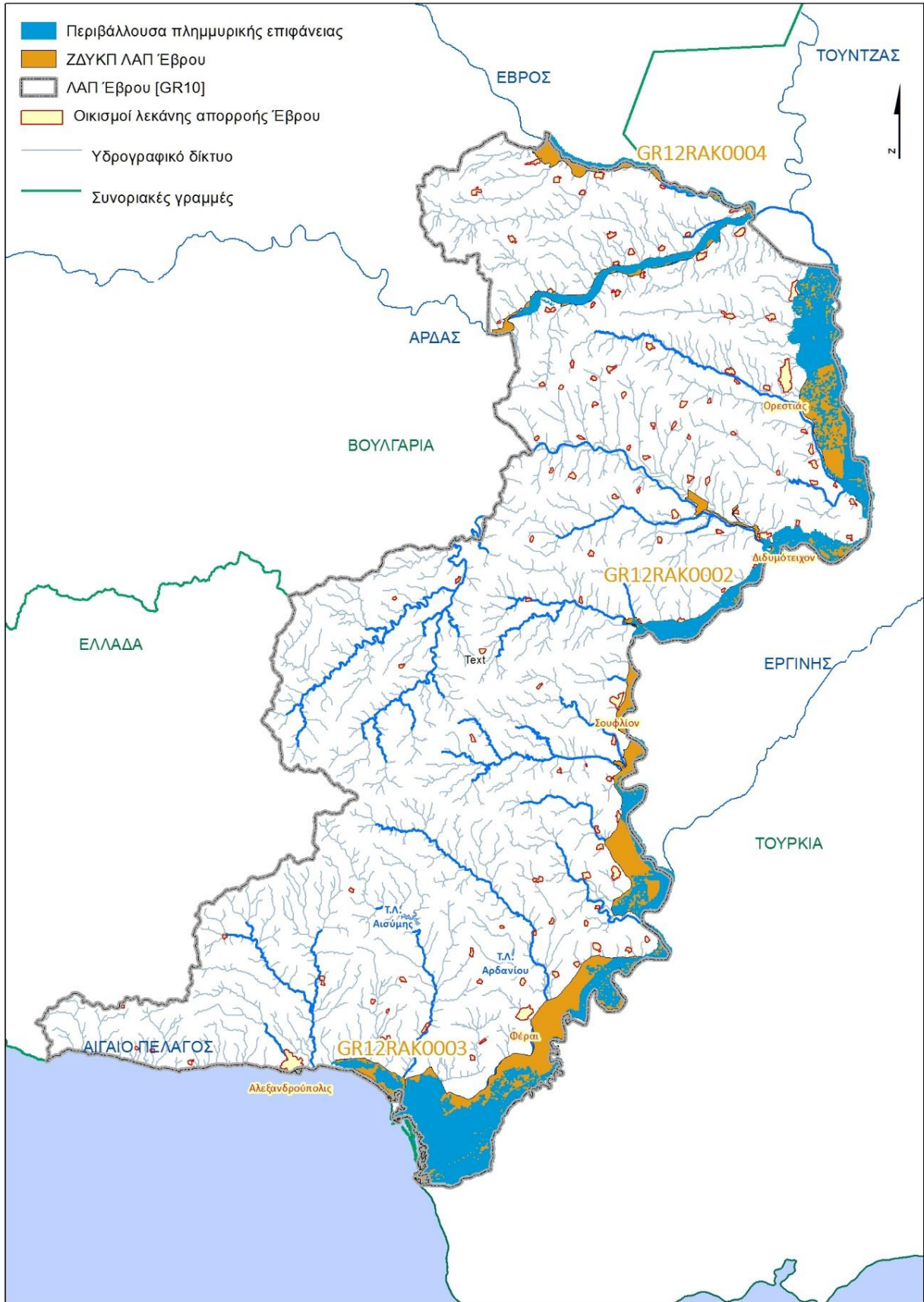


Figure 5.1: Surrounding flood area and APSFR of Evros river basin

5.2. Comments on findings

This paragraph analyses the results of the hydraulic modelling, as depicted in the flood hazard maps for each APSFR and flood scenario. Although it has previously been mentioned, it is noted that the following commentary concerns the hydraulic modelling which refers to the exceedance and not the natural or anthropogenic failure of the embankments. In this case, the flood areas may be differentiated depending on the failure point.

5.2.1. Baseline scenario Scla

APSFR GR12RAK0004

- Ormenio - Kastanies section and Arda: At the Ormenio - Marasia section for events of a high exceedance probability (T=20 and 50 years), the flood is restricted by the flood defence embankment or the upgraded route of the railway line³. At Arda river, the flood is restricted by the banks (upstream) and the flood defence embankments. For 100-year and 1,000-year return periods, both Evros river and Arda river have greater flow depths, without significantly affecting the flood zone. Especially for Arda river, events with a low exceedance probability (i.e., for a discharge of 1,000m³/sec that exceeds the low nuisance threshold, see Chapters 5 and 6) appear as restricted local bank-embankment exceedance in the area of Kyprino and Kastanies due to backwater of Evros river at its confluence with Arda river.

APSFR GR12RAK0002

- Nea Vyssa - Lavara section: In this section, for events with a high exceedance probability (T = 20 and 50 years), a flood is observed between the river and the main embankment of Orestiada. Also, flooding is also observed between the river and the axis of the railway line at the Rigio - Stathmos and Praggi - Didymoteicho - Neoi Psathades section, including the Erythropotamos confluence. For a 50-year return period, the flood extends downstream of Psathades to Lavara, while a quantity of water begins to accumulate at the northern end of the Orestiada embankment, in Nea Vyssa, but without presenting exceedance. For events of a medium exceedance probability, local flooding is observed at the low-lying areas of the Nea Vyssa farm, whereas the Orestiada farm is protected from this flood due to the vertical flood defence embankment. Also, the entire area between the river and the railway line from Rigio to Lavara is flooded. Lastly, for the 1,000-year return period, the entire Vyssa farm and part of the Orestiada farm (while low flow depth) are also flooded. In all cases, there are areas the water levels exceed the ground level by at least 2.0 m, with the problem naturally intensifying for greater return periods.
- Lavara - Feres section: For the 20-year return period, the flood in this section is restricted to the area of Lavara and Lagyna from the axis of the river to the limit of the railway line. Also, the flooding is restricted by the main flood defence embankments of Tycherio and Feres, while the horseshoe-shaped area of Poros has only local flooding. For the 50-year return period, the appears in the corresponding locations, but covers larger areas with greater depths. Moreover, a small flood is noted in the Mandra area and the confluence of Potistiko stream with the main Evros river (which intensifies, and the return period increases). In the case of medium exceedance probability phenomena, almost the entire area is flooded between the main riverbed and the main flood defence embankments; however, without exceedance being observed. For low exceedance probability flood events (1,000-year return period), flooding is observed in the Tycherio farm area due to the exceedance of its crest at the southern part close to the confluence with Provatona stream, and

³ For the assessment of the potential flood risk of the railway line and the surrounding settlements, see below, Chapter 6.

the Feres embankment in the Petalo area. Finally, the section between Lagyna and Lykofotos is flooded from the river up to the route of the upgraded railway line. High water depths (> 2.0 m) are recorded in all the scenarios and prevail for the 1,000-year return period.

- Feres - Estuary section: For floods of a high probability of exceedance, the flood is contained by the main flood defence embankment with the exception of the downstream section where exceedance of the embankment and flooding of the delta areas is observed with flow depths of < 2.0 m even for 50-year return periods. A similar image is observed for floods with a medium exceedance probability (100-year return period), while for 1,000-year return periods the flood extends to the majority of the APSFR in the Delta zone, with depths that exceed 2.0 m locally.

5.2.2. Sclb scenario

As previously mentioned, this scenario examines the potential consequences of a significant Arda river flood (1,500m³/sec), whose peak is synchronised with the peak of a high exceedance probability event (50-year return period) at Evros river. At **APSFR GR12RAK0004**, namely north Evros and up to the Arda river confluence, the flood and flow depths are identical to those of the baseline scenario Scla for the same return period. At Arda river, exceedance is observed at the riverbanks in the upstream section, in the Kyprino area, as well as local embankment exceedances are noted in the area of Elaia and in the downstream end, in Kastanies, near the confluence with Evros river. The Arda river flow depths exceed 2.0 m at almost the entire riverbed that is being simulated. At **APSFR GR12RAK0004**, namely from Nea Vyssa to the Delta, the flood of the Sclb scenario ranges between the medium and low exceedance probability events of the baseline scenario Scla, while the observed flow depths are generally in the order of 2.0 m or greater, especially close to the main riverbed. More specifically, the Vyssa farm area and the part of the floodplain between the riverbed and the flood defence embankment of Orestiada is flooded. Moreover, the flooding at the Praggi - Lavara section extends from the riverbed to the upgraded railway line, including the confluence with Erythropotamos river in Didymoteicho. Downstream of Lavara the flood affects almost the entire area between the riverbed and the main flood defence embankments; however, without exceedance being observed. Finally, at the Delta the flood is contained by the main flood defence embankment with the exception of the downstream section where exceedance of the embankment and flooding of the delta areas is observed with flow depths of less than 2.0 m.

5.2.3. ScII scenario

This scenario shows a discharge with a high probability of exceedance (20-year return period) at the main Evros river, a discharge of 700m³/sec at Arda river and floods of a medium exceedance probability (100-year return period) at Erythropotamos and Ergene. Consequently, at north Evros and Arda up to the confluence of the two rivers in Kastanies (**APSFR GR12RAK0004**), the flood is identical with the one described above in the baseline scenario and the corresponding cases. With respect to **APSFR GR12RAK0002**, in the area between Nea Vyssa and Orestiada, exceedance of the main protective embankments was not observed, whereas in the Rigio - Neoi Psathades section the flood extends from the riverbed to the railway line. Downstream of Didymoteicho, where Erythropotamos river contributes, and until its confluence with Ergene river, the flood area does not present a significant increase; however, greater flow depths are observed compared to the corresponding return period (20 years) of the Scla scenario. Downstream of Tycherio, where Ergene river contributes, the flood extends between the riverbed and the flood defence embankments of Tycherio and Feres, while a part of Petalo is also flooded with relatively low flows (< 2.0 m), compared to the phenomenon for the 50-year return period of the baseline Scla scenario. The flood of the Delta River flood corresponds to the case of the 50-year Scla scenario.

5.2.4. ScIII scenario

In this case, which examines the increase of the consequences of an event of medium probability of exceedance (100-year return period) for the simultaneous bursting of a small reservoir dam on Bulgarian soil, the flood is significant in the northern part of Evros until its confluence with Arda river, i.e., within the **APSFR GR12RAK000**. In this area, considering the embankment failure which occurred in the past in the area of Ormenio, the flood ranges at the limit of the APSFR from the Greek-Bulgarian border to Dikea, with significant flow depths (>2.0 m). From the Arda river confluence and in the downstream direction, within **APSFR GR12RAK0002**, the flood of the scenario does not differ from the corresponding flood of the 100-year return period, which has already been commented on, due to the impairment of the flood discharge of the burst.

5.2.5. Flood from MSL rise

As observed in relevant maps, the flood covers a significant part of the delta areas of **APSFR GR12RAK0002**, and up to the outskirts of the Alexandroupoli GZP in **APSFR GR12RAK0003**. The water depths above sea level are, at most, equal to 1.17 m and 1.23 m for 50-year and 100-year return periods, respectively.

The flooded areas per APSFR and the scenario under consideration are summarised in the following Table.

Table 5.4. Flood areas per APSFR and hydrological scenario

APSFR	Flood Area (stremma)							MSL rise, T=50 years	MSL rise, T=100 years
	Scla scenario, T=20 years	Scla scenario, T=50 years	Scla scenario, T=100 years	Scla scenario, T=1,000 years	ScIb scenario, T=50 years	ScIb scenario, T=100 years	ScIII scenario, T=100 years		
GR12RAK0002	107351	155,511	168,871	251,270	190,160	139,741	168,871	49,800	52,810
GR12RAK0003								7720	8,190
GR12RAK0004	20980	24,483	26,188	28,370	28,175	25,418	39,467		

5.3. Strategic conclusions from the flood hazard map preparation procedure

From the FHM preparation procedure for the study period, some basic flood risk conclusions are reached, which constitute the basis for the formulation of the main objectives of the FRMP and the proposed measures.

The flood risk assessment was carried out in the absence of basic data and information - mainly of a topographic nature - which are due, in part, to the study area being a border zone. Nevertheless, it is estimated that the analysis level that was achieved, in addition to meeting the country's obligations regarding the implementation of Directive 2007/60/EC, allows us to reach safe conclusions that have a general validity, regardless of the urgent need to update the current results after collecting the missing data and information. That said, it is not expected that the necessary update and revision of the results of the flood risk analysis that was carried out will substantially alter the validity of the main conclusions that are stated below.

The main conclusions are summarised in the following Table and are presented in further detail in the chapters that follow.

Table 5.5. Strategic conclusions of the flood hazard analysis

S/N	Strategic conclusions of the flood hazard analysis in the study period	APSFR which they concern
1.	The existing main (primary) flood defence embankments along the main Evros river south of Nea Vyssa (constructed based on the Harza study) provided they do not break, have an adequate altitude to protect the area covered by floods of up to a 100-year return period , under various adverse flood scenarios. It is pointed out that an assessment has not been made regarding the condition of the main embankments, only for the adequacy of their expected height, based on their initial design and construction. For the embankments along north Evros (Greek-Bulgarian border - Arda confluence) and along Arda river, it is possible for the level of protection to be greater under the same conditions.	GR12RAK0002 GR12RAK0004
2.	The existing secondary (over-topped or summer) flood defence embankments that contain the main bed of Evros river south of Nea Vyssa, offer a protection level which, under any conditions, is lower or much lower of the 10-year return period.	GR12RAK0002
3.	It is estimated that the existing proposals - that primarily originate from the Turkish side - regarding the increase of the discharge capacity of the main riverbed (e.g., removal of islet, etc.) other than being problematic (border issues, environmental commitments, etc.) they cannot significantly contribute in addressing the flood impacts if the current width of the main river bed is maintained (as implied), since its discharge between the over-topped embankments is already restricted (< 10-year return period from natural flood, without being burdened by the exceedance of Arda river or other factors).	GR12RAK0002
4.	Interventions on the main riverbed should be restricted to those necessary in order to restore drainage to a minimum level of flooding (e.g., 10-year return period) and under normal conditions, aimed at the reduction of "normal" floods. Rarer floods, or events resulting from an adverse combination of multiple causes should be accepted that they will be released in the flood zone that is confined by the main flood defence embankments, which should be subject to specific management.	GR12RAK0002 and GR12RAK0004
5.	The flood risk level of the entire study area greatly depends on the combination of individual flood runoff sources (mainly Evros, Arda, Ergene, etc.) and to a lesser degree on the discharge of each source for all return periods up to 100 years. Arda river, whose flood discharges can cause adverse consequences on their own , due to the sudden exceedance of the Bulgarian dams, is the only exception.	GR12RAK0002 and GR12RAK0004
6.	Arda river is the most important source of flooding in terms of combined adverse effects. The relevant scenario (Sclb) showed that the high flood discharge of Arda river can magnify the impacts of a main Evros river flood event from a rare 50-year return period to a return period in excess of 100 years and slightly residual event in a 1000-year return period.	GR12RAK0002 and GR12RAK0004
7.	The impacts of one of the many small dams on Bulgarian soil bursting , in the intermediate Evros basin between Harmanli and Svilengrad, appear to be restricted in the north Evros area. However, the impacts may be significant in this section.	GR12RAK0004
8.	Floods due to MSL rise cover a significant area of the deltas, even reaching the outskirts of the Alexandroupoli GZP. However, the flood depth is relatively restricted (<1.30m) , while it does not differ significantly for the examined return periods.	GR12RAK0003 and GR12RAK0002

6. Preparation of Flood Risk Maps

6.1. Flood Risk Map preparation method

As summarised in Chapter 1.2, the Flood Risk Maps (FRM) show the potential adverse consequences associated with each flood in the study area based on the hydraulic calculations for the various hydrological scenarios that are being examined. The alternative hydrological modelling scenarios and the hydraulic modelling have been presented above in Chapters 5.1.2 and 5.1.3, respectively.

The FRMs, in correspondence with the applicable information of the FHMs, have been prepared in the European Terrestrial Reference System 1989 (ETRS89) using the Transverse Mercator Projection TM07, while the scale that has been selected for all the return periods, flood scenarios and flood causes is 1:25,000. The online ESRI Topographic Map has been used for the background of the maps. The maps have been posted to the specially designed YPEEN/SSW web page, namely floods.ypeka.gr.

Based on the Guidance Documents, the FRMs contain information to measure the potential flood impacts on the population, economic activities and infrastructures, the natural and anthropogenic environment, which are examined using the following parameters in this study area:

- the indicative number of inhabitants potentially affected
- Types of economic activities that may be affected, which, for the study area, are measured in relation to land uses, the transport infrastructures (road and rail network), the irrigation and drainage pump stations, the natural gas pipeline, and the main flood defence embankments.
- Installations, according to Annex I of Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control, as amended by Regulation (EC) no. 166/2006 of the European Parliament and of the Council, which may cause accidental pollution in case of flooding. There are no IPPC, SEVESO facilities, open UWDS or other uses that could cause accidental pollution, and only the flood impact on WWTPs in the study area is being examined.
- Protected areas, which are defined in Annex IV, point 1, points i), iii) and v) of Directive 2000/60/EC and can be affected and which are areas designated for the abstraction of water, areas designated as recreational waters, including bathing waters and areas designated for the protection of flora and fauna species. In the study area, this requirement is specialised with the measurement of potential flood impacts in groundwater bodies (GWBs), drilling for potable water, Natura network sites and bathing water areas.

In order for the user to be able to conveniently read the information provided, two maps have been prepared for each flood cause and flood scenario, as follows:

- Map R1: Influence on population, economic activities, infrastructures
- Map R2: Influence on protected areas.

Every map consists of four (4) sheets for the following parts:

- Sheet 1: Feres - Estuary section (APSFR GR12RAK0002 and GR12RAK0003)
- Sheet 2: Lavara - Feres section (APDFR GR12RAK0002)
- Sheet 3: Nea Vyssa - Lavara section (APSFR GR12RAK0002)

- Sheet 4: Ormenio - Kastanies section and Arda river (APSFR GR12RAK0002 and GR12RAK0004).

The ScIII scenarios and the MSL rise are exceptions which, as in the case of FHPs, are limited to one (1) sheet, in APSFR GR12RAK0004 in the first case and in APSFR GR12RAK0002 and GR12RAK0003 in the second. If the hydrological scenario consists of more than one return period (baseline scenario Ia and MSL rise) all the flood area assessments are depicted on the same map in a blue colour gradient.

A total of ten (10) flood risk maps were prepared. Of these, five (5) are R1 type maps (see above) and the remaining five (5) are R2 type maps. In particular, they comprise of:

- Two (2) flood risk maps for the four (4) fluvial flood scenarios (Scla, ScIb, ScII and ScIII) - i.e., a total of eight (8) which concern APSFR GR12RAK0002, GR12RAK0004 and GR12RAK0003⁴
- Two (2) MSL rise flood risk maps for APSFR GR12RAK0002 and GR12RAK0003.

The assessment of the potential flood impacts that are presented in the following paragraphs has been carried out for all the scenarios, for the critical return periods and depending on the type of infrastructure that is affected.

6.2. Comments on results

This paragraph analyses the potential impacts of floods that were simulated for each APSFR and flood scenario. It is noted that the measurement of potential impacts is not carried out for the baseline scenario Scla and the very high recurrence (20-year return period) since this return period has not been officially adopted by the Greek side and has only been included for purposes of transboundary cooperation with the Bulgarian side and is not posted to the European databases. It is noted that the following commentary concerns the hydraulic modelling which refers to the exceedance and not the natural or anthropogenic failure of the embankments.

6.2.1. Influence on population

The Guidance Documents state that the impact of the floods under consideration on the population is expressed in terms of indicative number of inhabitants potentially affected and includes consequences to human health and the community. The first case comprises of the potential impact on the population due to pollution, interruption in the supply of drinking water or loss of human life, while the second concerns potential impacts on public administration, education, health, and social benefits, including the immediate response of these agencies in cases of an emergency. In this study, the restricted accuracy of topographic data does not permit the precise identification of social infrastructures within the settlements that could be affected, thus the number of inhabitants who may be affected based on the population density, determined by the demographic data of ELSTAT (2011 census) is determined. In case of settlements of more than 3,000 inhabitants, the flood area was multiplied by the population density; whereas for smaller settlements, it was considered that the flood, even part of the settlement, directly or indirectly affects all of the inhabitants, rounded up to the next decimal. The analysis results are summarised in the Table on the following page.

However, it should be pointed out that in the case of Didymoteicho and Lagyna, the above estimations of affected population constitute more of a theoretical rather than a realistic approach due to the significant uncertainties in the analysis. On the one hand the large cells

⁴ APSFR GR12RAK0003 in particular is depicted solely for completeness in the fluvial flood risk maps since it is located outside the delta of the Evros river and is not flooded.

size of the two-dimensional modelling and the rough topographic data do not permit the accurate determination of the flood level. On the other, on many occasions the flood is located within the approved GPZ, which is not necessarily identical to with residential areas, but also contains unbuilt land plots and crops. Therefore, the results could be interpreted as a theoretical number of inhabitants that will be affected if the settlements expand to the outskirts of the GPZ in the future, by maintaining the current population density per stremma.

Table 6.1 Potential impact on population (number of persons)

APFR	Scla						ScIb	ScII		ScIII		
	T=50		T=100		T=1000			Total	Individual settlements	Total	Individual settlements	
	Total	Individual settlements	Total	Individual settlements	Total	Individual settlements						
GR12RAK0002	1,000	Didymoteicho=1,000	4,200	Didymoteicho=1,100 Praggi=300 Nea Vyssa=2,800	4,830	Didymoteicho=1,380 Praggi=300 Nea Vyssa=2,800 Lagyna=330 Stathmos=20	4,200	Didymoteicho=1,100 Praggi=300 Nea Vyssa=2,800	730	Didymoteicho=730	4,200	Didymoteicho=1,100 Praggi=300 Nea Vyssa=2,800
GR12RAK0003	-	-	-	-	-	-	-	-	-	-	-	-
GR12RAK0004	-	-	140	Marasia=140	140	Marasia=140	-	-	-	-	1270	Dikea=570 Ormenio=560 Marasia=140

6.2.2. Influence on economic activities

The Guidance Documents state that the impact of the floods under consideration on the population is expressed in terms of indicative number of inhabitants potentially affected and includes consequences to human health.

Land uses

The types of economic activities that can be affected by flooding due to exceedance of river embankments or due to MSL rise are determined based on a land cover background which resulted from aggregation (grouping) of specific land use and cover codes of the Corine Land Cover inventory, as shown in the Table below.

Table 6.2. Grouping of Corine Land Cover inventory land uses for the preparation of flood risk maps

Individual coverage category	Corine description	Description of grouped cover category
111	Continuous urban fabric	Continuous urban structure
112	Discontinuous urban fabric	Discontinuous urban structure
121 122 123 124 131 132 133 141 142	Industrial or commercial units Roads and Rails Port zones Airports Mineral extraction sites Waste disposal sites Building sites Urban green areas Sports and recreation facilities	Industrial - commercial units
211 212 241 242 243	Non-irrigated arable land Permanently irrigated land Annual crops that are associated with permanent crops Complex cultivation patterns Land principally occupied by agriculture, with significant areas of natural vegetation	Arable crops
213 221 222 223 244	Rice fields Vineyards Fruit tree and berry plantations Olive Groves Agro-forestry areas	Permanent crops
311 312 313	Broad-leaved forest Coniferous forest Mixed forest	Forests
231 321 322 323 324	Pastures, meadows, and other permanent grasslands under agricultural use Natural grassland Moors and heathlands Sclerophyllous vegetation Transitional woodland/shrub	Other natural areas

Individual coverage category	Corine description	Description of grouped cover category
331	Beaches, dunes, and sand plains	
332	Bare rock	
333	Sparsely vegetated areas	
334	Burnt areas	
335	Glaciers and perpetual snow	

Based on the above Table, the distinction between arable and permanent crops reflects the fact that the latter (mainly for orchards, olive groves and tree crops in general) are much more resistant to the effects of flooding than the former. The land cover background, after the grouping of land uses, was composed in the form of a polygon file and their boundaries were compared with the extent of the flood area in order to determine the type of economic activities that are at risk in each case. It was considered in all cases that there was a flood if one polygon, or part thereof, was located within the flood area. The relevant results according to return period, hydrological scenario and APSFR are provided in the following tables.

Table 6.3. Extent of economic activities is a potential flood risk, APSFR GR12RAK0004

APSFR GR12RAK0004

Grouped coverage category	Total area within the APSFRs (stremmas)	Flood Area (stremma)			
		Scla scenario, T=20 years	Scla scenario, T=50 years	Scla scenario, T=100 years	Scla scenario, T=1,000 years
Continuous urban structure (*)	0				
Discontinuous urban structure	390	282.5	300	310	325
Industrial - commercial zones	0				
Arable crops	23,092	8,247.5	10,532.5	11,617.5	12,870
Permanent crops	396	10	10	10	10
Forests	1,665	660	680	710	720
Other natural areas	7,517	5,030	5,512.5	5,787.5	6,385
Wetlands - Water surfaces	11,380	6,668	7,448	7,753	8,060
TOTAL:	44,440	20,898	24,483	26,188	28,370

Grouped coverage category	Total area within the APSFRs (stremmas)	Flood Area (stremma)		
		ScIb scenario, T=50 years	ScIb scenario, T=100 years	ScIII scenario, T=100 years
Continuous urban structure (*)	0			
Discontinuous urban structure	390	325	310	310
Industrial - commercial zones	0			
Arable crops	23,092	12,730	11,097.5	19,617.5
Permanent crops	396	10	10	200
Forests	1,665	680	660	1,670
Other natural areas	7,517	6,410	5,787.5	5,787.5
Wetlands - Water surfaces	11,380	8,020	7,553	11,885

Grouped coverage category	Total area within the APSFRs (stremmas)	Flood Area (stremma)		
		ScIb scenario, T=50 years	ScIb scenario, T=100 years	ScIIl scenario, T=100 years
TOTAL:	44,440	28,175	25,418	39,467

(^{*}): The term 'continuous urban structure' means areas where building, roads and artificially surfaced areas cover almost the entire area. In the study area, continuous urban structure is only observed in Alexandroupoli and in the centre of Orestiada, outside the APSFRs.

Table 6.4. Extent of economic activities is a potential flood risk, APSFR GR12RAK0002

APSFR GR12RAK0002

Grouped coverage category	Total area within the APSFRs (stremmas)	Flood Area (stremma)			
		Scla scenario, T=20 years	Scla scenario, T=50 years	Scla scenario, T=100 years	Scla scenario, T=1,000 years
Continuous urban structure ([*])	0				
Discontinuous urban structure	1,362	720	990	990	1,240
Industrial - commercial zones	1,175				
Arable crops	273,696	53,121	81,971	97,221	171,790
Permanent crops	395	270	270	290	300
Forests	872	300	510	430	560
Other natural areas	4,039	1,030	2,420	2,380	2,650
Wetlands - Water surfaces	87,871	51,910	69,350	67,560	74,730
TOTAL:	369,410	107,351	155,511	168,871	251,270

Grouped coverage category	Total area within the APSFRs (stremmas)	Flood Area (stremma)				
		ScIb scenario, T=50 years	ScIb scenario, T=100 years	ScIIl scenario, T=100 years	MSL rise, T=50 years	MSL rise, T=100 years
Continuous urban structure ([*])	0					
Discontinuous urban structure	1,362	1,200	720	990		
Industrial - commercial zones	1,175					
Arable crops	273,696	115,080	69,301	97,221	11,520	12,010
Permanent crops	395	290	270	290		
Forests	872	510	430	430		
Other natural areas	4,039	2,450	2,370	2,380	2,020	2,020
Wetlands - Water surfaces	87,871	70,630	66,650	67,560	36,260	38,780
TOTAL:	369,410	190,160	139,741	168,871	49,800	52,810

(^{*}): The term 'continuous urban structure' means areas where building, roads and artificially surfaced areas cover almost the entire area. In the study area, continuous urban structure is only observed in Alexandroupoli and in the centre of Orestiada, outside the APSFRs.

Table 6.5. Extent of economic activities is a potential flood risk, APSFR GR12RAK0003

APSFR GR12RAK0003

	Flood Area (stremma)

Grouped coverage category	Total area within the APSFRs (stremmas)	MSL rise, T=50 years	MSL rise, T=100 years
Continuous urban structure (*)	0		
Discontinuous urban structure	131		
Industrial - commercial zones	1,860	70	80
Arable crops	1,581	490	630
Permanent crops	0		
Forests	0		
Other natural areas	0		
Wetlands - Water surfaces	8,588	7,160	7,480
TOTAL:	12,160	7,720	8,190

(*): The term 'continuous urban structure' means areas where building, roads and artificially surfaced areas cover almost the entire area. In the study area, continuous urban structure is only observed in Alexandroupoli and in the centre of Orestiada, outside the APSFRs.

Transport infrastructures

The most important transport infrastructures that are being examined in this study concern the national and main (provincial) road network as well as the upgraded railway line which has been designed and is being constructed by OSE SA. The most important axes of the national road network in the wider study area are Egnatia Odos (motorway) and the A21/E85 Ardania - Soufli - Didymoteicho - Orestiada - Kastanies - Ormenio Motorway (Vertical axis to Egnatia Odos), which is under construction. "Democritus" the airport of Alexandroupoli is located outside the examined APSFRs.

The Egnatia Odos motorway crosses the wider study area at the southwestern part for 59km from the north of Alexandroupoli to Ardania, at a significant distance from the APSFR and without being affected by the floods. Vertical axis A21 to Egnatia Odos runs for a total of 124km, it is of strategic importance and is the basic link to Bulgaria. It is part of the Trans-European networks and the end of Pan-European Corridor IX on Greek territory. The axis is currently being upgraded by following the route of the old NR51 for the greatest part. From an aerial view, it is located at the western outskirts of the APSFR and/or beyond, while in some parts it runs parallel to the railway line. The embankment of the vertical axis is generally higher than the flood level. However, the presence of underpasses and culverts allows the water to travel upstream flatlands, resulting in the flooding of farms that are located west of the A21.

NR2, From Alexandroupoli to the Kipoi Bridge, also belongs to the national road network in the study area, however it is located far from the APSFR and the limits of the flood area. The main road network of the area can be considered, quite safely, that it is located at ground level with the only exception being the Pythio - Rigio - Sofiko section of PR 9, which crosses at the hill's edge, higher than the eastern flatland areas, and constitutes the APSFR limit without affecting the floods. The sections of the main road network that are located within and around the estimated flood area for each scenario and APSFR are provided in Table 6.6.

Aerial views and elevation data of the upgraded route, which has been designed by OSE SA, were used to depict the railway line, and assess how the flood will impact it, in order to assess the risk of the railway infrastructure after the completion of the scheduled works. Especially for the Mandra - Psathades section, the variant of the railway line is constructed from the Egnatia Odos, so that part of the vertical axis of the A21 to be constructed in the place of the

existing railway line. It should be noted that the railway line is of great importance for the flood protection of riparian settlement, since in many cases, its embankment is located at the level of the residential areas on the side of the river, thus it acts as a border for the flood while protecting the residential infrastructures from being flooded.

According to information that were provided by the OSE SA letter, the existing line is affected by floods at the following sections:

- GR12RAK0002: Mandra - Lavara and Didymoteicho - Pythio
- GR12RAK0004: Marasia - Dilofos and Dikea - Ormenio

There is no railway infrastructure within the flood limits in the APSFR GR12RAK0003. Table 6.7 below shows the potential impacts that various floods will have on the future upgrade of the line, according to network section.

Table 6.6 Potential flood impact on the main road network (km network)

APSFR	Scl _a						Scl _b	Scl _{II}		Scl _{III}		
	T=50		T=100		T=1000			Total	Individual roads	Total	Individual roads	
	Total	Individual roads	Total	Individual roads	Total	Individual roads						
GR12RAK0002	1.7	Didymoteicho-Isaakio Provincial Road -=1.7	1.7	Didymoteicho-Isaakio Provincial Road -=1.7	6.2	Didymoteicho-Isaakio Provincial Road -=1.7 Nea Vyssa- Drainage System=4.5(***)	6.2	Didymoteicho-Isaakio Provincial Road 9=1.7 Nea Vyssa- Drainage System=4.5(***)	1.7	Didymoteicho-Isaakio Provincial Road -=1.7	1.7	Didymoteicho-Isaakio Provincial Road 9=1.7
GR12RAK0003	-	-	-	-	-	-	-	-	-	-	-	-
GR12RAK0004	1.4	Kanadas-Rizia=0.6 Kastanies - Marasia=0.8	1.4	Kanadas-Rizia=0.6 Kastanies - Marasia=0.8	1.4	Kanadas-Rizia=0.6 Kastanies - Marasia=0.8	1.4	Kanadas-Rizia=0.6 Kastanies - Marasia=0.8	1.4	Kanadas-Rizia=0.6 Kastanies - Marasia=0.8	1.4	Kanadas-Rizia=0.6 Kastanies - Marasia=0.8

(*): The Table refers to parts of the road network between the settlements or infrastructures that are mentioned

(**): Where there is no numbering, the Provincial Roads that are noted are anonymous.

(**): The specific Provincial Road connects the Nea Vyssa settlement with a riparian drainage pump station.

Table 6.7 Potential impact of floods on the upgraded (future) railway line (network sections)

APSEFR	Scla			ScIb	ScII	ScIII
	T=50	T=100	T=1000			
GR12RAK0002	1. Section around the Didymoteicho settlement	1. Didymoteicho-Petrades section, particularly at the limits of the Didymoteicho and Praggi settlements.	1. Didymoteicho-Petrades section, particularly at the limits of the Didymoteicho and Praggi settlements. 2. Lagyna settlement. 3. Section between Amori - Neoi Psathades (outside settlement). 4. Section north of Neoi Psathades until the Stathmos settlement.	1. Marginal exceedance of the line between Lagyna and Lykofotos, for a length of 2.5km ^(*) . 2. Didymoteicho-Petrades section, particularly at the limits of the Didymoteicho and Praggi settlements.	1. Section around the Didymoteicho settlement	1. Didymoteicho-Petrades section, particularly at the limits of the Didymoteicho and Praggi settlements.
GR12RAK0003	-	-	-	-	-	-
GR12RAK0004	-	1. Marasia-Dilofos section, particularly at the limit of the Marasia settlement.	1. Marasia settlement. 2. Section in the Sakkos area.	-	-	1. Dilofos-Ormenio section, west of Dilofos until the border and for a length of 13.5km impacting the Dikea and Ormenio settlements ^(**) . 2. Marasia-Dilofos section, particularly at the limit of the Marasia settlement.

(*): In this section the altitude exceedance of the railway line from the flood is marginal (in the order of 0.1m). Given the intense ambiguities in the topographic information, this uncertain result can only be treated as an indication of potential risk in the area, which in fact is not verified by the information that is gathered.

(**): During the 2012 flood it was observed that in addition to any crest exceedance, the embankment was undermined by the forces of the water, thus destroying it, and further intensifying the impact of the flood in the areas upstream of the railway line.

Irrigation and drainage pump stations

All the pump stations are positioned at ground level, and it is estimated that they are flooded if they are located within the flood area for the various return periods. A total of nineteen (19) drainage and eleven (11) irrigation pump stations were identified in the **APSFRs GR12RAK0002 and GR12RAK0004**, while there are no pump stations in APSFR GR12RAK0003. The modelling results showed the following. With respect to the ScIII scenario, the results are identical to those of the Scla scenario for a 100-year return period, unless otherwise stated.

Table 6.8. Flood risk assessment for drainage and irrigation pump stations, scenario Scla (and ScIII)

Drainage pump stations	APSFR	Pump station flooding			
		T=20 years	T=50 years	T=100 years	T=1,000 years
Feres A Zone (Municipality of Evros)	GR12RAK0002	No	YES	YES	YES
Feres B Zone (Municipality of Evros)		No	YES	YES	YES
Tychero		No	No	No	YES
Petalo		YES	YES	YES	YES
Megalo Pythio		No	No	No	YES
Vyssa		No	No	YES	YES
Sfagia		No	No	No	No
Pythio A1		YES	YES	YES	YES
Pythio A2		YES	YES	YES	YES
Pythio A3		YES	YES	YES	YES
Pythio A4		YES	YES	YES	YES
Pythio A5		YES	YES	YES	YES
Ormenio		GR12RAK0004	No	No	YES*
Dikea	YES		YES	YES	YES
Marasia	No		No	No	No
Kastanies	No		No	No	No

(*) In ScIII

Irrigation pump stations	APSFR	Pump station flooding			
		T=20 years	T=50 years	T=100 years	T=1,000 years
Feres - Peplo	GR12RAK0002	No	No	No	YES
Petalo		YES	YES	YES	YES
Tychero 1 (south of settlement)		YES	YES	YES	YES
Tychero 2 (east of settlement)		YES	YES	YES	YES
Tychero 3 (north of settlement)		YES	YES	YES	YES
Lykofotos		YES	YES	YES	YES
Kornofolia		YES	YES	YES	YES
Soufli		No	No	YES	YES
Lavara		YES	YES	YES	YES
North Arda Flatlands		GR12RAK0004	No	No	No

North Arda Flatlands - Neoch.-Valt. - Sterna		No	No	No	No
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Table 6.9. Flood risk assessment for drainage and irrigation pump stations, scenarios ScIb and ScII

Drainage pump stations	APSFR	Pump station flooding	
		ScIb scenario	ScII scenario
Feres A Zone (Municipality of Evros)	GR12RAK0002	YES	YES
Feres B Zone (Municipality of Evros)		YES	YES
Tychero		No	No
Petalo		YES	YES
Megalo Pythio		No	No
Vyssa		YES	No
Sfagia		No	No
Pythio A1		YES	YES
Pythio A2		YES	YES
Pythio A3		YES	YES
Pythio A4		YES	YES
Pythio A5		YES	YES
Ormenio		GR12RAK0004	No
Dikea	YES		YES
Marasia	No		No
Kastanies	No		No

Irrigation pump stations	APSFR	Pump station flooding	
		ScIb scenario	ScII scenario
Feres - Peplo	GR12RAK0002	No	No
Petalo		YES	YES
Tychero 1 (south of settlement)		YES	YES
Tychero 2 (east of settlement)		YES	YES
Tychero 3 (north of settlement)		YES	YES
Lykofotos		YES	YES
Kornofolia		YES	YES
Soufli		YES	YES
Lavara		YES	YES
North Arda Flatlands		GR12RAK0004	YES
North Arda Flatlands - Neoch.-Valt. - Sterna	No		No

Trans Adriatic Pipeline (TAP)

The route of the pipeline is generally located outside the APSFRs with the exception of approximately 0.85km close to Kipi (about 2km north of Gemisti), where it falls in APSFR **GR12RAK0002**. At this location the pipeline crosses from Turkey to Greece via the river, thus the crossing zone is flooded in shorter return periods for all the scenarios.

6.2.3. Impact on installations likely to cause accidental pollution

Wastewater Treatment Plant (WWTP)

Three (3) WWTPs are identified within the **APSEFR GR12RAK0002**, at Soufli, Didymoteicho and Orestiada, close to Palea Sagini, The Orestiada WWTP is located on the western outskirts of the flood zone and is not at risk of being flooded due to embankment exceedance. The Didymoteicho WWTP has been constructed at an artificially elevated position, whereas the Soufli WWTP is protected from floods by surrounding embankments. The exact levels of the infrastructures are unknown; however, it is estimated that they are flood proof given that flooding of the two critical WWTP (Didymoteicho and Soufli) were not seen. Measures are proposed in the following Chapter for the removal of any uncertainties and the clear identification of flood risks.

6.2.4. Impact on protected areas

Natura 2000 Network Sites

Floods due to fluvial flows and MSL rise of the **APSEFRs GR12RAK0002 and GR12RAK0003** have an impact, for all the scenarios and all the return periods under consideration, on the National Wetland Park in Evros Delta, which has been characterised by JMD 4110 (GG 102/Series IV/16-03-2007) and has a total area of 18,429ha. The terrestrial and sea area of the Delta wetlands at the estuaries of the Evros river and its wider area have been characterised as the National Wetland Park in Evros Delta, which is found outside the limits of the approved General Zoning Plans and outside the limits of settlements with less than 2,000 inhabitants and falls under the administrative limits of the Municipal Unit of Alexandroupoli, Feres and Traianoupoli. Following the implementation of the Kallikratis Plan, the National Park now falls under the administrative limits of the Municipality of Alexandroupoli.

Two areas of the National Parks which are also affected by the flood have been included in the Natura 2000 Network. These are the Special Protection Area (SPA) “Evros Delta” (GR1110006) and the Special Management Area (SMA) “Evros Delta and Dytikos Vrachionas” GR1110007). At the same time, the estimated flood area is also located within the limits of the Park’s Regional Area, which is the terrestrial area that is located outside the limits of the approved General Zoning Plans and outside the limits of settlements with less than 2,000 inhabitants and falls under the administrative limits of the Municipality of Alexandroupoli.

Fluvial floods also impact the SPA GR1110008 “Riparian Forest of Northern Evros and Arda” which extends along the Evros river from Pythio to Ormenio and along a section of Arda river within the **APSEFRs GR12RAK0002 and GR12RAK0004**. The wider area has been designated as an Important Bird Areas of Greece (SPPE) under code GR001.

Groundwater Bodies (GWB)

The estimated flood area is also located within the limits of the following GWBs which are used for water abstraction intended for human consumption:

- GWB Alexandroupoli, GR1200130, APSEFR GR12RAK0003, flood due to MSL rise
- GWB Riparian Area - Evros Delta, GR120T020, APSEFRs GR12RAK0002 and GR12RAK0003, flood due to MSL rise and fluvial flows
- GWB Evros, GR1200140, APSEFR GR12RAK0002, fluvial floods
- GWB Soufli– Didymoteicho, GR12BT150, APSEFR GR12RAK0002, fluvial floods
- GWB Orestiada, GR12BT010, APSEFR GR12RAK0004 and GR12RAK0002, flood due to fluvial flows

Potable Water Boreholes

One potable water borehole exists at the western end of APSFR GR12RAK0002, borehole “Γ4” of Poros village, which belongs to the Municipal Water Supply and Sewerage Company (DEYA) of Alexandroupoli. This borehole is on the boundary between GWBs GR120T020 and GR1200140, at a distance from the Evros river and is not affected by flooding in any return period or hydrological scenario under consideration.

Bathing Water Areas

Flooding due to MSL rise affects bathing water area GRBW129006011 in APSFR GR12RAK0003 for both return periods that are under consideration. Fluvial floods do not affect any bathing water areas.

7. Flood risk management objectives of the FRMP

7.1. Flood risk management objectives

The FRMP objectives arise according to the following:

- The requirements of Directive 2007/60/EC. According to the Directive and the relevant Guidance Documents, the objectives must focus on:
 - reducing the negative consequences of floods to human health, the environment, cultural heritage, and economic activities
 - If deemed necessary, reducing the likelihood of flooding by structural or non-structural means, including the raising of public awareness and improving the flood forecasting capacity.
- The analysis of the area that was undertaken in order to prepare the flood risk maps
- The experience from responding to the consequences of flood events in the area and lastly
- The priorities set for the implementation of measures that are deemed necessary due to the need to overcome pending uncertainties concerning the analysis and modelling of flood events. These uncertainties arise due both to the nature of the area as a border and the need for transboundary collaboration on many issues, and the internal weaknesses and gaps in the necessary information.

Based on the above, we estimate that the main management objective of the 1st FRMP for the study period and their correspondence with the flood events and the APSFR they concern are provided in the following tables. Table 7.1 below corresponds the main objectives with the flood occurrence level which they refer to.

Table 7.1. Management objectives and the probability of floods.

S/N	Management objective of FRMP for Evros RB	Floods concerning
O1	Securing the protection level from flood events of medium probability (T=100 years) by restoring and completing the perimeter of the flood zone as defined by the existing	Flood events of medium probability (T=100 years). The objective refers to the theoretically attainable protection level of the existing primary flood defence embankments (“main” embankments”) from natural-

S/N	Management objective of FRMP for Evros RB	Floods concerning
	primary flood defence embankments (restoration / reinforcement / extension of existing primary flood defence embankments and other auxiliary works) and the management framework for this area (land use regulation / terms for specific activities / increase of preparedness / codification of emergency action plans).	occurring floods or floods due to both natural and anthropogenic causes, where human causes do not substantially change the characteristics of the natural flood phenomenon.
O2	Protection from high probability floods (T=20 and 50 years) including actions to restore the protection level of secondary flood defence embankments (“summer” or “over-topped” embankments).	Flood events of high probability (T=20 and 50 years). The restoration actions for the secondary flood protection works will help in increasing the protection level of even higher probability floods (e.g., T=10 years).
O3	Prevention, protection, and increased preparedness against flood events due mainly to anthropogenic causes (dam burst) and against flood events, the joint cause of which due to anthropogenic causes drastically modify their natural characteristics, such as the magnitude and/or timing of the flood peak (dam overflow).	The objective concerns, on the one hand, high and medium probability natural floods of Evros river which are augmented due to simultaneous overflow of the Arda river dams in Bulgaria and, on the other, floods due to possible bursting of third-country dams, with or without the simultaneous occurrence of a natural flood.
O4	Protection and increase of preparedness from flood events due to sea water level rise.	The objective concerns high and medium probability natural floods due to sea water level rise occurring as a result of combined causes of astronomical tide, level elevation from meteorological flood and wave setup.
O5	Acquisition, improvement, and organisation of information regarding the technical flood defence infrastructure and the reduction of uncertainties related to the assessment of flood hazards and flood risks.	This objective concerns flood events due to all mechanisms and probabilities of occurrence that have been examined during the preparation of the FRMP. It aims to achieve completeness, improve accuracy, and systematically organise information regarding the flood defence infrastructure. It mainly (but not exhaustively) includes topographical data, the acquisition of ground elevation data at crucial points, hydrological network data, riverbed geometric data and collection and management actions.

Table 7.2 corresponds the above management objectives with the designated APSFRs in the study area. The following paragraphs provide give a detailed description of the objectives and specialisation per APSFR.

Table 7.2. Management objectives and APSFR of implementation.

S/N	Management objective for the Evros RB FRMP	APSFR of implementation
O1	Securing the protection level from floods of medium probability (T=100 years) by restoring and completing the perimeter of the flood zone as defined by the existing primary flood defence embankments	GR12RAK0002 “Riparian areas south of Nea Vyssa and delta of Evros river” GR12RAK0004 “Areas of north Evros and Arda”

02	Protection from high probability floods (20- and 50-year return period)	GR12RAK0002 “Riparian areas south of Nea Vyssa and delta of Evros river”
03	Prevention, protection, and increased preparedness from floods due mainly to anthropogenic causes	GR12RAK0002 “Riparian areas south of Nea Vyssa and delta of Evros river” GR12RAK0004 “Areas of north Evros and Arda”
04	Protection and increase of preparedness from flood events due to sea water level rise.	GR12RAK0002 “Riparian areas south of Nea Vyssa and delta of Evros river” GR12RAK0003 “Areas west of Loutro torrent”
05	Acquisition, improvement, and organisation of information regarding the technical flood defence infrastructure and the reduction of uncertainties related to the assessment of flood hazards and flood risks.	GR12RAK0002 “Riparian areas south of Nea Vyssa and delta of Evros river” GR12RAK0003 “Areas west of Loutro torrent” GR12RAK0004 “Areas of north Evros and Arda”

7.2. Description of flood risk management objectives

7.2.1. Management objective O1

Securing the protection level from flood events of medium probability (T=100 years) by restoring and completing the perimeter of the flood zone as defined by the existing primary flood defence embankments (restoration / reinforcement / extension of existing primary flood defence embankments and other auxiliary works) and the management framework for this area (land use regulation / terms for specific activities / increase of preparedness / codification of emergency action plans).

This objective concerns rarer floods events which were examined when preparing the risk maps (T=100 and 1000 years). It includes the protection from natural flood and floods originating from a combination of natural and anthropogenic causes (however when anthropogenic causes – such as dam overflows – do not substantially change the characteristics of the natural flood) with the highest level of the anticipated complete flood protection of a 100-year event and the increased protection level for rarer floods. The objective includes measures and actions to identify, design and implement the technical works required to complete and restore the perimeter of the area that is defined by the primary flood defence embankments (“main” embankments), i.e., for the restoration / reinforcement / extension of the existing primary embankments and other auxiliary works. It also includes the formulation and application of the management measures to manage the flood zone (between the main embankments and the Evros and Arda rivers), include regulations relating to land uses, terms, and conditions for exercising certain activities, the application of financial tools, warning systems, etc. keeping in mind that this area will always be subject to partial or complete flooding depending on the rarity of the flood event.

7.2.2. Management objective O2

Protection from high probability floods (T=20 and 50 years) including actions to restore the protection level of secondary flood defence embankments (“summer” or “over-topped” embankments).

This objective concerns flood events of high probability that are examined in the preparation of the FRMP, i.e., floods in a 20-year and 50-year return period. It is obvious that measures and actions to protect from these flood events will also achieve an increased protection level from “usual” floods (even lower return periods) that impact the area due to natural causes (however, without having a significant contribution from Arda river). The analysis conducted for the preparation of the risk maps showed that the actual mean discharge capacity (about 1000 m³/s) is well below the 10-year flood

level, a finding which is shared by the Turkish side pursuant to discussions held at technical meetings between representatives of both sides (see Diagram 7.1).

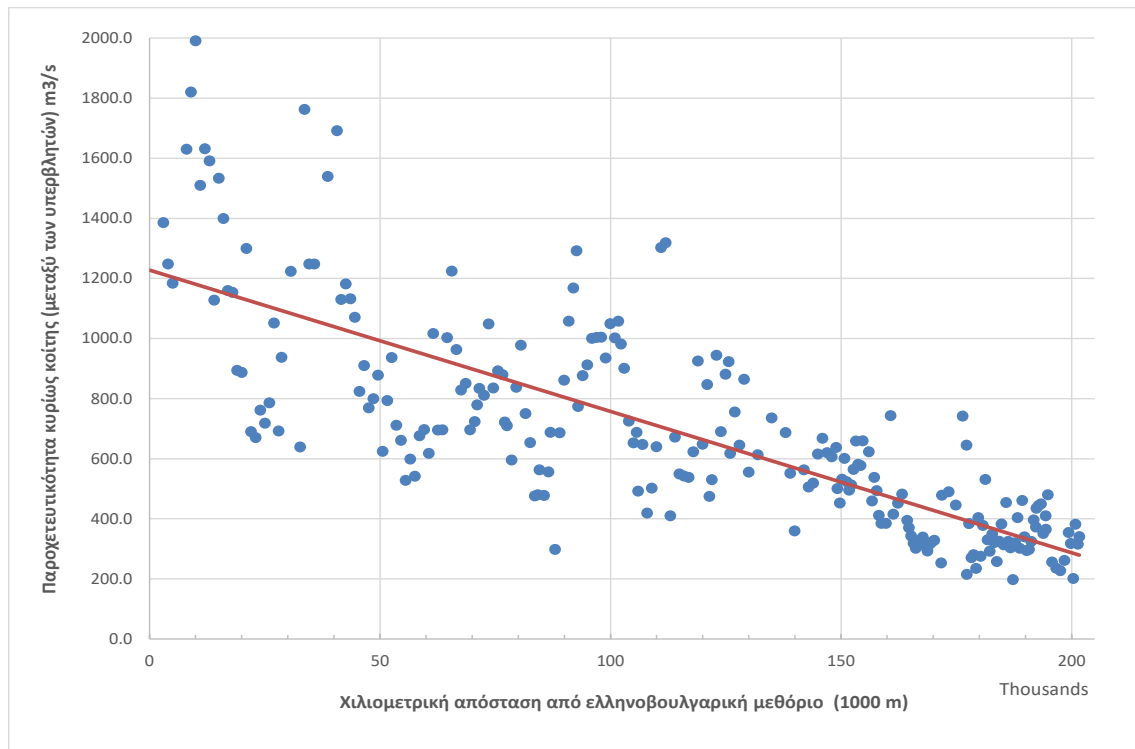


Diagram 7.1 Discharge capacity of main Evros riverbed. The main riverbed is defined by the existing embankments at north Evros between the “over-topped” embankments at the section between Nea Vyssa and Feres and the riverbed itself from Feres to the estuary.

Objective O2 includes measures aiming at minimum technical interventions to restore the discharge capacity of the main riverbed (between the “over-topped” embankments) at the level of the 10-year event (corresponds to a 1200 m³/s from the Greek-Bulgarian border up to the Arda river confluence (Kastanies) and 1400 m³/s downstream of Nea Vyssa). In practice, it concerns the necessary interventions to reduce the frequency of the “usual” flood, which will also bring about the necessary reduction for high probability floods⁵.

7.2.3. Management objective O3

Prevention, protection, and increased preparedness against flood events due mainly to anthropogenic causes (dam burst) and against flood events, the joint cause of which due to anthropogenic causes drastically modify their natural characteristics, such as the magnitude and/or timing of the flood peak (dam overflow).

The FRMP management objectives O1 and O2 concern the river’s “natural” flood events, i.e., without adverse contribution from Arda river (or in other words, keeping the discharges of Arda river below the “low nuisance” threshold, which was estimated at 700 m³/s during the preparation of the flood hazard and risk maps). The analysis of the risk maps showed that flood events with Arda river as main source, in the analysis that was dedicated to a specific scenario (Sc1b), could completely overturn the magnitude and the entire discussion on the rarity of flood events. The ability of the Arda floods to multiply the impacts of a certain flood level leads to the flood risk management of this source constituting a separate management objective in the FRMP. In the scenario being

⁵ It is clarified that this need relates to the specific characteristics of the study period and does not concern the wider concern on the appropriateness of the selected return periods of the analysis for the rest of the territory.

examined, which has already been exceeded by this year's (2015) floods in the Arda/Evros system, the 50-year flood caused almost a 1000-year flood.

An additional reason is that any attempt to manage the problem mandatorily involves transboundary cooperation and the pursuit of a common FRMP with Bulgaria, as required by Directive 2007/60/EC.

This objective includes actions at transboundary level and proposals for management measures and flood prevention and prediction measures which could resolve the problem or at the very least reduce the consequences from the specific flood events.

7.2.4. Management objective O4

Protection and increase of preparedness from flood events due to sea water level rise.

This objective concerns the protection and preparedness of a potential flood due to sea water rise due to a combination of astronomical tide, meteorological flood, and wave setup. No such events have been experienced in the study area to date. Moreover, within the areas potentially affected by these kinds of floods, there are no permanent installations or settlements. However, the areas potentially affected include areas of significant environmental interest.

7.2.5. Management objective O5

Acquisition, improvement, and organisation of information regarding the technical flood defence infrastructure and the reduction of uncertainties related to the assessment of flood hazards and flood risks.

This objective concerns all the mechanisms of flooding under consideration, all the flood scenarios and the return periods. It aims to supplement, improve, and organise the information of the technical flood defence infrastructures in the area (flood defence embankments, drainage works, etc.) as well as geometrical data concerning the hydrographic network which includes Evros river, Arda river and their tributaries. It mainly concerns the collection, confirmation and improvement of topographical data relating to the infrastructures and geometrical data of watercourses, but also includes actions to improve the future ability of hydraulic modelling to simulate flood events for the preparation of flood hazard and risk maps. It is pointed out that other than the long-term benefits in the ability to analyse flood phenomena, the actions under this objective will contribute important information and will be a valuable aid in the planning and implementation of flood response actions, both in terms of preparation and during the occurrence of the phenomena.

7.3. Specialisation and hierarchisation of management objectives per APSFR

7.3.1. APSFR GR12RAK0002 "Riparian areas south of Nea Vyssa and delta of Evros river"

The APSFR "Riparian areas south of Nea Vyssa and delta of Evros river" is the largest of the three designated APSFRs in the Evros river basin and the one that is under the greatest pressure and incurs the most significant impacts from all the flood events that are being examined in the context of the FRMP, irrespective of the mechanism of flooding, the flood probability, and the combination of flood causes (namely the flood scenario under consideration). The area is exposed (a small area) even by floods due to the sea water rise.

Therefore, all the management objectives apply to this APSFR. However, the achievement of some management objectives will have more of an impact in the area than others. The management objectives have following importance for this area:

- (1) O5: The objective is important for the APSFR because it encompasses the majority of the infrastructures, and the watercourses whose objective is the supplementation and improvement of the topographical and other related information. The importance of this

objective is such that even if none of the other objectives of the FRMP are implemented, the implementation of objective O5 will greatly improve the existing flood response level in this APSFR. The reason being that the implementation of the objective will facilitate the Directorate of Civil Protection in the immediate intervention and response to the flood, by providing better information and planning, both before the occurrence of floods and during flood response operations. In this sense, although the measure is not hierarchically superior, it has a greater value than simply improving the flood modelling capacity. Needless to say, the necessity and the importance of implementing the other objectives of the FRMP for the APSFR in question are not overridden.

- (2) O1-O2-O3: The implementation of these objectives will improve the protection from flood events in this APSFR. It is pointed out that the implementation of objective O3, although equally important with the others, it relies on the cooperation with the neighbouring countries, primarily with Bulgaria.
- (3) O4: This is the least important objective for the APSFR since only a very small section is subject to flood risk from the rise of sea water level and this section addresses flood risk from other causes and mechanisms of flooding.

7.3.2. APSFR GR12RAK0003 “Areas west of Loutro torrent”

This the smallest area of the designated APSFRs. It is mainly related to the case of flooding from sea level rise. The management objectives have following importance for this area:

- (1) O4: This is the most important objective for the APSFR since the area is mainly subject to flood risk from sea level rise.
- (2) O5: This objective is important for the APSFR, mainly for the small section of the Alexandroupoli GZP that is included in the limits of the zone.

7.3.3. APSFR GR12RAK0004 “Areas of north Evros and Arda”

The APSFR “Areas of north Evros and Arda” is exposed to a flood risk that primarily originates from flood discharges of Arda river and secondly from the flooding of Evros river for the section of the zone that extends to the Greek-Bulgarian and Greek-Turkish borders, north of the Evros and Arda confluence. The management objectives have following importance for this area:

- (1) O3: This is the most important objective for both sections of the APSFR: In the section of the zone along Arda river, the objective is important because the area is the recipient of the entire flood discharge from Arda, as this is formulated by the operation and overflow of the Bulgarian dams. Until recently, this zone has incurred relatively small impacts from this flood source due to the greater discharge capacity of the wider Arda riverbed. These impacts become significant downstream of the Arda - Evros confluence (i.e., at APSFR GR12RAK0002), where the combination of other causes contributes towards significantly increasing the flood risk. Nevertheless, the flood risk exposure remains and was all too clear during the recent flood in 2015. With respect to the section of the zone along Evros river, the objective is important because it takes into consideration the possible failure of a Bulgarian dam, which occurred in 2012.
- (2) O1: This objective is significant for the APSFR for the section along Evros river. The flood risk due to a natural flood of Evros in this section is reduced in relation to the downstream APSFR GR12RAK0002; however, it continues to be a flood risk source, especially for the longer return periods.
- (3) O5: This objective continues to be important for the APSFR which comprises of significant flood defence infrastructure along Evros river and along Arda river. In the context of this objective, the consolidation of the information collected about Arda river during the

preparation of the recent ARDAFORECAST project and the organisation of a single database is also important.

8. Proposed Management Plan measures

8.1. Introduction - general description of measures

The proposed management measures are categorised based on the requirements of Directive 2007/60 and the guidance documents. Paragraph 8.2 follows the categorisation of measures in accordance with Guidance Document no. 29, based on which the Table of Measures of paragraph 8.2 is prepared. The proposed measures are divided into four basic groups: **Prevention, Protection, Preparedness and Recovery.**

- **Prevention** encompasses the following measures:
 - Measure to prevent the location of new or additional receptors in flood prone areas, (human or installations)
 - Measures to assist the relocation of activities outside the flood prone areas
 - Measure to reduce the adverse consequences in the event of a flood
 - Other prevention measures
- **Protection** encompasses the following measures:
 - Runoff management measures to slow down or retain the runoff in its course to the final recipient
 - Water flow regulation measures (storage, timing changes)
 - Intervention measures to the hydrographic network, with in-channel, floodplain works
 - Surface water management (such as enhancing artificial drainage capacities or though sustainable drainage systems)
 - Other protection measures
- **Preparedness** encompasses the following measures:
 - Flood forecasting and early warning measures
 - Emergency event response planning / contingency planning
 - Public awareness and preparedness
 - Other preparedness measures
- Lastly, **Recovery** encompasses the following measures:
 - Individual and societal recovery measures of flood impacts on humans, property, and infrastructures
 - Environmental recovery measures of flood impacts on the environment
 - Other recovery measures

8.2. Prioritisation and hierarchisation of FRMP measures

The prioritisation of the implementation of the measures is done based on three separate implementation time horizons. The time horizons and the associated priority include:

- **Short-term measures.** The implementation time horizon extends to **one (1) year** of the Management Plan entering into force. It concerns immediate action measures that do not require particular preparation for their implementation (e.g., administrative actions), or measures that are considered urgent, regardless of the level of preparation (e.g., preparation of any supporting study) that is required for their implementation

- **Medium-term measures.** The implementation time horizon is extended until the end of the Management Plan's six-year review cycle (i.e., until 2021). This category includes measures that do not concern immediate, but rather structural management actions which require sufficient time for their full specialisation and/or implementation of significant preliminary actions, such as the preparation of supporting studies to identify critical implementation parameters of the measures - preliminary actions which cannot be implemented immediately.
- **Long-term measures.** The implementation time horizon exceeds the Management Plan's six-year review cycle. Included in this category are measures for which the required implementation duration cannot be objectively estimated for the time being. A typical example would be the measures concerning the transboundary cooperation, where progress largely depends on the neighbouring countries' assistance in the procedure. Every effort was made for the least number of measures to be included in this category.

Of the 24 proposed measures (see. Table 8.2), **eight (8)** belong to the short-term horizon, **twelve (12)** to the medium-term horizon, **two (2)** to the long-term horizon, while **two (2)** measures consist of individual actions that escalate across all time horizons.

8.3. Proposed management measures

Table 8.1 presents the types of measures that are included in each category of measures and their description.

Table 8.1. Categories and types of measures based on Guidance document no. 29.

Category of measures	Type of Measure	Description
Prevention	Avoidance	Measure to prevent the location of new or additional receptors in flood prone areas, such as land use planning policies or regulation.
	Relocation	Measure to remove receptors from flood prone areas, or to relocate receptors to areas of lower probability of flooding and/or of lower hazard.
	Reduction	Measure to adapt receptors to reduce the adverse consequences in the event of a flood actions (on buildings, public utility networks, etc.)
	Other prevention	Other measure to enhance flood risk prevention (may include, flood risk modelling and assessment, maintenance programmes or policies etc.)
Protection	Runoff management	Measures to reduce the flow into natural or artificial drainage systems, such as overland flow interceptors and / or storage, enhancement of infiltration, etc. Including in-channel, floodplain works and the

Category of measures	Type of Measure	Description
		reforestation of banks, that restore natural systems to help slow flow and store water.
	Water flow regulation	Measures involving physical interventions to regulate flows, such as the construction, modification or removal of water retaining structures (e.g., dams or other on-line storage areas or development of existing flow regulation rules), and which have a significant impact on the hydrological regime.
	Watercourse and floodplain works	Measures involving physical interventions in watercourse beds, mountain streams, estuaries, coastal waters, and flood-prone areas of land, such as the construction, modification or removal of structures or the alteration of channels, sediment dynamics management, dikes, etc.
	Surface water management	Measures involving physical interventions to reduce surface water flooding, typically, but not exclusively, in an urban environment, such as enhancing artificial drainage capacities or through sustainable drainage systems.
	Other protection	Other measure to enhance protection against flooding, which may include flood defence asset maintenance programmes or policies.
Preparedness	Flood Forecasting and Warning	Measure to establish or enhance a flood forecasting or warning system.
	Emergency measures and planning	Measure to establish or enhance flood event institutional emergency response planning.
	Public Awareness and Preparedness	Measure to establish or enhance the public awareness or preparedness for flood events.
	Other preparedness	Other measure to establish or enhance preparedness for flood events to reduce adverse consequences.
Rehabilitation	Individual and societal recovery	Clean-up and restoration activities (buildings, infrastructure, etc). Health and mental health supporting actions, incl. managing stress. Disaster financial assistance (grants, tax), incl. disaster legal assistance,

Category of measures	Type of Measure	Description
		disaster unemployment allowances due to temporary or permanent relocation.
	Environmental recovery	Clean-up and restoration activities (mould protection, well water safety and securing hazardous materials containers)
	Other recovery	Lessons learnt from flood events, insurance policies, etc.

Based on the above categorisation of measures, a Table of proposed Management Plan measures was prepared. The table provides the name of the measure, the category and type based on Table 8.1, a short description, the authorities that are responsible for its implementation and application and the estimated cost of the measure.

It is recalled that, regardless of the individual competent authorities that are associated with the implementation of specific measures, the general overview of the FRMP implementation is exercised by the competent Water Directorate in the relevant Decentralised Administration, which in the case of the Evros river basin is the Water Directorate of Eastern Macedonia and Thrace of the Decentralised Administration of Macedonia-Thrace. Finally, the Special Secretariat for Water which belongs to the Ministry of the Environment and Energy is responsible for the national-level implementation of Directive 2007/60/EC. The proposed measures, which are presented below, have been revised and amended based on the results of the consultation actions that have taken place (See Chapt. 9).

Table 8.2. Proposed measures for the Evros river basin Flood Risk Management Plan.

NAME OF MEASURE	Topographies / Database creation of technical works
MEASURE CODE	GR12-24-001
NATURE OF MEASURE	Group of interventions
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Prevention, M24
FRM OBJECTIVE	O5
DESCRIPTION OF MEASURE	Topographical survey of existing flood protection works via LIDAR (main and over-topped flood defence embankments, embankments of major arrangement projects and drainage ditches) and specialisation of the information using terrestrial means (verification/correction of LIDAR elevation points at uncertain points, cross-sections of drainage ditches, depiction of bridges and “zero” level gauges). Collection of topographical information (where available) and supplemental topographical depiction using terrestrial means, at critical points within the flood zone, such as: Crest altitudes of the protective embankments of the Didymoteicho and Soufli WWTPs, locations, dimensions and altitudes (aerial views - longitudinal sections) of underpasses running along the vertical axis of Egnatia Odos motorway, locations and dimensions of large rainwater culverts under the OSE railway line, depiction of the so-called “dam” in the alignment of

	the Ainisio Delta, etc.). Retrieval of critical “reference” altitudes using terrestrial means in settlement of the riparian zone. This measure concerns the creation of a database that will consist of the above data.
IMPLEMENTATION BODIES	YPYME/GS Infrastructures (Directorate of Flood Defence and Land Reclamation Works) - REMTH (Directorate of Technical Works)
TYPE OF MEASURE	Acquisition, supplementation, and improvement of information for flood defence infrastructure
AREA OF IMPLEMENTATION	APSFGR GR12RAK0002, GR12RAK0004
GEOGRAPHIC EFFECT OF MEASURE	APSFGR GR12RAK0002, GR12RAK0004
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	--
CORRELATION WITH CLIMATE CHANGE	--
PRIORITISATION OF MEASURE	Short term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 150,000
COST ANALYSIS	Estimation based on man hours and the unit price of the Preliminary Cost Estimate Code for the provision of services.
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Update of hydrographic network topographical data
MEASURE CODE	GR12-24-002
NATURE OF MEASURE	Group of interventions
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Prevention, M24
FRM OBJECTIVE	O5
DESCRIPTION OF MEASURE	Topographical depiction using terrestrial means of the riverbed and slopes of watercourses that contribute to Evros river from the Greek side (includes the depiction of transverse cross-sections). Depiction of transverse cross-sections of large watercourses: Mainly the Evros riverbed and the Arda riverbed at selected points.
IMPLEMENTATION BODIES	YPYME/GS Infrastructures (Directorate of Flood Defence and Land Reclamation Works) - REMTH (Directorate of Technical Works)
TYPE OF MEASURE	Acquisition, supplementation, and improvement of information for flood defence infrastructure
AREA OF IMPLEMENTATION	APSFGR GR12RAK0002, GR12RAK0004

GEOGRAPHIC EFFECT OF MEASURE	APSFR GR12RAK0002, GR12RAK0004
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	--
CORRELATION WITH CLIMATE CHANGE	--
PRIORITISATION OF MEASURE	Short term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 60,000
COST ANALYSIS	Estimation based on man hours and the unit price of the Preliminary Cost Estimate Code for the provision of services.
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Procurement of high-precision Digital Terrain Model (DTM)
MEASURE CODE	GR12-24-003
NATURE OF MEASURE	Individual Intervention
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Prevention, M24
FRM OBJECTIVE	O5
DESCRIPTION OF MEASURE	Digital terrain model of the flood area (i.e., with corrected vegetation effects, such as tributary tree clusters, etc.) for the entire flood area and the topographical depiction of appropriate control points for orthorectification. The anticipated elevation accuracy should be <1.0 m.
IMPLEMENTATION BODIES	Special Secretariat for Water-DAMTH (Water Directorate)
TYPE OF MEASURE	Acquisition, supplementation, and improvement of information for flood defence infrastructure
AREA OF IMPLEMENTATION	APSFR GR12RAK0002, GR12RAK0003, GR12RAK0004

EFFECT OF MEASURE ON GEOGRAPHY	APSEFR GR12RAK0002, GR12RAK0003, GR12RAK0004
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	--
CORRELATION WITH CLIMATE CHANGE	--
PRIORITISATION OF MEASURE	Short term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 80,000
COST ANALYSIS	Estimation based on market prices of similar digital products.
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Improvement of the functionality of a hydrometric data collection network
MEASURE CODE	GR12-24-004
NATURE OF MEASURE	Group of interventions
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Prevention, M24
FRM OBJECTIVE	O5
DESCRIPTION OF MEASURE	<p>The measure consists of the following individual actions: (a) Revision of the design and restoration of the hydrometric network operation on Evros river and its tributaries (see below). Investigation into whether the management (maintenance and smooth operation) can be handled by one body; (b) Functional integration of the hydrometric data collection network with the gauges that were installed in the context of the ARDAFORECAST project (Therapeio dam, Egnatia bridge) and with the station that was installed at Petalo bridge by the OP Evros Management Body; (c) Ensuring the supplementation / synergy with Project Management Committees (PMC) and the drafting of a data collection, processing, distribution / notification and archiving protocol as well as ensure access to data by all stakeholders via a web application.</p> <p>The measure aims at implementing the following:</p> <p><u>ERYTHROPOTAMOS Stations</u></p> <p>ER.1 Placement of one (1) meter at the river’s entry into the Greek territory (Avdella - Polia Bridge) with a water velocity radar sensor.</p> <p>ER.2 Placement of one (1) meter at the new Vrysiko - Evgeniko Bridge.</p> <p>ER.3 Repair and commissioning of the REMTH’s existing instrument at the National Road bridge in Didymoteicho, shortly before the confluence of Erythropotamos with Evros.</p> <p><u>ARDA Stations</u></p> <p>AR.1 Calibration verification of existing instrument at Therapeio dam (of the ARDAFORECAST Project)</p> <p>AR.2 The addition of a water velocity radar sensor to the existing meter at the Egnatia Odos bridge (of the ARDAFORECAST Project).</p> <p><u>EVROS Stations</u></p> <p>EV.1 Repair and commissioning of the REMTH’s existing instrument at the river’s entry into the Greek territory at Ormenio.</p> <p>EV.2 Placement of one (1) meter at the old Arda river railway bridge at the point where it meets with Evros river.</p> <p>EV.3 Repair and commissioning of the REMTH’s existing instrument at the Pythio railway bridge.</p> <p>EV.4 Placement of one (1) meter at the confluence of Evros river with Ergene in the Tychero area.</p> <p>EV.5 Calibration verification of the instrument at Petalo-Peplo Bridge which was placed by the OP Evros Management Body.</p> <p>EV.6 Repair and commissioning of the REMTH's existing instrument at the Kipi road bridge.</p> <p>EV.7 Placement of one (1) meter at Evros Delta to measure backwater.</p>

IMPLEMENTATION BODIES	Special Secretariat for Water (Coordination to ensure supplementation / synergy with PMCs) - DAMTH (Water Directorate), REMTH (Directorate of Civil Protection), YPYME/GS of Infrastructures (Special Agency for Public Works/Construction and Maintenance of Transportation Infrastructures (EYDE/KSY)) / Evros Project Construction Department (TKE)
TYPE OF MEASURE	Acquisition, supplementation, and improvement of information for flood defence infrastructure
AREA OF IMPLEMENTATION	APSEFR GR12RAK0002, GR12RAK0004
GEOGRAPHIC EFFECT OF MEASURE	APSEFR GR12RAK0002, GR12RAK0004
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	--
CORRELATION WITH CLIMATE CHANGE	--
PRIORITISATION OF MEASURE	Short term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 75,000
COST ANALYSIS	Estimation based on market prices of similar equipment.
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Adequacy, restoration, and reinforcement check of primary flood defence works
MEASURE CODE	GR12-33-001
NATURE OF MEASURE	Group of interventions
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Protection, M33
FRM OBJECTIVE	O1
DESCRIPTION OF MEASURE	Adequacy, restoration, and reinforcement study of existing primary flood defence embankments running parallel to Evros river, Arda river and on either side of the riverbeds of watercourses that contribute to Evros river. The study of this measure can be carried out piecemeal (e.g., per region or per primary embankment, etc.)
IMPLEMENTATION BODIES	YPYME/GS Infrastructures (Directorate of Flood Defence and Land Reclamation Works) - REMTH (Directorate of Technical Works)
TYPE OF MEASURE	Technical Flood Protection Measures
AREA OF IMPLEMENTATION	APSFR GR12RAK0002, GR12RAK0004
GEOGRAPHIC EFFECT OF MEASURE	APSFR GR12RAK0002, GR12RAK0004
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	--
CORRELATION WITH CLIMATE CHANGE	High
PRIORITISATION OF MEASURE	Mid term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 1,150,000
COST ANALYSIS	Estimation based on man hours and the unit price of the Preliminary Cost Estimate Code for the provision of services.
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Design and construction of supplemental flood defence works
MEASURE CODE	GR12-33-002
NATURE OF MEASURE	Group of interventions
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Protection, M33
FRM OBJECTIVE	O1
DESCRIPTION OF MEASURE	The measure initially concerns the study of construction works of supplemental primary embankments at selected locations which will provide a safe perimeter around the flood zone. It also involves the expansion/elevation of selected parts of the existing primary embankments.
IMPLEMENTATION BODIES	YPYME/GS Infrastructures (Directorate of Flood Defence and Land Reclamation Works - Evros RKE) - REMTH (Directorate of Technical Works)
TYPE OF MEASURE	Technical Flood Protection Measures
AREA OF IMPLEMENTATION	APSFR GR12RAK0002, GR12RAK0004
GEOGRAPHIC EFFECT OF MEASURE	APSFR GR12RAK0002, GR12RAK0004
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	--
CORRELATION WITH CLIMATE CHANGE	High
PRIORITISATION OF MEASURE	Mid term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 100,000
COST ANALYSIS	Estimation based on man hours and the unit price of the Preliminary Cost Estimate Code for the provision of services.
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Design and construction of National motorway underpass protection embankments
MEASURE CODE	GR12-33-003
NATURE OF MEASURE	Group of interventions
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Protection, M33
FRM OBJECTIVE	O1, O2, O3
DESCRIPTION OF MEASURE	Study for the construction of structures for preventing the passage of the flood (protective embankments) from the underpasses of the National Road (vertical axis of Egnatia Odos) while ensuring normal traffic conditions.
IMPLEMENTATION BODIES	YPYME/GS Infrastructures (Directorate of Flood Defence and Land Reclamation Works) - REMTH (Directorate of Technical Works)
TYPE OF MEASURE	Technical Flood Protection Measures
AREA OF IMPLEMENTATION	APSFR GR12RAK0002
EFFECT OF MEASURE ON GEOGRAPHY	APSFR GR12RAK0002
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	--
CORRELATION WITH CLIMATE CHANGE	High
PRIORITISATION OF MEASURE	Mid term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 25,000
COST ANALYSIS	Estimation based on man hours and the unit price of the Preliminary Cost Estimate Code for the provision of services.
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Replacement of Ainisio Delta “blockage” with a variable height construction.
MEASURE CODE	GR12-32-001
NATURE OF MEASURE	Individual Intervention
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Protection, M32
FRM OBJECTIVE	S1, S2, S3, S4
DESCRIPTION OF MEASURE	Study for the construction of a new bench terrace of variable height to replace the so-called "dam" of the Ainisio Delta, using inflatable flood barriers or other suitable technology in order to prevent the salt wedge during the summer while permitting the unimpeded and unobstructed passage in spring. The study involves the drafting of tender documents for the removal of the existing bench terrace and the environmental recovery of the surrounding area.
IMPLEMENTATION BODIES	YPYME/GS of Infrastructures (Directorate of Flood Defence and Land Reclamation Works) - REMTH (Directorate of Technical Works) - OP Evros Management Body
TYPE OF MEASURE	Technical Flood Protection Measures
AREA OF IMPLEMENTATION	APSFR GR12RAK0002
EFFECT OF MEASURE ON GEOGRAPHY	APSFR GR12RAK0002
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	Related Measure RBMP GR12: M12S0701 - Redesign of existing drainage network at Evros Delta
CORRELATION WITH CLIMATE CHANGE	High
PRIORITISATION OF MEASURE	Long-term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 100,000
COST ANALYSIS	Estimation based on man hours and the unit price of the Preliminary Cost Estimate Code for the provision of services.
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Immediate flood protection restoration and maintenance measures
MEASURE CODE	GR12-33-004
NATURE OF MEASURE	Group of interventions
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Protection, M33
FRM OBJECTIVE	O1, O2, O3
DESCRIPTION OF MEASURE	Identification and performance of immediate measures to restore the discharge capacity of the Evros riverbed and its tributaries. These actions indicatively involve the removal of aquatic plants and transport sediments at specific areas, reinforcement, and restoration of “over-topped” embankments, restoration of transverse techniques (at tributaries), etc.
IMPLEMENTATION BODIES	YPYME/GS of Infrastructures (EYDE/KSY Y / Evros TKE) - REMTH (Directorate of Technical Works)
TYPE OF MEASURE	Technical Flood Protection Measures
AREA OF IMPLEMENTATION	APSFR GR12RAK0002, GR12RAK0004
GEOGRAPHIC EFFECT OF MEASURE	APSFR GR12RAK0002, GR12RAK0004
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	--
CORRELATION WITH CLIMATE CHANGE	Moderate
PRIORITISATION OF MEASURE	Short term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 350,000
COST ANALYSIS	Estimation based on man hours
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Study to address the effects in the water supply and sewerage sectors
MEASURE CODE	GR12-23-001
NATURE OF MEASURE	Group of interventions
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Prevention, M24
FRM OBJECTIVE	O1, O2, O3
DESCRIPTION OF MEASURE	Preparation of a study for the removal of boreholes that are located within the embankment zone. Preparation of a study which will look into alternative solutions for the operation of the pipes of treated wastewater of WWTPs that are located within the embankment zone. The purpose of the measure is to protect public health from the submersion of treated wastewater pipes in case of flood.
IMPLEMENTATION BODIES	MUNICIPALITIES - DAMTH (Water Directorate) - REMTH (Directorate of Technical Works & Directorate of the Environment and Spatial Planning)
TYPE OF MEASURE	Technical Flood Protection Measures
AREA OF IMPLEMENTATION	APSEFR GR12RAK0002, GR12RAK0004
GEOGRAPHIC EFFECT OF MEASURE	APSEFR GR12RAK0002, GR12RAK0004
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	Related Measure RBMP GR12: M12B0301: Preparation/Update of water master plan, M12B0404 - Implementation of Water Safety Plans
CORRELATION WITH CLIMATE CHANGE	--
PRIORITISATION OF MEASURE	Mid term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 25,000
COST ANALYSIS	Estimation based on man hours
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Development of an early-warning flood tool
MEASURE CODE	GR12-41-001
NATURE OF MEASURE	Individual Intervention
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Preparedness, M41
FRM OBJECTIVE	O1, O2, O3
DESCRIPTION OF MEASURE	Development of a tool and necessary early-warning flood infrastructures for the entire Evros river basin based on the data of existing and new stations of the hydrometric network - as formulated by measure GR12-24-004 - and other relevant data. Over time this tool shall incorporate the ARDAFORECAST system based on new requirements that will arise and extend the warning capacity of the main Evros river and its major tributaries.
IMPLEMENTATION BODIES	DAMTH (Water Directorate - Dir. of Civil Protection) - REMTH (Dir. of Civil Protection)
TYPE OF MEASURE	Non-Structural Interventions
AREA OF IMPLEMENTATION	APSFR GR12RAK0002, GR12RAK0004
GEOGRAPHIC EFFECT OF MEASURE	APSFR GR12RAK0002, GR12RAK0004
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	--
CORRELATION WITH CLIMATE CHANGE	High
PRIORITISATION OF MEASURE	Short term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 1,000,000
COST ANALYSIS	Estimated cost based on data of recently implemented similar systems (e.g., ARDAFORECAST). Including the operating/maintenance costs for a 3-year period after final acceptance of the project.
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Update of Emergency Plans / codification of emergency flood response actions
MEASURE CODE	GR12-42-001
NATURE OF MEASURE	Individual Intervention
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Preparedness, M42
FRM OBJECTIVE	O1, O2, O3
DESCRIPTION OF MEASURE	Update or preparation of the required emergency plans for response to floods pursuant to the General Plan for Civil Protection under the code name "Xenokrates" (Law 3013/2002, MD 1299/7-4-2003), Circular 8184/2015 of the GS of Civil Protection for floods as in force and the guidelines for the preparation of emergency plans considering the risk analysis results of the current Flood Risk Management Plan for the Evros river basin. Preparation of a memorandum of flood response actions among the Municipalities and Municipal Units within the flood zone according to the provisions of the Emergency Action Plans.
IMPLEMENTATION BODIES	DAMTH (Directorate of Civil Protection) - REMTH (Directorate of Civil Protection) - Regional Unit of Evros (Department of Civil Protection) - Municipalities (Civil Protection Office)
TYPE OF MEASURE	Administrative Regulations
AREA OF IMPLEMENTATION	APFSR GR12RAK0002, GR12RAK0004
GEOGRAPHIC EFFECT OF MEASURE	APFSR GR12RAK0002, GR12RAK0004
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	--
CORRELATION WITH CLIMATE CHANGE	High
PRIORITISATION OF MEASURE	Short term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 15,000
COST ANALYSIS	Estimation based on man hours
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Restructure of crops within the flood zone
MEASURE CODE	GR12-21-001
NATURE OF MEASURE	Individual Intervention
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Prevention, M21
FRM OBJECTIVE	O1, O2, O3
DESCRIPTION OF MEASURE	Restructuring study of crops within the designated flood zone. This involves the utilisation of existing soil and agronomy analysis tools in the flood zone, estimating crop sensitivity and resistance to flood risk, proposed crops, exploration, and proposals of financial and other incentives for switching crops, proposals for necessary administrative arrangements.
IMPLEMENTATION BODIES	YPAAT (Strategic Rural Development Planning Directorate) - REMTH (Directorate of Rural Economy)
TYPE OF MEASURE	Non-Structural Interventions
AREA OF IMPLEMENTATION	APSFGR GR12RAK0002, GR12RAK0004
GEOGRAPHIC EFFECT OF MEASURE	APSFGR GR12RAK0002, GR12RAK0004
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	--
CORRELATION WITH CLIMATE CHANGE	Moderate
PRIORITISATION OF MEASURE	Mid term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 30,000
COST ANALYSIS	Estimation based on man hours
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Building control and determination of land uses within the 100-year flood zone
MEASURE CODE	GR12-21-002
NATURE OF MEASURE	Individual Intervention
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Prevention, M21
FRM OBJECTIVE	O1, O2, O3
DESCRIPTION OF MEASURE	Preparation of the study for: (a) Building control and designation of land uses and establishment of terms and conditions within the 100-year flood zone; (b) Identification of controlled flood zones beyond the embankments and the determination of their protection level. The study will also determine the mechanism via which the legislative act will be processed.
IMPLEMENTATION BODIES	YPEN (Dir. of Spatial Planning) - REATH (Dir. of the Environment and Spatial Planning - Dir. of Rural Economy - Dir. of Civil Protection)
TYPE OF MEASURE	Non-Structural Interventions
AREA OF IMPLEMENTATION	APSFR GR12RAK0002, GR12RAK0003, GR12RAK0004
EFFECT OF MEASURE ON GEOGRAPHY	APSFR GR12RAK0002, GR12RAK0003, GR12RAK0004
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	--
CORRELATION WITH CLIMATE CHANGE	High
PRIORITISATION OF MEASURE	Mid term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 50,000
COST ANALYSIS	Estimation based on man hours
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Upgrade of flood-related damage recording and assessment mechanisms
MEASURE CODE	GR12-51-001
NATURE OF MEASURE	Group of interventions
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Recovery, M51
FRM OBJECTIVE	O1, O2, O3
DESCRIPTION OF MEASURE	Modification of existing flood-related damage recording and assessment mechanisms for the closest determination of the extent of flood-related damages, particularly for agricultural damages (loss of agricultural production), damages to buildings (damage restoration cost for different building categories) and to mechanical equipment of collective irrigation works. Definition and implementation of direct and indirect flood damage assessment indexes and damage assessment measures and damage recording and assessment archive requirements by relevant agencies (Fire Department, ELGA, YASBE, Regional Agencies, etc.)
IMPLEMENTATION BODIES	YPAAT (Dir. of Crisis and Risk Management in the Rural Sector - Dir. of Land Reclamation Works - Dir. of Rural Policy) ELGA - YPOMEDI (YASBE) - YPROPO (FD) – MUNICIPALITIES (Welfare Directorates)
TYPE OF MEASURE	Measures of a financial nature
AREA OF IMPLEMENTATION	APSEFR GR12RAK0002, GR12RAK0003, GR12RAK0004
EFFECT OF MEASURE ON GEOGRAPHY	APSEFR GR12RAK0002, GR12RAK0003, GR12RAK0004
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	--
CORRELATION WITH CLIMATE CHANGE	Moderate
PRIORITISATION OF MEASURE	Short term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 25,000
COST ANALYSIS	Estimation based on man hours
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	

NAME OF MEASURE	Renewal of criteria for financial compensation of damages to agricultural activities
MEASURE CODE	GR12-51-002
NATURE OF MEASURE	Group of interventions
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Recovery, M51
FRM OBJECTIVE	O1, O2, O3
DESCRIPTION OF MEASURE	Amendment of existing criteria and scales for calculating compensation with priority given to the payment of damages that are caused to the production of products that have increased potential for export promotion or import substitution, as well as for vertical (e.g., manufacturing) processing. Determination of the products that will be included in these categories.
IMPLEMENTATION BODIES	YPAAT (Dir. of Crisis and Risk Management in the Rural Sector - Dir. of Land Reclamation Works - Dir. of Rural Policy) - ELGA
TYPE OF MEASURE	Measures of a financial nature
AREA OF IMPLEMENTATION	APSFR GR12RAK0002, GR12RAK0003, GR12RAK0004
EFFECT OF MEASURE ON GEOGRAPHY	APSFR GR12RAK0002, GR12RAK0003, GR12RAK0004
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	--
CORRELATION WITH CLIMATE CHANGE	Moderate
PRIORITISATION OF MEASURE	Mid term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 15,000
COST ANALYSIS	Estimation based on man hours
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	

NAME OF MEASURE	Relocation of activities and installations outside the flood zone
MEASURE CODE	GR12-22-001
NATURE OF MEASURE	Individual Intervention
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Prevention, M22
FRM OBJECTIVE	O1, O2, O3
DESCRIPTION OF MEASURE	Establishment of an administrative mechanism to facilitate relocation of agricultural activities and building installations to a smaller flood risk area. Initially, this measure involves the issuance of a JMD which shall determine the procedure and the responsibilities of related agencies, the criteria applied to approve relocation, financial and economic incentives (e.g., subsidize relocation costs, consulting services, and assistance in the organisation of new positions). The measure shall be implemented following the issuance of the relevant JMD.
IMPLEMENTATION BODIES	YPAAT - REATH (Dir. of Rural Economy)
TYPE OF MEASURE	Measures of a financial nature
AREA OF IMPLEMENTATION	APSFR GR12RAK0002, GR12RAK0003, GR12RAK0004
EFFECT OF MEASURE ON GEOGRAPHY	APSFR GR12RAK0002, GR12RAK0003, GR12RAK0004
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	--
CORRELATION WITH CLIMATE CHANGE	Moderate
PRIORITISATION OF MEASURE	Mid term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	- €
COST ANALYSIS	Zero cost (Management act).
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Optimal land management techniques for reducing surface runoff from rural areas
MEASURE CODE	GR12-34-001
NATURE OF MEASURE	Group of interventions
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Protection, M34
FRM OBJECTIVE	O1, O2, O3
DESCRIPTION OF MEASURE	This measure concerns a pilot project targeted to developing land management techniques to reduce surface runoff from rural areas, the retention of flood waters and reduction of pollution spread downstream. The measure includes the following: (a) research into available best practices based on bibliography and international practice and considering the Code of Good Agricultural Practice, (b) the choice of specific practices for the pilot implementation at the Evros river basin, (c) running of pilot in selected area of the Evros river basin (in the sub-basins of Arda and Erythropotamos river) and (d) monitoring/control and assessment of results
IMPLEMENTATION BODIES	REMTH (Dir. of Rural Economy) DAMTH (Water Directorate)
TYPE OF MEASURE	Measures of an Environmental Nature
AREA OF IMPLEMENTATION	APsFR GR12RAK0002, GR12RAK0004
GEOGRAPHIC EFFECT OF MEASURE	APsFR GR12RAK0002, GR12RAK0004
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	Related Measure RBMP GR12: M12B0803 - Reduction of water pollution caused by agricultural sources in the vulnerable zones of Directive 91/676/EEC
CORRELATION WITH CLIMATE CHANGE	
PRIORITISATION OF MEASURE	Medium term (pilot project) Long term (implementation)
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 80,000
COST ANALYSIS	Estimation based on man hours
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Evaluation of flooding impacts in the National Wetland Park of Evros
MEASURE CODE	GR12-35-001
NATURE OF MEASURE	Group of interventions
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Protection, M35
FRM OBJECTIVE	O1, O2, O3
DESCRIPTION OF MEASURE	Flood impact study from sea level rise or sea penetration (surface and underground) in the protected areas of the Evros Delta (lagoons, wetland areas) and the study for the restoration of the natural flooding regime of these areas from fluvial sources. It involves the redesign of existing and design of new protection infrastructures and the management of sea water penetration into the wetland areas also considering fishing management.
IMPLEMENTATION BODIES	DAMTH (Water Directorate)- Management Body of the National Wetland Park of Evros
TYPE OF MEASURE	Measures of an Environmental Nature
AREA OF IMPLEMENTATION	APSFR GR12RAK0002
EFFECT OF MEASURE ON GEOGRAPHY	APSFR GR12RAK0002
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	Related Measure RBMP GR12: M12S0701 - Redesign of existing drainage network at Evros Delta
CORRELATION WITH CLIMATE CHANGE	High
PRIORITISATION OF MEASURE	Mid term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 200,000
COST ANALYSIS	Estimation based on man hours
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Restoration of natural route of watercourses
MEASURE CODE	GR12-33-005
NATURE OF MEASURE	Group of interventions
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Protection, M33
FRM OBJECTIVE	O1, O2, O3
DESCRIPTION OF MEASURE	<p>Preparation of the study for the restoration of sections of the hydrographic network with hydro morphological modifications, in ways that will not adversely impact the floods.</p> <p>This measure concerns sections of the hydrographic network (surface water bodies) to which, according to the provisions of the River Basin Management Plans (RBMP) of WD 12, have sustained hydro morphological modifications which automatically results in an ecological status assessment of “less than good”. The purpose of this measure is to identify that restoration actions that will not have a negative effect on flood routing.</p>
IMPLEMENTATION BODIES	YPYME/GS Infrastructures (Directorate of Land Reclamation Works) - DAMTH (Water Directorate) - REMTH (Directorate of Technical Works)
TYPE OF MEASURE	Measures of an Environmental Nature
AREA OF IMPLEMENTATION	APSEFR GR12RAK0002, GR12RAK0003, GR12RAK0004
EFFECT OF MEASURE ON GEOGRAPHY	APSEFR GR12RAK0002, GR12RAK0003, GR12RAK0004
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	<p>Related Measure RBMP GR12: M12S1301 - Design and implementation of works to address dam-related impacts, flow barriers and terrace benches in the free movement of backward-moving and forward-moving marine species at selected SWBs in the WD, M12S1604 - Research programme to identify the cause of the degradation on macro invertebrates in river bodies</p>
CORRELATION WITH CLIMATE CHANGE	Moderate
PRIORITISATION OF MEASURE	Mid term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 50,000
COST ANALYSIS	Estimation based on man hours
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Monitoring of coastal zone
MEASURE CODE	GR12-35-002
NATURE OF MEASURE	Group of interventions
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Protection, M35
FRM OBJECTIVE	O4
DESCRIPTION OF MEASURE	Development and keeping of a common database for monitoring the shoreline and the coastal zone of the APSFRs. The database will record spatial and temporal information to monitor the development of coastal formations (sand bars) that act as a deterrent in the occurrence of flooding from sea level rise and also to monitor changes in the coastline due to the combined effect of marine erosion and the deposition of sediments transported by the Evros river.
IMPLEMENTATION BODIES	REATH (Dir. of the Environment and Spatial Planning)
TYPE OF MEASURE	Measures of an Environmental Nature
AREA OF IMPLEMENTATION	APSFR GR12RAK0002, GR12RAK0003
GEOGRAPHIC EFFECT OF MEASURE	APSFR GR12RAK0002, GR12RAK0003
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	--
CORRELATION WITH CLIMATE CHANGE	High
PRIORITISATION OF MEASURE	Mid term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 25,000 (5 years x € 5,000 / year)
COST ANALYSIS	Estimation based on man hours
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Pilot project to develop lateral flood defence interventions at Erythropotamos River (natural retention interventions)
MEASURE CODE	GR12-33-006
NATURE OF MEASURE	Group of interventions
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Protection, M33
FRM OBJECTIVE	O1, O2
DESCRIPTION OF MEASURE	<p>The measure includes the following:</p> <p>(a) Investigation into whether the appropriate lateral flood defence interventions can be implemented at Erythropotamos River to address floods and reduce the flood risk and the appropriate preparation of study tender documents and specifications, having regard to: (i) The technical capabilities and experience from the implementation of similar interventions in Greece and in other countries, (ii) The flood generation mechanism in the Erythropotamos area and the technical capabilities of addressing them with such interventions, (iii) The existence of suitable locations for the development of such interventions, taking into account the geomorphological, geotechnical and other characteristics of these locations as well as other commitments related to the ownership status, the environmental parameters of the areas, the provisions of Directive 2000/60/EC on the state of the water bodies and the changes to the hydro morphological characteristics, the planned relevant projects in the Erythropotamos basin and other technical data required for this purpose.</p> <p>(b) Implementation of the technical study with the basic technical and operational characteristics of the proposed interventions accompanied by their cost and the search for the best solution and design of the required works for the construction and operation of the pilot project in an area. The scope of the study will also include the proposal for the assessment of the efficiency of the interventions, the parameters that should be monitored and the assessment indicators regarding the efficiency of the projects.</p> <p>(c) Implementation of the pilot project (construction, operation, monitoring of results) based on the conclusions and proposals of the above investigation and monitoring of its efficiency in relation to the benefits and the implementation cost. Preparation of a report with guidelines of the development of such projects in the context of country-level Flood Risk Management.</p>
IMPLEMENTATION BODIES	REMTH (Dir. of Technical Works)
TYPE OF MEASURE	Technical Flood Protection Measures
AREA OF IMPLEMENTATION	APSFGR GR12RAK0002
EFFECT OF MEASURE ON GEOGRAPHY	APSFGR GR12RAK0002
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	--
CORRELATION WITH CLIMATE CHANGE	High

PRIORITISATION OF MEASURE	Short term (investigation) Medium term (study) / Long term (pilot project)
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 700,000
COST ANALYSIS	Estimation based on man hours
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	--

NAME OF MEASURE	Determination of recovery material quarries/maintenance of emergency embankments
MEASURE CODE	GR12-53-001
NATURE OF MEASURE	Group of interventions
TYPE OF MEASURE (PILLAR & TYPE OF FRM ACTION)	Recovery, M53
FRM OBJECTIVE	O1, O2, O3
DESCRIPTION OF MEASURE	The measure supports the competent agencies' preparedness for the immediate restoration of flood embankment damage in emergency situations, providing a permanent administrative and institutional framework that removes the need to resort to extraordinary procedures for the performance of the necessary works. The measure includes the following: (a) identification of suitable quarry locations (in terms of geographical dispersion in the APSFR), (b) geotechnical material suitability, (c) determination of recoverable quantities, (d) other actions/studies that are required to secure the locations.
IMPLEMENTATION BODIES	REMTH (Dir. of Technical Works - Dir. of Civil Protection)
TYPE OF MEASURE	Technical Flood Protection Measures
AREA OF IMPLEMENTATION	APSFR GR12RAK0002, GR12RAK0004
GEOGRAPHIC EFFECT OF MEASURE	APSFR GR12RAK0002, GR12RAK0004
CORRELATION WITH OBJECTIVES AND RBMP MEASURES	Related Measure RBMP GR12: M12B0905 - Determination of selected transport sediment collection areas for technical project needs
CORRELATION WITH CLIMATE CHANGE	Moderate
PRIORITISATION OF MEASURE	Mid term
IMPLEMENTATION STAGE	Proposed
COST OF MEASURE	€ 100,000
COST ANALYSIS	Estimation based on man hours
OTHER COMMUNITY DIRECTIVES THAT CONCERN THE MEASURE	

8.4. Monitoring of the implementation of the FRMP measures.

To facilitate the monitoring of the implementation of the FRMP, the proposed measures are grouped by reference to their relevance in addition to the categorisation required by the Directive (e.g., measures that identify or require the application of administrative regulations, regardless of whether one of these concern prevention or protection). This grouping is proposed for easier "navigation" of the measures and to facilitate in the **monitoring the implementation of the measures** by the SSW and the competent Water Directorate. The reasons for this additional grouping include:

- According to the Directive, the proposed measures must refer to specific APSFR. However, the characteristics of the study area are such that the majority of the measures refer to all or most of the designated APSFRs of the area. Therefore, the grouping per APSFR is marginally helpful for the supervision of all the measures.
- The above additional grouping is proposed as a tool for the implementation of the measures to be better monitored by the competent Water Directorates and the SSW. While the categories of Prevention, Protection, Preparedness and Recovery make sense in terms for grouping similar actions in relation to flood risk per se, they also have little relevance with operational monitoring of implementation actions. The proposed grouping into groups of related actions and implementation (and not a related flood management category) is a useful tool for achieving the organisational objective of the timely implementation of the measures. It is proposed that the implementation timetable of the measures is based on this grouping.

The groups of related measures are summarized in Table 8.3 below. The following paragraphs give a brief description of each group and the criteria that merge the measures included therein.

Table 8.3. Groups of measures for monitoring the implementation of the FRMP

Group	Title	Description
1 st	Acquisition, supplementation, and improvement of information for flood defence infrastructure	Concerns the collection of field data, primarily infrastructure and watercourse geometry surveys.
2 nd	Technical Flood Protection Measures	Concerns structural flood protection works and studies for their implementation
3 rd	Administrative regulations	Concern administrative regulation decisions
4 th	Non-structural interventions	Concern regulatory provisions (e.g., land use inspection, zone determination, financial tools) and non-structural works (such as early-warning systems)
5 th	Measures of a financial nature	Concern measures and interventions for better determination of flood-related damage as well as financial tools for the management of flood-related effects.
6 th	Measures of an environmental nature	Concerns measures and interventions for the protection of environmentally sensitive areas.

The following table presents the correlation of the categories to which the proposed measures belong based on the flood risk management level (i.e., based on the categorisation of the Directive) with the groups of measures of relevant content to monitor their implementation in the best manner.

Table 8.4. Correlation of category of measures with monitoring groups.

S/N	Category of measures	Type of Measure	Monitoring measure group
1	Prevention	Avoidance	Non-structural interventions
2	Prevention	Relocation	Measures of a financial nature
3	Prevention	Reduction	Non-structural interventions
4	Prevention	Reduction of Impacts	Technical flood protection measures
5	Prevention	Other prevention	Acquisition, supplementation, and improvement of information for flood defence infrastructure
6	Protection	Water flow regulation	Technical flood protection measures
7	Protection	Watercourse and floodplain works	Technical flood protection measures
8	Protection	Watercourse and floodplain works	Measures of an environmental nature
9	Protection	Surface water management	Measures of an environmental nature
10	Protection	Other protection	Measures of an environmental nature
11	Protection	Other protection	Measures of an environmental nature
12	Preparedness	Flood Forecasting and Warning	Non-structural interventions
13	Preparedness	Emergency measures and planning	Administrative regulations
14	Recovery	Individual and societal recovery	Measures of a financial nature
15	Recovery	Individual and societal recovery	Measures of a financial nature
16	Recovery	Other Recovery	Technical flood protection measures

8.5. Brief description of the measures.

8.5.1. Acquisition, supplementation, and improvement of information for flood defence infrastructure

This category of proposed measures includes actions for the collection of crucial data of the natural and anthropogenic environment of the study area, aimed at the removal of doubts and ambiguities that were ascertained during the initial development of the flood hazard and risk maps.

The implementation of these measures aims to gather currently missing and necessary information which will be used during the Management Plan's first review. This information will be useful during the implementation of this first Management Plan as in many cases they are involved in the more comprehensive implementation of other proposed measures. Therefore, this group is a first priority group in terms of the implementation of the Management Plan.

The measures of this group are limited to those that can be implemented unilaterally by the Greek side, i.e., without the assistance of neighbouring countries in the context of transboundary cooperation.

Included in the relevant measures are GR12-24-001, GR12-24-002, GR12-24-003, GR12-24-004. Particularly important is the GR12-24-001 "Topographies / Database creation of technical works, which aims to fill the significant gap of topographic information in relation to the existing flood protection works as well as the GR12-24-004 "Improvement of the functionality of a hydrometric data collection network" which aims at the restoration of damages to hydrometric stations from recent floods, the consolidation of the REMTH network with instruments installed by other bodies into a single network with a common data collection and publication protocol. It also aims at the network's functional connection with the National Monitoring Network.

8.5.2. Technical flood protection measures

This section includes measures related to structural projects. Both new projects and reconstructions, repairs and the reinforcement of existing projects are included. Also included are design and research work (e.g., geotechnical surveys) that area required for the planning of these interventions.

The proposals for new projects include proposals that have emerged in the course of the work for the implementation of the flood hazard and flood risk maps, as well as proposals that have been reported by third parties.

Obviously, for the implementation of all projects, some preliminary design works are required, which include topographic mapping. Some of the topographic maps (such as the mapping of existing flood defence embankments) in the context of implementing its measures are useful in each case as necessary baseline data for updating the models and the flood hazard and risk maps, regardless of whether other projects will arise in order to utilise them. All topographic works that are exclusively related to the implementation of the works that describe the measures of this section, are understood to be included in the measures in question.

The group includes measures of smaller and larger scope; however, for the main purposes of this FRMP, the group's most important measures include GR12-33-001 "Adequacy check, restoration and reinforcement of primary flood defence works" and GR12-33-002 "Design and construction of supplemental flood defence works". These measures concern the basic studies for diagnosing the problems, the restoration, the reinforcement, but also the

completion with new projects of the basic flood protection infrastructure which are the main flood defence embankments (Vyssa-Pythio, Tychero, Peplo-Feres-Delta).

Secondary, due to their more local character, but also important are the projects provided in measures GR12-33-003 "Design and construction of National Road motorway underpass protection embankments" and GR12-32-001 "Replacement of Ainsio Delta "dam" with a variable height construction". The first concerns the protection of the eastern side of the town of Didymoteicho from the flood waters that pass through the National Road's underpasses and the second concerns the replacement of the overburdened dam ("blockage") in the delta alignment which no longer serves the purpose for which it was constructed since it has been bypassed by the river and creates problems in the drainage of flood waters.

Specifically for measure GR12-23-001 it should be mentioned that the need for the study arose as a result of the public consultation. The boreholes that fall under the provisions of Article 7 of Directive 2000/60/EC and which are mainly affected by this measure, were only partially recorded in the 1st River Basin Management Plan (RBMP) for WD 12 (from which the relevant information arises). This was due to the organisational inability of some Municipalities in the area to respond to the relevant recordings because the drafting of the RBMP coincided with the period of organisational restructuring of Municipal water services and the DEYA due to the implementation of the "Kallikratis" Plan. As a result, some boreholes that area included in the flood zone were not known during the drafting of the PFRA. Their existence became known during the public consultation and in response to this, the said measure was included in the FRMP to address the need for their relocation. At the same time, the public consultation highlighted the problem of wastewater management of the WWTPs that are located in the flood zone during the occurrence of floods. The address of the problem was included in the study that is provided by the FRMP measure.

For reasons of completeness, it is also noted that the Directorate of Flood Defence and Land Reclamation Works of the General Secretariat of Infrastructures of YPOMEDI, which is responsible for preparing the flood protection studies, as part of its participation in the public consultation of the Evros FRMP, announced the planning (within 5 years) related to the completion of the studies of the Derios Dam and Mantheia Dam projects. Until the completion of the relevant studies, the impact that these dam projects will have on the occurrence of floods cannot be substantiated. Given the mentioned completion time frame of these studies, the impact of the projects on the floods will be examined during the 1st review of this FRMP, on condition that the projects have the required maturity and having regard to the provisions of the relevant RBMP of WD12.

Measure GR12-33-006 concerns the implementation (in stages) of a pilot project for the containment and relief of the Erythropotamos river flood waters, which includes the following:

(a) In the short term, the investigation into whether the appropriate lateral flood defence interventions can be implemented at Erythropotamos River to address floods and reduce the flood risk and the appropriate preparation of study tender documents and specifications, having regard to:

- The technical capabilities and experience from the implementation of similar interventions in Greece and in other countries.
- The flood generation mechanism in the Erythropotamos area and the technical capabilities for addressing them with these interventions.
- The existence of suitable locations for the development of such interventions, taking into account the geomorphological, geotechnical and other characteristics of these

locations as well as other commitments related to the ownership status, the environmental parameters of the areas, the provisions of Directive 2000/60/EC on the state of the water bodies and the changes to the hydro morphological characteristics, the planned relevant projects in the Erythropotamos basin and other technical data required for this purpose.

(b) In the medium term, the implementation of the technical study with the basic technical and operational characteristics of the proposed interventions accompanied by their cost and the search for the best solution and design of the required works for the construction and operation of the pilot project in an area. The scope of the study will also include the proposal for the assessment of the efficiency of the interventions, the parameters that should be monitored and the assessment indicators regarding the efficiency of the projects.

(c) Lastly, in a long-term horizon, the implementation of the pilot project (construction, operation, monitoring of results) based on the conclusions and proposals of the above investigation and monitoring of its efficiency in relation to the benefits and the implementation cost. Preparation of a report with guidelines of the development of such projects in the context of country-level Flood Risk Management.

Lastly, the need for measure GR12-53-001 emerged as extremely important during the public consultation. The measure supports the competent agencies' preparedness for the immediate restoration of flood embankment damage in emergency situations, providing a permanent administrative and institutional framework that removes the need to resort to extraordinary procedures for the performance of the necessary works.

To date, the restoration of flood embankment damage after floods is delayed due to time-consuming bureaucratic procedures needing to be completed for the agencies to be able to carry out the restoration works (permits, etc.) Extraordinary procedures (such as the issuance of Legislative Acts) are often required in order to complete the restorations before the next flood period. This measure provides a permanent mechanism that removes the need to specify the framework under which the necessary flood protection restoration interventions will be made.

The measure includes the following: (a) identification of suitable quarry locations (in terms of geographical dispersion in the APSFR), (b) geotechnical material suitability, (c) determination of recoverable quantities, (d) other actions/studies (such as the Strategic Environmental Impact Assessment) that are required to secure the locations and for their permanent licencing.

8.5.3. Administrative regulations

This group concerns administrative acts, at various levels (central agencies, regional and local self-government) to regulate issues that arise for the closest implementation of the FRMP.

Measure GR12-42-001 concerns the "Update of Emergency Plans / codification of emergency flood response actions" and consists of the following:

The preparation of a comprehensive Civil Protection Plan to address flood risks at Evros river is necessary. This Plan should detail, in the case of Evros, the civil protection actions defined in the "Xenocrates" Plan and in the flood-related Circulars of the General Secretariat for Civil Protection. This specialisation will be based on the Flood Risk Management Plan of the Evros river basin, i.e., it will consider the Plan's different flood scenarios and the consequences of floods per scenario, the flood risk maps, and the flood hazard maps.

The Civil Protection Plan in question will include all issues related to the civil protection planning and actions to address flood risks in the Evros basin area, such as:

- Prevention and preparedness projects, actions, and measures to address the phenomena
- Planning for the coordination of civil protection actions that are undertaken by the various bodies
- Public Information and provision of instruction for potential flood risks
- Warning for expected flood (based on the early warning flood system that is provided in the Flood Risk Management Plan)-
- Increased preparedness
- Initial flood warning
- Stakeholder involvement in emergency response and the management of the consequences of flooding
- Declaration of areas as a state of emergency
- Organised evacuation of citizens due to floods, etc.

8.5.4. Non-structural interventions

The group of measures concerns measures relating to the determination of a management framework and practices which are not linked to structural constructions. Measures for the establishment of land uses, the setting of conditions and restrictions for exercising activities, good land management practices, crop restructuring and the use of financial tools fall under this group.

Especially for land uses and urban planning, it is proposed that studies are prepared to control construction (revision of existing GZPs, settlement limits and building conditions), the determination of land uses within the 100-year flood zone, as well as the general designation of the zone that is surrounded by the flood defences embankments as a flood zone. This designation should be made in the context of existing spatial planning legislation. Therefore, the relevant study should also investigate the mechanism through which the flood zone designation legislation act will be made, as well as the modifications and restrictions on land use, given that there is specific involvement from existing urban, spatial, and other commitments (e.g., existing settlement limits and General Zoning Plans (GZPs), Evros Delta Presidential Decrees).

The studies will clearly identify the building restrictions and the permitted uses and the specific requirements for new projects or activities within this zone. The horizontal regulation through the Urban Control Zone does not suffice given that measures must be taken within the limits of the settlements and GZP, but also the limit of the National Park (e.g., regarding special requirements for rural/livestock facilities within the Regional Zone of the Park).

Overall, studies should provide for regulations such as:

1. Location and area of buildings and facilities
2. Integration of various flood protection measures in the building designs via the General Building Code
3. Restriction of the storage and goods and materials that can cause pollution during floods
4. Special requirements for the construction of rainwater drainage or containment works
5. Special requirements for the construction of sewage disposal works

6. Special requirements for the construction of road works.
7. Availability of emergency preparedness plans (for example at tourist attractions, campsites, hotels, etc.) and
8. Provision of adequate water retention or drainage works.

8.5.5. Measures of a financial nature

During the assessment of the financial impact of the past floods in the study area (see Stage I of the FRMP preparation study - Chapter 5.1 of the relevant deliverable), there were significant deficiencies in the information, on the basis of which indicators of financial importance were exported of the damages caused by floods.

These indicators were based on data provided by ELGA and PERS.

ELGA provided data regarding the compensation amount that was paid out for damages to agricultural production per flood, with a parallel determination of the total stremmas that were affected by the flood by spatial unit (Municipal Unit or Municipal-Local Community), without further specifics. No data were available to determine the amount of damage that was covered by the compensation, either directly - for example, information on the value of agricultural production that was lost - either indirectly, but with greater accuracy - e.g., information on the quantities that were destroyed or sustained damages, which could be used (in combination with producer's prices) to calculate the financial amount of the loss⁶. As a consequence, the financial indicators that show the damage to the rural economy of the areas affected by the floods were indicatively approached, with an increased degree of uncertainty, by combining the acreage of crops affected by the average production value per stremma of all the products⁷.

In the case of flood damage caused to buildings, the available data of the PERS refer to the total compensation amount per incident, with simple reference to the affected spatial units, but without further dividing this compensation into individual spatial units, indicating the amount of damage, part of which is covered by compensation, or even the building categories that were affected (e.g., residences, shops, handicrafts-industries, services, offices, hotels or other, equipment of these facilities, etc.). The lack of this information makes it virtually impossible to estimate the amount of damage caused by the floods, or the percentage of these damages that is covered by the compensation - it is only possible to approximately determine the compensation amount per inhabitant for the total area covered each time by compensations.

The above weaknesses in determining the financial extent of the damage caused by floods also affect the ability to assess the clear advantage that will be brought about by the various measures proposed to address floods, as required for the assessment of individual measures/interventions and the choice among the most beneficial (from a purely financial aspect) - which could arise by comparing the cost of measures / interventions with the arising benefit, where the benefit could be the reduction of flood-related financial losses.

⁶Or even for the composition of the acreage that were affected per cultivated product, based on which, in combination with average acreage yields, the quantities and, consequently, the value of the agricultural products affected could be determined.

⁷The average value of agricultural production per product per spatial unit was calculated based on ELSTAT data on the quantities of products produced and producer prices provided to the Ministry of Rural Development and Food. Based on these, the average value of agricultural production per stremma was also determined according to the ELSTAT data for the cultivated acreage of agricultural land (per product and overall).

Therefore, the first step for a more thorough assessment of flood-related financial impacts and measures/interventions to address these impacts is the provision of more systematic and detailed information regarding the damage amount in the study area, especially for damage to agriculture (as reflected by the damage of value of agricultural production) and damage to the building stock (as determined by the cost of restoring the damage to various building categories in the individual spatial units), as follows:

- Directly, by determining the amount of the damage on which the compensation is calculated, in a way that ensures immediate availability. In the case of agriculture, the amount of damage may be the value of agricultural production that is lost each time, whereas in the case of damages to buildings and related installations, the amount could be the damage restoration cost.
- Alternatively, if the above is practically impossible, indirectly:
 - In the case of agriculture, determination of the loss of agricultural production (e.g., in tonnes per product) in each spatial unit - or (although difficult) at least the detailing of the acreage of crops affected by cultivated product. Also, the determination of the category of damage (e.g., total, significant, moderate, low, etc.).
 - In the case of buildings, at least a determination (a) of the uses of the buildings or sites that were affected; (b) whether the damage relates exclusively to buildings and sites and/or equipment and (c) the damage degree (e.g., total, significant, moderate, low, etc.).

Where data is provided for the indirect determination of the damage, the availability of further data/standards of wider implementation would be required, for example, the quantification of the concepts "total", "significant", "moderate", "low", etc.⁸ the average value of building and mechanical equipment of various facilities (e.g., building / site value per sq.m., value of mechanical equipment of commercial and other installations, etc.). The determination of these standards would require relevant research-studies, possibly with specialisations according to a model region in the country, with updates at reasonable intervals (e.g., every five years).

As previously mentioned, the determination of the flood-related financial damage amount is a precondition for the identification and specialisation of measures to address them - preventively or remedially - and more so for the assessment firstly of the necessity and secondly of the possible effectiveness of these measures, as well as their hierarchisation on a scale of priorities which is a critical issue in periods the availability of financial resources is scarce. From a financial standpoint, measures that are estimated to form a better cost-benefit ratio would rank higher⁹. Generally speaking, until the adequate assessment of the benefit ratio (such as flood damage reduction) to cost (of each measure), criteria that can be considered for the hierarchisation of the measures are:

- In the case of agriculture, giving higher priority to the prevention and recovery of damages to the production of products that are more critical to the basic economy of

⁸For example, total damage (or total destruction) could be related to a loss of all agricultural production in the affected area or the value of the building, low damage could be related to a 10% loss (absolutely indicative) of the value, etc.

⁹Needless to say, that when adequate funds are available to finance the assessed measures (in the context of satisfying the overall needs and taking advantage of the development prospects of the areas), all the measures included in the list of hierarchised measures could be implemented, according to chronological order and spatial priorities that are related the various intervention categories, measures that are a precondition for the beneficial operation of other measures, etc.

the country and their region - i.e., products with increased potential for exports or import substitution, as well as for vertical (e.g., manufacturing) processing which contributes towards economic growth.

A prerequisite for this is the determination of the products that will be included in these categories. This determination is not a simple matter, given that it is influenced by a variety of parameters, in a complex process that examines demand, supply and prices (in the local, national, and international market), in relation to the suitability of the physical operator and the cost of production. It is likely, however, that this assessment of agricultural production is part of a broader framework for enhancing national economic growth, through the corresponding growth of its core component, as defined above.

- The consideration of relocating agricultural and livestock activities to less flood prone areas - but considering important relevant constraints such as land ownership, land availability in the potential new location, bonds with the area, social cohesion etc. Even if it is clear (through the relevant consultation) that this is a possibility, it is almost certain that, more often than not, a subsidy will be required for relocation costs, consultancy services and assistance for the organisation in the new positions, etc. - the costs of which should be included in the cost-benefit assessment, as well as the production discontinuation cost during the relocation and the organisation of production in new location and other costs that will arise.
- Similar measures could be considered in the event of damages caused to buildings by floods. With regard to plants that are located within the urban fabric, the prevention of related damage should probably be included in a wider urban / residential planning framework, with incentives for the concentration of future development (when this exists) in areas and settlements that are less prone to flooding or provide greater flood protection. Relocations are probably more realistic in the case of individual plants (outside the urban fabric), as long as the reasons that attracted them to their original location are not entirely restrictive.

It is noted, however, that relocations are often not practically possible, for a number of reasons, such as e.g., the beneficiaries' reluctance, prohibitive costs (it can be proven that the cost of relocating exceeds the cost of compensation¹⁰), lack of alternative positions that meet the necessary conditions, etc.

On the contrary, integration in the development, spatial and urban planning of the future flood risk component may be practically more feasible by creating incentives (infrastructure, financial facilitations, etc.) to attract new population and activities in areas that are recorded as being less prone to floods.

The above largely focus on the assessment of the benefit-cost ratio of various measures, as they are measured in financial terms. Obviously, financial evaluation is just one of many components that are (and should be) involved in determining and overall assessment the various measures. Social structure and cohesion of local communities, habits and traditions, cultural characteristics, the existing distribution of natural and anthropogenic resources, etc., must be given serious consideration, sometimes overshadowing the findings of any financial assessments - in general and specifically in terms of timing of the interventions in question.

Nevertheless, there are two basic prerequisites for the better planning of the prevention and management of flood-related damage:

¹⁰ At least when the multiplier effects on the national economy are not considered.

- The precise identification of areas exposed to flood risks of varying intensities and the activities in these.
- The creation of a sufficient historical file which will record, other than the compensation amounts, the amount of damage caused by floods in the various activities and areas.

8.5.6. Environmental measures

This group includes measures that concern the protection and management of protected areas which are of environmental importance and are included within the limits of the designated APSFRs. The measures relate to actions for the management flood waters in favour of environmental functions and the redesign of existing infrastructures in light of the environmental upgrade of environmentally sensitive areas.

The measures of an environmental nature are summarised as:

- The execution of the pilot project aimed at the development of land management practices that will allow the containment of the flood within the river basin and the reduction in diffuse pollution. Poor land management can increase the flood risk in the rural areas themselves and downstream. The pilot project shall be aimed at the development of land management practices that will allow the containment of the flood within the river basin in cooperation with local communities. The practices that will be examined will aim at reducing diffuse pollution and will work towards achieving the objectives that have been set by Directive 2000/60/EC at river basin level. The practices that should be examined concern the implementation of sustainable drainage systems (SuDS). These systems have multiple benefits since they retain heavy metals, phosphorus, pesticides, and pathogens in sediments before entering surface waters. They also contribute to flood protection by retaining water, regulating flow, and reducing flood peaks locally. They also contribute to climate change adaptation as they enable local storage of water for use in times of drought and increase the local supply of groundwater. They also contribute to protecting biodiversity by creating small-scale wetlands. The results of the above pilot project regarding best land management practices can be promoted to the local community through the organisation of workshops and the provision of consultancy services to groups of farmers or individual farmers.
- Preparation of a study for the restoration of the natural flooding conditions of the Evros Delta National Park. The ecosystem function of the Evros Delta is inextricably linked to floods. The creation of a large number of bench terraces and small dams all the closer to the main Evros riverbed, prevent the flooding of areas along the main riverbed, which in the past were flooded periodically. Also, at the Evros river estuaries, intense processes take place and the sediments transported from Evros river to the sea are deposited in bars by the currents. The new bars that are created tend to close bays in front of the estuaries of the Drana and Monolimni lagoons.

The preparation of a study is proposed to assess the effects of floods in the National Park and to determine the optimal amount of flood water that does not degrade the functions of wetland ecosystems. The study will contribute towards understanding the flood risks for the National Park and will assess the impacts that existing flood defence structures carry. It will also examine their usefulness in containing the salinisation phenomenon. It will also consider their removal or replacement with other means if they do not contribute to flood protection and degrade ecosystem function. The objective is to restore the natural flooding conditions of the National Park. The study should also examine any changes in tidal sediments, habitats,

halophytic communities and wet meadows and pastures in the Evros Delta. It is noted that the Agency prepares special monitoring programmes for habitat types and species in the framework of the implementation of Directive 92/43/EEC. The results of the programme that monitors the extent to which habitat types and flora and fauna species have been conserved should be correlated with flood discharge and spread data.

- Preparation of study for the depiction and recording of parts of the hydrographic network where changes have been made to the natural flow and interventions have to the riparian zones. The study will look into the recovery measures, as appropriate, which will include measures for increase in discharge capacity, flow velocity, the reconnection with the broader floodplain and any detached meanders.
- Development and maintenance of a joint database for monitoring the coastal zone in which spatial and temporal information will be recorded. The recorded information must include sea level monitoring, coastal and fluvial flooding, mappings, as well as information of affected property and infrastructures. Coastal monitoring will also help adapt to climate change (sea level rise and protection from sea floods). It is pointed out that this proposed measure is in synergy with the measure WD12-SM16-01 "Monitoring the coastal erosion of the Eastern Macedonia - Thrace coastline" of the River Basin Management Plan of the Thracian WD.

This group of measures has the most synergies with the measures that have been determined as part of the River Basin Management Plan of the Thracian WD. A number of measures are provided there regarding the protection and management of the marine environment of protected areas, which are directly related to the measures of this FRMP. These specific measures and the synergies with the FRMP are listed in Chapter 10 herein.

8.5.7. Other guidelines

Set of transboundary water cooperation guidelines

The following paragraphs set out proposed guidelines in the context of transboundary water cooperation, to address the emergence of critical issues from the preparation of the Management Plan. The responsibility for the finalisation and the implementation of these guidelines belongs to the Special Secretariat for Water in collaboration with the regional services of the REMTH (Directorate of Technical Works - Directorate of Civil Protection) and their implementation should be sought in the context of the operation of the Greek-Bulgarian Joint Working Group and the Greek-Turkish Joint Committee regarding floods in transboundary rivers.

The proposed guidelines are in fact proposals for measures to be discussed in the context of the Joint Expert Working Group that has been established between the Greek and Bulgarian sides. These measures cannot be unilaterally achieved by the Greek side. In particular, some of them concern actions that are exclusive to Bulgaria. Therefore, only in the context of cooperation in preparation and implementation of a joint flood management plan with Bulgaria can there be any hope that these proposals will be implemented.

The continued exchange of topographic information relating to existing flood defence works (main and over-topped flood defences on the Turkish and Bulgarian sides) and the further coordination of the peak flood discharges for given return periods with neighbouring countries, mainly with Bulgaria, but also with Turkey for Ergene, should be pursued in the immediate future. In particular, the following should be pursued:

- The search for topographic information regarding the over-topped and the main embankments on the Turkish side.

- The coordination with the Bulgarian side regarding the topographic information of the Bulgarian embankments in north Evros.
- The implementation and activation of the electronic hub for the exchange of information with the Turkish side, as agreed at a previous Joint Committee meeting.
- Coordination of peak flood discharges with Bulgaria for Erythropotamos and Arda, and with Turkey for Ergene. It is recalled that there is a relevant agreement between the flood peaks of the main Evros river provided by the Bulgarian side and the estimates made in this Management Plan, but there is a large discrepancy between the respective assessments regarding the Erythropotamos and Arda flood peaks. With respect to Ergene, a flood peak assessment was made in this Management Plan based on primary data that was provided by the Turkish side, whose view regarding the assessment amount must be sought.

With respect to the Arda river floods in particular, a set of proposals / guidelines is presented for discussion in the context of the existing cooperation with the Bulgarian side for the management of the Arda river flood risk. In particular, the following should be sought:

- Adoption of commonly accepted flood discharge "thresholds" for Arda river (measured at the Therapeio dam station) which should not be exceeded for high and medium probability floods. In the context of preparing the flood hazard and risk maps, a "low nuisance threshold" for the Arda river discharge (700 m³/s) was set, which separates the flood scenarios into those where Arda simply participates in the formation of the Evros river flood (without drastically changing the characteristics of the phenomenon) and those in which its contribution is decisive, by significantly changing the characteristics of the total flood and magnifying the effects downstream. This estimate was based on the analysis of the empirical frequency of data relating to the maximum annual discharges of Evros, using a time series of data after the construction of the Bulgarian dams and without resorting to theoretical statistical assumptions.

On the basis of this assessment, a discussion with the Bulgarian side is proposed on the possible adoption of appropriate thresholds for floods of high and medium probability with the simultaneous adoption of appropriate measures on both sides in order for the agreed "thresholds" to be complied with as much as possible. However, the basis of this discussion should be the "low nuisance" threshold of 700 m³/s and the relevant substantiation as presented in the deliverable of Stage II of the project preparation of this Management Plan.

- Operation of the ARDAFORECAST programme in the context of transboundary cooperation with specific measures linking the early warning with Arda dam management practices (e.g., linking warnings with dam filling levels or the similar indications).
- Preparation of a feasibility study on the installation of an overflow control system (e.g., through tilting flood barriers) at the Ivaylovgrad Dam, in order to increase the dam's flood containment volume, better flood management and the production of additional energy.

9. Public Information and Public Consultation

9.1. Public consultation according to Directive 2007/60/EC

Both the Directive and the legislation transposing it into national law provide that public information and their active involvement all stages of its implementation should be requested.

In particular:

Article 3 of JMD no. 31822/1542/2010 as amended and in force

Competent authority

2. In the context of their responsibilities, as these are described in Article 5 (para. 5, subparagraph a, case 6) of Law 3199/2003, the Water Directorates of the Decentralised Administrations, shall undertake the following specific responsibilities:

.....

e) encourage the active involvement of the public in the flood risk management procedures pursuant to Article 9.

2.2. Following the request by the Secretary General of the Decentralised Administration, it is possible for the Preliminary Flood Risk Assessment, the Flood Hazard Maps, the Flood Risk Maps and the Flood Risk Management Plan to be developed, reviewed, or revised by the Special Secretariat for Water of the Ministry of the Environment and Energy.

Article 6 of JMD no. 31822/1542/2010 as amended and in force

Management Plans

3. In the event that the flood risk management plan is developed by the Special Secretariat for Water in accordance with the new para. 2.2 of Article 3, the management plan in question is approved by the National Committee on Water following the recommendation by the Special Secretariat for Water of the Ministry of the Environment and Energy, provided the consultation process of Article 9 has been observed, as amended by Article 1, paragraph 3 of this decision. During the development, final processing, review or revision of the flood risk management plan, the Special Secretariat for Water collaborates with the competent Water Directorate of the relevant Decentralised Administration and with the co-responsible Ministries which are represented by the National Committee on Water.

Article 8 of JMD no. 31822/1542/2010 as amended and in force

Coordination with the regulations of PD 51/2007

d) the active involvement of all interested parties according to Article 9 (2), as amended and supplemented by Article 1 (4) of this decision, is coordinated as appropriate with the active involvement of interested parties in the context of implementing Article 15 of PD 51/2007, as in force or paragraph 1, case (g) of the fifth article of Law 4117/2013 (Series I, 29).

Article 9 of JMD no. 31822/1542/2010 as amended and in force

Public information-Involvement

1. The preliminary flood risk assessments, the flood hazard maps, the flood risk maps, and the flood risk management plans are made available to the public, pursuant to the provisions of JMD no. 11764/653/2006.

2. The Water Directorates of the Decentralised Administrations ensure for the substantial involvement of the interested parties and stakeholders including the users, during the

elaboration, processing, review, or revision of the Flood Risk Management Plan. For this purpose, they proceed with the public consultation of the Preliminary Flood Risk Management Plan by providing all the relevant data and information that they have gathered. In particular:

a) The Water Directorates of Decentralised Administrations shall upload the Flood Hazard Maps, the Flood Risk Maps and the Preliminary Flood Risk Management Plan by addressing an invitation to interested parties and stakeholders to become aware of their contents, so that they are able to express their opinions and submit their observations in writing, electronically or by other appropriate means. The publication of the above can be made by other appropriate means.

b) The competent Water Directorate of the relevant Decentralised Administration shall provide sufficient time from its publication for the expression and submission of observations and opinions. Observations by the public and authorities are considered during the Flood Risk Management Plan approval procedure.

2.1. Where the new paragraph 2.2 of Article 3 is applied, the above publication procedure for the involvement of interested parties and stakeholders pursuant to paragraph 2 is carried out by the Special Secretariat for Water. The publication of the preliminary Flood Risk Management Plan can be done in collaboration with the competent Water Directorate of the relevant Decentralised Administration, using other appropriate means.

In addition, Article 7 of JMD 11764/653/2006 states the following:

Article 7 Dissemination of environmental information

1. Public authorities organise the environmental information of their possession as well as information that they possess or is possessed on their behalf for their active and systematic dissemination [...].

2. The information that must be provided and disseminated, are updated as appropriate and include the following:

.....

b) the policies, plans and programmes relating to the environment

.....

4. Without prejudice to special obligations imposed by national and Community law, in the event of an imminent threat to human life or the environment due to human activities or natural causes, all information held by or on behalf of public authorities and which could enable the public, which may be affected, to take measures to prevent or limit damage from that threat shall be disseminated promptly and without delay.

6. Public authorities may meet the requirements of this Article by creating links to websites on the Internet, where such information can be sought.

7. The General Directorate of Environmental Policy of YPEN ensures, in the context of its responsibilities, that the provisions of this Article will be implemented.

9.2. Preparation of list of social partners

9.2.1. Relevant definitions

In the context of compiling the list of social partners that should participate in the consultation, the following definitions are adopted:

Public: One or more natural or legal person, and, in accordance with national law or practice, their associations, organisations or groups (SEA Directive (2001/42/EC), Aarhus Convention No. 2 (4))

Social partners: Members of the public with only a limited interest in the subject matter and limited influence on the outcome of the final decision. Collectively, their interest and influence can be significant.

Interested party (or body GROUP 1 and GROUP 2): Any person, group, organisation, or institution that is either institutionally involved, or will be directly affected, or may have some influence on the outcome of the final decision.

Consultation: Lowest level of information provision. The service makes the documents available for written comments, organises a public consultation and actively seeks the comments and opinions of the public.

Active involvement: Active involvement presupposes that stakeholders are invited to actively contribute to the design process, by discussing issues and contributing to their resolution.

Collective decision making. This term refers to a process where all involved persons or parties have equal rights. Negotiation takes place at the same competence level.

9.2.2. Social partners

Based on the above definitions, the overall social partner list was compiled. It is noted that the most complete list of social partners that had been prepared by the SSW in the context of preparing the River Basin Management Plan for the Thracian Water District was used for this purpose. Having regard to the features of the public consultation of Directive 2007/60/EC in relation to the corresponding features of Directive 2000/60/EC and the limited geographical and administrative area in which the subject-matter of the consultation for the study area is developed, the list was fine-tuned in order to obtain the list of social partners for the purposes of the public consultation of this Flood Risk Management Plan of Evros River Basin.

The involvement of the public and the social partners in the management of flood risks includes the division into the following groups:

1. Directly institutionally involved in the Evros RB flood risk management issue (GROUP 1 - COLLECTIVE DECISION MAKING)
2. Representatives of the co-competent authorities in related fields (GROUP 2 - ACTIVE INVOLVEMENT)
3. Stakeholders such as non-governmental organisations (NGOs) and / or individuals or entities that could be affected by management and planning issues (e.g., water users, businesses that may affect citizens) (SOCIAL PARTNERS - CONSULTATION)

9.3. Proposed consultation actions for the FRMP of the Evros RB

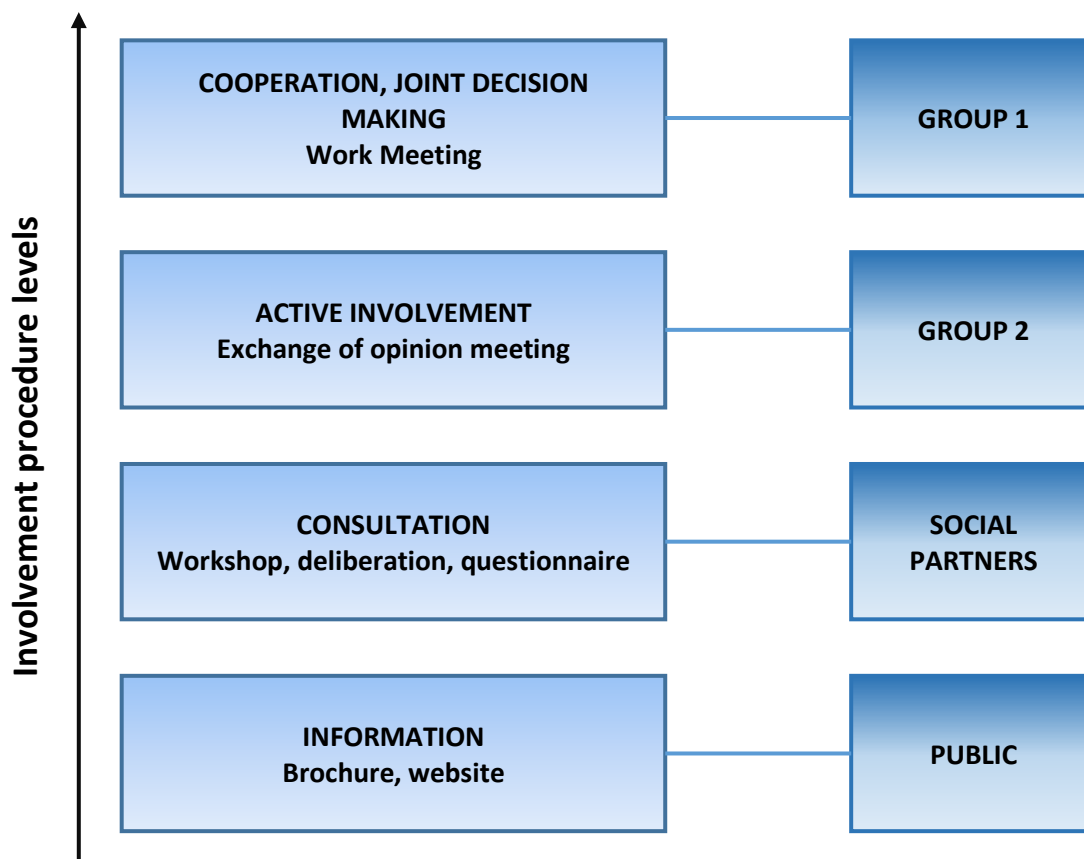
The organisation of the consultation for the FRMP of the Evros RB was planned to take place in three separate stages:

1. Discussion of the Draft with Group 1 (directly involved in flood risk management) and exchange of opinions on the proposed measures for their finalisation and recommendation at the next stages of the consultation.
2. Discussion of the Draft with Group 2 of stakeholders (all relevant authorities in relevant areas) in the form of a wide-scope meeting for the purpose of providing information and the exchange of opinions on the proposed measures, and
3. The presentation and discussion of the Draft to the other social partners and the public following an invitation for expression of involvement (workshop) where the

social partners' opinions will be obtained through a specifically designed questionnaire.

In addition to these actions, the Special Secretariat for Water has set up a special website (floods.ypeka.gr) which is dedicated to the issue of flood risk management and the implementation of Directive 2007/60/EC, where the public and any interested party can obtain information about the content of the Plan as well as for the individual preparation stages.

The consultation organisation chart is shown in the figure below.



9.4. Consultation actions for the FRMP of the Evros RB that were realised

As part of the Management Plan's public consultation, a number of actions were implemented for the purpose of informing stakeholders and the public and for collecting views and proposals both on the proposed measures in the Draft Management Plan and to give the opportunity for primary flood risk response and management proposals for the study area to be expressed.

Initially, a broad-scope meeting was held with the participation of local authorities and DAMTH and REMTH agencies. The authorities and agencies that participated further to the relevant invitation by the SSW, correspond to Groups 1 and 2 of the figure in the previous paragraph.

The meeting was held on 19.11.2015 in Alexandroupoli and lasted all day. The flood hazard and risk maps, the Draft FRM plan and the proposed Programme of Measures were presented at the meeting by the researchers and representatives of the SSW and the Technical Advisor.

A workshop was then organized for 22.12.2015 in Alexandroupoli, which was open to the general public. Relevant publicity actions preceded. The involvement of stakeholders was extremely satisfactory, since they were represented by all central, regional, and local flood-related agencies. The involvement of the general public was less satisfactory, however, representatives of involved agricultural organizations (LLRO, GLRO) and individual farmers, a social group that is particularly affected by the problem in the region, did participate.

A discussion on the proposed measures followed, during which the proposed measures of the Draft were discussed in detail and views were exchanged on a number of individual issues. The discussion was extremely creative and resulted in the clarification, specialisation, and amendment of many details of the proposed measures.

Recommendations were also made for the introduction of new measures as well as for the merger, amendment or even revocation of some of the proposed measures. During the intervening period between the two consultations, many of the proposals that were expressed in the first meeting were discussed further, and at the meeting held on 22.12.2015 they were expressed with greater clarity.

The results of the discussion were codified, and a consultation results report was prepared, listing the individual proposals in detail.

Subsequently, the proposed measures were revised and amended in accordance with the comments made in the two consultations.

The agencies and authorities that participated are detailed below:

- Water Directorates of Eastern Macedonia-Thrace of the DAMTH
- Evros TKE of the EYDE/KYY of YPOMEDI
- Dir. of Civil Protection of the REMTH
- Department of Civil Protection of the Regional Unit of Evros of the REMTH
- Dir. of Civil Protection of the DAMTH
- Department of Technical Infrastructures and Natural Resource of Eastern Macedonia-Thrace of the DAMTH
- General Dir. of the Environment and Spatial Planning of the DAMTH
- Management Body of the National Wetland Park of Evros
- Dir. of the Environment and Spatial Planning of Eastern Macedonia-Thrace of the DAMTH
- Dir. of Technical Works, Regional Unit of Evros of the REMTH
- Water Directorates of Central Macedonia of the DAMTH

In addition, in the period that followed the SSW moved forward with consultation meetings with the relevant agencies of the Ministries, which have co-responsible for the administrative acts that are required for the implementation of the measures of the FRMP or have subject-matter jurisdiction regarding the implementation of some of these measures. In the context of the consultation, similar working meetings were held with the agencies of the Ministry of Rural Development and Food and the Ministry of the Environment and Energy.

9.5. Consultation on the Strategic Environmental Impact Assessment (SEIA) of the FRMP.

With respect to the FRMP of the Evros RB, an SEIA was prepared in accordance with the provisions of the relevant legislation (JMD YPECHODE/EYPE/oik.107017/2006, GG

1225/Series II/2006 as amended by JMD no. oik. 40238 (GG 3759/Series II/25.10.2017) and in force) which was also put to public consultation.

The SEIA was forwarded to the following bodies by the competent Directorate of Environmental Licensing of the Ministry of the Environment and Energy in December 2016 and the relevant procedure was completed in April 2017.

Ministry of the Environment and Energy:

- Directorate for the Protection of Biodiversity, Soil & Waste Management
- Directorate of Climate Change and Air Quality
- Directorate of Forestry and Management of the Environment and
- Directorate of Spatial Planning.

Ministry of the Interior:

- Directorate of Emergency Planning and Management of the General Secretariat for Civil Protection and
- Directorate for the Organisation and Operation of Local Governments

Ministry of National Defence:

- Directorate of Infrastructure and Environmental Protection of the Hellenic General Army Staff.

Ministry of Health:

- Directorate of Public Health
- 4th Healthcare Region of Macedonia - Thrace

Ministry of Culture and Sports:

- General Directorate for Restoration
- Directorate of Prehistoric and Classical Antiquities
- Directorate of Byzantine & Post-Byzantine Antiquities
- Service of Modern Monuments and Technical Works of East Macedonia and Thrace
- Ephorate of Antiquities of Evros
- Ephorate of Underwater Antiquities

Ministry of Infrastructures and Transport:

- Directorate of Flood Relief and Land Reclamation Works
- General Directorate of Natural Disaster Recovery

Ministry of Maritime Affairs and Insular Policy:

- Directorate of Ports and Building Infrastructures

Ministry of Rural Development and Food:

- Directorate of Land Reclamation, Soil & Water Resources and Fertilisers
- Directorate of Spatial Planning, the Environment and Climate Change

Ministry of Tourism:

- Directorate of Spatial Planning and Infrastructures

Ministry of Economy and Development:

- General Directorate of Strategic Investments

- General Directorate of Private Investments
- General Directorate of Public Investments

Ministry of Finance:

- General Directorate of Public Property & Public Welfare Services
- Regional Directorate of Public Property of Macedonia-Thrace
- Evros Office of Public Property

Decentralized Administration of Macedonia-Thrace

- Directorate of Civil Protection
- Directorate of the Environment & Spatial Planning of Eastern Macedonia - Thrace
- Water Directorate of Eastern Macedonia– Thrace
- Directorate of Technical Control
- Directorate of Forest Coordination and Inspection
- Directorate of Evros Forests
- Directorate of Rural Affairs of Eastern Macedonia– Thrace
- Forest Service of Alexandroupoli
- Forest Service of Didymoteicho
- Forest Service of Soufli

Region of Eastern Macedonia– Thrace:

- Regional Council of Eastern Macedonia - Thrace
- Independent Directorate of Civil Protection
- Directorate of Technical Works
- Directorate of the Environment and Spatial Planning
- Department of the Environment and Hydro economy of the Regional Unit of Evros
- Management Body of the National Wetland Park of Evros.
- Management Body of the Dadia-Lefkimi-Soufli Forest National Park.

The following authorities submitted their opinions at the SEIA consultation.

- Directorate of Agricultural Affairs of Eastern Macedonia - Thrace of the DAMTH
- Directorate of Civil Protection of the Region of Eastern Macedonia - Thrace
- Directorate of Civil Protection of the Decentralised Administration of Macedonia - Thrace
- Directorate for the Organisation and Operation of Local Governments of the Ministry of the Interior
- Directorate of Land Reclamation, Soil & Water Resources and Fertilisers of the YPAAT

The authorities' views were considered by the SSW and to a large extent were incorporated in this Final Flood Risk Management Plan, and the necessary corrections were made. In detail, the commentary, and the incorporation method of the authorities' views in the FRMP is presented in document no. 140649/19.07.2017 of the Directorate for Water Protection and Management of the Special Secretariat for Water entitled "Memorandum on the opinions of the bodies that emerged from the consultation of the Strategic Environmental Impact Assessment (SEIA) of the study "Flood Risk Management Plan for the Evros River Basin. Implementation of Directive 2007/60/EC".

The Plan and the SEIA is approved by virtue of a single administrative act by the Planning Authority (SSW/YPEN), after the "proposal for SEIA approval" is forwarded to the Planning Authority [article 7 of MD YPECHODE/EYDE/oik.107017/2006 (GG 1225/Series II/5.9.2005) as

amended by the JMD no. 40238 (GG 3759/Series II/25.10.2017) as in force] by the authority that is responsible for the environmental licencing of the Environmental Plan (DIPA/YPEN). DIPA/YPEN gives its positive recommendation for the approval of the SEIA of the Evros RB FRMP with its document under ref. no. oik.48106/23-11-2017 (ref. no. SSW 142576 / 20-12-2017).

10. Synergies with the River Basin Management Plan of GR12

Directive 2007/960 was transposed to national law with JMD HP 31822/1542/E103 (GG Series II/1108/21.07.2010) "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" as amended and in force with JMD 177772/924 (GG Series II 2140/22.06.2017).

Pursuant to Article 8 of the JMD coordination is required with the provisions of PD 51/2007 "Determination of the measures and procedures for the comprehensive protection and management of waters in compliance with the provisions of Directive 2000/60/EC". In essence, these are measures to coordinate the implementation of Directives 2000/60/EC and 2007/60/EC, focusing on opportunities for improving efficiency, information exchange and for achieving common synergies and benefits having regard to the environmental objectives laid down in Article 4 of Directive and PD 51/2007. In particular:

- the development of the first flood hazard maps and flood risk maps and their subsequent reviews as referred to in Article 5 of the JMD shall be carried out in such a way that they contain information that is consistent with relevant information presented according to PD 51/2007. They are further coordinated with the reviews that are provided in Article 5 (para. 2) of PD 51/2007 and can be incorporated therein.
- the flood risk management plans supplement the river basin management plans, in accordance to Article 10 (para. 6) of PD 51/2007.
- the development of the first flood risk management plans and their subsequent reviews, which are provided by Article 6 of JMD HP 31822/1542/E103 (GG/Series II/1108/21.07.2010) as amended and in force with JMD 177772/924 (GG/Series II/2140/22.06.2017) are conducted in sync with the reviews of the river basin management plans which are provided by Article 10 (para. 3) of PD 51/2007 and can be incorporated therein.
- the active involvement of all interested parties under Article 9 of this decision shall be coordinated, as appropriate, with the active involvement of interested parties under Article 15 of PD 51/2007.

With respect to the above, the Flood Risk Management Plan and the regulations that will be provided therein should be incorporated in the Management Plan of the WD in the future.

In this regard, below is an excerpt from the list of measures included in the approved 1st Review of the River Basin Management Plan of the Thracian WD12 (GG Series II/4680/29.12.2017) which are related to the area that concerns the Flood Risk Management Plan. These measures result in synergies with the proposed measures of RBMP WD12 which are indicated below.

Group II Baseline Measures for the RBMP WD12 - Measures to address the negative impacts in the status of surface water bodies, particularly due to hydro morphological alterations

Measure code: M12B0905 - Identification of selected transport sediment collection areas for technical project needs

The measure aims to address one of the main problems of arbitrary uses and interventions to WB throughout the country in a rational and environmentally friendly way in order to address the existing hydro morphological pressures.

For this purpose, the following are implemented:

- A) Identification of transport sediment collection areas along the wide bed of the WB and the lakeside riparian zone.
- B) Assessment of available quantities of aggregates per area.
- C) Ecological evaluation per area with emphasis on the type of natural habitats (structure, conservation status), the types of flora (herbaceous, shrub or tree vegetation with emphasis of trees with a good conservation status) and fauna habitats.
- D) Hierarchisation of collection areas in terms of the possibility of obtaining materials, considering the hydro morphological characteristics of the WB and the aforementioned ecological assessment.

The competent Regions shall determine, in cooperation with the Water Directorates of the Decentralised Administration and the relevant Municipalities, the RBs for which the preparation of such studies is considered a priority.

The study will be prepared under the responsibility of the competent Region.

The aim of the measure is to manage the sedimentation and regulate the extraction of materials from the stream, rivers and lakes beds in a manner that preserves the sustainable exploitation of this resource on the one hand and ensures the maximum possible protection of ecosystems that develop in the relevant water bodies and to ensure the protection of the coasts from erosion on the other hand.

The relevant FRMP, in application of Directive 2007/60 / EC, will be taken into consideration when implementing the measure.

Synergies with the Evros RB FRMP: The designated areas for the removal of accumulated sediments to improve the discharge capacity of the Evros riverbed and its tributaries (at locations that do not require transboundary cooperation) as provided by the relevant measure of FRMP, should be included in the scope of the proposed study of measure M12B0905 of the RBMP ED12 of the Evros RB.

Supplementary measures for RBMP WD12 - Recreation and restoration of wetlands

Measure code: M12S0701 - Redesign of existing drainage network at Evros Delta

Preparation (studies and mappings) and implementation of the redesign of the existing drainage network at the Evros Delta. The measure includes the redesign of the operation of the Delta drainage network, the transfer of the drainage pumping stations of the Feres A and B Zones to a new upstream position, and secondary network rearrangement works. The measure will contribute towards ensuring the water balance throughout the Evros Delta by covering the hydrological needs of both the wetland, thereby contributing to its hydrological restructure, as well as to the optimisation of irrigated areas.

Synergies with the Evros RB FRMP: The Management Body of OP Evros has made specific proposals for the redesign of the drainage network in the Delta area which should be regarded as guidelines during the preparation of this measure. This concern, among other things, the relocation of the Feres A and B Drainage Zones on either side of the Dytikos Vrachionas upstream of the current positions, with simultaneous redesign of the drainage ditches that end there and consequently the areas to which they are drained. This measure should be coordinated in its implementation with the measures proposed in the FRMP to determine land uses in the flood zone. The redesign of the network the supply of the Delta with freshwater should include a plan to release the flood waters from the flood zone towards the wetlands and the sea.

Supplementary measures for RBMP WD12 - Research, development, and demonstration projects**Measure code: M12S1606 - Exploration of appropriate measures to address the saltwater wedge intrusion phenomenon at the estuaries of Nestos, Lissos and Evros rivers**

The measure refers to the preparation of the study to determine the length of each river that is affected by the saltwater wedge. It involves the installation of a local monitoring network with physiochemical parameter measurement stations to determine the physical boundary of the transitional water body and based on this the proposal of measures to limit saltwater wedge intrusion upstream during the summer period.

Synergies with the Evros RB FRMP: This measure should be considered during the implementation of the proposed measure in the FRMP for the removal of the so-called "dam" of the Ainsio Delta in the alignment of the Evros river and its replacement with construction of variable height so that it's not an obstacle to the route of flood waters, while in the summer it will act as a saltwater intrusion dam. The location of the new construction should consider the results of the study referred to in the above measure M12S1606 of RBMP Thracian Wd12 for the Evros river estuary.

11. BIBLIOGRAPHY

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