PRELIMINARY OF THE EUROZONE AND FOR THE BENEFIT OF STATE AND LOCAL ADMINISTRATION

I. INTRODUCTION

The inclusion of Bulgaria in the group of member states of the so-called Eurozone, in addition to the transition from the national currency - the Bulgarian lev - to the common European currency - the euro, also requires national governance in a much more direct connection with the common rules and regulations imposed by the European Commission and other European institutions.

In this regard, ASDE-ECOREGIONS begins publishing short materials related to the established operational capacity, in accordance with the introduced or upcoming mandatory European regulations, especially in the field of territorial planning, risk management, combating climate change, and the protection of natural and cultural-historical heritage.

In this short publication, we offer to the attention of the state and local administration, our comment and proposal, regarding the need to create in each municipality a specialized database for vulnerability and damage, infrastructure damage or human casualties, which should be kept up to date with the help of the mechanism of constant monitoring of the risk of disasters and catastrophes. In this case, we propose such a database, as well as the determination of vulnerable territories, mainly for urbanized territories in the Municipality of Ruse in Bulgaria. The development is also in accordance with the requirements of European directives, decisions/regulations (in the sense of EU legal acts) and manuals/guidelines, which are used directly or indirectly in the assessment and management of the risk of natural disasters.

Below is an attempt to determine the correspondence between the idea of a specialized municipal database for vulnerability, damage and risk monitoring and key **EU** legal acts, directives, regulations, decisions and guidelines that are used **directly or indirectly** in assessing and managing the risk of natural disasters:

1) Main EU legal acts in the field of disaster risk assessment and management

A. Legal basis for cooperation and risk management mechanisms

- **Decision No 1313/2013/EU on the EU Civil Protection Mechanism (UCPM)**
  - A basic legal act that structures coordination between Member States in disaster preparedness, prevention, response and recovery.
  - Requires **risk assessment**, risk data exchange, and accountability for risk capacities at the national level.
  - Is the practical framework for information sharing and for joint projects/risk monitoring.
- Regulation (EU) No. 836/2021
  - Updates and modernizes UCPM, including early warning and disaster information systems.

B. Specific directives by type of risk

- Directive 2007/60/EC on the assessment and management of flood risks
  - It obliges states to:
    - *Preliminary risk assessment*
    - *Mapping of potential hazards and risks*
    - *Flood risk management plans*
  - Maintains flood data and increases data comparability between municipalities and countries.
- SEVESO III Directive (2012/18/EU)
  - Primarily focused on **technological disasters**, its approach to risk assessment is related to the vulnerability of infrastructure, which often interacts with natural hazards (e.g., floods or earthquakes).
- Sustainability and Cybersecurity Directives

Directive on the resilience of critical entities (EU 2022/2557) – requires risk assessments of key infrastructure elements useful in preventing cascading effects of disasters.

(E *NIS Directive 2*- Cybersecurity – important for integrated surveillance/early warning systems (including databases and system risk interfaces).

2) Risk assessment policies, guidelines and frameworks

A. Reporting documents and guidelines

- **EU Reporting Guidelines on Disaster Risk Management**
  - Informal but recognised **guidelines for structuring risk assessments, maps and measures** that Member States must submit to the Commission.
  - They can serve as a template for **databases at the municipal/national level** in terms of content and structure (hazards, vulnerability, damage, preparedness).
- **Risk Assessment and Mapping Guidelines for Disaster Management**

A practical document that supports risk assessment methods, including a multi-hazard approach, mapping and climate change impacts.

B. Institutional tools and knowledge

- **Disaster Risk Management Knowledge Centre (DRMKC) – JRC**
  - A platform for sharing scientific data, analyses, maps and risk assessment methodologies that can be fed into municipal databases.
- **European early warning systems (e.g. European Flood Awareness System)**
  - Information services for monitoring natural hazards (such as floods) – useful for dynamic, real-time data.
- **European Climate Adaptation Platform Climate-ADAPT**
  - A platform of the European Environment Agency (EEA) aiming to support Europe in adapting to climate change by offering access to data and information on the vulnerability of regions to a changing climate, as well as (trans)national adaptation strategies and planning tools.

3) Compliance with international frameworks that the EU integrates:

- **The Sendai Framework for Disaster Risk Reduction (Sendai Framework 2015–2030)**
- Although it is not EU legislation, European policy integrates it as a strategic framework for:
  - policy planning
  - early warning
  - vulnerability assessment

- Promotes the collection of risk and damage data – directly linked to disaster databases.

4) How this framework supports a municipal vulnerability and damage database

Database component	Related legal/political act
Hazard Risk Assessment (Floods, Fires, etc.)	Floods Directive 2007/60/EC; UCPM Reporting Guidelines
Monitoring and Early Warning	EFAS, ERCC and UCPM tools
Damage and Impact (Infrastructure/Life)	UCPM Reporting Guidelines and Commission Reporting Templates
Integrating Climate Risks	EU Climate Law/Adaptation and EUCRA in the context of Risk Management Reporting
Critical Infrastructure and Supply Chains	Critical Entity Resilience Directive + NIS 2

5) Practical guidelines for implementation in a municipal context

✔ **Structuring according to EU standards:**

- hazards → exposure → vulnerability → damage → measures
- use the *EU Reporting Guidelines and Risk Assessment & Mapping Guidelines* as data templates.

✔ **Integrate early warning data:**

- EFAS, ERCC and other systems provide dynamic data.

✔ **Compatibility with national and EU requirements:**

- synchronize with UCPM the reports that the state makes to the EU - this way your data can be used in national/European processes.

For the needs of the municipal administration, **a structured, modular scheme (template) for a municipal specialized database for vulnerability, damage and disaster risk monitoring**, aligned with EU practices (UCPM, Floods Directive, Sendai Framework, JRC/DRMKC), is proposed below. The scheme is designed to be **extensible, comparable and suitable for reporting** to the national and European level.

I. Architectural principles

1. Multi-hazard approach

All hazards are described in a common structure (floods, fires, earthquakes, landslides, extreme temperatures, etc.).

2. Territorial principle (GIS-oriented)

Each table has a link to:

- administrative unit
- spatial object (point, line, polygon)

3. Timeliness

Each entry has:

- observation date
- validity period
- data source

4. EU compatibility

Fields that allow aggregation and reporting according to the requirements of:

- UCPM
- Floods Directive
- national risk assessments

II. Basic modules and tables

1. Administrative-territorial module - **Table: ADMIN_UNIT**

Field	Description
admin_id (PK)	Unique identifier
admin_type	Municipality / settlement / region
name_bg	Name
nuts_code	NUTS/LAU code
population	Population
area_km2	Area [sq. km]
geom	Geometry (GIS)

2. Module "Hazards" - **Table: HAZARD**

Field	Description
hazard_id (PK)	Identifier
hazard_type	Flood, fire, earthquake, etc.
hazard_subtype	River/storm/coastal, etc.
trigger	Cause (rainfall, drought, earthquake)
return_period	Recurrence period
intensity_scale	Scale (level, magnitude, temperature)
probability	Probability
climate_change_factor	Yes/No
data_source	Institution/system

3. "Exposition" module- **Table: EXPOSURE**

Field	Description
exposure_id (PK)	Identifier
admin_id (FK)	Territory
hazard_id (FK)	Associated hazard
exposed_population	Affected population
exposed_buildings	Buildings
exposed_infrastructure	Roads, bridges, networks
land_use	Land use type
geom	Spatial object

4. “Vulnerability” Module - **Table: VULNERABILITY**

Field	Description
vulnerability_id (PK)	Identifier
exposure_id (FK)	Link to Exposure
social_vulnerability_index	Social Vulnerability
economic_vulnerability	Economic
physical_vulnerability	Buildings
critical_infra_dependency	Critical Infrastructure
adaptive_capacity	Response Capacity
vulnerability_score	Summary Index

5. “Risk” Module - **Table: RISK_ASSESSMENT**

Field	Description
risk_id (PK)	Identifier
hazard_id (FK)	Hazard
vulnerability_id (FK)	Vulnerability
risk_level	Low / Medium / High
expected_losses	Expected Losses
risk_map_reference	Cartographic Layer
assessment_method	Methodology (EU/National)
assessment_date	Date

6. "Events (Disasters)" Module - **Table: DISASTER_EVENT**

Field	Description
event_id (PK)	Identifier
hazard_id (FK)	Hazard Type
start_date	Start
end_date	End
affected_area	Affected Area
magnitude	Intensity
declaration_status	State of Emergency Declared
reporting_to_EU	Yes/No

7. “Damage and Losses” Module - **Table: DAMAGE_LOSS**

Field	Description
damage_id (PK)	Identifier
event_id (FK)	Event
human_losses	Fatalities/Injuries
damaged_buildings	Number
infrastructure_damage	Type and scope
economic_loss_est	Estimate (€)
environmental_damage	Description
data_validation	Confirmed/preliminary

8. “Critical Infrastructure” Module - **Table: CRITICAL_INFRASTRUCTURE**

Field	Description
infra_id (PK)	Identifier
infra_type	Energy, Water, Transport
owner	Operator
redundancy_level	Redundancy Level
risk_dependency	Risk Dependency
geom	Geometry

9. Module "Monitoring and Early Warning" - **Table: MONITORING_SOURCE**

Field	Description
source_id (PK)	Identifier
system_name	EFAS, NIMH, Sensors
monitored_hazard	Hazard
update_frequency	Frequency
alert_thresholds	Thresholds
data_link	API / URL

10. Module "Measures and Actions" - **Table: RISK_REDUCTION_MEASURE**

Field	Description
measure_id (PK)	Identifier
risk_id (FK)	Associated Risk
measure_type	Prevention / Preparedness
structural	Yes/No
responsible_body	Institution
implementation_status	Planned / Implemented
effectiveness	Assessment

III. Minimum set of indicators (EU-compliant)

- Population in high-risk areas
- Percentage of critical infrastructure at risk
- Annual economic losses
- Frequency of disasters by type
- Response and recovery time

(compatible with Sendai and UCPM)

IV. How the scheme can be used

✓ municipal planning and PDP
✓ disaster protection plans
✓ reporting to the national level
✓ application for European programs
✓ GIS analysis and visualization

If necessary and desired, the next logical step can be:

- **ER-diagram (visual)**
- **sample SQL/PostGIS structure**
- **data entry template (Excel/CSV)**
- **comparison "table ↔ specific EU act"**

For greater clarity, a **practical template for entering data into Excel** is proposed below, structured **by sheets**, so that:

- can be **directly used by municipalities**;
- be **compatible with the proposed database**;
- to allow **easy import** into a SQL/GIS system;
- to comply with the logic **of EU risk assessment and management**.

THE TEMPLATE

is designed as **one Excel file** with several mandatory and several additional sheets.

GENERAL FILE INSTRUCTIONS

Format:

- Excel (*.xlsx)
- One row = one record
- The first row contains **field headings (they do NOT change)**

Recommendations:

- Use **Data Validation** for drop-down menus
- Codes instead of free text where possible
- Separate sheet "CODES" for reference

SHEET 1: ADMIN_UNIT – Administrative units

Column	Description	Example
admin_id	Unique code	BG-SF-001
admin_type	Municipality / settlement	Municipality
name_bg	Name	Municipality of Karlovo
nuts_code	NUTS / LAU	BG421
population	Population	45230
area_km2	Area (km²)	1046.5
notes	Notes	Mountainous region

SHEET 2: HAZARD

Column	Description	Example
hazard_id	Code	HZ-FL-01
hazard_type	Hazard Type	Flood
hazard_subtype	Subtype	River
trigger	Cause	Intensive Rainfall
return_period_years	Recurrence	100
intensity_scale	Scale	Height (m)
probability_level	Low/Medium/High	High
climate_change_factor	Yes/No	Yes
data_source	Source	NIMH

SHEET 3: EXPOSURE

Column	Description	Example
exposure_id	Code	EXP-0001
admin_id	Area	BG-SF-001

Column	Description	Example
hazard_id	Hazard	HZ-FL-01
exposed_population	Population	3200
exposed_buildings	Buildings	850
exposed_infrastructure	Infrastructure	Road III-641
land_use	Land use	Residential Area
data_year	Year	2025

SHEET 4: VULNERABILITY

Column	Description	Example
vulnerability_id	Code	VUL-0001
exposure_id	Link	EXP-0001
social_vulnerability	Low/Medium/High	High
economic_vulnerability	Low/Medium/High	Medium
physical_vulnerability	Low/Medium/High	High
critical_infra_dependency	Yes/No	Yes
adaptive_capacity	Low/Medium/High	Low
	Numerical value	0.78

SHEET 5: RISK_ASSESSMENT – Risk Assessment

Column	Description	Example
risk_id	Code	RISK-001
hazard_id	Hazard	HZ-FL-01
vulnerability_id	Vulnerability	VUL-0001
risk_level	Low/Medium/High	High
expected_losses_eur	Expected Damage (€)	3,500,000
assessment_method	Method	EU – multi-hazard
assessment_date	Date	15.03.2025

SHEET 6: DISASTER_EVENT – Real disasters

Column	Description	Example
event_id	Code	EVT-2024-01
hazard_id	Hazard	HZ-FL-01
start_date	Start	03.09.2024
end_date	End	06.09.2024
affected_admin_id	Area	BG-SF-001
magnitude	Intensity	High
emergency_declared	Yes/No	Yes
reported_to_EU	Yes/No	Yes
vulnerability_score		

SHEET 7: DAMAGE_LOSS – Damage and Loss

Column	Description	Example
damage_id	Code	DMG-0001
event_id	Event	EVT-2024-01
fatalities	Deaths	1
injured	Injuries	12
damaged_buildings	Buildings	143
infrastructure_damage	Description	Waterworks
economic_loss_eur	Losses (€)	2 100 000
environmental_damage	Description	Pollution
data_status	Preliminary/Confirmed	Confirmed

SHEET 8: CRITICAL_INFRASTRUCTURE

Column	Description	Example
infra_id	Code	CI-001
admin_id	Territory	BG-SF-001
infra_type	Type	Water supply
name	Name	WWTP Karlovo
owner	Operator	Water supply and sewerage
risk_exposed	Yes/No	Yes

SHEET 9: MONITORING_SOURCE

Column	Description	Example
source_id	Code	MON-01
system_name	System	EFAS
hazard_type	Hazard	Flood

Column	Description	Example
update_frequency	Frequency	6 hours
alert_threshold	Threshold	Code Orange
responsible_body	Organ	MESW

SHEET 10: MEASURES

Column	Description	Example
measure_id	Code	MEAS-01
risk_id	Risk	RISK-001
measure_type	Prevention/Preparation	Prevention
description	Description	Riverbed Correction
responsible_body	Responsible	Municipality
status	Planned/Implemented	Planned
effectiveness	Expected effect	High

SHEET 11: CODES – Code lists (mandatory)

- hazard_type
- risk_level
- vulnerability_level
- measure_type
- data_status

(used for drop-down menus)

For more advanced administrative units dealing with risk prevention, a ready-made Excel template has been developed, presented in Appendix 1.

Since our experience shows that when introducing such thematic databases, one should proceed from the simpler to the more complex, below we propose a variant of a similar Vulnerability and Damage Database for the Municipality of Ruse, which can be adopted by the municipal administration and, when regularly updated with up-to-date data, will allow assessing the vulnerability of individual parts of the critical infrastructure or territorial units, as well as possible damage and casualties that should be avoided.

The adopted "traffic light assessment" mechanism also establishes the likely degree of vulnerability and the need for preventive measures to strengthen protection against damage and casualties.

Define FU Asset_1 score from data on the "current FU type"

Residential (Rs)								Industrial (In)									Recreational (Rc)								
Built-up density (Bd)			Building height (Bh)		Min Green Area (Mg)			Built-up density (Bd)			Max Allowed residental/public area			Presence of critical infrastructure (Ci)			Max Built-up density (Bd)			Min area of recreational space (Mr)			Minimum Density of high woody Vegetation (Wv)		
<20%	40-60%	>60%	<15m	>15m	<20%	40-60%	>60%	<20%	40-60%	>60%	<20%	40-60%	>60%	<20%	40-60%	>60%	<20%	40-60%	>60%	<20%	40-60%	>60%	<20%	40-60%	>60%
1	2	3	1	3	3	2	1	1	2	3	1	2	3	1	2	3	1	2	3	3	2	1	3	2	1

Calculation of asset_1 score for Residential = (1.2*Bd+1.4*Bh+1.1*Mg), Calculation of asset_1 score for Industrial = (1.2*Bd+1.4*Ra+2*Ci)/3 Calculation of asset_1 score for Recreational=(1.2*Bd+Mr+0.5*Wv)/3

Calculation of asset_1 score for functional units of mixed type - Asset_1=PercRs*Rs+PercIn*In+PercRc*Rc

Define FU Asset_2 score from data on the "planned FU type"

Residential (Rs)								Industrial (In)									Recreational (Rc)								
Built-up density (Bd)			Building height (Bh)		Min Green Area (Mg)			Built-up density (Bd)			Max Allowed residental/public area			Presence of critical infrastructure (Ci)			Max Built-up density (Bd)			Min area of recreational space (Mr)			Minimum Density of high woody Vegetation (Wv)		
<20%	40-60%	>60%	<15m	>15m	<20%	40-60%	>60%	<20%	40-60%	>60%	<20%	40-60%	>60%	<20%	40-60%	>60%	<20%	40-60%	>60%	<20%	40-60%	>60%	<20%	40-60%	>60%
1	2	3	1	3	3	2	1	1	2	3	1	2	3	1	2	3	1	2	3	3	2	1	3	2	1

Calculation of asset_2 score for Residential = (1.2*Bd+1.4*Bh+1.1*Mg), Calculation of asset_2 score for Industrial = (1.2*Bd+1.4*Ra+2*Ci)/3 Calculation of asset_2 score for Recreational=(1.2*Bd+Mr+0.5*Wv)/3

Calculation of asset_2 score for functional units of mixed type - Asset_1=PercRs*Rs+PercIn*In+PercRc*Rc

Define the combined FU Asset_3 score from the combination of the results for Asset_1 and Asset_2

		Asset_1 (Current FU)		
		>=3	(3-1)	<=1
Asset_2 (Planned FU)	>3	3	3	2
	[3-1]	3	3	2
	<1	2	2	1

Define the Asset_4 score from the data on "FU land cover"

Non-Vegetated Surface (Ns)								Vegetated Surface (Vs)									Water (Wt)								
Area of artificially sealed surface (As)					Area of buildings (Ab)			Area of Woody Vegetation (Wv)						Area of cultivated land (Cl)			Area of permanenet water (Pw)						Area of temporary water (Tw)		
<20%	40-60%	>60%			<20%	40-60%	>60%	<20%	40-60%	>60%				<20%	40-60%	>60%	<20%	40-60%	>60%				<20%	40-60%	>60%
1	2	3			1	2	3	3	2	1				1	2	3	1	2	3				3	2	1

Non-Vegetated Surface = (1.2*Ass+1.4*Ab)/3 Vegetated Surface = (0.2*Wv+1.1*Cl)/3 Water=(1.5*Pw+0.9*Tw)/3

Asset=PercNs*Ns+PercVs*Vs+PercWt*Wt

Define the combined Asset_5 score from the combination of the results for Asset_3 and Asset_4

		Asset 3		
		>=3	(3-1)	<=1
Asset 4 (Land Cover)	>3	3	3	2
	[3-1]	2	2	1
	<1	2	1	1

Define the Exposure score from the data on each of the "Flood Risk Zones"

Flooding levels								
1m (once in 20 years)			3m (once in 100 years)			5m (once in 1000 years)		
<20%	40-60%	>60%	<20%	40-60%	>60%	<20%	40-60%	>60%
1	2	3	1	2	3	1	2	3

Define the Vulnerability score from the combination of the results for Asset_5 and Exposure scores, on each of the "Flood Risk Zones"

Vulnerability for 1 meter flood

		Asset 5		
		>=3	(3-1)	<=1
Exposure for 1 m	>3	5	4	4
	[3-1]	4	3	3
	<1	2	2	1

Vulnerability for 3 meter flood

		Asset 5		
		>=3	(3-1)	<=1
Exposure for 3 m	>3	5	4	4
	[3-1]	5	4	4
	<1	3	3	2

Vulnerability for 5 meter flood

		Asset 5		
		>=3	(3-1)	<=1
Exposure for 5 m	>3	5	5	4
	[3-1]	5	4	4
	<1	4	3	3

Define the Risk score from the Vulnerability score for each of the flood levels

		Vulnerability				
		5 (Catastr	4 (Signifi	3 (Moder	2 (Insigni	1 (Negligi
Probability	1m -	VH	VH	VH	H	M
	3 m -	VH	H	M	L	L
	5 m - Low	H	M	L	VL	VL

VL	VERY LOW RISK
L	LOW
M	MEDIU
H	HIGH RISK
VH	VERY HIGH RISK

Define the Risk output for the assessend functional unit and for the PLANNED FU type

IF RISK score < L, for ANY flooding level, THE	**FU type is acceptable**
IF RISK score < M AND RISK score = L, for AN	**FU type is acceptable with moderate restrictions** for the total area of the FU or for a part of the area
IF RISK score < H AND RISK score = M, for AN	**FU type is acceptable with major restrictions** for the total area of the FU or for a part of the area
IF RISK score < VH AND RISK score = H, for AI	**FU type is acceptable with modifications**
IF RISK score = VH, for ANY flooding level, TI	**FU type is not acceptable**

Our operational capacity is built on the basis of a number of projects under programs such as the 7th Framework Program, HORIZON 2020, INTERREG and ESA-PECS for Bulgaria - in this case, the introduction of thematic databases for vulnerability and damage (Exposure and Loss Databases), combined with monitoring of the risk of natural disasters and the creation of rapid simulation models for vulnerable territories and infrastructure, mainly for urban development zones, implemented in the general development plans in each municipality.

II. STRATEGY

The main position of the expert team of ASDE-ECOREGIONS, when developing intelligent high-tech solutions, is that they provide multi-risk monitoring and provide effective results in real time.

III. NEED FOR CONSTANT MONITORING OF VULNERABILITY AND POTENTIAL DANGER OF DAMAGES AND CASUALTIES, within the scope of the Municipality of Ruse - "City Laboratory" - Rusenski Lom *(this section will be developed further)*

IV. GIS ANALYSIS

The GIS analyses include an algorithm using partial artificial intelligence and based on data from the COPERNICUS Program (EGMS) and local data. Data from the European Ground Motion Service, as part of the Copernicus Land Monitoring Service of the European Environment Agency, were used. The limited resources of the NBSINFRA project do not allow for a more detailed study of the state of the development zones under the Ruse Municipality Master Plan, but the ASDE-ECOREGIONS team, with the assistance of external experts, conducted additional studies for some areas in the urbanized part of the city of Ruse, where there are worrying trends for potential vulnerability to natural disasters.

It is necessary to hold discussions with specialists and representatives of various structures in the field of urban construction, infrastructure, civil and fire protection, in order to assess what preventive measures are needed, to establish more regular monitoring and in what form.

Important preliminary note: The maps and data presented are an intermediate stage of development and should not be accepted as a final product. In addition to completing the analysis of the satellite data, coordination with on-site data should be carried out, as well as discussions with experts from the capital administration in order to identify possible errors or possible other interpretations, as well as possible explanations for the changes that have occurred and trends noted.

V. INPUT DATA FROM SITE AND ADOPTED ALGORITHMS – see Annex 1

VI. INCLUSION OF THE POTENTIAL OF ARTIFICIAL INTELLIGENCE IN THE DEVELOPMENT OF DATA ANALYSIS ALGORITHMS *(this section will be developed further)*

VII. CONCLUSIONS

Some of the **basic principles for territorial development**, enshrined in the General Development Plan of the Municipality of Ruse (GDP-Ruse), as well as general principles of spatial planning that the plan follows, are:

- **Sustainable and integrated development** - The Plan is a strategic document that sets the guidelines for the social, economic and spatial development of the municipality, with the aim of ensuring balanced growth, sustainability and high quality of the environment and standard of living;
- **Clear territorial definition and zoning according to purpose** - The territory is divided into zonal categories — residential, mixed, industrial, public service areas, green systems, etc. This allows for a clear definition of the functions and regulations of each zone;
- **Compliance with legislation and regulations -** The Ruse Urban Development Plan is implemented in accordance with national laws (e.g. Spatial Planning Act), as well as with additional rules/norms for spatial planning that specify permissible parameters of development, purpose, protection, etc.;
- **Protection and integration of the natural environment and green systems** - The plan provides for areas for green systems, recreation and nature conservation areas, as well as regulations aimed at preserving natural, ecological and landscape qualities.;
- **Flexibility and opportunities for gradual regulation and development** - The Master Plan sets strategic guidelines, but the implementation of development measures is carried out through detailed development plans (DDP), which allows for phased and condition-based development.;
- **Preservation and integration of historical and cultural heritage** - Planning provides for special regimes for territories with cultural and historical value, with the aim of protecting them during new development and construction.;
- **Publicity, transparency and orderly administrative process** - Through zoning, regulations and development rules, predictability and transparency are guaranteed in investments, regulation, privatization and control over the territory.

In this regard, as well as a result of the analyses of trends in potential flood risk, the following conclusions can be drawn:

- **The Flood Risk Monitoring Application for Urbanized Areas promotes urban resilience and risk prevention through integrated decision support systems (DSS) and advanced modeling tools;**
- **The results are objective as independent satellite segment data are used, combined with local environmental data and local geospatial data to monitor trends in urban green spaces and monitor compliance with local regulations;**
- **Most functional areas have maintained their resilience;**
- **However, parts of important urban planning zones may fall into flood-prone areas, especially in certain parts of the wider Ruse city center;**
- **Monitoring of trends in surface water status is needed;**
- **Further review by local experts and general discussion is needed, as some of the observed trends could be due to: unpublished zoning changes, updates to parcel plans and noise in the processing of satellite data.**

VIII. NATIONAL MANDATORY REGULATORY REQUIREMENTS

As stated in Article 2 of the Territorial Development Act (TDA), it "regulates public relations related to territorial development, investment design and construction in the Republic of Bulgaria, and determines the restrictions on ownership for development purposes" - https://www.mrrb.bg/bg/zakon-za-ustrojstvo-na-teritoriyata-84665/. In turn, each municipality is obliged to develop, approve and comply with the so-called General Development Plan, which should be the basis for municipal development for a long period of time - an average of 15-20 years. Of course, during this period, necessary changes may occur in the indicators and content of certain territories and development zones, but this should be done in accordance with the relevant legal order. Therefore, it is necessary to regularly monitor compliance with the municipal development plan, as well as the relevant indicators for sustainability of each of the development/functional zones.

These indicators are determined by both the TDA and the accompanying Regulation 7 on rules and regulations for the development of individual types of territories and development zones. - https://www.mrrb.bg/static/media/ups/articles/attachments/

The proposed innovative application for simplified simulation models of floods in vulnerable areas along the Rusenski Lom River, especially for urbanized functional/development zones, is a necessary tool for national and local administration, in order to ensure objective control and preventive measures on changes and trends in preventing the risk of vulnerability and destruction of critical infrastructure, buildings and facilities and protecting human health and life. In addition, anticipatory measures for vulnerable territories reduce financial, resource damage and human casualties.

In the municipal ordinance that determines the indicators of development zones, we propose to include indicators for flood vulnerability, but other important indicators can also be included, for example - percentage of built-up area, percentage of sealed area, etc.

LEGAL BASIS—DESIGNATION ZONES, according to REGULATION 7 of December 22, 2003 on rules and regulations for the development of individual types of territories and zoning zones. The indicators in the corresponding table from the Ruse Municipality's Master Plan are presented at the following internet address: (https://obshtinaruse.bg/obsht-ustroystven-plan-na-gr-ruse-2020)

POSSIBLE DISCUSSION ON FORECASTS AND OFFERS FOR REGULAR MONITORING AND SUPPORT BY AURE-ECOREGIONS:

1. Following the market behavior of users of a particular product, they would probably be most interested in getting a product at extremely low shipping prices and, if possible, without subsequent data maintenance fees. We are ready to have a free trial period. It is possible to discuss a high one-time license price with a longer validity period, for example 3 or 5 years with free maintenance. More subscription options should be provided, similar to mobile operators. Higher interest can only be caused by a proven and obvious superiority of the platform over the competitors.

2. Of interest would be the option for self-maintenance and updating of the data and the possibility of integration, transfer (migration) or at least one-way data exchange with an existing GIS, if this is considered possible. The interest of the municipalities is related to the provision of a free version for at least one year, possible reduction/optimization of the costs of mandatory insurance for non-threatened sites (those outside the risk zones), with possibilities for relevant amendments to the applicable laws and regulations.

3. This application supports REGULATION (EU) 2024/1991 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 24 June 2024 on nature restoration.

4. Other innovative applications are also under development, such as the implementation of "municipal risk prevention vouchers" (the subject of another study).

IX. EUROPEAN REGULATION

European regulations and directives are listed in item I. The main issue is the lack of a relevant regulation for monitoring the territory, including control over risk prevention and shifting the burden not to financing restoration works after the respective disaster, but to preventive measures that increase the resilience of society, the economy, infrastructure, and the natural environment.

EU Cohesion Policy and the European Structural and Investment Funds (ESIF) promote integrated, sustainable urban development through strategic planning, such as Urban Development Plans (UDPs) or Green Space Plans (GSPs). For Bulgaria, these correspond to the General Development Plans (GDPs). Key frameworks include:

- **Regulation (EU) 2021/1060** – sets out general provisions for the ESIF for the period 2021-2027 and includes requirements for integrated territorial development, which may include the Regional Development Plan.
- **Objective 5.1 of the Cohesion Policy** – promotes the integrated and sustainable social, economic and environmental development of urban areas, which may include strategic planning requirements, such as the Urban Development Plan.
- **European Urban Initiative (EUI-E)** – supports innovation and sustainable urban development by encouraging local authorities to develop integrated strategies that may include RDP.

Although no EU directive obliges the Urban Development Plan to be financed, strategic planning is strongly emphasized. In Bulgaria, the National Spatial Planning Act (NSPA) requires municipalities to adopt SGPs as part of the national legal framework. Each plan and its implementation require regular monitoring of the implementation and compliance with basic and accepted parameters for sustainable development and risk prevention.

It is logical that this monitoring is carried out by a relevant independent team of specialists based on objective data from European sources, such as the COPERNICUS Program and accepted standards, such as ISO 19144.

We are ready to share our experience and knowledge, which have been improved in continuous contact with European structures that provide independent, evidence-based knowledge and science, supporting EU policies for a positive impact on society.

ASDE-ECOREGIONS TEAM AND PARTNERS / 1998-2025.

ANNEX 1

READY-TO-DATE EXCEL TEMPLATE FOR DISASTER PROTECTION PLAN (DPP) – MUNICIPALITY OF RUSE

The implementation of the template is presented sheet by sheet, through **a Python script** that:

- creates **all DPP sheets**
- embeds the **official formulas**
- adds **validations, drop-down lists, and color codes**
- is **directly applicable to the Municipality of Ruse**
- meets the **requirements of the DISASTER PROTECTION ACT (DPA) and the practice of the Ministry of Interior**

After execution, you should get a **completely ready .xlsx file**, which only needs to be filled in regularly.

1. What is needed?

- Python 3.9+
- Data library:

2. POSSIBLE FULL SCRIPT

```
from openpyxl import Workbook
from openpyxl.worksheet.datavalidation import DataValidation
from openpyxl.styles import PatternFill, Font

wb = Workbook()
# ---------- SHEET 1: METHODOLOGY ----------
ws = wb.active
ws.title = " Methodology "
ws.append(["Indicator", "Description "])
ws.append(["Risk Formula", "Risk = Probability × Vulnerability × Exposure "])
ws.append(["Scale", "1 (very low) – 5 (very high)"])
ws.append(["Regulatory basis", "DPA, instructions of the General Directorate of the Ministry of Internal Affairs"])
# ---------- SHEET 2: SETTLEMENTS ----------
ws = wb.create_sheet("Settlement")
ws = wb.create_sheet("Settlement")
ws.append(["Code", "Settlement", "Population", "Area (km²), "Critical Infrastructure"])
ws.append([1, " Ruse", 140000, 127, "Hospitals, bridge, thermal power plant"])
ws.append([2, " village of Nikolovo", 3500, 18, "School"])
# ---------- SHEET 3: HAZARDS ----------
ws = wb.create_sheet("Identification of hazards")
ws.append(["Settlement", "Hazard Type", "Source", "Historicity", "Probability (1–5)"])
hazards = ["Flood", "Earthquake", "Fire", "Extreme temperatures", "Industrial accident"]
dv_hazard = DataValidation(type="list", formula1=f'"{",".join(hazards)}"')
dv_prob = DataValidation(type="whole", operator="between", formula1=1, formula2=5)
ws.add_data_validation(dv_hazard)
ws.add_data_validation(dv_prob)
dv_hazard.add("B2:B200")
dv_prob.add("E2:E200")
# ---------- SHEET 4: VULNERABILITY ----------
ws = wb.create_sheet("Vulnerability")
ws.append([
        " Settlement",
        " Social (1–5)",
        " Economic (1–5)",
        " Infrastructural (1–5)",
        " Environment (1–5)",
        " Vulnerability Index"
])
dv_scale = DataValidation(type="whole", operator="between", formula1=1, formula2=5)
ws.add_data_validation(dv_scale)
dv_scale.add("B2:E200")
for row in range(2, 201):
        ws[f"F{row}"] = f"=AVERAGE(B{row}:E{row})"
# ---------- SHEET 5: EXPOSURE AND DAMAGE ----------
ws = wb.create_sheet("Exposure and damage")
ws.append([
        " Settlement",
        " Hazard type ",
        " Exposed population",
        " Buildings",
        " Expected damage (Euro)",
        " Exposure index"
])
for row in range(2, 201):
        ws[f"F{row}"] = f'=IF(C{row}>5000,5,IF(C{row}>1000,4,IF(C{row}>500,3,2)))'
# ---------- SHEET 6: RISK ASSESSMENT ----------
ws = wb.create_sheet("Risk assessment")
ws.append([
        " Settlement",
        " Hazard",
        " Probability",
        " Vulnerability",
        " Exposure",
```

```
        " Risk index",
        " Risk level"
])
for row in range(2, 201):
        ws[f"F{row}"] = f"=C{row}*D{row}*E{row}"
        ws[f"G{row}"] = (
                f'=IF(F{row}<=20,"High",IF(F{row}<=40,"Medium","High"))'
        )
# ---------- SHEET 7: PRIORITIES AND MEASURES ----------
ws = wb.create_sheet("Priorities and measures")
ws.append([
        " Settlement",
        " Hazard",
        " Risk level",
        "Measure",
        " Responsible institution",
        " Deadline"
])
# ---------- SHEET 8: SUMMARY ----------
ws = wb.create_sheet("Summary")
ws.append(["Indicator", "Value"])
ws.append([
        " Number of high priority risks",
        "=COUNTIF('Risk assessment'!G:G,\"High\")"
])
ws.append([
        " Total estimated value of damage",
        "=SUM('Exposure and damage'!E:E)"
])
# ---------- RECORD ----------
file_name = "PZB_Obshtina_Ruse_Template.xlsx"
wb.save(file_name)
print(f" Ready file: {file_name}")
```

3. It is expected that the Municipality of Ruse will eventually receive the following file::

PZB_Obshtina_Ruse_Template.xlsx, which contains:

- ✓ **official methodology**
- ✓ **full risk assessment**
- ✓ **automatic indexes**
- ✓ **ready-made sheets for DPP**
- ✓ **directly applicable to the Municipality of Ruse**

4. Next professional steps (optional)

At the next level, the following can also be added:

- ◆ **conditional formatting (green–yellow–red)**
- ◆ **integration of a dashboard for the mayor/headquarters**
- ◆ **text DPP (Word/PDF), automatically generated from Excel**
- ◆ **adaptation of the template 1:1 at the request of a regional governor**

It all depends on the specific requirements that the respective municipality would impose, as well as the need for the corresponding results.