



Republic of Bulgaria

**Advisory Services on a National Climate Change
Adaptation Strategy and Action Plan**

***Appendix 8:
Assessment of the
Urban Environment Sector***

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DISCLAIMERS

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Abbreviations and Acronyms

ACE	Architects’ Council of Europe
AESOP	Association of the European Schools of Planning
ARC	Assessment Report on Climate Change and Cities
ASDE	Agency of Sustainable Development and Eurointegration
BAS	Bulgarian Academy of Sciences
BFSA	Bulgarian Food Safety Agency
BGBC	Bulgarian Green Building Council
BGN	Bulgarian Lev
BIS	Bulgarian Institute for Standardization
CAB	Chamber of Architects in Bulgaria
CAP	Common Agricultural Policy
CBA	Cost-Benefit Analysis
CCA	Climate Change Adaptation
CCMA	Climate Change Mitigation Act
CEA	Cost-Effectiveness Analysis
CEMAT	Conference of Ministers Responsible for Spatial/Regional Planning
CFP	Common Fisheries Policy
CoM	Council of Ministers
COP 21	Conference of the Parties
DEFRA	Department of Environment, Foods, and Rural Affairs
DG CAA	Directorate General “Civil Aviation Administration”
DG CLIMA	European Commission Directorate General for Climate Action
DG Regio	Directorate General on Regional and Urban Policy
DGFSCP	Directorate of Fire Safety and Civil Protection
DGNB	Deutsche Gesellschaft für Nachhaltiges Bauen (German Sustainable Building Council)
DNCC	Directorate for National Construction Control
DRM	Disaster Risk Management
DTP	Danube Transnational Programme
EAAE	European Association for Architectural Education
EC	European Commission
ECLAS	European Council of Landscape Architecture Schools
ECTP-CEU	European Council of Spatial Planners – Conseil Européen des Urbanistes
EEA	European Environment Agency

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EIA	Environmental Impact Assessment
EMEPA	Enterprise for Management of Environment Protection Activities
EMFF	European Maritime and Fisheries Fund
ENI	European Neighborhood Instrument
ERDF	European Regional Development Fund
ESIF	European Structural and Investment Funds
ESPN	European Spatial Planning Observation Network
ETC/ACC	European Topic Center on Air and Climate Change
EU	European Union
EU ETS	European Union Emissions Trading System
ExAAA	Executive Agency Automobile Administration
ExAEMDR	Executive Agency for Exploration and Maintenance of the Danube River
ExAMA	Executive Agency Maritime Administration
ExARA	Executive Agency Railway Administration
ExEA	Executive Environment Agency
ExFA	Executive Forest Agency
FCERM	Flood and Coastal Erosion Risk Management
FEAD	Fund for European Aid to the most Deprived
FIEC	Fédération de l'Industrie Européenne de la Construction (European Construction Industry Federation)
FP7	Seventh Framework Programme of the European Commission, managed by DG Research and Innovation
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIP	Green Infrastructure Partnership
GIS	Geographic Information System
GLA	Greater London Authority
GML	Geography Markup Language Encoding Standard
GVA	Gross Value-Added
HEAL	Health and Environment Alliance
ICPDR	International Commission for the Protection of the Danube River
ICT	Information and Communication Technology
ICZM	Integrated Coastal Zone Management
IFLA	International Federation of Landscape Architects
IIED	International Institute for Environment and Development

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IO-BAS	Institute for Oceanology at the Bulgarian Academy of Sciences
IPA	Instrument for Pre-Accession Assistance
IPCC	Intergovernmental Panel on Climate Change
ISoCaRP	International Society of City and Regional Planners
IURDP	Integrated Urban Regeneration and Development Plans
JRC	Joint Research Centre
LCCS	Land Cover Classification System
LCML	Land Cover Meta Language
LEED	Leadership in Energy and Environmental Design
LUZ	Larger Urban Zone
M&E	Monitoring and Evaluation
MAFF	Ministry of Agriculture, Food and Forestry
MARSPLAN - BS	Maritime Spatial Planning in the Black Sea
MC	Ministry of Culture
MCA	Multi-Criteria Analysis
MEc	Ministry of Economy
ME _n	Ministry of Energy
MES	Ministry of Education and Science
ME _x	Ministry of Exterior
MF	Ministry of Finance
MH	Ministry of Health
MI	Ministry of Interior
MoEW	Ministry of Environment and Waters
MRDPW	Ministry of Regional Development and Public Works
MSP	Maritime Spatial Planning
MTITC	Ministry of Transport, Information Technology and Communications
NAMRB	National Association of Municipalities in Republic of Bulgaria
NAP	National Adaptation Programme
NAPCC	National Action Plan on Climate Change
NAS	National Adaptation Strategy of the Netherlands
NBRI	National Building Research Institute
NCCD	National Construction Control Directorate
NCRD	National Centre for Regional Development
NCSD	National Concept for Spatial Development
NECCC	National Expert Council on Climate Change

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NGO	Non-Governmental Organization
NIMH	National Institute for Meteorology and Hydrology
NPPF	National Planning Policy Framework
NPV	Net Present Value
NSI	National Statistical Institute
NTEF	National Trust EcoFund
NUTS	Nomenclature of Territorial Units for Statistics
OGC	Open Geospatial Consortium
OP	Operational Programme
OPE	Operational Programme Environment
OPRG	Operational Programme ‘Regions in Growth’
ÖROK	Österreichische Raumordnungskonferenz (Austrian Conference on Spatial Planning)
PIK	Potsdam Institute for Climate Impact Research
POS	Public Open Spaces
PPP	Public Private Partnership
PV	Present Value
R&D	Research and Development
RAPIV	Regional Agency for Entrepreneurship and Innovations Varna
RCP	Representative Concentration Pathway
RDA	Regional Development Act
RDP	Rural Development Program
RIA	(1) Road Infrastructure Agency (2) Regulatory Impact Assessment
RIEW	Regional Inspectorate of Environment and Water
RTPI	Royal Town Planning Institute (U.K.)
RVA	Risk and Vulnerability Assessment
SAP	Standard Assessment Procedure
SDG	Sustainable Development Goal
SEA	Strategic Environmental Assessment
SECAP	Sustainable Energy and Climate Action Plan
SeGA	State ‘eGovernment’ Agency
SG	State Gazette
SOFENA	Sofia Energy Agency
SPA	Spatial Planning Act

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SU	Sofia University “St. Kliment Ohridski”
TA2020	Territorial Agenda of the European Union 2020
TCPA	Town and Country Planning Association
TQM	Total Quality Management
TU	Technical University, Sofia
UAB	Union of Architects in Bulgaria
UACG	University of Architecture, Civil Engineering and Geodesy
UBA-Ö	Umweltbundesamt Österreich (Environment Agency Austria)
UCCRN	Urban Climate Change Research Network
UF	University of Forestry
UIA	International Union of Architects
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNHCE	United Nations Conference on the Human Environment
UNWE	University of National and World Economy
UPB	Union of Planners in Bulgaria
VROM	Ministerie van Volksgezondheid, Ruimtelijke Ordening en Milieu (former Dutch Ministry of Spatial Planning, Housing, and Environment)
WGII AR5	Working Group II, Assessment Report 5 (UNFCCC)
WHO	World Health Organization
WMO	World Meteorological Organization

Glossary¹

Climate change refers to a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

Global warming refers to the gradual increase, observed or projected, in global surface temperature, as one of the consequences of radiative forcing caused by anthropogenic emissions.

Adaptation is the process of adjustment to actual or expected adverse effects of climate change and taking appropriate action to prevent or minimize the damage they can cause. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.

Mitigation (of climate change) is a human intervention to reduce the sources or enhance the sinks of greenhouse gases (GHGs).

Vulnerability to climate change is the degree to which any system is susceptible to, and unable to cope with, the negative impacts that climate change imposes upon it. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity.

Resilience is the opposite of vulnerability and is defined as the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change.

Risk is the potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as probability or likelihood of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur.

¹ Definitions are based on WGII AR5 (IPCC 2014)

Executive Summary

1. Today, more and more people in the world are attracted by greater diversity of jobs, higher quality of services, better accessibility and mobility, and self-development opportunities, offered by the cities. Despite the demographic crises in Bulgaria and the overall population decline, the urban population in the country follows global trends and is expected to reach 81 percent by 2050. About 46 percent of this population is concentrated in the six biggest cities, creating pressure on land, infrastructure, and services, and exposing more people to disaster risks due to greater concentration of vulnerable groups, including children, old, sick, disabled, and poor. That is why the transition from a monocentric toward a polycentric urban development model is in the focus of the regional policy and among the main priorities of the National Concept for Spatial Development (NCS D) (2013–2025), both aiming at reducing regional disparities and improving accessibility to infrastructure and services.

2. Considering the complexity of urban environment and the variety of urban settings in the current analysis, cities are systematized into three groups according to their population—big, medium, and small—and in four groups, according to their location—coastal (on Danube River and Black Sea coast), in plain areas, mountainous, and semi-mountainous areas. The vulnerability of the urban environment is also considered according to their pattern, zoning, and specific land use. The analysis of past and present weather events shows that the Bulgarian cities will be affected most by the extreme temperatures and the increased precipitations intensity and frequency. The consequences of the latter—floods and landslides—will be among the priorities of the government, municipalities, and population in the next years, together with solving old housing stock problems through energy efficiency and structural renovation.

3. In the big cities with higher concentration of people, activities, buildings, and infrastructure, despite their potential and resources, climate change will have a larger-scale impact. More vulnerable to extreme weather events will be their central urban areas with higher density, intensive traffic, reduced green and open spaces, and old infrastructure with limited capacity. These are areas with high pollution due to heavier traffic, concentration of activities, and higher share of ‘sealed’ surfaces, which affect human health. On the periphery of the bigger cities are situated the largest prefabricated housing estates, built between the 1960s and 1980s. Renovation of the housing stock and implementation of energy efficiency measures in public and private residential and non-residential buildings will require significant resources. Most vulnerable to increased frequency of intensive precipitations and floods will be the cities near watercourses. Hailstorms, often combined with intensive precipitations, will also flood the cities and damage buildings, cars, public transport, and infrastructure. Prolonged precipitation, combined with a rise in groundwater levels or wastewater seepage with some additional human factors, will activate landslides, especially those in the most sensitive areas of the Black Sea coast and Danube cities. The most vulnerable groups of the population to extreme weather events and their consequences are the elderly, sick, and poor, especially those living in low standard housing, or the homeless. They are concentrated in the national and urban periphery and quite often, occupy illegally constructed houses close to flood-risk zones.

4. The most important challenges for the adaptation of the urban environment in Bulgaria will be information exchange and knowledge communication, capacity development, and

awareness raising among decision makers and the public.

5. Climate change adaptation (CCA) of the urban environment should be based on an integrated approach at all levels of governance, in line with existing legislation in different sectors. Accordingly, a thorough review of this legislation and amendments of planning regulations are needed. These changes should clarify the roles and responsibilities at the national, regional, municipal, and city levels, improve cooperation and communication among all sectors, state, and municipal authorities, nongovernmental organizations (NGOs), business communities, and all other stakeholders. Reducing natural disasters risks calls for a solid institutional basis, which should be strengthened by building capacity, good governance, promotion of adequate policies, facilitating the flow of information, adoption of effective coordination mechanisms, and appropriate education. These adaptation options are selected on the basis of identified needs, current capacity, and European Union (EU) best practices, and are grouped in 10 categories, related respectively to policies, information, research, institutions, legislation, finance, education, technologies/construction, capacity, and partnership.

6. The urban environment analysis also suggests that the policies and actions for CCA of the sector should be oriented toward the big cities, where there is a concentration of considerable part of the population and which enjoy considerably more potential and expertise as well as toward the smaller cities and villages in the periphery, with less numerable but much more vulnerable population, with limited access to services. Together with the implementation of a holistic approach to the urban environment and the principles of integrated planning, each region and each city/town will need an individual approach and thorough indigenous knowledge about the symbiosis between people with different social status, age, gender, culture and behavior, unique natural resources, and variety of human activities, practices, and artificial constructions. In this context, participation and communication, and the use of indigenous knowledge are crucial elements in adapting the urban environment to climate change. At the same time, a more comprehensive and up-to-date philosophy of integration of all efforts and resources (including information and knowledge) of different sectors within a unified national strategy will undoubtedly make these policies more effective.

7. The prioritization of the adaptation options in the proposed ten categories of options is based on the results of consultations with the main stakeholders and a session with stakeholders. The applied selection criteria included, potential social, economic and environmental benefits, and implementation risks. The priority ranking narrows down the range of the adaptation options to the following categories and options:

Category Policy - Mainstream CCA into the policy of regional and urban development, including housing and construction

Adaptation option – *Incorporate climate change adaptation into the National Housing Strategy (2017–2030)*

8. The option is considered of high priority, because it could be decisive for the country's overall regional policy reform. Implementation results will directly affect the urban population living in better standard housing, improved microclimate comfort, and higher resilience to extreme weather events. The proposed structural observations and surveys, strengthening of construction, and energy efficiency measures included in the building stock renovation package

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will improve the overall quality and safety of buildings and their resilience to multiple risks. This adaptation option, with wider coverage of urban areas, buildings and population, will require considerable human and financial resources and time, but will bring considerable social, environmental and economic benefits in the longer term.

Category Legislation – Revise and amend legislative documents to transpose the CCA issues (after Regulatory Impact Assessment [RIA] when applicable and necessary)

Adaptation option – *Mainstream the CCA requirements in all related legislative documents, relevant to Regional and Spatial/Urban Planning and Environmental protection (Spatial Planning Act [SPA], Regional Development Act [RDA], Regulations No, 4, 7 and, 8, Regulation for spatial development documents, for Environmental Impact Assessment [EIA] and Strategic Environmental Assessment [SEA]).*

9. This option with its proposed actions refers to the national level, the expected change of the climate, and to extreme weather events. Its implementation requires minimal efforts, resources and time, but will lay the basis for improved quality of plans and projects, for cooperation and control, as well as for the interrelation between regional and spatial development documents, and documents regarding climate change adaptation, thus reducing risks and potential losses.

Category Information – Secure institutionally regulated exchange of information and data according to the INSPIRE Directive

Adaptation option – *Create common standards for the type, structure, scope and format of metadata and data, harmonized with the EU on city level.*

10. The option addresses accurate and up-to-date information required for science-based decisions in the field of climate change adaptation actions. It facilitates information and knowledge exchange, networking, capacity building and awareness development. A reliable information system will justify the exchange of information with other countries and international institutions, will support education, research and climate change adaptation practices and decision making at the national and local levels.

Category Research – Provide common long-term vision and objectives in urban environment CCA research through amendment of the National Scientific Research Development Strategy

Adaptation option – *Identify priority scientific topics, linked with the city, open and green spaces, buildings, infrastructure, construction materials and human health.*

11. The adaptation option aims at establishing a better focus on adaptation of the urban environment to climate change. Actions should be incorporated in the scientific research agenda of universities and institutes of the Bulgarian Academy of Sciences. Start-up companies, working in the area of smart and green technologies, have a role in their implementation. The result of the actions could be more efficiency in Research and Development (R&D), better informed decisions, more innovative construction technologies and materials for the urban environment, as well as better-quality education.

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Category Education – ‘Train the trainers’ for CCA

Adaptation option - *Organize an appropriate format for education and training at all levels – from politicians to the general public.*

12. Although targeted at all levels and participants in the area of climate change adaptation, implementation of this option will place the main responsibility on academic institutions and professional bodies. Results are expected to include expert and institutional capacity, improved communication of knowledge between architects, planners, engineers, landscape architects, economists, sociologists and environmentalists, and better quality and higher value rendered to all further adaptation actions. Along with the social and environmental benefits, this will bring financial benefits and stimulate creativity and academic development in educational institutions. Implementation of most of the above adaptation options will require financial support.

Category Finance – Change financial, social and insurance policy

Adaptation option - *Revise the existing financial instruments and design new ones for CCA and Disaster Risk Management (DRM), including for energy renovation.*

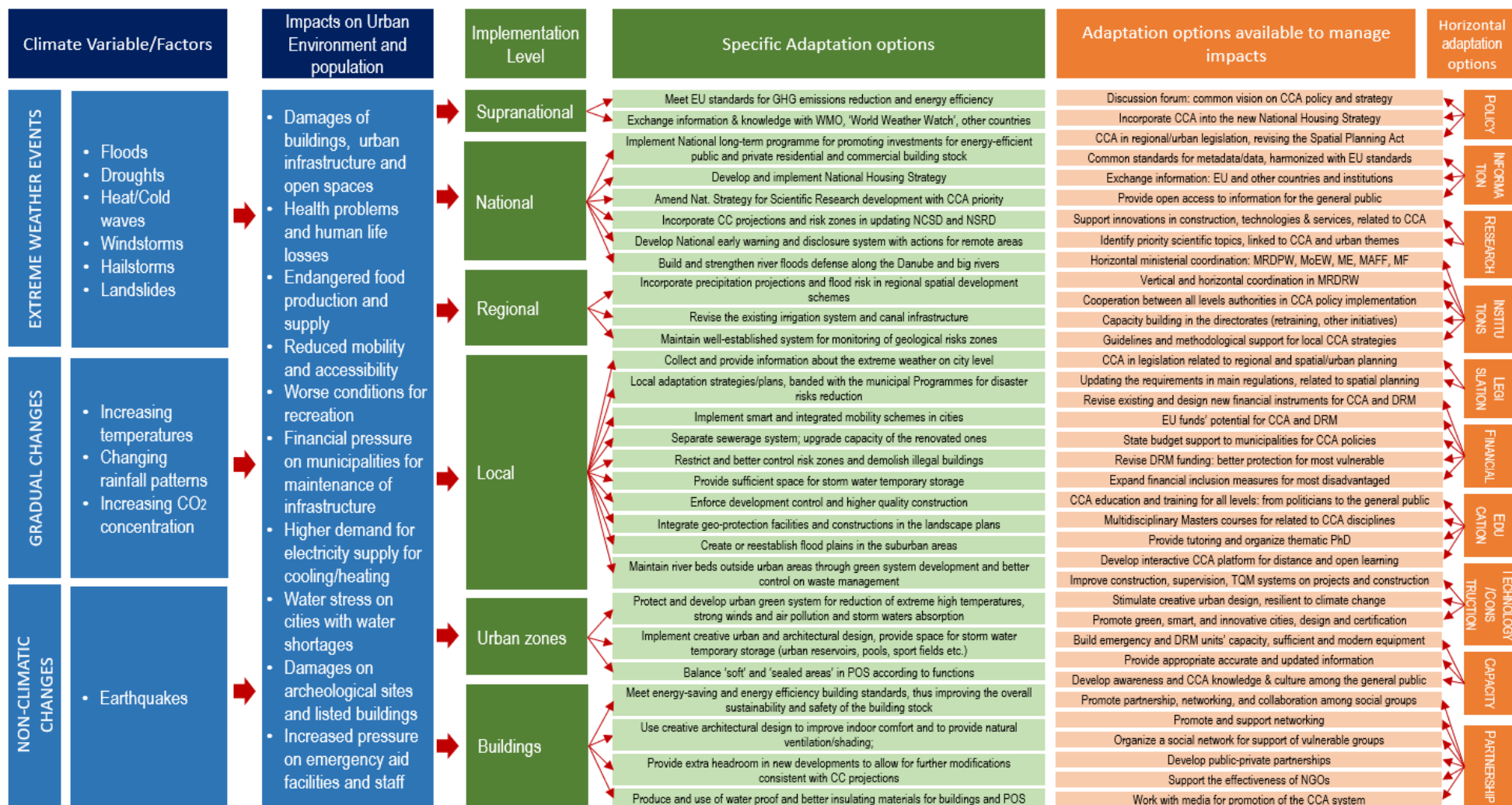
13. Applied to the urban environment, adaptation actions require appropriate financial tools to attract investments for housing stock renovation, for energy efficiency and for implementation of construction strengthening measures, for revision of spatial planning documents and for their legislative framework. Additionally, new responsibilities of local authorities for climate change adaptation will need state budget support. The integration of financial, regional, social and insurance policies and implementation of more comprehensive measures is expected to result in greater social justice, increased awareness and commitment, and better distribution of responsibilities and of the financial burden among the state, local authorities and individuals.

14. Prioritized options create a common framework for climate change adaptation in regard of the urban environment. More specific, the development of local climate change adaptation strategies is recommended, considering the local resources, needs and micro-climate, and consistent with the size and location of the city, its population, economic and functional characteristics, spatial development and density.

15. The adaptation process in the urban environment in Bulgaria will require considerable time, finance, and other resources. There are no simple and unambiguous solutions to climate change related problems in the urban environment. They all require comprehensive actions and consistent policies for implementation of a system of legislative, planning, technological, financial and social measures.

Climate Change Adaptation – Assessment of the Urban Environment Sector

Figure 1. Simplified illustration of impacts of climate change and identified adaptation options



Source: World Bank design.

Introduction - Climate Change in Bulgaria

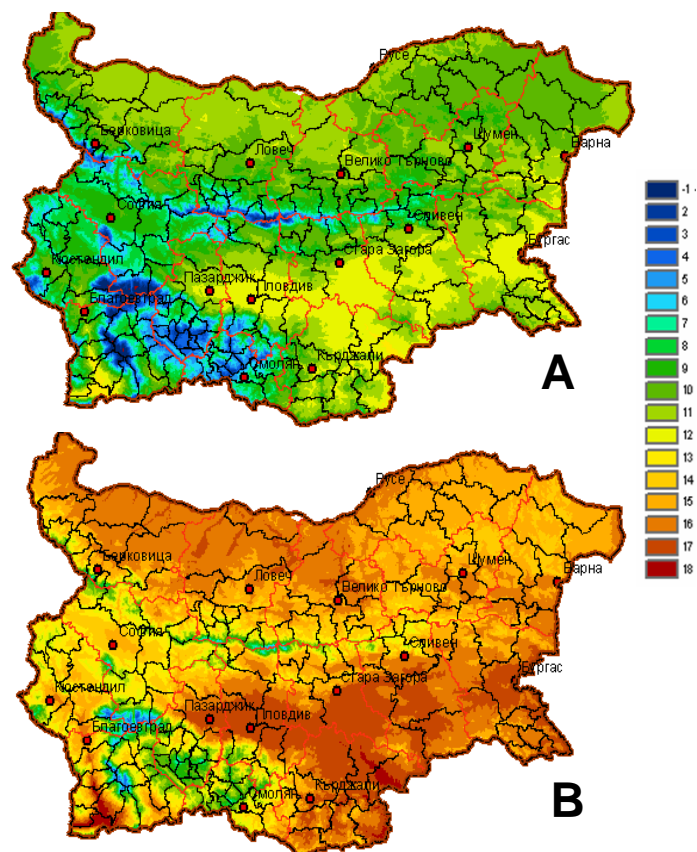
16. Bulgaria is situated in one of the regions that are particularly vulnerable to climate change (mainly through temperature increase and extreme precipitation) and to the increased frequency of climate change-related extreme events, such as droughts and floods. The risks inflicted by climate change-related events may lead to loss of human life or cause considerable damage, affecting economic growth and prosperity, both nationally and transboundary.

17. Consensus exists in the scientific community that climate change is likely to increase the frequency and magnitude of extreme weather events. Over the past decades, in Bulgaria, this frequency has increased significantly. The most common hydro-meteorological and natural hazards are extreme precipitation and temperatures, storms, floods, wildfires, landslides, and droughts. The number of deaths and victims due to natural hazards is considerable, indicating weather and climate vulnerability. The vulnerability of Bulgaria's population and businesses to the impacts of climate change is accelerated by a relatively high degree of poverty in the most affected areas, the continuing concentration of the country's population in several industrial and urban regions, and various consequences of the transition from a state-controlled economy to a free-market economy. A growing body of evidence suggests that economic losses from climate- and weather-related disasters have also been rising.

18. Scientific projections indicate that global temperature will rise between 1.8°C and 4°C by 2100, with the temperature increase in Europe expected to be even higher than the estimated global average.

19. Research conducted by the Department of Meteorology, National Institute of Meteorology and Hydrology (NIMH) and the Bulgarian Academy of Sciences (BAS) projects an increase in annual air temperature in Bulgaria of between 0.7°C and 1.8°C by 2020. Even warmer temperatures are expected by 2050 and 2080, with projected increases of between 1.6°C and 3.1°C and between 2.9°C and 4.1°C, respectively. Generally, the temperature increase is expected to be more significant during the summer season (from July to September).

Figure 2. Average year temperature for 1961–1990 (A); Pessimistic climate scenario for average year temperature for 2080 (B)



Source: NIMH-BAS.

20. In terms of the expected changes in rainfall patterns, a reduction in precipitation is likely, leading to a significant reduction of the total water reserves in the country. In this regard, projections suggest a decrease in precipitation by approximately 10 percent by 2020, 15 percent by 2050, and up to 30–40 percent by 2080. In most climate change scenarios, rainfall during the winter months is likely to increase by the end of the century, but significant decrease in rainfall during the summer months is expected to offset this increase.

21. According to the available climate change scenarios for Bulgaria, there is a trend toward increased frequency of extreme events and disasters, as demonstrated in more often occurrences of heavy rainfalls, heat and cold waves, floods and droughts, hurricane winds, forest fires, and landslides.

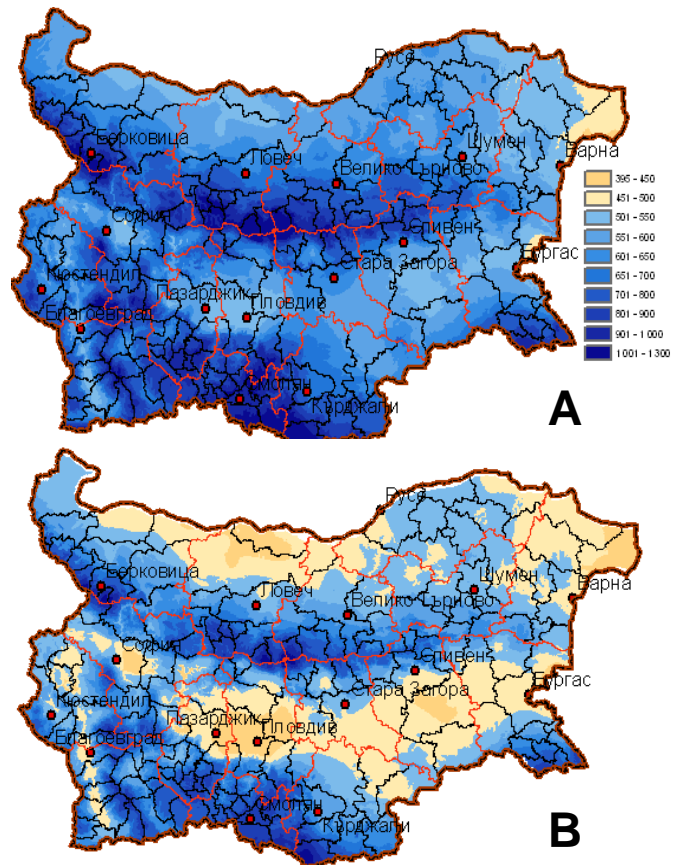
22. Biodiversity, land and aquatic ecosystems, as well as water resources, agriculture, and forestry sectors are expected to be affected by the anticipated changes. These changes would furthermore affect society and its citizens as well as the economy.

23. Climate change impacts do not affect all people and territories equally due to different levels of exposure, existing vulnerabilities, and adaptive capacities to cope. The risk is greater for the segments of the society and businesses that are less prepared and more vulnerable.

24. This report aims to provide an insight into climate change-related risks and vulnerabilities of the urban sector in Bulgaria. It describes the sector’s legal and policy context in relation to climate change and provides options on adapting to the changing climate circumstances.

25. This report aims to inform on vulnerabilities to Bulgaria’s urban sector and at the identification of adequate climate change adaptation options. The report is part of a set of nine sectoral assessment reports considered under the climate adaptation support program for Bulgaria, which will form the baseline for the National Climate Change Adaptation Strategy and Action Plan. The report follows the general logic and structure as proposed for all sectors and is divided into three parts: (1) part one of the report (Chapter 1) focuses on the climate change risks and vulnerabilities’ assessment; (2) part two comprises a gap analysis of the policy, legal and institutional context (Chapter 2); and (3) part three focuses on the identification and

Figure 3. Precipitation per year for 1961–1990 (A); Precipitation per year for 2080, according to the pessimistic scenario (B)

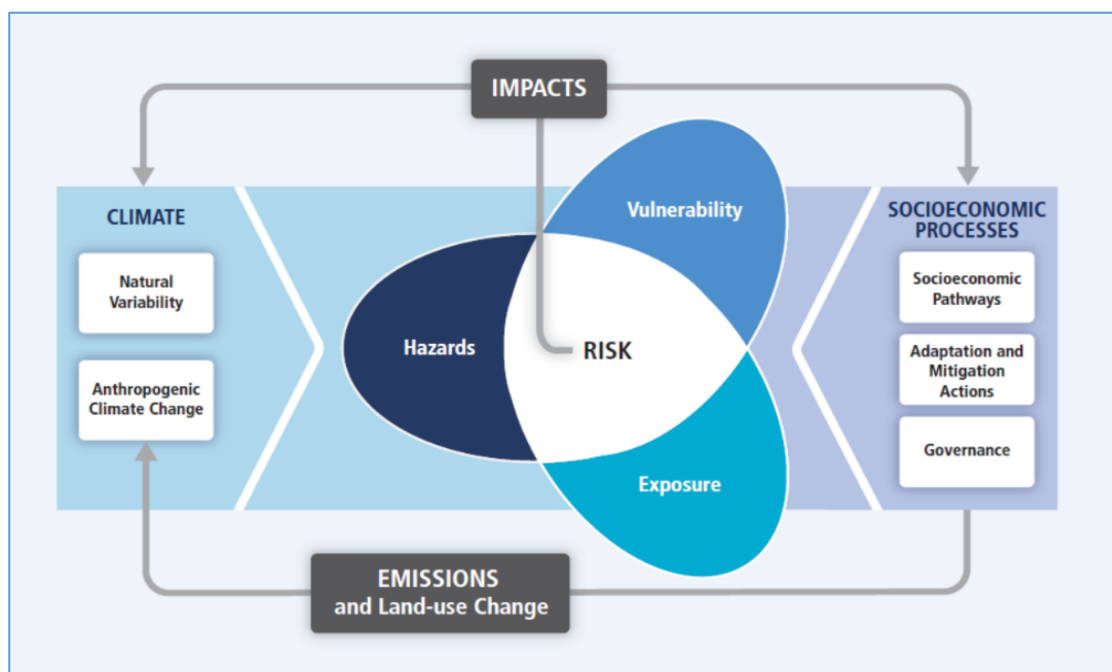


Source: NIMH-BAS.

prioritization of adaptation options (Chapter 3). This sector assessment was carried out during March – November 2017, as a combination of quantitative and above all, qualitative analysis. Several workshops have been organized as part of an ongoing consultation process, bringing in the wealth of expertise of various stakeholders.

26. The report uses the terms and definitions of risk, vulnerability and adaptation options as introduced by WGII AR5 (IPCC 2014). Risk of climate-related impacts results from the interaction of climate-related hazards with the vulnerability and exposure. Changes in both the climate system (left side in *Figure 4*) and socio-economic processes including adaptation and mitigation (right side in *Figure 4*) are drivers of hazards, exposure, and vulnerability. This understanding reveals the importance of the adaptation options. When they are properly identified and timely implemented, vulnerability, hazard and/or exposure will be reduced, thus the risk will be mitigated.

Figure 4. General concept of WGII AR5



Source: IPCC 2014.

Chapter 1. Urban Environment Risk and Vulnerability Assessment and Analysis

27. This chapter presents the main urban trends in Bulgaria and the impact of climate change on urban populations, assets, and services. The analysis describes previous extreme meteorological events in Bulgaria and their impact on the urban environment, people, buildings, and infrastructure, and the current situation and future urban trends. The purpose is to identify and evaluate vulnerabilities in the urban environment, population, and institutions and the capacity of the latter to adapt to climate change.

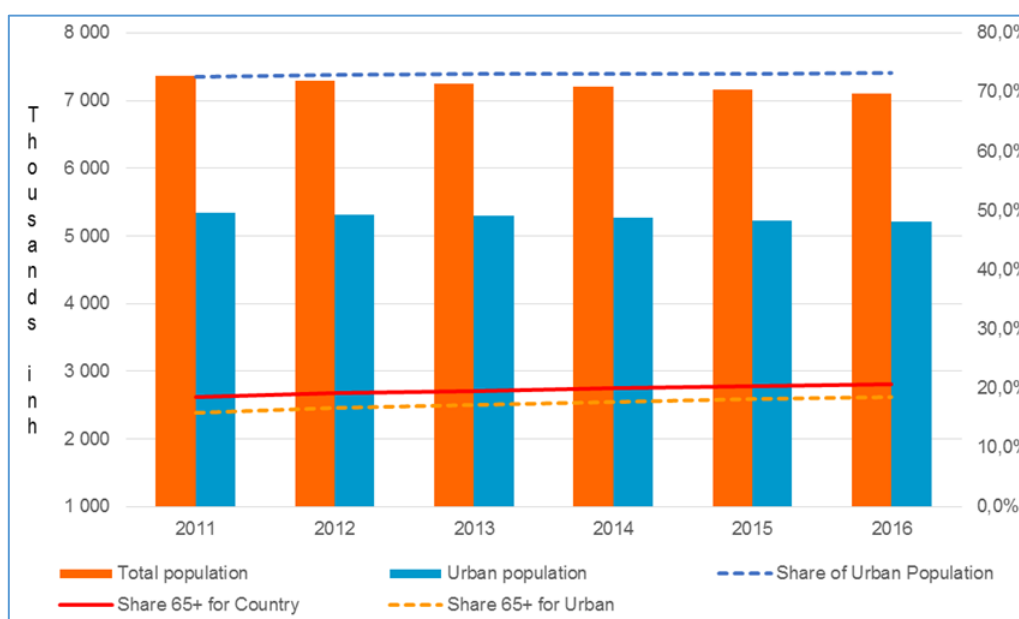
1.1. Urban Environment Characteristics and Trends

1.1.1. Urbanization and demographic trends

Population

28. The urban population of Bulgaria gradually increased until the 1980s. After that, there was a progressive decrease, initially in small cities and then, toward the end of the century, across cities, except for 23 cities that have seen some population increase. The main reasons being aging, declining fertility, and out-migration. By the end of 2016, Bulgaria's total population was 7,101,859, which is a decrease of 51,925 (0.7 percent) compared to 2015.² During the same period, the urban population in Bulgaria was 5,204,385, or 73.2 percent of the total.

Figure 5. Population, urban population, and aging

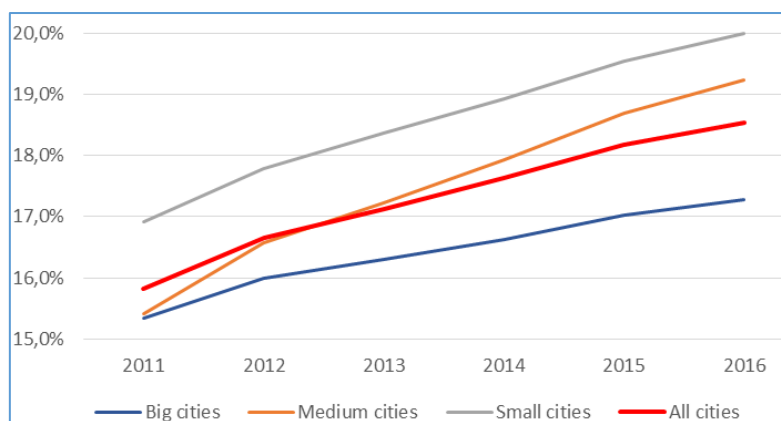


Source: NSI 2017.

29. The number of people ages 65+ is 1,472,116, which accounts for 20.7 percent of the total population and is a 3.8 percent increase compared to 2001.

² National Statistical Institute (NSI), <http://www.nsi.bg/en/content/6703/population>

Figure 6. Share of urban population ages 65+ (2011–2016)



Source: NSI 2017

30. There are 5,256 human settlements in the country, including 257 cities. For the purposes of spatial planning, cities are classified into five categories—very big, big, medium, small, and very small.³ For the purposes of this report, cities have been regrouped into three categories—big, medium, and small. The last category corresponds to the official definition of rural areas.⁴

Table 1. City size according to population (2016)

Groups of Cities by Population	Cities		Population	
	Number	Percentage	Inhabitants	Percentage
Total	257	100	5,204,385	100
Big - over 100,000	6	2	2,399,131	46
Medium - 30,000 to 100,000	24	9	1,337,111	26
Small - below 30,000	227	88	1,468,143	28

Source: NSI. Compiled by the National Center for Regional Development (NCRD).

31. About 46 percent of the urban population is concentrated in six big cities, attracted there by the larger number and greater diversity of jobs, higher quality of services, and better accessibility and mobility. The population in this group of cities increased slightly in 2016.

Table 2. Population change in the six big cities (2001–2016)

City	Population						
	2001	2011	2012	2013	2014	2015	2016
Sofia	1,113,742	1,208,097	1,213,542	1,221,292	1,228,282	1,231,981	1,236,047
Plovdiv	340,475	338,184	339,129	341,041	341,567	341,625	343,424
Varna	313,408	334,781	334,744	335,819	335,949	334,466	335,177
Burgas	192,566	199,484	199,083	199,364	198,725	203,017	202,766
Ruse	160,006	149,134	148,350	147,817	147,055	145,765	144,936
Stara Zagora	143,871	137,416	137,881	137,834	137,729	136,807	136,781

Source: NSI.

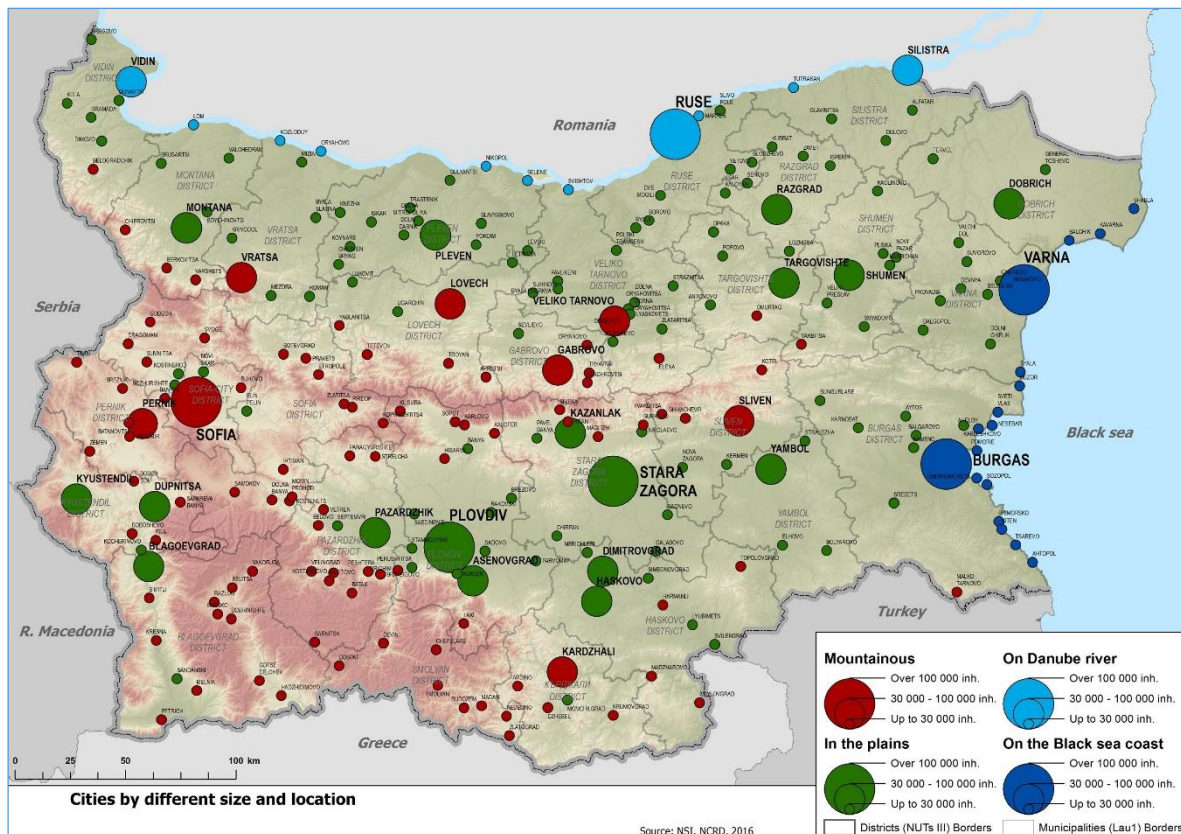
³ Pursuant to § 1 (1) of Regulation No. 7 on the rules and norms for development of separate kinds of territories and development zones (State Gazette [SG] No 3/2004), cities are classified as (a) Very big - over 200,000 inhabitants; (b) Big - from 100,000 to 200,000; (c) Medium - from 30,000 to 100,000; (d) Small towns - from 10,000 to 30,000; and (e) Very small towns - up to 10,000 inhabitants.

⁴ According to the National Rural Development Program (RDP) (2007–2013), a ‘rural area’ is a municipality with no settlement beyond 30,000 inhabitants. This program was based on the estimate of 231 existing rural municipalities, covering 81.4 percent of the territory of the country.

Climate Change Adaptation – Assessment of the Urban Environment Sector

32. The smallest towns are Melnik with a population of 199 and Madjarovo with 587. By the end of 2016, only 23 cities saw population increase, including 4 district centers (Sofia, Varna, Plovdiv, and Veliko Tarnovo), and 5 cities along the Black Sea coast. The remaining 234 cities shrunk, and the peripheral ones became gradually depopulated.

Figure 7. Cities by size and location



Source: NSI, 2017. Compiled by the NCRD.

33. The population projection of the NSI till 2070 shows certain trends in Bulgaria's total population continuing as well as disparities among different regions and districts (Table 3).

Table 3. Population projections⁵

Scenario (Variant)	Total Population						
	2015	2020	2030	2040	2050	2060	2070
I – Target (Realistic)	7,168,009	6,966,607	6,554,784	6,167,774	5,813,550	5,467,629	5,132,023
II – Relative acceleration	7,178,343	7,006,278	6,677,652	6,377,962	6,097,764	5,810,092	5,500,114
III – Relative slowdown	7,163,065	6,947,381	6,493,971	6,062,456	5,668,504	5,289,923	4,938,709

Source: NSI.

⁵ The scenarios are defined according to the European Union (EU) regulations on the member states demographic and social-economic development <http://www.nsi.bg/en/content/6727/population-projections-sex-and-age>

Poverty

34. An additional concern, along with population decline and aging, is poverty. The share of the poor during 2015 was 22 percent, with 25 percent of the poor of ages 0 to 17. Most vulnerable are single-person households of ages 65+ (53 percent) and adults with three or more dependent children (66 percent).⁶ The highest share of poor according to their economic activity are the unemployed (53 percent), and according to their declared ethnic group are the Roma (67 percent). In 2015, almost one out of eight (13 percent) retired persons in the 28 EU member countries was exposed to poverty risk, while in Bulgaria, this figure was more than twice as high at 30 percent.⁷

35. The most significant share of both consumer spending and total household expenditure is on food. There was a process of gradual decrease in the relative share of food costs, amounting to 44 percent of the total cost after 1999. This share continued to decline to 36 percent in 2011 and 31 percent in 2016. According to Eurostat data, as of 2014, Bulgaria is one of three countries with the highest level of ‘energy poverty’, together with Greece and Hungary. The share of population below the poverty line that could not cover their household bills is 58 percent, while 66 percent cannot afford to heat their homes and 23 percent live in homes with wet walls. The electricity costs of about 25 percent of poor households in Bulgaria are 20 percent and higher than their monthly income (Zahariev, Grigorova, and Yordanov, 2016).

36. The lowest poverty level is in the capital city—about three times lower than in other district centers and about four times lower than in other smaller cities. In the bigger cities, poverty is expressed in monetary terms, while in smaller cities and towns, it is connected to access to the labor market and to educational, social, and health services. The highest share (54 percent) of the poor population is observed in the municipality of Boynitsa (Vidin District). The other 12 municipalities with more than 30 percent of the population living in poverty—almost twice higher than the national average of 14 percent—are Opaka, Nikola Kozlevo, Kainardzha, Dospat, Kotel, Omurtag, Makresh, Belitsa, Varbitsa, Yakoruda, Satovcha, and Rakitovo. Half of these municipalities are situated in mountainous areas or on the national periphery.

37. The high share of population at risk of poverty additionally increases climate change vulnerability due to the cumulative effect of several factors, such as poor living conditions, lower employment rate, limited incomes, malnutrition, poor health status, and aging.⁸

1.1.2. Cities location, urban structure, and planning

Geographical location

38. The impact of climate change on the urban environment and population will differ according to the cities’ geographical location. Altitude and location affect the urban microclimate, the character of slopes affects surface water drainage, the proximity of rivers increases the risk of flooding, while the proximity of forests and agricultural lands brings the risk of fires. Considering the complex impact of geographical location on the urban environment and vulnerability to climate change, cities are divided into four groups based on their type of

⁶ <http://www.nsi.bg/bg/content/>

⁷ http://ec.europa.eu/eurostat/statistics-explained/index.php/Income_distribution_statistics

⁸ Bulgaria: The Challenges of Poverty (Regional analysis of the data from the multipurpose observation of households 2003) http://www.nsi.bg/sites/default/files/files/publications/Poverty_regio.pdf

location (see *Figure 21* in *Annex 4*).

Table 4. Cities by location type and population

Location	Cities		Population 2016	
	Number	Percentage	Number	Percentage
Total	257	100	5,204,385	100
Coastal	28	11	923,934	18
- Including River Danube	11	4	306,146	6
- Black Sea	17	7	617,788	12
Plain	129	50	2,015,005	39
Mountain and semi-mountain⁹	100	39	2,265,446	44

Source: NSI and BAS 2017. Compiled by the NCRD.

39. Although the least numerous group is coastal cities along the Danube River and the Black Sea coast, accounting for around 18 percent of the urban population, five of these cities are district centers and three (Varna, Burgas, and Ruse) are big cities with populations above 100,000. Considering the population increase due to visitors during the summer tourism season, more than 1.5 million people on the Black Sea coast are exposed to climate change risk. Two big cities on the Black Sea coast are Varna and Burgas. Cities and towns with the largest seasonal increases due to tourism are located on the Black Sea coast (Varna, Burgas) and in winter sports locations such as Borovets and Bansko. The largest number of cities and the greatest proportion of the urban population, accounting for 83 percent of the urban population, live in the 229 cities situated in plain and mountain and semi-mountain areas. Sofia, the capital city which has the largest population by far, is in a mountain and semi-mountainous area along with Plovdiv and Stara Zagora, which are two key economic centers. Within the group of cities located in plain areas, the population in cities, located along the rivers Maritza, Tundzha, Arda, Struma, Mesta, Iskar, Yantra, Osam, and Kamchia is at higher risk.

Urbanization pattern

40. The concentration of population in several big cities in the country and regional disparities are among the main reasons the country has put in place plans to transition from a monocentric toward a polycentric urban development pattern, which is a focus of national regional policy.

41. One of the main aims of the National Concept for Spatial Development (NCSD) (2013–2025)¹⁰ is ‘Polycentric territorial development’—strengthening of a polycentric network of core-cities with improved quality of the urban environment, contributing to the achievement of balanced territorial development, and diminishing of disparities between central urban and peripheral rural areas.

42. The adopted ‘moderate polycentric model’ is assumed to be attainable under conditions of reduced rates of population decline and a successfully implemented regional policy, accompanied by economic growth, moderate technological innovation, and expansion and

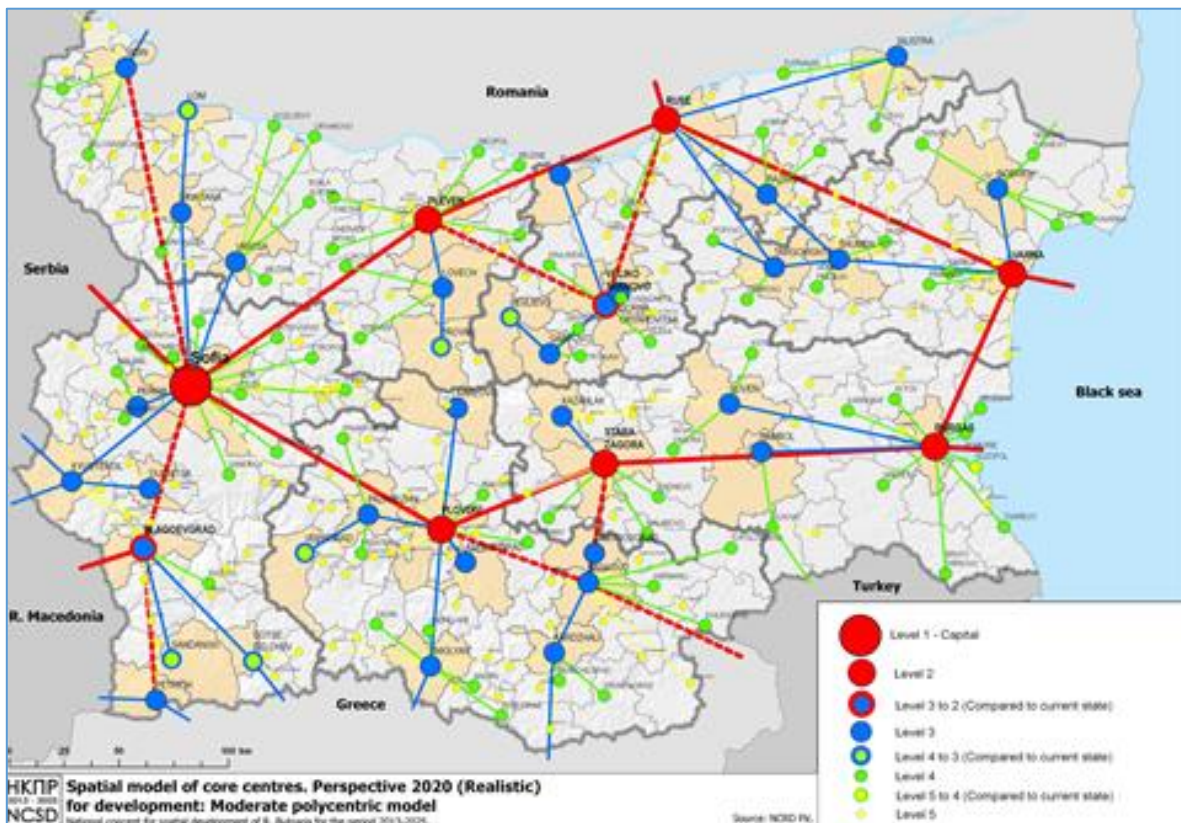
⁹ Altitude above 700 m, or altitude above 500 m and 15 percent slope, or more than 20 percent slope.

¹⁰ http://www.bgregio.eu/media/Programirane/NKPR_28012013_Last_en.pdf

improvement of technical infrastructure.

43. Adaptation to climate change is set out as a priority under Strategic aim 5, ‘Promoting the development of specific territories’. The aim here is recovery of damaged areas, including those along the Danube River and Black Sea coast, protection of territories vulnerable to social and ecological risks, preservation of the network of ‘blue’ and ‘green’ corridors, and reduction of natural disasters risk.

Figure 8. Moderate polycentrism model, NCSd (2013–2025)



Source: Ministry of Regional Development and Public Works (MRDPW), NCRD.

44. The selected core cities in the document, based on their socioeconomic characteristics and potential for growth, have the primary task to provide links to the European and national networks, systems, and urban centers, as well as to provide administrative, educational, health care, cultural, and social services of higher value to neighboring smaller human settlements. They are major urban centers for integrated allocation of investments from Operational Programme ‘Regions in Growth’ (OPRG), which is also expected to improve the natural disaster risk management (DRM) and climate change adaptation (CCA) capacity.

45. The implementation of this key national spatial planning document is of crucial importance for coordinating the sectoral policies and their binding with the national territory, while considering not only their development potential, but also the limitations and risks for growth. In addition, the reduction of monocentric urban development trends will preserve the network of active core cities, which provide vital services to the peripheral areas with concentration of highly vulnerable population. The distribution of the population, investment activities, and services among several core centers throughout the country will reduce the

pressure on the biggest cities, their infrastructure and institutions, responsible for climate change risk management and adaptation.

Spatial structure

46. Bulgarian cities have traditionally developed as compact structures and seldom as linear ones along mountain valleys or rivers. During the period of fast urbanization in the second half of the 20th century, the construction of multifamily housing estates has not resulted in significant sprawl, despite the urban population increase.

47. The last two decades show extensive development of peripheral areas of the big cities, following the construction boom and the demand for modern housing and commercial and production complexes. A typical example is Plovdiv, a city with a stable number of inhabitants, where despite the existing potential of the urbanized territories, several industrial and logistic complexes have been built on fertile land along the motorways.

48. Preserving the traditional compact development urban structure is one of the main goals of the new Spatial Development Plans/Master Plans aiming not only at reduction of municipal costs for technical infrastructure provision and maintenance, but also at more efficient energy supply.

Development zoning

49. The vulnerability of cities to climate change also depends very much on their land-use and applied development zoning and planning regulations. Seven categories of territories—‘urbanized territories (human settlements and settlement formations), agricultural territories, forest territories, protected territories, damaged territories for restoration, territories covered by waters and water sites, and transport territories’ are determined by the Spatial Planning Act¹¹ and planning regulations. By the end of 2015, the urbanized territories comprised 5 percent of the total surface area of the country, while agricultural land was 47 percent, forestry was 38 percent, and protected territories was 5 percent.¹²

50. The specific land use of the different territories is determined by Spatial Development Plans/Master Plans. The urbanized territories include different types of residential areas, public and business zones, industrial and production zones, mixed use/multifunctional zones, green and recreational zones, sports and attractions zones, transportation and technical infrastructure zones, social and public services zones, and so on. Housing zones claim the largest territorial share in cities and depending on the population, vary between 50 percent of the territory in big cities and up to 75 percent in smaller ones. Cities above 400,000 inhabitants are subject to special analyses in terms of land use and zoning. The green areas are calculated at 20 m² per person for the big cities and 8 m² per person in the very small ones.¹³

51. Major transformations in land use and zoning in the last two decades, a consequence of the land reform and restitution, affected overall urban planning and development and contributed to excessive density growth in the most attractive urban built-up areas. The reduced

¹¹ Spatial Planning Act, adopted in 2001. Last amended SG No 96/01.12.2017.

¹² Statistical Reference Book. 2016. Ministry of Agriculture, Food and Forestry reports, Executive Environmental Agency, Bulgaria database; Corine Land Cover data. Within the European Ecological Network Natura 2000, 34.4 percent of the territory is designated for protection of habitats and species.

¹³ Regulation No. 7 on the rules and norms for development of the separate kinds of territories and development zones, (SG No 3/13.01.2004, last amended SG No 41/22.04.2008.

open and green spaces, mainly in residential areas, compromises the quality of the urban environment and increases vulnerability of these areas to extreme weather events such as high temperatures and intensive precipitation.

Urban infrastructure

52. The analysis of urban infrastructure location and conditions including transport, technical, and social infrastructure, points to a concentration of sites and facilities and higher quality of services in the big cities, resulting in part by the EU policy for regional and urban development and the concentration of investments in highly developed urban centers. The location of hospitals, centers for emergency care, educational facilities, regional police stations, courts, fire stations, and other facilities related to safety and accessibility are among the criteria determining the system of urban centers in the polycentric model for urban development in the NCS D 2013–2025¹⁴ (see **Figures 22, 23, 24, 25, 26** and **Table 24** in **Annex 4**). The 39 cities, mainly big and medium-size municipal centers with adopted Integrated Urban Regeneration and Development Plans (IURDP), are beneficiaries of the OPRG,¹⁵ eligible for integrated urban regeneration, including infrastructure renovation with co-financing from the European Regional Development Fund (ERDF). Additionally, 28 smaller cities with adopted integrated plans are supported by the operational program for energy efficiency renovation of public buildings and private residential buildings.

53. More than 5,000 settlements (cities and villages) in Bulgaria have access to piped water and centralized water supply systems, which cover 99 percent of the population of the country. In urban areas, 98 percent of dwellings have centralized water supply systems. The quality of drinking water in 95 percent of the cases complies with standards.¹⁶ There are still problems with water supply networks and facilities in cities and a need for either considerable repair or full reconstruction to reduce massive water losses. From the total pipe length of over 75,000 kilometers, about 30,000 kilometers were built before the 1970s. This aging infrastructure is one of the main reasons for water losses of over 60 percent in some cities. During drought periods about one-third of settlements are subject to water stress and water rationing (see **Figure 27** in **Annex 5**).

54. Bulgaria is lagging EU standards in terms of wastewater management. On a national level, about 66 percent of the population is connected to the wastewater collection system and 50 percent to wastewater treatment plants as indicated in the World Bank assessment of the sector. According to the NSI, by the end of 2015, overall 93 percent of dwellings were connected to a sewerage system, while in cities the percentage is higher at 97 percent.

55. Traditionally, Bulgarian cities have combined sewerage and storm water networks with sufficient capacity for high-level storm waters. Separate systems are provided in the new municipal Spatial Development Plans in integration with the Regional Integrated Master Plans for water supply and sewerage systems.

¹⁴ NCS D 2013–2025, http://www.bgregio.eu/media/Programirane/NKPR_28012013_Last_en.pdf

¹⁵ OPRG 2014–2020, <https://www.eufunds.bg/archive/documents/1434963441.pdf>

¹⁶ Strategy for Development and Management of the Water Supply and Sanitation Sector in the Republic of Bulgaria 2014–2023, Available at <http://www.mrrb.government.bg/static/media/ups/articles/attachments/24e7666f6785ee40bfb094bec3ad5f45.pdf>

56. Central heating exists mainly in the big regional cities, but due to high prices, many households have opted not to use it. Only 15 percent of the national housing stock has central heating, with the highest ratio in District Sofia (capital)—61 percent, or 284,528 dwellings. Central heating systems exist in the district centers of Pernik (26 percent of all dwellings), Pleven (19 percent), Ruse (17 percent), and Vratsa (15 percent). The rest of the district centers have a share from almost 10 percent (Plovdiv) down to 0.1 percent (mainly local heating systems). The second type of energy used for heating in residential buildings is electricity with a share of 29 percent, mainly air-conditioning.¹⁷ Solid fuels (wood and coal) as a source of house heating have the highest share in small towns and villages (about 54 percent of all dwellings in the country). They are among the main greenhouse gas (GHG) air pollutants, especially in cities with unfavorable climatic conditions.

57. The share of residential buildings and public facilities supplied with natural gas is low. The highest number of dwellings on gas are in the district centers of Sofia (11,782 dwellings), Dobrich (3,802), Gabrovo (3,466), Varna (2,493), Stara Zagora (2,377), and Plovdiv (2,052).

58. The cooling of buildings is usually by air-conditioning. Most renovated hospitals and care facilities for the elderly and the new ones have such systems installed. There is a very limited number of new buildings using more intelligent centralized cooling systems. Among them are the recently completed new office and commercial buildings in the big cities, using renewable energy for heating/cooling, contemporary high-efficient air-conditioning systems, decentralized ventilation with recuperation of the waste energy, and other innovations.

59. Public transport is best developed in the big cities and their central parts with higher population density. Bus transportation is predominant. The share of the electric transport increased from 18 percent in 2000 to 24 percent in 2015.¹⁸ The highest share of passenger-kilometers in the total volume of electric public transport services is for the metro (12 percent), followed by trolley buses (7 percent) and trams (5 percent). There are seven Integrated Urban Transport Plans, which are being implemented in the big cities with the aim to reduce urban traffic and share of private cars, improve mobility and develop bicycle networks, introduce intelligent traffic management systems, reduce air pollution, and improve the urban environment quality (Sofia, Varna, Plovdiv, Burgas, Ruse, Stara Zagora, and Pleven).

Spatial and urban planning

60. The policy for regional and urban development is implemented by the MRDPW, while at the local level, control is delegated to municipalities. The urban planning system is subject to the Spatial Planning Act,¹⁹ which covers, in addition to urban planning per se, also investment designs, construction, and control. It regulates public relations in spatial development and planning, together with the Black Sea Coast Spatial Planning Act and the Sofia Municipality Territorial Planning and Building Act. The Spatial Development Plans (Master Plans), subject to Strategic Environmental Assessments (SEAs), include also analyses of the state of the environment and recommendations for reduction of climate change impacts. Strategic documents for regional and spatial development on national, regional, and local levels are

¹⁷ Analysis of the housing sector, prepared by the NCRD and submitted to the MRDPW in April 2017.

¹⁸ See NSI, Yearbook 2016

¹⁹ Spatial Planning Act, adopted in 2001, Last amended SG No 96/01.12.2017

subject to the Regional Development Act.²⁰

61. Control over urban planning and construction is exercised by the Minister of MRDPW supported by the Directorate for National Construction Control (DNCC). At local level, this control is exercised by the regional structures, assisted by municipalities, their councils, and chief architects. There are different levels of control for the different stages of planning, design, and construction. At the planning stage, administrative control over the compliance of the plans and projects with the effective legislation and judicial control is exercised. At the stage of investment design and building permit, administrative control is exercised by the bodies of the DNCC for construction activities from the first to the third category, and by the inspection bodies of the municipal administrations for the fourth to the sixth category construction activities.

62. In the established multi-level planning system, not all newly developed documents adequately cover all environmental factors, climate change risks, and adaptation measures, which require additional clear and unambiguous regulation in the existing legislation.

1.1.3. Construction sector and housing

Construction

63. The construction sector, as one of the important sectors in the urban economy, has considerable potential to contribute to mitigation of climate change impacts on the urban environment through reduction of emissions and energy consumption, innovative technologies, materials and facilities implementation, and better construction waste management.²¹

64. Different analyses of the construction sector in Bulgaria show a significant decline of employment (37 percent between 2008 and 2013), a 50 percent decline in the construction of buildings between 2008 and 2014, and a 36 percent decline in turnover because of the economic crisis (EC European Construction Sector Observatory 2016). Positive developments in the construction sector after 2015 are due not only to economic recovery, but also to increased investments in infrastructure, mainly with EU funds. In the last quarter of 2016, there was another decline in production. Current Eurostat data about the construction sector show that the country follows the common trends in the sector on a European level (see **Figures 28, 29, 30, 30** in **Annex 6**).

65. In 2015, investment in construction covered 32 percent of the production of the construction industry, with the biggest share in housing. According to the 2015 annual report of the European Construction Industry Federation (FIEC), the non-residential buildings construction sector accounts for 24 percent of revenues of the construction sector.²² In 2015, the construction industry generated production equal to 5 percent of the gross value-added (GVA) and 4 percent of the gross domestic product (GDP) at market prices (NSI 2016c).

²⁰ Regional Development Act, adopted in 2008, Last amended SG No 58/18.07.2017

²¹ Fifth Assessment Report, Intergovernmental Panel on Climate Change (IPCC), 2013 https://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_chapter9.pdf

²² Construction Industry in Bulgaria in 2015.

66. Several programs and initiatives have been launched since 2010 to improve the energy performance of buildings and to reduce GHG emissions in the sector.²³ The analysis and assessment of the characteristics of residential and more than 8,000 non-residential buildings in Bulgaria proved the low energy efficiency of the old building stock and demonstrated the need for further implementation of packages of measures aimed at reaching the GHG emission reduction goals in the sector. The measures proposed in the energy efficiency renovation programs are preceded by a technical and energy audit and evaluation of the building stock, structural reinforcement, where needed, quality of structural design assurance, thus reducing the seismic risk and risk of other extreme hydro-meteorological events, including floods for both, the existing and new structures.

Housing

67. According to the last census (2011), the Bulgarian population of 7,327,224 has at its disposal 3,887,149 dwellings with 283,833,000 m² useful area and 215,197,000 m² net living area. At the end of 2015, the number of dwellings was 3,935,105, situated in 2,071,699 buildings. There is a disproportion of the territorial distribution of the dwellings, whereby 73 percent of the population lives in urban dwellings which represent 66 percent of the total number or 2,613,318 urban dwellings, located in 777,062 residential buildings in the cities.

68. The biggest share of dwellings (40 percent) were built during the period of industrial development (1971–1990). Out of 1,557,522 dwellings built during this period, 1,234,958 (79 percent) are in cities. There are 10 percent of buildings which date from before 1945 (70+ years of age), and around half of these are in cities (132,887). Housing construction after 1990 had lower growth rates compared to the previous years. For the last 25 years, only 650,972 new dwellings have been built, marking a 17 percent increase, with 83 percent of these being in cities.

69. According to the type of construction, residential buildings are divided into 4 categories: (a) panel buildings—698,454 dwellings or 27 percent; (b) reinforced concrete construction—427,438 dwellings or 16 percent; (c) solid construction—1,425,996 dwellings or 55 percent, and (d) others—shallow/flimsy type with main construction material such as bricks, raw bricks, wood, and so on—61,530 dwellings or 2 percent of the housing stock. The share of the last category differs, ranging between 0.3 percent for Sofia and 0.6 percent for Burgas, and 13 percent in Smolyan. There are about 172,000 people living in such houses, and they are the most vulnerable group of the population in terms of climate change, exposed to higher risk of being affected by extreme temperature, flooding, wind storms, and so on.

70. Housing depreciation assessment according to their age, *based on the national statistics*, includes around 2,750,000 residential buildings, or 70 percent, subject to renovation, including energy efficiency measures.²⁴ Another 9 percent of the housing stock, or about 340,000 dwellings, located mainly in the national periphery, need a much more serious overall

²³ National Green Investment Scheme with the National Trust EcoFund, National Programme for Energy Efficiency of Residential Buildings, Demonstration Project for Renovation of Multifamily Residential Buildings, jointly implemented by the MRDPW and UNDP, OPRD 2007–2013 with the ‘Energy Renovation of Bulgarian Homes’ project, OPRG 2014–2020, National Long-term Programme for promoting investments for implementing measures aimed at improving the energy characteristics of public and private residential and commercial building facilities (2016–2020).

²⁴ Analysis of the State of the Housing Sector, Annex to the draft National Housing Strategy, prepared by the National Center for Regional Development, 2017.

reconstruction that will exceed their reasonable renewal price.

71. There are numerous illegal houses populated by Roma, the third-largest ethnic group in the country, who in 2011 numbered 325,323 self-identified people, or 4.9 percent of the population.²⁵ Houses of this type are concentrated in the big cities of Sofia, Plovdiv, Burgas, Sliven, and Stara Zagora. Most of the illegal buildings are situated on municipal land, next to rivers, gullies, and landslides, which makes them extremely vulnerable during natural disasters. There is one more category—primitive non-residential buildings (barracks, trailers, and so on) numbering 2,272 in cities with 6,360 dwellers, according to the last 2011 census. The highest share of such primitive and mobile ‘homes’ is in Sofia (24 percent). People occupying these kinds of primitive shelters are more vulnerable to extreme temperature, storms, and floods.

72. According to the 2011 census, 54 percent of inhabited dwellings rely on heating from wood and coal, while in the smaller cities, especially in the mountain regions, this percentage reaches 95 percent. About 27 percent of the dwellings use heating by electricity, 16 percent use central heating based on naphtha, and 1 percent based on gas. The biggest problem for air quality in the urban areas presents heating of homes with solid fuel, which is directly linked to poverty. There is frequent illegal cutting of trees for heating, mainly by Roma. Cutting considerable forest areas leads to deterioration of the quality of the environment, droughts, erosion, and increased flood risk.

Box 1. Share of dwellings with solid fuel heating in different ranks of cities

In big cities, solid fuels used for heating have the lowest share (12 percent). This share is the highest in Ruse (24 percent) and the lowest in Sofia (7 percent), of the occupied dwellings.

In medium-sized cities, 41 percent of the occupied dwellings use solid fuel. This percentage is the highest in Silistra (62 percent) and Kyustendil (61 percent), and the lowest in Pleven (16 percent).

In small cities, 76 percent of the occupied dwellings use solid fuel. In some, the percentage is about 90 percent and is connected to poverty.

Source: NSI, Tome 2: Housing, Book 2: Housing, 2012.

73. Despite the sufficient number of dwellings in the country, there is a great number of over-occupied ones. The residents of about 327,000 dwellings, or 1,357,000 persons, share a room with one or more persons, thus using at least twice less housing area than the average per person (21.8 m²). About 85,000 of these dwellings are occupied by three or more persons per room and all occupants need either social housing or social support.²⁶ These people would also fall under the category of homeless, if Bulgaria had a legal definition of homelessness.²⁷ They are another vulnerable group exposed to higher risk, particularly of extreme temperatures.

²⁵ NSI, <http://www.nsi.bg/en/content/8294/poverty-and-social-inclusion-indicators-national-level>

²⁶ National Housing Strategy. Analysis of the housing sector submitted by the NCRD to the Ministry of Regional Development and Public Works in April 2017.

²⁷ European Commission Employment, Social Affairs and Inclusion defines homelessness as ‘Sleeping rough or living in temporary, insecure or poor-quality housing’.

1.1.4. Municipal property management

74. According to the Municipal Property Act,²⁸ the management and maintenance of municipal property is the responsibility of municipalities. In addition to health care, education, cultural, and administrative buildings, the municipal building stock also includes social housing, rented to people in need, subject to sale, exchange, or compensation of former owners. In recent years this stock, distributed in different buildings and difficult to maintain, has diminished considerably. Thus, the state and municipalities have very limited options to offer shelter or to rehouse those in need of proper dwelling, who occupy primitive non-residential buildings and are the most vulnerable to climate change.

75. The urban technical infrastructure is being maintained and managed by the municipalities, municipal enterprises, service providers, and private companies. According to the Energy and Water Regulatory Commission, there are 64 water supply and sewerage companies providing services, 49 percent of which are fully owned by municipalities. The activities of the main electricity supply and distribution companies are subject to control by the above commission. The planning, management, and responding to emergencies and natural disasters is covered by a regulation issued by this commission, which also controls all other supply and distribution companies through water and gas supply directorates.

76. The European initiative in support of the municipalities for sustainable energy management and CCA is the Covenant of Mayors, ‘Mayors Adapt’. Among the 25 signatory Bulgarian cities, three—Sofia, Burgas, and Dimitrovgrad—have already developed their strategies and adaptation action plans.²⁹

77. Sofia municipality prioritizes environmental protection and encourages youth participation and innovation start-ups. The variety of initiatives include measures for air purification, integrated waste management, increase in green areas and their protection, improved management of waters (surface, drinking, mineral, and waste), and energy efficiency. The Vision of Sofia 2050, which is under development, envisages transformation of the capital into a green and innovative city for the people. The Action Plan for Sustainable Energy Development of Sofia Municipality 2012–2020, developed under the Covenant of Mayors initiative, puts an emphasis on adaptation to climate change and includes among the risk factors, extreme temperatures, intensive precipitation, and floods.

78. Like Sofia, Burgas, the second biggest city on the Black Sea coast, has the ambition to become a model for sustainable development. The city was a partner in the ‘Liveable Cities’ project (2004–2007) of the EUROCITIES network³⁰ and contributed to the development of the Guidance for Sustainable Urban Management with a focus on air quality, public health, GHG emissions, urban sprawl, generation of waste, and wastewater. More recently, the municipality developed a Strategy for Sustainable Energy Development for 2011–2020 and Action Plan for 2012–2020 and has a well-established network for achieving its strategic goals for ‘smart’ and ‘green’ growth.

²⁸ Adopted in 1996. Last amended SG No 96/01.12.2017.

²⁹ http://www.covenantofmayors.eu/about/covenant-of-mayors_en.html

³⁰ https://www.researchgate.net/publication/305990956_Towards_Liveable_Cities_and_Towns_-_Guidance_for_Sustainable_Urban_Management

79. The third city, which adopted a Sustainable Energy and Climate Action Plan (SECAP) until 2030 under the Mayors Adapt initiative,³¹ Dimitrovgrad, is a municipal center with 35,074 inhabitants or a medium-sized city in the group of those located in a plain territory. The lowest parts of the city have an altitude of 92 m along Maritza River, the most vulnerable areas to floods. Because of the high level of air pollution, the analysis of the Action Plan explores all sources for GHG emissions in the municipality and considers measures toward a 40 percent reduction target. Among the long-term strategic goals are those directed toward reduction of risks of extreme temperatures, floods, and droughts.

80. These three plans could be considered good practice examples to be followed by other municipalities in the country and represent different typology of city and location. Development of CCA capacity goes through development and implementation of such relevant strategic documents, meaning that smaller municipalities will need considerable technical, financial, and methodological support.

1.2. Past and Present Weather Events and their Consequences and Response Actions in the Urban Sector

81. The first assessment report of the IPCC in 1990 suggested four scenarios (RCP2.6, RCP4.5, RCP4.5, and RCP8.5) based on representative concentration pathways (RCPs) in a combination of different factors—pollution, population size, economic development, land use, energy consumption, and climate policy. Even the most optimistic scenario, RCP2.6, assumes global warming of up to 2°C and a considerable impact on the economic sectors, environment, and human health despite the CCA measures implementation.³²

82. The recently published report of the European Environmental Agency ‘Climate Change, Impacts and Vulnerability in Europe 2016’ (EEA 2017) pointed out the increased probability of various extreme weather and climate events in Europe. In Eastern Europe, heat extremes and reduced summer precipitation could increase drought risk, health risks, and energy and water demand in summer. Increased intensive precipitation would increase the risk of river floods. In mountain regions, climate change would increase the risks to infrastructure and urban environment from floods and landslides. European cities with aging urban populations would be more vulnerable to heat waves and extreme precipitation would increase exposure to floods.³³

83. Among the variety of global and regional climate change studies, the Second Assessment Report on Climate Change and Cities (ARC3-2) of the Urban Climate Change Research Network (UCCRN) was presented in 2015. The projections presented in this report drew from 100 cities from different regions in the world and was based on 35 global climate models and 2 RCPs (RCP4.5 and RCP8.5). The findings were that average annual temperatures and precipitation increased for all 100 cities and sea levels rose for all 53 coastal cities.³⁴

84. Similarly, the Bulgarian urban environment is experiencing climate change through very frequent extreme weather events such as extreme high and low temperatures, intensive

³¹ http://www.covenantofmayors.eu/actions/sustainable-energy-action-plans_en.html

³² http://sedac.ipcc-data.org/ddc/ar5_scenario_process/RCPs.html

³³ <https://www.eea.europa.eu/publications/climate-change-impacts-and-vulnerability-2016>

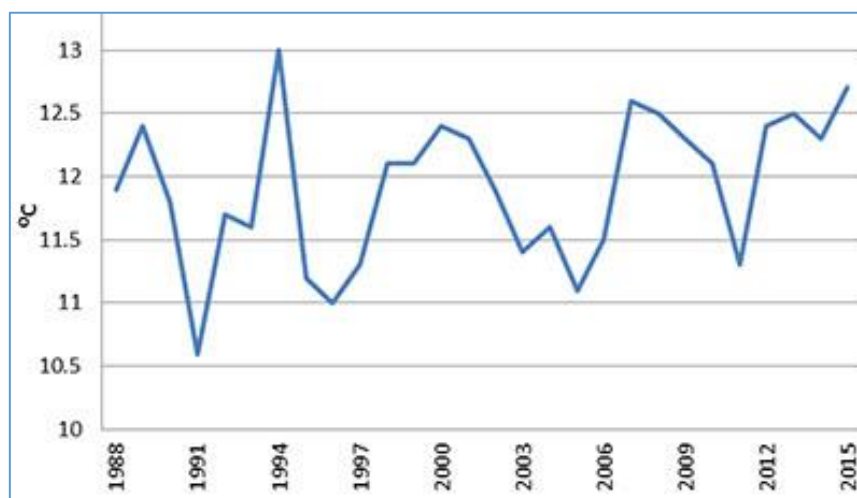
³⁴ <http://uccrn.org/arc3-2/>

precipitations, often accompanied by storm winds, and climate related floods, drought, and landslides (see *Figure 32* in *Annex 7*).

1.2.1. Extreme temperatures

85. Like other European countries, Bulgaria is also witnessing weather warming trends since the end of the 1970s. Between 1988 and 2011, the average annual temperature increased by 1.3°C, compared to the baseline period 1961–1990. In 1994, 2000, 2007, and 2011 this deviation exceeded 2°C. The NIMH-BAS observed persistence of the warming trends and recorded the warmest 20 years in the last three decades.

Figure 9. Average annual air temperature fluctuations (°C) for the period 1988–2015



Source: *State of the Environment Country Report, Bulgaria 2015*, based on data from the NIMH-BAS.

86. The absolute maximum temperature in Bulgaria of 45.2°C was recorded in Sadovo in 1918. Slightly lower high temperatures have been recorded in Boychinovci, Chirpan, and Ruse (Geography Institute to BAS 2002). After 1989, there are 18 cases of recorded warmest years with temperatures between 32°C and 38°C (Alexandrov 2010). In 2015, the highest temperatures were recorded on July 30—41.2°C in Sandanski, 40.5°C in Pleven, and 39.5°C in Veliko Tarnovo.

87. The regions with the highest risk of extremely high temperatures include Blagoevgrad, Sandanski, Haskovo, Kardzhali, Plovdiv, Yambol, and Stara Zagora in the southern part of the country, and Pleven, Ruse, and Veliko Tarnovo in the northern part.

88. At the same time, during the last 10 years, there has been a general reduction in precipitation by 30 percent to 40 percent. This trend, which in the past was more pronounced in the southern regions, has during recent years spread throughout the country. According to the NIMH-BAS, the greatest droughts have been recorded in 1945 and 2000. Projections for further precipitation decrease with 10 percent (2020) up to 40 percent (2080) during summer months will put additional pressure on urban water supply systems.

89. The absolute minimum temperature of -38.3°C was recorded in Trun in 1947. Similar recordings have been made in Knezha and Sevlievo. In the past, sudden drops in temperature, including freezing of the Black Sea coastal area (in 1929, 1942, and 1954) and more often of the Danube River, as well as prolonged cold periods, have resulted in considerable damage,

including limited shipping and floods during ice melting.

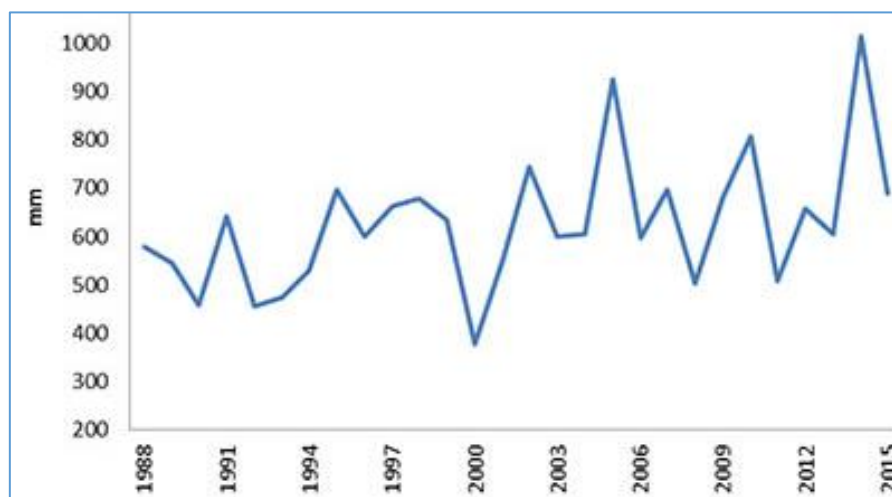
90. Despite the overall warming, mainly in January and February, there are long periods with temperatures below 0°C throughout the country. In January 2012, the absolute minimum temperature was close to the values recorded between 1961 and 2011. Between the end of January and the second decade of February, the lowest temperatures were recorded in Knezha (−29.4°C), Vidin (−28.6°C), and Montana (−24.6°C).³⁵ January 2017 was the coldest month for Sofia since 1964, with temperature between −16°C and −20°C. At the same time temperatures below −20°C were recorded in several regions across the country.

91. In urban areas, extreme temperatures create greater health hazards for the elderly, especially for the poor and those living in low standard housing or the homeless. There is a risk for outdoor workers, employed in the construction sector or in public utilities maintenance. Extreme temperatures also put pressure on water supply systems in summer and on electricity supply systems for heating and cooling. In periods with extreme low temperatures, there is a risk for traffic and mobility due to icing. An additional burden for municipalities in the winter seasons are the periods with a combination of extreme low temperatures, strong wind, and snowfall.

1.2.2. Intensive precipitation

92. Along with the longer dry periods, there is a considerable increase in the number of days with precipitation above 100 mm, which was about 30 percent higher between 1991 and 2007. There are also more registered intensive precipitations compared to the baseline period (1961–1990) and an increased number of thunderstorms and hailstorms during the winter (Maneva et al. 2012).

Figure 10. Mean annual precipitation sum fluctuations (in mm) for the period 1988–2015



Source: State of the Environment Country Report, Bulgaria 2015, based on data from the NIMH-BAS.

93. Between 2005 and 2011, five daily precipitations were measured of more than 200 mm. In 2015, the average annual precipitation amount was close to normal and for the areas up to 800 m above sea level was 689 mm. For the same period, the maximum daily precipitation was measured in February in the district of Kardzhali (209.5 mm), while in the beginning of March,

³⁵ http://meteorology.meteo.bg/poster_AG_KM_LB-f.pdf

the daily precipitation measured in Momchilgrad was 154 mm.

94. The climate projections for Bulgaria indicate a continuous increase in rainfall in the winter months, but a decline in snowfall and snow cover, as well as a decline in the number of days with sufficient snow cover for ski facilities. For the cities in mountain areas without tourism potential, snowfalls are also an important factor, because they affect everyday life, food supply, mobility, and access to education and social and health services.

95. **Hailstorms.** In recent years, increased precipitation is quite often accompanied by storm winds, thunderstorms, or hailstorms. Bulgaria is known as one of the most hailstorm-prone countries in Europe. In 2004, a hailstorm in Varna, with ice pieces of 4.5 cm in diameter, accompanied by heavy rain and a hurricane, inflicted considerable damages to cars and property. Similar in strength and damage was the hailstorm in 2014 in Sofia. For the country as a whole, 85 hailstorms were recorded during the period 2010–2015, causing damages of BGN 52.3 million.

1.2.3. Floods

96. Floods are one of the most devastating natural risks for the country. They account for 30 percent of all the natural disasters for the period 1974–2006. The floods during the summer of 2005, which affected the whole territory of the country, are the biggest natural disaster for all recorded history in Bulgaria, resulting in damage inflicted on over 60,000 people, loss of 11,000 heads of livestock, and 3,000 houses left unfit for living. The intensive precipitations during the following several years, some of which reached 300 l/m², led to emergency conditions in 21 municipalities along the Danube River and in many more throughout the central and southern provinces, where considerable damage was inflicted on hundreds of thousands of acres of agricultural crops. A total of 2,898 floods were registered in human settlements for the period 2010–2015 alone, with the highest number in 2012.³⁶ The total estimated damages for the same period amounted to BGN 630.3 million (see *Figures 33 and 34*, and *Table 25 in Annex 4 [Floods]*). Big floods in Varna during the past 10 years regularly turn many of the streets into rivers, especially in the lower part of the city. Part of the damage is attributed to the low capacity of the sewerage network. The flood during 2014 in the Asparuhovo neighborhood killed 13 people and left another 600 homeless.

97. The Preliminary Flood Risk Assessments of the four river basins in Bulgaria³⁷ determine the most vulnerable flood areas to be those along the Danube River and along the Black Sea coast. The vulnerable plain cities are those along Maritsa River—Pazardzhik, Plovdiv, and Svilengrad—and along Tundzha River—Yambol and Elhovo. The vulnerable population in these five cities numbers around 509,000 people. For the cities in mountain and semi-mountainous areas, the risk is higher for those situated along rivers and gorges (Haskovo, Chepelare, Smolyan, and Kyustendil), while the town of Kardzhali has a high-risk location below the Kardzhali Dam.

98. The growing number of floods during recent years, attributed partly to climate change, mostly affects the lower parts of the cities, the neighborhoods with poor or incomplete sewerage

³⁶ <http://www.nsi.bg/en/content/13272/floods>

³⁷ http://www5.moew.government.bg/?page_id=54663

systems, and housing areas and buildings near river beds, including illegal ones. Most of these areas are inhabited by poor people who find it very difficult and often impossible to recover the inflicted damages. Flood damage in the big cities is also associated with an increased intensity and density of developments and increased share of urban sealed surfaces. Except the flooding of private and public buildings and streets, impacts include damages on infrastructure, archaeological sites, and listed buildings.

1.2.4. Landslides

99. Intensive precipitations, floods, underground waters, erosion and abrasion, earthquakes, and anthropogenic activities are the main factors for activation of landslides in Bulgaria. Until the end of 2017 about 2,000 landslides had been recorded, localized in several regions, including the high coastal Danube area (Dunavci, Nikopol, Svishtov, and Tutrakan) and the Black Sea coast (the coast between Kavarna and Varna, Sarafovo near Burgas). Additional areas include Eastern Rhodopes, Pernik, and Sofia valley (Bankya, Kokalyane, Bistritsa, Dragalevtsi, Kutina, and Zemlyane). There were 458 landslides recorded during 2010–2015, and 125 in 2015 alone.³⁸ The total estimated damage for this period amounted to BGN 558.1 million.

100. The MRDPW keeps a register of the landslides and carries out monitoring of the landslide regions in Bulgaria through its state geo-protection companies. According to the current monitoring and data revision, 603 landslides have been identified in urban areas. (see **Figures 35** and **36**, and **Tables 26** and **27** in **Annex 7** [Landslides]). The highest number of landslides are in the cities located along the Black Sea coast (total of 182) and along the Danube (total of 111),³⁹ where additional aggravating factors are erosion and abrasion. Along the Black Sea coast, there is one more man-made factor—the delay of sewerage construction in the new vacation villages.

101. Having more than 50 percent of the total number of landslides in the country within the settlements' boundaries creates additional risk for the building stock, transport infrastructure, underground networks for water, electricity, and gas supply, and for the sewerage system.

1.2.5. Urban water resources

102. In future, the most important issue resulting from higher temperatures and longer drought periods will be linked to fresh water supply. Compared with the other EU countries, Bulgaria has sufficient fresh water resources and is rated among the first 10 EU-28 countries with a total of 14,000 m³ per year fresh water average per capita.⁴⁰ There is strong competition among the different water consumers. In the Danube River basin region, it is due to the water needs of the nuclear power plant cooling system and on the Black Sea coast, to the high number of newly built hotels and vacation villages.⁴¹

103. The National Strategy for Management and Development of the water sector in Bulgaria, adopted in 2012, is based on the water consumption prognosis of the data from 1999 to 2009 (between 87 and 113 l per day) and estimated average daily consumption of 120 l per

³⁸ NSI Crisis Events Statistics, incl. landslides. Data are based on the annual reports presented by 83 municipal administrations in NSI, <http://www.nsi.bg/en/content/13274/landslides>.

³⁹ MRDPW, <http://gis.mrrb.government.bg/KGR>.

⁴⁰ <http://eea.government.bg/bg/soer/2013/water/index>.

⁴¹ State of the Environment National Report, Republic of Bulgaria, available at <http://eea.government.bg/bg/soer/2014>.

capita in 2035. For all four river basins management regions in the country, the strategy envisages an increase by 29 percent for the Black Sea river basin and 15 percent for the East Aegean river basin. The total household water consumption is expected to increase by 4.4 percent till 2035, and business water consumption is expected to follow similar trends and increase by 6.4 percent.⁴²

104. Special attention is given to one of the least exploited water resources—thermo-mineral waters. Among the 200 deposits studied with a flow of about 5,600 liters per second, there is a great variety of chemical and physical characteristics and healing effects. On a national scale, only about 24 percent of the mineral waters are used for various purposes, with the highest share for sport and attractions (37 percent), next for drinking and water supply (28 percent), and for treatment and rehabilitation (19 percent), followed by heating and other uses. The city of Sofia is the only European capital with eight types of thermo-mineral waters in 31 deposits (Penchev and Velichkov 2011). Many other cities such as Stara Zagora, Kyustendil, Velingrad, Sandanski, and Hisarya, and a number of smaller towns have been developed throughout the centuries around mineral springs. There is a great potential for developing these places as Balneology Resorts, providing spa services. Thermal waters with a temperature of 90°C–100°C could be used for heating and for improving the water supply.

105. Another important issue in the cities is the wastewaters, particularly storm waters, during periods of long and intensive precipitations and snow melting. To reduce the risk of technogenic floods in such periods, the municipalities implement different hydrotechnical solutions in addition to the reconstruction of the wastewater systems and introduction of separate systems for household and surface wastewaters.

106. According to the published strategic documents, analyses and assessments of the Ministry of Environment and Waters (MoEW), no general water stress is expected during the period till 2021, and a low level of stress is expected till 2035. Nevertheless, based on the detailed analysis of the water stress in the vulnerable areas in the country, mainly because of the uneven distribution of the water resources, recommendations are given for construction of water retention reservoirs and surveys and drilling for new water sources.

1.2.6. Air pollution

107. In combination with extreme temperature and increased humidity in both hot and cold seasons, air pollution is the most crucial factor with negative impacts on human health in Bulgarian cities. Transport emissions, solid fuel heating, sanding of streets in winter, power production, and industry and construction works contribute to air pollution. Additional factors include unfavorable climatic conditions such as low wind velocity over extended periods, long-lasting droughts, and impeded airing of the densely built-up urban areas. Particulate matter represents a well-known risk for respiratory diseases. Depending on its composition, it also affects the environment adversely through reduction of visibility and damage of buildings.

108. According to the last EU Environmental Implementation review, published in 2017 (EC 2017), Bulgaria is among the countries with highest concentration of PM_{2.5} and PM₁₀ in EU-28 with 77 µg/m³ of the daily mean concentration, exceeding the EU limit of 50 µg/m³. Similar

⁴² http://www5.moew.government.bg/?page_id=51489

observations were published by the Executive Environment Agency (ExEA) at the MoEW in the State of the Environment Country Report.⁴³ The World Health Organization estimated 11,787 premature deaths in the country due to PM_{2.5} and ozone exposure (HEAL 2014).

109. The largest number of exceedances of the daily average values of PM₁₀ in 2014 was recorded in Vidin (171 days), Montana (171 days), and Lovech (150 days). The capital city of Sofia is considered the city with the most polluted air in the country. That is why Sofia municipality launched a variety of initiatives: to reduce the number of cars, to establish a more reliable public transport system and smarter mobility schemes, to change the public transport vehicles with ‘greener’ ones, to stimulate cycling and walking through better designed networks and public open spaces (POS), and to increase air quality control in the main monitoring stations and install automatic air pollution early warning system.

110. Bulgaria is the only EU country with recorded exceedances of the norms for sulfur dioxide. In 2014, there were two exceedances of the alert threshold in Galabovo. All monitoring centers have reported compliance with the norms for nitrogen dioxide in 2014.

1.2.7. Earthquakes

111. Although not related to weather extremes, earthquakes are one of the natural disasters in Bulgaria with devastating effect on urban environment and population. Considerable seismic activity covers as much as 98 percent of the territory with serious impact on constructions, housing stock, technical infrastructure, and human safety. Eight great earthquakes with magnitudes between 7.0 and 7.8 were registered last century before 1942. The devastating earthquake in Vrancea, Romania in 1977 with a magnitude of 7.2 was felt throughout Bulgaria, killed 120 people, and left many homeless. During the past 30 years, there were 13 earthquakes with magnitude between 4.0 and 4.7, one of 4.9 near Kaliakra on the Black Sea coast (2009) and two of 5.6 in Popovo (1986) and in Pernik (2012).⁴⁴

112. As with most other areas of vulnerability, a number of anthropogenic factors contribute to the possible damages during earthquakes, including weak illegal homes and shelters, different transformations of building structures, such as removal of walls and columns to accommodate shops in ground floors or to provide more living space in apartments. To ensure the safety of residential and non-residential private and public buildings with the amendment of the Spatial Planning Act and with a special regulation from the beginning of 2007, the structural survey and the technical passport have become obligatory.

113. The analysis of the NSI data about earthquakes in the country (2010–2015) shows that the most devastating earthquake in the period was the one in 2012 in Pernik with estimated damages of BGN 52.38 million. The total number of earthquakes for the period was 49 with damages of more than BGN 60 million (see **Figures 37** and **38**, and **Table 28** within **Annex 7** [Earthquakes], and **Figure 39** within **Annex 4** [Potential Seismic Risk]). In addition to these damages on urban environment, transport, and technical underground infrastructure on buildings, especially the listed ones, a serious problem is the protection of human life and the reduction of post-traumatic stress after a crisis event.

⁴³<http://eea.government.bg/bg/soer/2015>

⁴⁴ <http://www.nsi.bg/en/content/13286/earthquakes>

Table 5. Damages in Bulgaria by some crisis events during the period 2010–2015

Event	Damages (BGN, thousands)						
	2010	2011	2012	2013	2014	2015	Total
Floods	38,882	206,659	20,898	15,285	177,604	171,032	630,360
Landslides	2,182	224,790	17,384	294,459	9,291	10,011	558,117
Storms and tornados	54,722	1,614	3,488	99,387	746	1,640	161,597
Earthquakes	224	—	59,037	915	62	—	60,238
Hailstorms	505	50,150	187	—	853	583	52,278
Fires	2,239	2,186	1,437	2,013	729	1,795	10,399
Snow storms	441	1,205	945	200	410	5,436	8,637
Icing or extreme cold	—	128	136	—	—	200	464
Drought	1	117	149	—	1	—	268

Source: NSI 2016.

114. Under conditions of drought and high temperatures, the risk of fires increases, but in Bulgarian conditions such phenomena of cities or urban suburbs affected by forest fires have not been registered. Even though, between 2010 and 2015, there were 12,308 registered fires with damages of about BGN 10.4 million, most of these are the result of human negligence, deliberate action, or breach of fire regulations. Indirectly, these wild forest fires or fires arising from burning stubble in farmland near the populated areas can cause air pollution, visibility disturbance, and discomfort. In hot and dry periods of the years, there will be additional pressure on water resources for firefighting.

115. The results of the analysis of past and present weather events show that in the future, Bulgarian cities will be affected most by extreme temperatures and increased precipitations intensity and frequency. The consequences of the latter—floods and landslides—will be among the priorities of the government, municipalities, and population in the next 20 years.

1.3. Sector-related Climate Change Risks and Vulnerabilities

116. The main challenge in downscaling the climate change assessment to the urban level and even to the single building is to find the link between specific urban development scenarios and regional CCA models.⁴⁵ In the last 20 years, there are continuous searches for a commonly accepted methodology, based on the urban structure, land-use, or building typology, to make the climate change risk and vulnerability assessment (RVA) more effective and reliable, without underestimating the local characteristics (Moon et al. 2009). The adopted approach in the current assessment is based on the proposed typology of cities by size and location and their functional zoning.

1.3.1. Evaluation of the vulnerability of the urban environment

117. Evaluation of the urban environment vulnerability to climate change is a relatively undeveloped topic in Bulgaria compared to the energy, transport, health care, agriculture, and forestry sectors. The inclusion of this topic in the global political agenda during the last two

⁴⁵ <http://resilient-cities.iclel.org/fileadmin/sites/resilient-cities/files/docs/B1-Bonn2010-Hoornweg.pdf> and <http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1296405826983/Dickson.pdf>

decades has been justified by the concentration of a growing proportion of the population in bigger cities and the complex interaction among different natural and anthropogenic resources and activities (Carter et al. 2015). It is expected that by 2050, 65 percent of the world population will be living in cities, while this percentage is considerably higher for Europe at 82 percent (UN 2014).

118. In Bulgaria, despite the overall negative demographic forecast, the share of the urban population is expected to continue its growth to reach 81 percent by 2050. This will expose more people to natural disaster risks, especially in the bigger cities, which have greater concentration of vulnerable groups, including children, the elderly, sick, disabled, and poor, and minorities.

119. While evaluating climate change vulnerability of the urban environment in Bulgaria, the complex impact of various natural, material, economic, social, and political factors and their cumulative effect have been taken into consideration. They have different impacts on the cities depending on their size and location and the different degree of impact on urban population and the main environmental components such as functional zones, buildings, open and green spaces, transport and technical infrastructure networks and facilities, and service provision.

120. The natural factors, which determine the different levels of vulnerability include climate components (temperature, precipitations and snowfalls, winds, and storms); relief (including altitude, exposition, inclination, and segmentation); water resources; and forests. The grouping of cities into four groups depending on their location reflects the cumulative effect of these factors. Thus, the cities located along the Danube (Ruse, Silistra, Svishtov, and so on) and the Black Sea coast (Varna, Burgas, Pomorie, and so on) are more exposed to the risk of flooding, but less exposed to extreme high temperatures due to better air circulation, evident from the climate change scenarios, adopted for the country. In most of the Bulgarian cities located in the mountain and semi-mountain regions, the higher altitude and the forests located nearby make these cities more resilient to extreme high temperatures, but more vulnerable to extreme low temperatures, snow storms, and flooding during the periods of snow melting (Smolyan, Chepelare, Bansko, Samokov, and so on). The cities located in the plain areas are more vulnerable both to extreme temperatures and storms, as well as floods, when located along rivers (Plovdiv, Pazardzhik, Haskovo, Yambol, and so on).

121. The second group of factors, related to the first, is based mainly on the models for spatial and urban development. In a broader sense, these factors relate to planning issues and address urban morphology and urban typology, both affecting urban environment vulnerability to climate change. The vulnerability of cities depends not only on their location, but also on their form and structure, intensive or extensive development, land-use pattern, population density, green system, and location of the 'blue' and 'green' corridors. Built-up areas with high densities in big cities are more exposed to extreme high temperatures and heat waves than the ones built with individual houses, typical for small cities, because of the higher percentage of private gardens in the second group. The traditional urban pattern of the smaller and bigger Bulgarian cities with connected buildings and courtyards considerably reduces the storm winds vulnerability. The lavishly designed open and green spaces in the residential complexes, built since the 1960s on the periphery of the big industrialized cities to accommodate rural migrants,

make these areas more vulnerable to extreme low temperatures, snow and wind storms, and icing. Their advantage is the potential to accommodate inhabitants during earthquakes.

122. The third group of ‘material’ factors are closely related to the previous one and refers to buildings and facilities, considered either generally as a built environment, or as material assets, or as ‘grey’ infrastructure (EEA 2015). Urban functional zones, according to the Bulgarian planning regulations, have varied density, gross plot ratio, and green areas ratio, and thus, predetermine different vulnerability to climate change. Applied to big, medium, and small cities, under different investment pressure, usually with the highest indicative values of planning norms, the multifunctional zones often threaten the resilience of the territories with higher density, concentration of activities and services, visitors, and users. Old residential housing estates with their open structure and large amount of restituted lands between the blocks of flats after the 1990s also downscale climate change resilience of these areas, when they are subject to new investment initiatives because of the increased ‘sealed’ land ratio. The applied building technologies, structures, and materials, and their insulation and reflective properties have their impact and at the same time, hold a great potential for reducing urban heat and for protecting better indoor spaces. These factors have been examined more thoroughly in recent years in an attempt to restore the basic urban ecology principles implementation in favor of energy efficiency (Maneva et al. 2012; Maneva and Ivanov 2016).

123. The growing requirements toward the urban technical infrastructure in view of natural disasters risk reduction, together with the specific role of the water supply and drainage systems under conditions of prolonged droughts with drinking water shortages or high precipitation and floods risk, call for the urban infrastructure to be considered separately from the buildings and urban transportation systems when assessing risk and vulnerability in the urban environment sector.

124. The fourth group of factors includes the social ones, together with the demographic changes, in view of better identifying the risk groups, their characteristics, and concentration in specific cities and zones. According to data from the 2011 census and the analysis, among the more vulnerable groups are the elderly aged 65+ (23 percent of the total population in Bulgaria); the poor (30 percent of the population), concentrated mainly in the national periphery and in the north-western region; people living in primitive housing (2.3 percent) and those living in illegal houses (another 4.9 percent). Small children are also among the vulnerable groups. The social infrastructure (educational, health care, social services, including newly built centers for immigrants) and structures, related to disaster protection (like fire brigades, emergency medical care, and crisis centers) are almost evenly distributed throughout the country to provide equal accessibility in the event of crisis (see *Figures 21, 22, 23, 24 and 25* within *Annex 4*).

125. The human factor, health, and safety are in the center of this group. The numerous reforms in Bulgaria’s health care system during the past 25 years hinder the collection and processing of information on morbidity and mortality caused by climate change and the ensuing natural disasters, especially the extreme high temperatures and heat waves. There are but some minor studies on post-traumatic stress and the effects of natural disasters on the psyche and nervous system. The impact of this group of factors depends largely on the social behavior, level of education, knowledge of consequences, empathy, and sense of responsibility. It is well-

known that a considerable percentage of victims of natural disasters is due to panic and inappropriate reactions during and after such events.

126. The fifth group of factors includes the economic ones (often referred to as the main cause of adverse effects of many natural disasters), related to poor economic development, financial restrictions, and unfavorable economic conditions of a considerable part of the urban population in the country. These factors have several dimensions in relation to the urban environment. On the one hand, the economically developed cities, while being attractive for new residents and bigger investors, have more pronounced social inequalities and larger vulnerable groups. On the other hand, they have greater capacity to invest in innovative projects, related to the adaptation to climate change and mitigation of the vulnerability of the urban environment and its inhabitants. The smaller towns have more limited resources, more limited access to programs for financial assistance, limited capacity for development of projects related to natural disasters risk management, and limited capacity for recovering damages. The above statements are supported by the eligibility criteria and priority axes of all operational programs for the period 2014–2020 and by the monitoring of the projects co-financed by the EU.

127. Yet another dimension of the economic factors is the impact (positive and negative, direct and indirect) that climate change will have on the global and local economic sectors. The OECD report ‘The economic consequences of climate change’ (2015)⁴⁶ offers a thorough analysis of the expected damage until 2060 and beyond, including ‘*changes in crop yields, loss of land and capital due to sea level rise, changes in fisheries catches, capital damages from hurricanes, labour productivity changes and changes in healthcare expenditures from diseases and heat stress, changes in tourism flows, and changes in energy demand for cooling and heating*’. All these damages affect the urban economy and the population’s well-being. The significance of direct and indirect impacts calls for a ‘multisectoral, multi-regional economic approach’, which coincides with the EU priority goal to stimulate integrated spatial and sectoral planning and territorial investments.

128. The last and sixth group comprises the policies, strategies, and plans, the development of which is dependent on political will, cooperation, and coordination, as well as on the capacity and diversity of the participants in decision making and their ability to work in a network. Among the most important documents are the current National Strategy for Climate Change Adaptation and the National Housing Strategy (both to be adopted by the end of 2017); the National Disaster Protection Strategy (2014–2018); the National Strategy for Management and Development of the Water Supply and Sanitation Sector in the Republic of Bulgaria (2014–2023); the Energy Strategy of the Republic of Bulgaria 2020 together with the National Energy Efficiency Action Plan 2014–2020; the National Programme for Prevention and Limitation of Landslides, Erosion, and Abrasion on the Territories along the Danube River and the Black Sea Coast 2015–2020; and the NCS D 2013–2025 and many others, with direct or indirect impact on the CCA policy for the urban environment. One of the main disadvantages of all these well-prepared documents with their action plans, monitoring systems, and indicators is their poor implementation, in most cases due to financial and/or political reasons.

⁴⁶ <http://espas.eu/orbis/sites/default/files/generated/document/en/OECD%20Climate%20Change.pdf>

129. The influence of the above six groups of factors on climate change in the urban environment would differ in the case of different extreme events and should be considered in view of the natural disasters, predominant, and typical for each region (see **Table 30** within **Annex 8**). According to the NSI, the most common disasters during 2010–2015 were fires (12,308), followed by floods (2,898), storms (738), and landslides (458) (NSI 2016c). This trend is expected to continue in future, so it can be assumed that these are the natural disasters posing the highest risks. On the other hand, the disasters expected to have the most serious consequences and damages include floods, landslides, storms, earthquakes, and fires (see **Tables 18** and **19** within **Annex 1**). Bearing in mind that there is no information about wild fires affecting the urban environment and that earthquakes are not climate-related, most attention should be given to floods and extreme temperatures with their multifaceted impacts on the urban environment.

1.3.2. Potential impact of climate change on the urban environment

130. The potential impact of climate change on the urban environment is examined through the identified weather-related events which are most likely to occur in different regions and cities—extreme temperatures (high and low), intensive precipitations, and because of them, floods and landslides, and urban water and air pollution. Prioritization of the risks considers the complexity of the urban environment, impact of different groups of factors, variety of urban settings, and urban morphology.

131. The ‘Risk and Vulnerability Analysis and Assessment of the Bulgarian Economic Sectors to Climate Change’ (2014) implements six types of urban environment components in terms of their functions and type of buildings by height: (a) Areas with high-rise buildings, complex type; (b) Areas with medium height buildings; (c) Areas with low-rise buildings; (d) Industrial zones; (e) Green and recreational areas; and (f) Areas for public services. For the purposes of the current assessment, these components are further developed to determine potential climate impact and vulnerability of different functional zones, public services, transport, and technical infrastructure and buildings (see **Figures 28, 29, 30** and **31** in **Annex 6** and **Table 19** in **Annex 1**).

Extreme temperatures

132. The urban environment vulnerability assessment in the ‘Risk and Vulnerability Analysis and Assessment of the Bulgarian Economic Sectors to Climate Change’ (2014), under RCP2.6, RCP4.5, RCP6.0, and RCP8.5 IPCC scenarios, presents the expected trends for 2016–2035 and the degree of vulnerability for the identified six types of urban components listed earlier. By the end of the selected period, the average temperatures are expected to increase at 1.5°C–2.0°C under all scenarios except for RCP6.0, where the expected increase is estimated at 1.0°C–2.0°C. The calculated index of 0.87 corresponds to the category of ‘extremely sustainable’ because until 2035, no drastic climate changes are expected with considerable impact on the urban environment components and characteristics in the country.

133. The percentage of hot summer days is projected to rise with over 20 percent in most cities in Southern Bulgaria, located in plain areas. The increased number of days with extremely high temperatures and the ‘heat islands’ in the cities will create higher risk in residential and public areas in big cities, with higher density of built-up zones, higher concentration of

activities, people, and cars, less greenery, and bad natural ventilation. The two biggest cities, Sofia and Plovdiv, located in the plains and surrounded by mountains, will be the most affected due to the temperature inversions and formation of ‘heat islands’. The biggest cities on the Black Sea coast will be favored by the almost constant breeze circulation due to proximity to the sea, except for the most densely built remote central parts and residential and industrial areas with compact structure.

134. Medium and small cities with predominantly individual houses and well-developed green systems, with green streets and river beds, as well as water bodies and currents will have better ventilation and cooling potential, and the projected impact is expected to be lower. The extreme high temperatures will have even less impact on the cities located in the mountain areas with elongated and indented relief and nearby forests (Smolyan, Gabrovo, Vratsa, Sliven, Troyan, Chepelare, Kazanluk, and so on).

135. The increased frequency of high summer temperatures will call for more frequent limitations on heavy motor traffic, which causes deformation of the road surfaces, including those within the urban boundaries. Such periods will exert higher strain on the energy system, typical for the coldest and the warmest periods alike. There will also be demands for increased quantities of water, bringing about water stress and the need for water rationing. The higher consumption of water and energy will lead to increased running expenses, already high for the average consumer and for the small- and medium-sized enterprises, with their limited budgets for renewal of the building infrastructure and for introduction of innovations for effective energy and water consumption.

136. Most prone to the risk of extreme high temperatures will be the poor because of their primitive living conditions, the homeless people, and the elderly with more vulnerable cardiovascular systems. In addition to the health risk, a considerable climate discomfort is predicted for urban populations in Eastern Europe, including Bulgaria.

137. Extreme low temperature projections under almost all scenarios and models are not expected to have a very high impact on Bulgarian cities because of the expectations for milder winters in the following decades. Nevertheless, such weather events should not be underestimated in a country like Bulgaria with almost 60 percent of the territory determined as mountainous or semi-mountainous, and 100 cities and 44 percent of the urban population located in such areas. The prolonged periods with extreme low temperature will have more adverse impact on small cities, located at high altitude in the national periphery due to their remote location from the main service providing urban centers.

Intensive precipitations and floods

138. The projected changes in the annual average precipitation for 2016–2035 in all the RCP scenarios show about 10 percent increase in precipitation for the whole country. Intensive precipitations are expected to pose higher risk for the urban environment, followed by prolonged ones.

139. The aftermath of increased precipitation and the frequency of days with intensive precipitation in the urban environment are connected mainly with their location, altitude, and proximity to still waters and rivers. This applies mainly to the cities along the Danube River

and those in the proximity of the Maritsa, Tundzha, Struma, Mesta, Arda, Yantra, and Iskar Rivers, and the lower parts of the Black Sea coastal area.

140. The Preliminary Flood Risk Assessments, conducted in 2013–2014 for all four river basin directorates in the country under the supervision of the MoEW, are based on historical data, collected by the local authorities and other sources. These studies cover all main floods, analyses of their adverse effects on people, property, technical infrastructure, and the economy. Forecasts of likely future occurrences are also included.⁴⁷ According to these assessments, there are a total of 1,903 registered floods, 1,028 of which are considered to have had considerable consequences plus 573 identified potential ones. They are grouped under four headings, following specific national criteria—human health, business activities, environment, and cultural heritage. The identified regions with significant potential flood risk for the country are 116, spread along 3,889 km, including 11 regions with 267 km along the Black Sea coast and 472 km along the Danube River. These regions cover the territories of 453 human settlements and 4 resorts in 130 municipalities, which represent half the country, including the capital city of Sofia. The next step in the implementation of the Floods Directive envisages the development of detailed maps for flood threats, indicating the level of vulnerability of each human settlement.

141. The rise in the Black Sea level occurs mostly in winter, accompanied by storm surge due to strong northern and north-eastern winds. The vulnerable areas along the coast have been identified through geographic information systems (GIS) by the Institute of Oceanology to the BAS in Varna and include the lower parts of the city, the areas along Kamchia River, Kranevo, and the area between Sunny Beach and Burgas, as well as parts of the United Nations Educational, Scientific and Cultural Organization (UNESCO)-protected city of Nessebar, Pomorie, and Burgas itself. Most vulnerable are the bay areas, open to the north and north-east (Palazov 2015).

142. The main causes for floods in the urban environment, except intensive precipitations, are the poor state of the old wastewater networks, big share of sealed soils unable to take in the increased surface waters, inappropriate landscaping and drainage, and badly maintained river beds, guiding the surface runoff to the built-up areas. The latter are considered among the main reasons for the damages in many of the peripheral urban areas. In Sofia municipality, there is an additional risk of flooding due to the neglected parts of the irrigation system in the Sofia valley, which was also used for drainage 25 years ago.

143. The identified potential flood impacts on the urban environment are damaged structures and ground floors and basements of buildings, flooded lower-level POS and pedestrian underpasses, public transport, and traffic disturbances. Very heavy intensive precipitations with high waters in combination with additional artificial factors such as mismanagement of the reservoirs and dams close by may have fatal consequences for human life.

144. Most vulnerable to these potential risks will be illegally built housing areas close to rivers and in flood-prone zones in the periphery of big and medium cities.

⁴⁷ See for instance, the Flood Risk Management Plan for the East Aegean River Basin Management Directorate, available at http://earbd.org/indexdetails.php?menu_id=399

145. The potential positive impact of the increased precipitations on the urban environment relates to increase of water resources and decrease of water stress.

Landslides

146. Closely related to intensive precipitations and floods are landslides in Bulgaria. Despite the extensive research, monitoring, and computer modelling, it is difficult to predict their activity or the correlated causes and potential impacts. Among the main causes are tectonic and modern movements, earthquakes, erosion, abrasion, precipitation, snow melting, and groundwater tables. Artificial factors—construction and mining works, outdated sewerage systems, irrigation, and vibrations—additionally provoke landslides. About two-thirds of the territory of Bulgaria has a potential for landslide reactivation (Berov et al. 2002).

147. According to the Register of Landslides in Bulgaria, nine new landslides were registered in 2015 within the urbanized areas of the cities. Their activity is most likely to occur in periods of intensive precipitation. Among the priorities for monitoring and stabilization are the most potentially endangered areas along the Danube River with additional impact of erosion, along the Black Sea coast due to additional impact of abrasion, and Eastern Rhodope. Landslides will affect buildings and transport infrastructure mainly on the urban periphery without completed sewerage system or areas close to riverbeds and high slopes. The impact may occur not only in the areas with illegally constructed poor housing, but also in new developments and luxury vacation villages with swimming pools that have poorly designed and executed engineering works or in violation of building regulations.

Earthquakes

148. Despite not being linked to climate change, earthquakes can result in additional disasters or exacerbate climate change impacts, like landslides, floods, accidents, epidemics, and interruption in communication and transportation systems. Most difficult is expected to be the situation in the densely populated and industrialized areas of the large cities, and in the urban areas with buildings predominantly designed and constructed before the introduction of modern seismic norms in 1987 and Eurocodes.

149. According to the seismic map of 1987, 98 percent of the territory of Bulgaria is potentially threatened by seismic impact with magnitudes of 7 or above, including 51 percent for magnitude 7, 28 percent for magnitude 8, 19 percent for magnitude 9, and above. These territories accommodate about 80 percent of the total population.

150. The potential impact on the urban environment is expected to affect the overall urban life with damages to all types of buildings and infrastructure, interruption of services and transportation, and threatening human safety. The collapse or damages on buildings, built on the street construction line along main urban roads, may additionally interfere rescue operations and accessibility. In the urban environment sector, reducing the risk and vulnerability of buildings requires a more integrated and comprehensive approach, based on better risk-informed land use planning and development control, higher quality of structural design, and construction quality assurance, applied for both new and existing structures.

Main findings

151. The main findings of the analysis and assessment of climate change risks and vulnerability are as follows:

➤ Extreme temperatures:

- **Higher temperatures leading to the formation of heat islands**, which will occur more often and will last longer, will have the greatest impact on big cities with increased density and intensity of construction.
- **Extremely low temperatures and cold waves are not expected to occur frequently** but can last for several consecutive days and affect life in both big and small mountain cities. When combined with abundant snowfall, they can endanger vital services, including food supply.

➤ Intense precipitation:

- **Flooding will increase in frequency and affect all settlements and cause floods for both big cities and small towns.** The most vulnerable will be those housing areas located near watercourses and the neighborhoods of large cities, built illegally on their periphery in flood-prone zones.
- **Hailstorms, which are often combined with intensive precipitations**, will also cause floods in cities and damage buildings, cars, public transport, and infrastructure.
- **Prolonged precipitation, combined with a rise in groundwater levels or wastewater seepage and some additional human factors, will trigger landslides**, especially those in the most sensitive areas of the Black Sea and Danube cities. Additional aggravating factors in this respect include abrasion and erosion.
- **Landslides can be provoked by earthquakes, typical of the country.** Although earthquakes are not related to climate change, their large impact on the urban environment and people's lives should be considered in the adaptation process.

➤ Water resource scarcity:

- **High temperatures combined with droughts will increase water stress** in settlements where there is water scarcity and obsolete networks that lose large amounts of water.

152. Extreme weather events will affect more significantly the population in risk - those living below the poverty line and under housing standards, the elderly, the sick - a higher proportion of which is concentrated either on the national or urban periphery.

153. The assessment of climate change risk is presented in **Table 6**, summarizing main findings.

Table 6. Potential direct risks and opportunities for the urban environment sector

	Risks	Opportunities
Extreme high temperature (including heat spells and heat waves)	<ul style="list-style-type: none"> • Health problems of older population, especially those living in low standard housing, and small children 	
	<ul style="list-style-type: none"> • Health and safety problems for construction outdoor workers (for example, heat stress) 	
	<ul style="list-style-type: none"> • Ineffective use of POS due to deterioration of microclimatic conditions and climate discomfort 	
	<ul style="list-style-type: none"> • Higher pressure on parks and gardens and water sports facilities due to the increased number of visitors 	
	<ul style="list-style-type: none"> • Higher demands for electricity supply for cooling systems of housing and public buildings in summer 	<ul style="list-style-type: none"> • Lower demands for electricity supply for heating systems of housing and public buildings in warmer winters
	<ul style="list-style-type: none"> • Urban fires in areas close to agricultural lands 	
	<ul style="list-style-type: none"> • Damage and deformation of streets asphalt cover, hindering urban traffic and mobility 	
Extreme low temperatures (including cold spells and cold waves)	<ul style="list-style-type: none"> • Health problems to older population, especially those living in low-standard housing or the homeless 	
	<ul style="list-style-type: none"> • Health and safety problems for construction workers working outdoors 	
	<ul style="list-style-type: none"> • Ineffective use of POS due to extreme low temperatures and climate discomfort 	
	<ul style="list-style-type: none"> • Higher demands for electricity supply for heating systems of housing and public buildings 	
	<ul style="list-style-type: none"> • Higher traffic and mobility risks due to possible streets' icing 	
	<ul style="list-style-type: none"> • Broken electricity power lines due to ice build-up and electricity supply cuts 	
Increased precipitation and humidity	<ul style="list-style-type: none"> • Flooding of ground floors of private and public buildings 	<ul style="list-style-type: none"> • Reduced air pollution after precipitation
	<ul style="list-style-type: none"> • Reduced use of flooded POS 	<ul style="list-style-type: none"> • Less water demands for irrigation of parks, gardens, and urban green areas
	<ul style="list-style-type: none"> • Surface water pressure on urban sewerage systems and potential drinking water reservoirs pollution 	
	<ul style="list-style-type: none"> • Potential public transport traffic disruptions due to flooding of streets and/or accidents 	
	<ul style="list-style-type: none"> • Damages to archaeological sites and listed buildings 	

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	Risks	Opportunities
	<ul style="list-style-type: none"> • Human life losses in urban housing areas built close to rivers, increased mortality risk, especially for the most vulnerable population—elderly, sick, poor, living in flood-prone zones 	
Increased water stress (including droughts)	<ul style="list-style-type: none"> • Water stress on cities with water shortages and water supply regime 	
	<ul style="list-style-type: none"> • Reduced water in reservoirs for regular urban water supply 	
	<ul style="list-style-type: none"> • Endangered food production and urban population supply 	
	<ul style="list-style-type: none"> • Insufficient water for urban green areas, parks and gardens 	
Increase in high winds and storms	<ul style="list-style-type: none"> • Incidents with pedestrians in urban open spaces during storm winds from falling trees and objects 	<ul style="list-style-type: none"> • Better urban air quality after strong winds and better ventilation
	<ul style="list-style-type: none"> • Damaged trees and flowers in urban parks, gardens and POS 	
	<ul style="list-style-type: none"> • Disrupted public transport system schedule 	
	<ul style="list-style-type: none"> • Damage to urban electricity supply infrastructure (for example, from falling trees) causing power disruption and increased costs for repair 	
Increase in frequency and severity of hailstorms	<ul style="list-style-type: none"> • Broken windows and damaged facades of public and residential buildings and damaged cars 	
	<ul style="list-style-type: none"> • Possible disruptions of the public transport system schedule 	
	<ul style="list-style-type: none"> • Damaged trees and flowers in urban parks, gardens, and POS 	
	<ul style="list-style-type: none"> • Potential pressure on surface waters sewerage system 	
	<ul style="list-style-type: none"> • Potential information and communication technology (ICT) air facilities damages 	
Heavy snowfall and storms	<ul style="list-style-type: none"> • Limited accessibility, mobility, services and food supply, especially in remote small towns 	<ul style="list-style-type: none"> • Increased options for children to play outdoors after a snowfall in the winter season
	<ul style="list-style-type: none"> • Limited mobility and increased number of accidents and injuries as a result of snow cleaning and collection delay 	
	<ul style="list-style-type: none"> • Disrupted public transport system schedule 	
	<ul style="list-style-type: none"> • Damage or disruption of electricity supply systems 	
	<ul style="list-style-type: none"> • Damage and/or disruption of ICT air facilities 	

	Risks	Opportunities
	<ul style="list-style-type: none"> Increased financial burden on municipalities for winter maintenance of the urban road network system 	
	<ul style="list-style-type: none"> Increased pressure on emergency aid facilities and staff during and after heavy snowfalls 	
Landslides	<ul style="list-style-type: none"> Degradation and destruction of residential and public/commercial buildings and facilities 	<ul style="list-style-type: none"> Better motivation for local authorities to remove illegal constructions in landslide risk zones
	<ul style="list-style-type: none"> Degradation and destruction of transport infrastructure and underground water supply and sewerage networks 	
	<ul style="list-style-type: none"> Loss of recreational facilities in coastal areas (for example, damaged beaches, clogged bays from abrasion with no access for swimming) 	
	<ul style="list-style-type: none"> Endangered gas supply system 	
Earthquakes	<ul style="list-style-type: none"> Human life losses, injuries, posttraumatic stress 	
	<ul style="list-style-type: none"> Degradation and destruction of residential and public/commercial buildings and facilities 	<ul style="list-style-type: none"> Seismic retrofitting reduces risks related to the other hazards.
	<ul style="list-style-type: none"> Degradation and destruction of transport infrastructure and underground water supply and sewerage network 	
	<ul style="list-style-type: none"> Endangered gas supply system 	
	<ul style="list-style-type: none"> Electricity supply cuts and ICT interruptions 	
	<ul style="list-style-type: none"> Accessibility and rescue operations problems 	
Air pollution	<ul style="list-style-type: none"> Higher mortality among the elderly and the sick, health issues of small children 	<ul style="list-style-type: none"> Better and more efficient use of parks and gardens
	<ul style="list-style-type: none"> Reduced use of POS due to possible activation of respiratory diseases and allergic reactions 	
	<ul style="list-style-type: none"> Potential contamination of soils and green areas along and/or close to pollution sources and urban motorways 	
	<ul style="list-style-type: none"> Contamination of facades' materials (either glass or stone lined) and deterioration of city image 	

154. The expert assessment of the three categories of cities in terms of population and the grouping in terms of their geographical location proves that small cities of all types have very low capacity to deal with vulnerability and to manage disaster risks. On the other hand, the residents of somewhat dispersed low-rise houses, with adjacent open spaces and green areas can find easier refuge in case of extreme temperatures and earthquakes. The big cities are in general better equipped to deal with water stress and extreme temperature, and they have higher potential to deal with CCA (see *Table 18* within *Annex 1*).

Disaster risk management

155. The activities for population protection in case of emergency or disasters are carried out by the Unified Rescue System according to Disaster Protection Plans. The Unified Rescue System includes structures from ministries and agencies, municipalities, commercial companies and sole entrepreneurs, emergency medical care centers, other medical and health care establishments, non-profit organizations, including voluntary formations under Article 41 of the Disaster Protection Act, and armed forces. Disaster Protection Plans are reviewed and updated at least once in five years after their adoption, as well as following legal framework changes, related to their implementation. A Disaster Risk Reduction Council was created as a permanent body to the Council of Ministers to ensure coordination and cooperation in the implementation of state policy in the field of disaster protection. The Council performs the functions of a national disaster risk reduction platform in implementation of the Hyogo Framework for Action 2005–2015 and Sendai Framework for Disaster Risk Reduction 2015–2030.

156. The development of the National Early Warning System started in 2009. It comprises two subsystems—one aimed at the population and another one, related to the executive authorities and the Unified Rescue System for Disaster Prevention. The early warning system is designed for simultaneous warning of large groups of people of impending or current disasters.

157. The subsystem for early warning of the executive authorities is designed on four levels—national, regional, municipal and local, whereby the last one includes automated warning systems in the enterprises, dealing with hazardous substances and materials as potential causes for industrial accidents and other disasters. This subsystem addresses a wide group of officials, including governors, mayors, enterprise managers, regional and municipal coordinating centers, and parts of the unified rescue system. There is a database containing 28,000 persons who can be warned and mobilized in cases of emergency.

158. In special cases, formations of the Bulgarian army can also be mobilized for control over and/or mitigation of disaster consequences. The corresponding organization covers the planning, preparation, warning, and maintenance of the earmarked equipment and resources.

159. A serious challenge for the effectiveness of the risk management system is the insufficient public awareness of the principles, objectives, and activities, related to reducing the disaster risks, as well as of the activities and behavior during and following disasters. The coordination of the responsible institutions is well below the required levels, which is due in part to the frequent change of regulations and the poor communication among the responsible units. Therefore, in the disaster risk reduction programs, developed by municipalities in pursuance of Art. 65b item 1 of the Disaster Protection Act (amended in 2016), priorities and actions for the protection of the lives and health of the population, of property, as well as infrastructure measures for information, communication and training at all levels, are laid down. The program is accompanied by a municipal plan with specific measures for disaster protection, which is reviewed and updated annually. An annual report on the state of disaster protection on the territory of the municipality with evaluation of the implemented measures is prepared by the appointed municipal Council for disaster protection.

160. There is considerable potential for improvement of the system through attraction of the still poorly developed volunteer structures, better utilization of the nongovernmental organizations (NGOs), further development of coordination networks including all participants, as well as development of information and knowledge systems. The management of activities related to the recovery of damages and provision and allocation of the necessary funds also leave much to be desired.

1.4. Conclusions

161. The above analysis demonstrates, that under the conditions of climate change, the urban environment in Bulgaria is vulnerable and at considerable risk. The data supporting such conclusion include the obsolete and often inadequate infrastructure in the big and small settlements alike and the large proportion of aging population, predominantly with low income and below the poverty line. These could be considered ‘objective’ factors, reflecting the demography and the relatively low level of economic development and living standards in the country, which is the poorest in the EU. In addition, there is a very important ‘subjective’ factor, namely the poor level of awareness of the problems under consideration, of their causes, possible prevention and management, among both the decision makers and the general public.

162. The analysis also suggests that the policies and initiatives addressing the adaptation to climate change should be oriented in two directions—toward the big cities, where there is a concentration of a considerable part of the population and which enjoy considerably more potential and expertise, and toward the smaller cities and the villages in the periphery, with less numerable but much more vulnerable population, keeping in mind the specifics of each region and settlement. At the same time, a more comprehensive and up-to-date philosophy of integration of all efforts and resources (including information and knowledge) of the different sectors within a unified national strategy will undoubtedly make these policies more effective.

Chapter 2. Baseline - Policy Context

163. This chapter examines the institutional, political, and legislative context and processes involved in adapting to climate change in the urban environment. The political issues are connected to the policies of the participating European-, national-, and local-level institutions, and main stakeholders. The legislative issues cover related legislation, including regulations and norms, and urban development planning instruments related to CCA. The social aspects include public attitudes, knowledge and levels of participation, response culture, and awareness. The analysis covers links to European policies, directives, and programs. Also, the best practices in institutionalizing and operationalizing the adaptation process in other European countries have been reviewed as a basis for examination and evaluation of activities undertaken in Bulgaria, including gaps and barriers in implementing adaptation measures.

2.1. State of Awareness, Understanding of Future Consequences of Climate Change, Knowledge Gaps

164. The ideas of sustainable urban development were promoted in the World Conference on Human Environment (United Nations Conference on the Human Environment [UNCHE]), held in Stockholm in 1972. In 1987, the World Commission on Environment and Development report 'Our Common Future' (World Commission on Environment 1987) (Brundtland Commission Report) presented the challenges faced by cities during their expansion, including problems of an increasing urban population and its food, drinking water, and energy supply, and decent housing for the poor. Twenty years after the UNCHE, Agenda 21 (UN Sustainable Development 1992) from the United Nations Conference on Environment and Development in Rio de Janeiro set goals for sustainable human settlements' development, including sustainable land-use planning and management and integrated provision of environmental infrastructure and focused on planning and management in disaster-prone areas. Most of the national- and local-level initiatives, scientific forums, research, and publications that followed in the next decade gradually adjusted their priorities to climate change.

2.1.1. Research policy and institutions in the urban environment sector

165. The shift from urban sustainability toward CCA of the urban environment at the end of the 20th century is reflected in the research policy of almost all planning professional bodies and academic institutions in Europe.⁴⁸ The improved coordination of education, research, and practice in the field, and the exchange of scientific knowledge and experience resulted in better-informed and evidence-based decisions and increased awareness throughout European countries.

166. Although urban environment sustainability concerns emerged in Bulgaria in the early 1970s, following the global trends and the rise of environmental movements, climate change and future consequences became a political and research issue in the last two decades. The messages from the global and European forums were reflected first in national policies, plans, and programs, to be followed by research and educational practices in the field of urban ecology

⁴⁸ <http://www.rtpi.org.uk/knowledge/topics/climate-change/our-seven-commitments-on-climate-change>, <http://www.eukn.eu/e-library/project/bericht/detail/european-cities-and-climate-change/>, <https://isocarp.org/news/ipcc-special-report-cities-climate-change/>

and sustainability. Over a long period, the main focus of research policy remains on energy efficiency as a result of the country's international and European commitments. Comprehensive studies on climate change impact on the urban environment are still missing.

167. The National Strategy for Scientific Research 2020, adopted in 2011, and its updated version until 2025,⁴⁹ presents a fair assessment of the state of science and scientific institutions. Among the main problems are poor management, unjustified closure of research units during the 1990s, ineffective financing, and limited access to information and research data. Within the set of strategic priorities in this document, there is no individual priority dedicated to climate change. A creative interpretation of its content could open the way for more systematic and holistic studies on the consequences of climate change on urban environment and human health.

168. Currently, climate change-related research is carried out by specialized research units at the BAS, including the NIMH, the National Institute of Geophysics, Geology, and Geodesy, and the Institute of Oceanology, Varna. In addition to data collection and processing, they monitor climate change, flooding, landslides, and earthquakes and provide research analysis and trends. Research, survey and maintenance of the landslides register in Bulgaria, including the ones in urban areas, is carried out by the geo-protection companies at MRDPW, located in Varna, Pleven and Pernik. One of the barriers to appropriate implementation of their scientific results in the analysis and planning for climate change is the limited access to research data and publications.

169. The ExEA at the MoEW collects and provides open access data about all climate components and is responsible for all country reports on the state of the environment. These reports are elaborated based on the information, analysis, and projections of the abovementioned research institutes, the NSI, the National Monitoring System on the Environment, and other relevant organizations.

170. Specialized research in the field of urban environment and construction is carried out by the National Research Institute for Constructions at the MRDPW. The institute has unique expertise for studying and testing construction materials and building behavior and stability in extreme high and low temperatures, storm winds, floods, and earthquakes. In recent years, it has worked with reduced capacity due to limited access to scientific programs and resources as a state commercial company.

171. Academic institutions, directly or indirectly related to urban environment and climate change, are the University of Architecture, Civil Engineering and Geodesy (UACG), the Technical University (TU) (Sofia), the University of National and World Economy (UNWE), and Sofia University (SU) 'St. Kliment Ohridski'. In most Bulgarian universities, academic research is mostly a matter of self-development rather than a well-grounded priority based on an institutional research agenda. PhD programs and young academic research follow similar logic. Climate change impacts on the urban environment is not sufficiently presented in the urban planning curriculum, thus reflecting the overall limited academic and professional capacity for promotion of aspects regarding CCA.

⁴⁹ National Strategy for Development of the Scientific Research in Republic of Bulgaria (2016–2025)
<http://www.mon.bg/?go=page&pageId=74&subpageId=143>

172. The number of small- and medium-size enterprises and private firms participating in research studies is negligible. A study by Market LINKS, Research and Consulting from 2005 shows more than 22,000 registered NGOs,⁵⁰ most of which only exist on paper with very few active ones working in the areas of urban research, environment, and climate change.

173. All these findings are considerable barriers for further capacity building and increasing understanding and awareness in the country, which is best measured through public engagement, communication access, and education.⁵¹

2.1.2. State of awareness and knowledge gaps

174. Environmental problems, especially those related to climate change, have been pushed to the background of the current political agenda in Bulgaria. This situation can be explained by the country's difficult economic situation and deep social problems, including poverty, unemployment, low health care level, and demographic crisis. During the last decade, the country's EU commitments on climate change require increased awareness and is found in all adopted political, legislative, and strategic documents for all sectors in the economy, including urban environment.

175. The concerns in Bulgaria about the consequences of climate change at the municipal level are related to local responsibilities to prevent and respond to natural disasters and problems, such as floods, water and air pollution, noise, transport casualties, drinking water shortages, excessive construction density, and destruction of green areas. In many cases, local authorities lack the competences and resources to take the necessary preventive and appropriate measures, usually asking for support from government institutions. Considering the extent to which these traditional municipal responsibilities are met, it appears hard to expect that they will develop quickly, thus securing proper adaptation to climate change and management of related risks. This is more likely to be a gradual process, extending into the future. At present, the only 'practical' measures related to climate change are limited to the preparation of documents at the national level and sparingly at the municipal level because of EU requirements.

176. CCA issues require awareness and understanding on all societal levels, from the government all the way down to individual citizens. NGOs in Bulgaria will need to play an important role in this process. Their current activities however are limited to addressing issues of designated protected areas and protection of the green system. A comprehensive and long-term vision on the urban environment and its problems, including the risks that derive from expected climate change is still lacking.

177. Some of the most important knowledge gaps that will challenge CCA in the urban environment in Bulgaria are the following:

- **Knowledge gaps** for relations between socioeconomic urbanization models and climate change scenarios; insufficient interdisciplinary and transdisciplinary approaches to urban environment climate change mitigation and adaptation;

⁵⁰ Image of the Bulgarian NGOs. SWOT analysis. Qualitative study among NGO's representatives and media, 2005. http://osi.bg/downloads/File/swot_analisys.pdf Market Links

⁵¹ <https://www.nature.com/nclimate/journal/v5/n11/full/nclimate2728.html>

- **Methodological gaps** - lack of commonly accepted methodology and relevant tools for climate change risks and vulnerability assessment at the city level; insufficiently developed methods and guidelines for climate change resilient cities' planning;
- **Information gaps** - lack of local-level scientific and technical information for different cities and different urban patterns or typologies; lack of information about non-residential public and private buildings' energy consumption and saving potential;
- **Technological gaps** - insufficient comparative analysis of traditional and 'green' buildings' consumption pattern and retrofitting costs;
- **Financial gaps** - few calculations of direct and indirect costs of damages, lack of cost and benefits assessment of implemented CCA actions, and cost of no-action or maladaptation; mainstreaming financial resources for CCA among different responsible institutions;
- **Implementation gaps** - low effectiveness of long-term measures and immediately applied ones; underdeveloped system of indicators for measuring the urban environment CCA impacts and results; and
- **Governance gaps** - no legislative tools for the implementation of CCA measures; no management tools in support of decision making, and poor communication skills for conflicts resolution and consensus building.

178. Generating knowledge and information at the local level will require additional data collection and research and longer-term observations. The most important challenge for Bulgaria however will be information exchange and knowledge communication if the required synergy in climate change mitigation and adaptation is to be achieved.

2.2. Experience with Urban Environment CCA in Other (EU) Countries

179. The overall framework of the EU environmental policy is determined by the 7th Environmental Action Programme till 2020, 'Living well, within the limits of our planet'. Two of its priority objectives address the urban environment 'to make the cities more sustainable' and 'to help the Union address international environmental and climate challenges more effectively'.⁵² The strategy, *Europe 2020*, sets the targets for reduction of GHG emissions up to 2050 with packages for climate and energy measures, which address sectors, closely related to urban environment. The EU's largest research and innovation program, Horizon 2020, finances flagship projects for CCA and contributes to knowledge generation.

180. The EU Strategy on adaptation to climate change 'Strengthening Europe's Resilience to the Impacts of Climate Change', adopted in 2013, aims to improve coordination and enhance capacity to respond to impacts of climate change at all governmental levels. Urban environment is not among the identified vulnerable sectors, but a cohesion policy is considered very important for Bulgarian regional and spatial development and the social and economic measures for reducing disparity. In favor of adaptation in the urban environment is the support to all member states and local authorities, provided by the European Platform Climate ADAPT and the Covenant of Mayors Initiative for Climate and Energy. The evaluation process of the

⁵² EC 7th Environmental Action Programme till 2020 'Living well, within the limits of our planet', <http://data.europa.eu/eli/dec/2013/1386/oj>

strategy is in progress and by the end of 2017, it should examine the relevance, effectiveness, efficiency, coherence, and EU added value of the implemented actions.⁵³

2.2.1. EU political context of CCA in the urban environment

181. In the EU, there is strong political support for researching climate change impacts on the urban environment, including urban planning and development. This is clearly reflected in strategic documents and assessments and best presented in the two consecutive reports on relating to the urban environment by the EEA in 2012 and 2016.⁵⁴ Both reports compliment other studies and information sources and support effective participation of local governments in the adaptation process.

182. The first report ‘Urban Adaptation to Climate Change in Europe: Challenges and Opportunities for Cities Together with Supportive National and European Policies’ presents the most important potential impacts of extreme temperature, precipitations, floods, and drought on cities, according to their size, geographic location, urban pattern, and economic development. It offers a range of adaptation responses for different spatial levels in a well-structured methodological and multilevel policy framework.

183. The second report ‘Urban Adaptation to Climate Change in Europe 2016: Transforming Cities in a Changing Climate’ builds upon the previous one, reviews the progress made in CCA in cities across Europe, and supplements other tools, publications, and initiatives on urban environment adaptation. It addresses a wider target audience including decision makers at different levels, a variety of stakeholders, researchers, planning practitioners, and representatives of the public. The report provides better links between socioeconomic factors and climate change trends, promotes a systemic approach, and presents mitigation and adaptation from a broader perspective. The characteristics of the analyzed adaptation approaches (coping, incremental, and transformational adaptation) are presented in terms of their aims, scale, time frame, planning, and management. Priority is given to the transformational adaptation approach because of the added quality by complex measures and potential for making cities more resilient to climate change and more attractive and sustainable places through creative urban design. The selected areas of action are governance, knowledge and awareness, planning and implementation, economics of urban adaptation, and monitoring and evaluation (M&E).

184. The final messages in these reports are about expanding urban planning horizons in space and time, reshaping the urban environment by removing vulnerable hotspots, upscaling knowledge, and broader, more effective and sustained stakeholders’ participation, and interventions tailored to the local needs. The integration of urban environmental aspects of adaptation in national policies is suggested to be through mainstreaming urban issues into the National Adaptation Strategy (NAS) of the Netherlands (EEA 2016, p. 53).

185. According to the EEA report, most Bulgarian cities are in the Central and Eastern European group, except for those at the Black Sea coast, appearing in the Mediterranean region. In this broad classification by regions, the cities that are geographically located in the

⁵³ https://ec.europa.eu/clima/policies/adaptation/what_en#tab-0-1

⁵⁴ <https://www.eea.europa.eu/publications/urban-adaptation-2016>

mountainous areas in Bulgaria did not find a proper place.

186. Preceding these CCA reports, a number of specific strategic planning documents over the last two decades were adopted to support smart and sustainable urban and regional development. The Guiding Principles for Sustainable Spatial Development of the European Continent,⁵⁵ adopted in 2000, underlines the protection of the environment, mitigation of harmful effects, and the impacts of natural disasters on the population, settlement structures, and buildings. These principles address specific recommendations for different European regions, including urban areas, flood plains, and coastal and mountain regions, and have been implemented in planning documents by almost all European countries.

187. The Territorial Agenda of the European Union 2020 (TA2020) ‘Towards an Inclusive, Smart and Sustainable Europe of Diverse Regions,’⁵⁶ adopted in 2011, placed the geographically diverse impacts of climate change and environmental risks among the main challenges and opportunities of the new millennium. The officials recognized the need of territorially based different approaches and better ‘territorial coordination of policies, especially climate, energy, water management, agriculture, housing, tourism, and transport.’

188. The Climate-ADAPT⁵⁷ platform, established as a partnership between the European Commission (EC) Directorate-General for Climate Action (DG CLIMA), the Joint Research Centre (JRC), other Directorate Generals, and the EEA, is one of the main source of information for CCA. Its main aim is to provide data on expected climate change in different regions and to share information about institutions, developed national and local strategies and assessments, adaptation case studies, implemented actions, and applied planning methods and tools. The urban environment is not among the main sectors for information and data classification, but urban areas are considered as a separate spatial category/level after countries and transnational regions.

189. European countries are at different levels of development and so is the adoption of their CCA documents. By the end of 2017, 23 European countries adopted such documents, while others were in a process of preparation. If the EC deems progress in the coverage and quality of national strategies insufficient, it will consider proposing a legally binding instrument. The selection of countries for the purposes of this report is based on literature review and different nations’ CCA documents’ analysis. The selected reference countries are the United Kingdom and Austria—the first being among the leaders in this area, and the second, an example of a well-developed urban sector.

2.2.2. The United Kingdom

190. The United Kingdom’s overall urban and spatial policy is based on the integration of the environment with various sectors—urban, transport, agriculture, and food production. This is reflected in the structure of the large Department of Environment, Foods, and Rural Affairs

⁵⁵ ‘Guiding Principles for Sustainable Spatial Development of the European Continent,’ adopted at the 12th session of the Council of Europe Conference of Ministers Responsible for Spatial/Regional Planning (CEMAT) in Hanover 2000, <http://www.coe.int/t/dgap/localdemocracy/cemat/VersionPrincipes/Anglais.pdf>

⁵⁶ TA2020 ‘Towards an Inclusive, Smart and Sustainable Europe of Diverse Regions,’ adopted at the informal meeting of ministers responsible for Spatial/Regional Planning in Gödöllő, Hungary (2011). http://www.nweurope.eu/media/1216/territorial_agenda_2020.pdf

⁵⁷ <http://climate-adapt.eea.europa.eu/countries-regions/>

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(DEFRA). The country’s comprehensive climate adaptation program was launched in 2000 as a responsibility of this ministry. The Climate Change Act, that came into force in 2008, updated the National Adaptation Programme (NAP) and set up a multilevel framework of planning, assessment, governance, and management of CCA. Through this act and the established partnerships at the regional and local levels, the United Kingdom institutionalized its overall CCA system. The national policy responsibility is shared between England, Northern Ireland, Scotland, and Wales.

191. The NAP’s ‘Making the Country Resilient to a Changing Climate,’ published in 2013, addresses the urban environment in Chapter 2: Built Environment, and sets the following vision: *“Buildings and places and the people who live and work in them are resilient to a changing climate and extreme weather and organizations in the built environment sector have an increased capacity to address the risks and take the opportunities from climate change.”* As a result of the assessment and the expected impacts by 2020, the flooding in England and Wales is given the highest priority. Second priority is given to the risk of projected higher temperatures in the cities, and third, to pressure on water resources.

Table 7. Urban environment sector

Focus Area	Objectives	Actions to Address Priority Risks
1. Flood and coastal erosion risk management (FCERM)	Objective 1: To work with individuals, communities, and organizations to reduce the threat of flooding and coastal erosion, including that resulting from climate change, by understanding the risks of flooding and coastal erosion; to put in place long-term plans to manage these risks and make sure that other plans take account of them.	Implement National FCERM ⁵⁸ for England
		Secure, together with industry, new arrangements for flood insurance beyond 2013
		Develop local flood risk management strategies that set out the approach to managing local flood risk and consider the effect of future climate change and the increasing severity of weather events
2. Spatial planning	Objective 2: To provide a clear local planning framework to enable all participants in the planning system to deliver sustainable new development, including infrastructure that minimizes vulnerability and provides resilience to the impacts of climate change	Implement the National Planning Policy Framework (NPPF) ⁵⁹
		Update planning practice guidance to support the implementation of the NPPF
		Climate Ready will support the Local Government Association’s ⁶⁰ Climate Local Initiative to signpost advice, tools, and examples that can help councils take action to improve the resilience of the local built environment
		Implement Green Infrastructure Partnership (GIP) ⁶¹ work on adaptation

⁵⁸ National FCERM Strategy for England <https://www.gov.uk/government/publications/national-flood-and-coastal-erosion-risk-management-strategy-for-england>

⁵⁹ National Planning Policy Framework <https://www.gov.uk/government/publications/national-planning-policy-framework--2>

⁶⁰ <http://www.local.gov.uk/topics/environment-and-waste>

⁶¹ GIP is launched by DEFRA in 2011. Since 2014 is run by the Town and Country Planning Association (TCPA), founded by Sir Ebenezer Howard in 1899. <https://www.tcpa.org.uk/pages/category/green-infrastructure-partnership>

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Focus Area	Objectives	Actions to Address Priority Risks
3. Increasing adaptive capacity in the sector	Objective 3: To help businesses and industries in the sector to access skills, training, knowledge, and tools to understand and manage climate change risks Objective 4: To ensure that investors and developers have the financial and appraisal decision tools they need to support and promote adaptation to climate change	Implement priority actions to increase the level of skills and training in the sector
		Disseminate learning from the Technology Strategy Board’s Design for Future Climate competition
		Develop guidance on making a business case for CCA
4. Making homes and communities more resilient	Objective 5: To increase the resilience of homes and buildings by helping people and communities to understand what a changing climate could mean for them and to act to become resilient to climate risks	Continue to deliver water efficiency campaigns to households and businesses
		Continue to encourage the uptake of property-level protection to reduce the impacts of floods on people and property
		Disseminate guidance on overheating risk
		Review of Standard Assessment Procedure (SAP) in relation to overheating
		Review of the framework of building regulations and local housing standards
5. Longer-term implications	Objective 6: To explore and build understanding of the long-term implications of climate change for the location and resilience of population centers	Ongoing national coastal erosion risk mapping work
		Review of the long-term investment strategy

Source: The NAP, United Kingdom. Compiled by the NCRD.

192. The NAP was developed in collaboration with about 270 relevant stakeholder organizations and promotes a key role for local governments and core cities in partnership and networking to implement innovative projects for CCA in the urban environment. It is supported by an agreement, signed by the core cities (Councils from Birmingham, Bristol, Leeds, Liverpool, Manchester, Newcastle, Nottingham, and Sheffield), London Councils and the Greater London Authority (GLA) for cooperation in periods of significant budgetary constraints or competition for resources.

193. Part of the strategy is the National Climate Change Communications Strategy of the United Kingdom ‘Tomorrow’s Climate – Today’s Challenge’,⁶² which aims to coordinate campaigns in different parts of the country. It was made public in 2006 and recommended elaboration of communication plans and programs. The initiatives should send clear messages for changing public attitudes toward climate change and social behavior.

194. The U.K. Climate Change Risk Assessment 2017 Evidence Report is based on the latest understanding of current and future climate risks and opportunities, vulnerability, and

⁶² <http://media.nationalarchives.gov.uk/index.php/climate-change-tomorrows-climate-todays-challenge/>

adaptation and identifies six priority risks for the next five years, scored by urgency. It upgrades the previous assessments, considering international climate risks that could have consequences for the United Kingdom and the interdependencies between the various sectors and climate risks. Despite the work done at different levels on implementation of recommended adaptation actions and dissemination of knowledge about climate change risks and vulnerabilities, the 2017 assessment shows that more actions are needed in the urban sector.

2.2.3. Austria

195. Austria is home to the International Commission for the Protection of the Danube River (ICPDR),⁶³ established in 1998 with 14 participating states, cooperating with the EU in integrated Danube River basin management. The ICPDR developed the Climate Adaptation Strategy for the Danube River Basin, adopted in 2012.⁶⁴ The country has a well-developed and well-coordinated network of research organizations, cooperating on research and knowledge transfer in the areas of environmental protection, spatial, landscape and urban planning, water management, and soil protection.

196. Climate change policy implementation is a main responsibility of the Austrian Federal Ministry for Agriculture and Forestry, Environment, and Water Management. The ministry cooperates with research institutions, NGOs, and representatives of civil society. Cooperation among the main stakeholders is supported by the National Climate Change Committee and the National Climate Change Council, established under the Climate Protection Act (2011) (Nachmany et al. 2015).

197. Austria's National Climate Change Adaptation Strategy was adopted in 2012 and is the result of joint efforts of different ministries, nine provincial states, interest groups, stakeholders, NGOs, and other institutions, including the Austrian Environment Agency.⁶⁵ The consultation process on the strategy involved about 100 institutions. The first progress report on the implementation of the strategy was adopted in 2015. One year later, a new funding program was launched, providing financial support to the regions to implement the recommended measures.

198. The first part of the strategy represents the Strategic Framework, and the second, an Action Plan for 14 sectors, among which construction and housing, spatial planning, and cities with the latter focusing on the green system and POS. Special attention is given to the social aspects of climate change and to the impacts on the quality of life with respective recommendations (see **Table 31** within **Annex 9**).

199. The main aims of the strategy are focused on cooperation and synergy, links between areas of actions and flexible recommendations, multilevel interdisciplinary research, capacity building, and awareness development. The guiding principles of adaptation and criteria for prioritizing the recommendations for actions, despite being generic, can be applied by different sectors, administrative levels, and stakeholders.

⁶³ <https://www.icpdr.org/main/activities-projects/climate-change-adaptation>

⁶⁴ ICPDR Strategy on the Adaptation to Climate Change. 2012.

https://www.icpdr.org/main/sites/default/files/nodes/documents/icpdr_climate-adaptation-strategy.pdf

⁶⁵ Environment Agency Austria (UBA-Ö)

http://www.umweltbundesamt.at/en/services/services_climate/services_climate_references/climateregulatory/

200. The actions recommended for the urban environment sector clearly demonstrates the complicated and comprehensive character of the sector and the cross-cutting issues. They address mainly flood risk, heat-related health risks, and droughts. The objectives and recommended measures for the construction sector could be considered as common for all sectors:

- Improvement of the information availability and accuracy and creation of reliable databases;
- Demonstration of the advantages of climate change-adapted sectors;
- Awareness raising and dissemination of knowledge about adaptation and the necessary measures; and
- Creation of a sound knowledge base for the implementation of measures.

201. In the overall process of implementation of the CCA strategy, an important role is assigned to the Austrian Conference on Spatial Planning (ÖROK)⁶⁶ which is a key actor for implementation of measures in the area of spatial planning, housing, and construction.

202. Both selected examples demonstrate that the success of the CCA depends not on a perfect single strategic document, but on the development and implementation of a comprehensive and viable program, supported by an interactive platform and wide public participation.

2.3. EU CCA Legal Framework and Policies in the Urban Sector

203. The EU environment policy is based on Article 11 and 191–193 of the Treaty on the Functioning of the European Union. Under Article 191, combating climate change is an explicit objective of the EU’s environmental policy framework. The EU has no specially developed regulations on urban planning and city development which has long been in the shadow of regional politics. Only in the last decade, as a result of the efforts of scientists, academics, professional organizations, and the European Committee of the Regions, and after a series of forums, projects, and publications, these issues have taken their proper place among the priorities of the EU. The guidelines and principles of integrated and sustainable urban development are shaped by policy, programs, and strategic charters, marking the scope and content of all city plans and programs of the last three decades.

2.3.1. EU reports on urban legal frameworks and policies

204. EU policies in general reflect the global trends and commitments of the EU to the global forums’ declarations and recommendations for further actions. In 2016, during the UN Habitat III New Urban Agenda, world leaders pledged to promote ‘environmentally sustainable and resilient urban development’ and ‘CCA and mitigation’ as well as to ‘support cities and human settlements, their inhabitants, and all local stakeholders to be important implementers’.⁶⁷

⁶⁶ The ÖROK was founded in 1971. Established by the federal government, the Länder, and municipalities to coordinate spatial development at the national level. It is responsible for the development and implementation of the Austrian Spatial Development Concept, adopted in 2011. <http://www.oerok.gv.at/english-summary/>.

⁶⁷ The New Urban Agenda Habitat III, adopted on the UN Forum Habitat III, Quito 2016.

205. Accordingly, the EU committed itself to implement the UN agenda through the European Urban Agenda,⁶⁸ based on three pillars—better legislation, better funding, and better knowledge. The EC is committed (a) to share the global vision for sustainable and integrated urban development; (b) to participate in developing a global, harmonized definition of cities; and (c) to foster cooperation between cities in the field of sustainable urban development. The drafted Action Plan is based on seven priority themes—the seventh being directed to climate adaptation and focused on vulnerability assessments, climate resilience, and risk management. In the next few years, the implementation of the European Urban Agenda will be one of the main challenges.

206. There is no single European convention directly focused on urban environment nor on CCA, except the ones on archaeological and architectural heritage protection. The first European Urban Charter: ‘Charter without a Status of Convention’, adopted in 1992, recognized the urban citizens’ rights to an unpolluted and healthy environment, affordable and salubrious housing, health care facilities, sustained development, and participation in urban management.⁶⁹ The adopted principles emphasized the protection of nature and green areas in the cities, pollution control and reduction, provision of good quality services, and implementation of energy- and resources-saving policies as an obligation of the local authorities. Most of these principles could be found in the CCA documents at the national and local levels.

207. Fifteen years later, the European Urban Charter II: Manifesto for a New Urbanity,⁷⁰ adopted in Strasbourg, laid down the principles of good urban governance aiming at reduction of the environmental footprint of the towns and cities, preservation of natural resources and biodiversity, and energy efficiency. It recognizes the role of urban form and structure, land use, and density in sound environmental planning.

208. Regarding the policy initiatives for CCA, the 2010 Toledo Declaration⁷¹ should be seen as a cornerstone. It addresses current urban challenges and implementation of the *Europe 2020* strategy by achieving smarter, more sustainable, and socially inclusive urban development. To achieve urban sustainability and a genuine ‘green and ecological’ regeneration of cities, the document recommends mixed-uses urban structures for combating urban sprawl, urban metabolism, renewable energies, and consumption of local green products to shorten consumption circuits, and protecting landscape, forestry, water resources and agricultural areas around cities.

209. For the last two decades, the European climate policy has focused almost exclusively on mitigation of climate change. It was only well after the turn of the century, when the impacts of climate change started being increasingly observed, adaptation was added to the policy agenda. Despite a flurry of activity in EU cities on climate change and growing interest in the research community, climate policy at city-scale remains fragmented and more flexible tools, to facilitate good decision making, are still lacking.

⁶⁸ European Urban Agenda <https://ec.europa.eu/futurium/en/urban-agenda>

⁶⁹ ‘European Urban Charter: Charter without a Status of Convention,’ 1992 (Revised 1996) <https://wcd.coe.int/ViewDoc.jsp?p=&id=887405&direct=true>

⁷⁰ European Urban Charter. Manifesto for a New Urbanity, 2008 <https://wcd.coe.int/ViewDoc.jsp?p=&id=1302971&direct=true>

⁷¹ Toledo informal ministerial meeting on Urban Development. Declaration 2010. http://urban-intergroup.eu/wp-content/files_mf/es2010itoledodeclaration.pdf

210. Many of the decisions relating to future urban development require information on climate change risks to cities. The short review of papers on CCA reveals a rich variety of quantifications and valuations of climate risks at the city-scale. The climate risks most frequently addressed in existing studies are associated with rising sea-levels, floods, health, water resources, and pollution.

2.3.2. Institutions and their relevant responsibilities in enforcing the CCA legislation and policies

211. The EU remains committed to playing a leadership role in international action aimed at keeping global warming below 2°C, compared to the pre-industrial temperatures, and thus preventing the most severe impacts of climate change.

212. The EU institutional framework, responsible for enforcing the CCA legislation and policies, involves the EC, the European Parliament, the Council, the Economic and Social Committee, and the Committee of the Regions. In 2010, climate change, which was till then under the Directorate General ‘Environment,’ was transferred to the newly established DG CLIMA of the EC.

213. The EC leads international negotiations on climate, helps the EU in dealing with the consequences of climate change and in meeting its targets for 2020, as well as develops and implements the EU Emissions Trading System (EU ETS). The EC facilitates CCA policy coordination and cooperates with member states through the Climate Change Committee. Member states should also appoint national contact points to coordinate communication between their countries and the EC and contribute to awareness-raising and reporting activities. The EC’s activities for 2017 under the CCA will include the following:

- Continuing to promote and support adaptation actions by member states, including by developing an ‘adaptation preparedness scoreboard’ that will identify key indicators for measuring member states’ level of readiness;
- Preparing multiannual work programs to define thematic priorities for LIFE project funding in line with the general objectives and priority areas of the EU Strategy on adaptation to climate change; and
- Preparing an initiative on supporting adaptation action by cities in the context of the Covenant of Mayors framework.

214. One priority and responsibility of the EC is to mainstream adaptation measures into EU policies and programs as the way to ‘climate-proof’ EU action. Adaptation has already been mainstreamed in the legislation in such sectors as marine waters, forestry, and transport, as well as in important policy instruments such as inland water, biodiversity, and migration and mobility. In addition, the EC has tabled legislative proposals on integrating adaptation in agriculture and forestry, maritime spatial planning and integrated coastal management, energy, disaster risk prevention and management, transport, research, health, and the environment.

215. The Directorate General on Regional and Urban Policy (DG Regio) supports the risk prevention efforts to adapt to the impacts of climate change, promotes ecosystem-based approaches, and contributes to developing new infrastructures or retro-fitting the existing ones and in developing disaster resilience at the regional and local levels. The guidelines provided

to the officials give a detailed information on the funding priorities including academic research, strategy development, ICT support, education and awareness development, through the ERDF, Cohesion Fund, and European Territorial Cooperation Regulations.⁷²

2.3.3. Legislation and regulations relevant to CCA for urban context

216. Among the common regulations, there is no Directive for the Urban Environment or urban sector CCA.⁷³ The following are some of the most appropriate directives for implementation of adaptation measures in spatial and urban planning:

- Directive 2001/42/EC of the European Parliament and of the Council of June 27, 2001, on the assessment of the effects of certain plans and programs on the environment (SEA);
- Directive 2011/92/EU of the European Parliament and of the Council of December 13, 2011, on the assessment of the effects of certain public and private projects on the environment (Environmental Impact Assessment [EIA]);
- Directive 2008/1/EC of the European Parliament and of the Council of January 15, 2008, concerning integrated pollution prevention and control;
- Directive 92/43/EEC of the Council of May 21, 1992, on the conservation of natural habitats and of wild fauna and flora - Habitats Directive;
- Directive 2008/50/EC of the European Parliament and of the Council of May 21, 2008, on ambient air quality and cleaner air for Europe;
- Directive 2000/60/EC of the European Parliament and of the Council of October 23, 2000, establishing a framework for community action in the field of water policy - Water Framework Directive;
- Directive 91/271/EEC of the Council of May 21, 1991, concerning urban wastewater collection and treatment - Urban Wastewater Directive; and
- Directive 2012/27/EU of the European Parliament and of the Council of October 25, 2012, on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU, and repealing Directives 2004/8/EC and 2006/32/EC.

217. Risks reduction in the construction sector is regulated with a set of Eurocodes for production of construction materials, design of buildings, infrastructure, and other civil engineering works. They are adopted in almost all EU member states, including Bulgaria⁷⁴ and cover the variety of weather impacts on construction and construction materials.

218. Among all EU legislative documents related to urban environment, only Directive 2001/42/EC and Directive 2011/92/EU refer to cross-cutting issues, because they offer a set of methods for assessment of all types of impacts on environment, human health, heritage, landscape, and biodiversity of any single planning or investment proposal and make the link with climate, air, and water quality. The SEAs also consider social and economic impacts in

⁷² Climate Change Adaptation, Risk Prevention, and Management. Draft Thematic Guidance for desk officer, Version 2.0, 20/02/2014. Relevant provisions in the legislation

http://ec.europa.eu/regional_policy/sources/docgener/informat/2014/guidance_fiche_climat_change.pdf

⁷³ https://ec.europa.eu/clima/about-us/climate-law_en

⁷⁴ For more information, see <https://ec.europa.eu/jrc/en/research-topic/standards-construction-eurocodes>

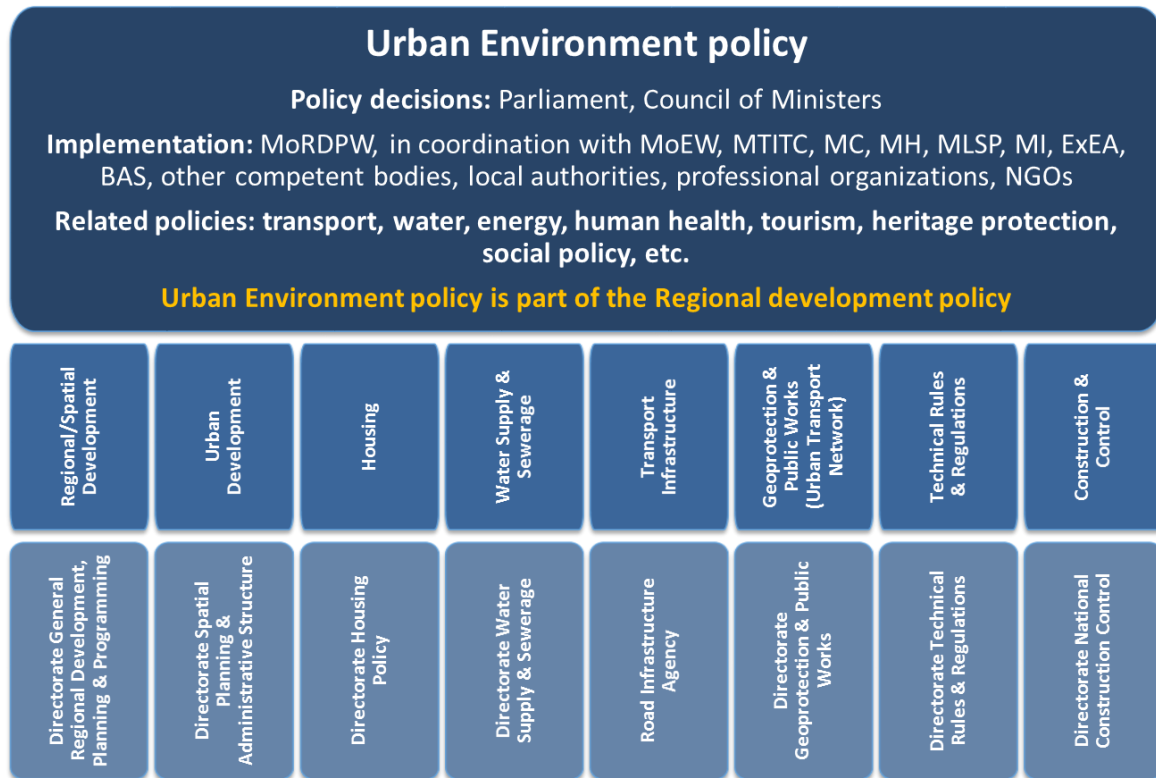
longer and shorter terms, the expected cumulative effects and the links with urban environment structure through analysis of the proposed planning norms and system of indicators.

219. As a cross-cutting issue, adaptation to climate change will affect key EU policy areas such as cohesion, agriculture, DRM, and environment. A major priority and responsibility for the EC is to ‘mainstream’ adaptation by integrating adaptation measures into EU policies and programs to make them resilient to the adverse impacts of climate change.

2.4. Bulgarian CCA Legal Framework and Policies in the Urban Environment

220. The legislation on CCA, as far as it exists, as well as the overall legislation in Bulgaria, lies within the competences of the legislative body—the National Assembly. The legislative initiative is a right of the Members of Parliament and the Council of Ministers, through which the sectoral ministries and agencies exercise their legislative initiative in the different sectors.

Figure 11. Structure and main actors in implementing the Bulgarian urban environment policy



Source: World Bank design.

2.4.1. Legislation and regulations relevant to CCA for the urban environment

221. Cities are considered responsible for combating climate change, as places with concentration of functions and activities, consumption of resources, and production of waste and emissions (including GHGs). Therefore, all sectoral policies and regulations are relevant to it and have their direct or indirect impacts on the environment as well as on the inhabitants. There are no legislation acts connected directly to weather or extreme events. Accordingly, the Bulgarian legal framework is concentrated on three groups of legislative documents: (a) acts and regulations directly connected to climate change, (b) urban and spatial planning and design acts and regulations, and (c) acts and regulations in other sectors, indirectly connected to urban environment.

Climate change-related legislation

222. The Climate Change Mitigation Act⁷⁵ does not address different weather-related elements such as extreme temperatures, precipitations, storms, and so on, but gives the overall framework of the country's climate change mitigation policy. It determines rules for implementation of the government policy on climate change mitigation and for fulfilment of the country's obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol to the UNFCCC. The government policy on climate change mitigation is defined by the National Assembly and implemented by the Council of Ministers through bylaws, plans, and strategies. The National Action Plan on Climate Change (NAPCC) defines the framework for the policy on climate change in accordance with the EU policy and the international agreements, mentioned earlier. The Minister of the MoEW, responsible for implementation of the overall climate change mitigation policy, jointly with the competent ministers, is responsible also for preparation of a national strategy draft, containing the key CCA measures for at least a 20-year period.

223. The Minister of the MRDPW, through its representatives, participates in the National Council of Climate Change and supports all mitigation actions. The only direct link of this act to the urban environment is referred to in Article 57, which determines the rules for using a percentage of the revenues from auctioning of the GHG emission allowances from installations for adaptation to climate change for funding research and development in this area, demonstration projects for reducing emissions, and energy efficiency in different sectors.

224. To implement this act properly, a better integration of the climate change mitigation policy in the respective sectoral policies, including those in the fields of regional and urban development, construction, and cultural heritage protection will be needed.

225. The Disaster Protection Act⁷⁶ does not address extreme weather events, but determines the general framework of disaster protection activities, including prevention, planning, organization, recovery, financing, and control. It determines the rules and responsibilities for disaster protection of health and life of the population, environment, and property. The list of prescribed preventive measures, pursuant Article 6, includes several very important ones for spatial and urban planning. The most important are disaster risks' mapping, human settlements categorization according to population likely to be affected, and planning and design standards for disaster-prone zones. According to the act, the important core cities under the first category are the biggest cities of Sofia, Plovdiv, Varna, Burgas, and Ruse, followed by the group of cities with population more than 80,000 (Article 8). There are two more categories for smaller cities but there is no clear indication how these categories affect the preventive measures implementation and/or the process of assessment, mapping, and planning.

226. The act gives full description of the system of disaster risk reduction planning, with scope, contents, and obligatory attributes of the documents at the national, regional, and local administrative levels.⁷⁷ The obligation to reflect the disaster risks zones from the elaborated

⁷⁵ Adopted in 2014. Last amended SG 85/24.10.2017

⁷⁶ Adopted in 2006, last amended SG 13/07.02.2017.

⁷⁷ The system of disaster risks reduction planning includes a National Strategy for Disaster Risk Mitigation, National Programme for Disaster Risks Mitigation, Regional/Sectoral programmes, District Programmes and Municipal Programmes for Disaster Risks Mitigation.

maps and plans pursuant this act, into the Spatial Development Plans/Master Plans, needs further clarification. Up until now, there are only micro-seismic maps of the country and river basins' floods risks maps. The latter are accessible through the MoEW portals, but there is no free access to the information for earthquake, landslides, and heritage, due to the unclear regulations.

227. The Regulation on the Conditions, Procedures, and Authorities for carrying out Disaster Risks Analysis, Assessment, and Mapping⁷⁸ sets the rules, procedures and responsibilities for identifying and assessing these risks and hazards, as well as the rules for mapping and maps' adoption, maintenance and control. Among them are seismic risks, floods, and landslides. This spatially determined territories under risk are accompanied by a specialized database. The attributive information should include the averages of potentially affected population, infrastructure, facilities, and economic activities and all zones for protection of waters, heritage, and biodiversity in case of disaster. The spatial information with the database and metadata base should be presented compatible to INSPIRE⁷⁹ Directive formats and according to the Geography Markup Language Encoding Standard (GML) and Open Geospatial Consortium (OGC) standards. This is an important condition for easier implementation of climate change and disaster data in the Spatial Development/Master Plans and for overcoming the main barriers to data compatibility, accuracy, accessibility, and cost in all spatial planning activities.

Spatial and regional development legislation

228. Urban planning legislation has no direct link to extreme weather events like extreme high or low temperatures, intensive precipitations, and storm winds and their consequences, but plays an important role regarding reduction of territories' vulnerability and risk protection through zoning and planning norms. To demonstrate better the link between urban environment and climate change, the main spatial planning acts and bylaws are being reviewed.

229. The Spatial Planning Act⁸⁰ is the main act, which regulates urban environment development and ensures its quality and sustainability in relation to climate challenges. The Spatial Development Plan for a city (Master Plan) or for a municipality is a main tool of the Spatial Planning Act. Its land-use zoning determines the different development and construction rules and codes to ensure a sustainable, healthy, and aesthetically acceptable urban environment. The initiation, commissioning, elaboration, public consultations, and reconciliation, and the adoption of the plan by a Planning Expert Council and its obligatory SEA handling, is a long, complicated procedure. According to Article 124 paragraph 2 of SPA the minister of regional development and public works gives permission for elaboration of spatial development plans (Master plans) of urbanized units of national significance, among which national resorts, and of the municipalities, according to the Black Sea Coast Spatial Planning Act. Pursuant to Article 19 paragraph 2 of the latter the commissioning of the spatial development plans under Article 18 paragraph 1 item 2 of the Black Sea Coast Spatial Planning Act, as well as their amendments is done by the minister of regional development and public works or by the mayor of the municipality, after agreement with the minister of regional

⁷⁸ Adopted in 2012, Last amended SG 9/31.01.2017

⁷⁹ Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007, establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

⁸⁰ Adopted in 2001, last amended SG 96/01.12.2017.

development and public works. These plans are considered and adopted by the National Expert Council of Spatial Planning and Regional Policy. The Sofia Municipality Comprehensive Development plan (Master Plan) and its amendments enter into force after adoption by the Council of Ministers, pursuant to Article 127 para. 8 of SPA and Article 4 of the Sofia Municipality Territorial Planning and Building Act. The rest of the plans are the responsibility of the local mayors and expert councils.

230. The detailed development plans further regulate the land property and functions transformations, and planning and building norms implementation. The provisions of detailed plans are compulsory for planning permission and investment design.

231. According to the provision of Article 106, item 5 and Article 107, item 6 of the Spatial Planning Act, all Master Plans or their amendments, which are being drafted and approved, shall determine the areas threatened by disasters. These risk zones are defined in the maps, prepared according to the ordinance under Article 6, paragraph 2 and the municipal plans under Article 9, paragraph 1 of the Disaster Protection Act. The plans also determine the necessary preventive measures and the way of construction and protection. An analogous requirement is made for the elaboration of the Detailed Plans and their modifications, according to Article 112, paragraph 2, item 12 of the SPA. Natural disasters risks reduction in Spatial Development Plans is ensured by analyses of the state of the environment in identified risk zones and of the measures proposed both in the Plan and in the Environmental Assessment. These measures must be in line with the measures of the Flood Risk Management Plans. The main problems are related to the formal implementation of the developed schemes and the system of measures, as well as to the poor control over their implementation.

232. Because the SPA Act includes investment design and planning and design of technical infrastructure, there are certain requirements for the construction of these elements of the territory, together with the general norms for buildings' design and construction. They refer to fire safety, hygiene, health, noise protection, energy saving and heat conservation, sustainable use of natural resources, and disaster protection. In Section VII of Chapter Four of the SPA monitoring of landslide processes and maintenance of the landslide register are regulated. The same section introduces requirements for preliminary consents under Article 96 paragraphs 3 and 4 for realization of fortification/drainage works and for construction in landslide areas, for obtaining building permit. The responsibility for landslide consolidation is for the property owner. Bylaws and regulations (issued jointly with other sectoral departments) lay down requirements for building sustainability and safety.

233. The Black Sea Spatial Development Act⁸¹ determines the specialized norms and regulation for spatial development and construction on the coast. It also regulates the responsibilities and coordination of activity of the central and territorial executive authorities and of the local self-government authorities. With some of the last amendments, the act prescribes rules for granting concessions. It determines the different protection zones outside urbanized territories: (a) zone 'A' (100 m) with a regime of special urban development protection, and (b) zone 'B' (2 km from zone 'A') with specific characteristics of the territory and special regime for protecting territorial land and water resources. Zone 'A' includes also

⁸¹ Adopted in 2007, last amended SG 28/29.03.2018.

part of the Black Sea territory with a width of 200 m measured from the coastal line. The act includes very detailed information on the rules and procedures for plans and schemes preparation and adoption, but almost no references to coastal protection from landslides and abrasion, which are the most devastating events on the coast. The critical infrastructure for coastal defense, constructed mainly in the territory, is subject to bylaws.

234. The last planning act, indirectly connected to the topic of CCA of the urban environment, is the specialized Sofia Municipality Territorial Planning and Building Act.⁸² It regulates the special rules and orders for commissioning, elaboration, adoption, and amendment of the Comprehensive Spatial Development Plan of the capital city. It is commissioned after a decision of the Municipality Council and adopted by the Council of Ministers (Article 127 paragraph 8, SPA). The mayor must report annually to the Council about the progress on the adopted plan implementation. There are two sets of regulations for functional zoning—for the city core and for the urban periphery, but they are generic, and the detailed parameters are given as an additional document.

235. All these three acts are applied together with the following two regulations for more detailed zoning and planning norms implementation.

236. Regulation No. 7 on the rules and norms for the development of the different types of territories and zones⁸³ defines the parameters of urban development, depending on land use, respective functions, and city size by population. For the territory of Sofia Municipality, the rules and norms are applied set by Sofia Municipality Territorial Planning and Building Act. For the territory of zone ‘A’ and zone ‘B’ along the Black Sea coast the rules and norms set by the Black Sea Coast Planning Act are applied.

237. Regulation No. 8 on the scope and contents of the Spatial Development Plans⁸⁴ defines the basic text and graphic materials and their mandatory parts. An element of the analytical and strategic part is the analysis of the state of the environment and its vulnerability to climate change, while the final part must propose measures for reducing the harmful effects of planning proposals. The graphical part accompanying the explanatory brief includes also a scheme of risk areas and areas designated for recultivation, but quite often it is being formally presented.

238. The Environmental Protection Act⁸⁵ requires a mandatory SEA of the Spatial Development Plans discussed earlier and an assessment of the detailed development plans, which include all the components and factors related to climate changes—climate, air quality, water, earthquakes, human health, and so on. The rules and procedures for carrying out the environmental assessment of plans and programs are determined by a special regulation which transposes Directive 2001/42/EC. In the preparation of the environmental assessment, relevant legislation regarding the different components of the environment is also being observed.

⁸² Adopted in 2006, last amended SG 31/10.04.2018.

⁸³ Adopted in 2004, last amended SG 21/01.03.2013.

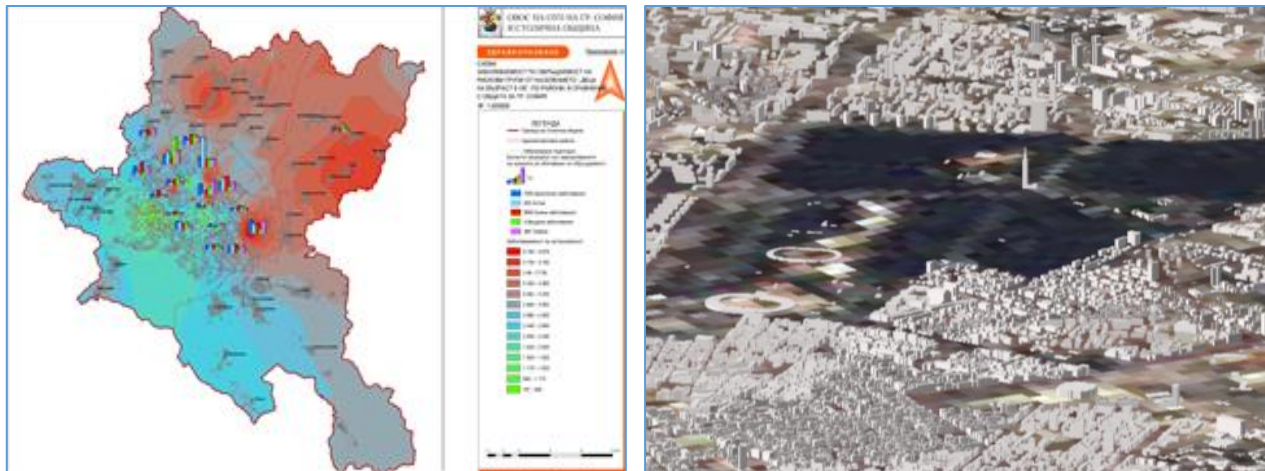
⁸⁴ Adopted in 2001, last amended SG 01/10.02.2015.

⁸⁵ Adopted in 2002, last amended SG 96/01.12.2017

Figure 12. SEA of the Comprehensive Development Plan of Sofia city and Sofia municipality (2002)

Pollution and Human Health - Risk Zones Assessment

Green System and Visual Analysis, GIS Spatial Analyst, DEM 10 m, Landsat 7TM, October 2001

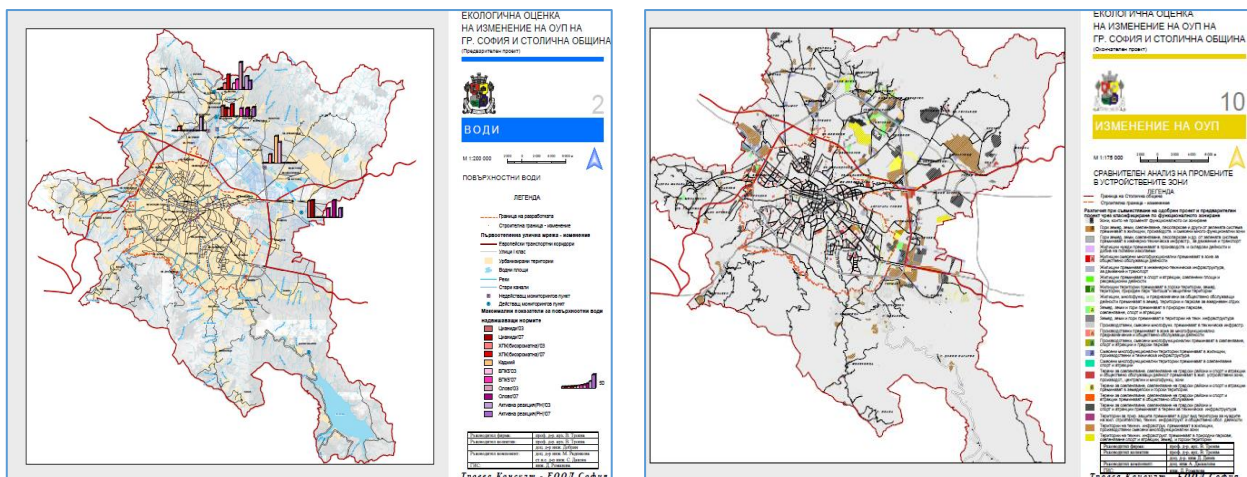


Source: SEA of the Comprehensive Development Plan of Sofia and Sofia municipality, 2002. Troeva Consult Ltd.

Figure 13. SEA of the Comprehensive Development Plan of Sofia city and Sofia municipality amendments (adopted in 2009)

Water Resources Assessment - Quality and Hotspots

Comparative Analysis of the Land Use Changes between 2002 and 2008



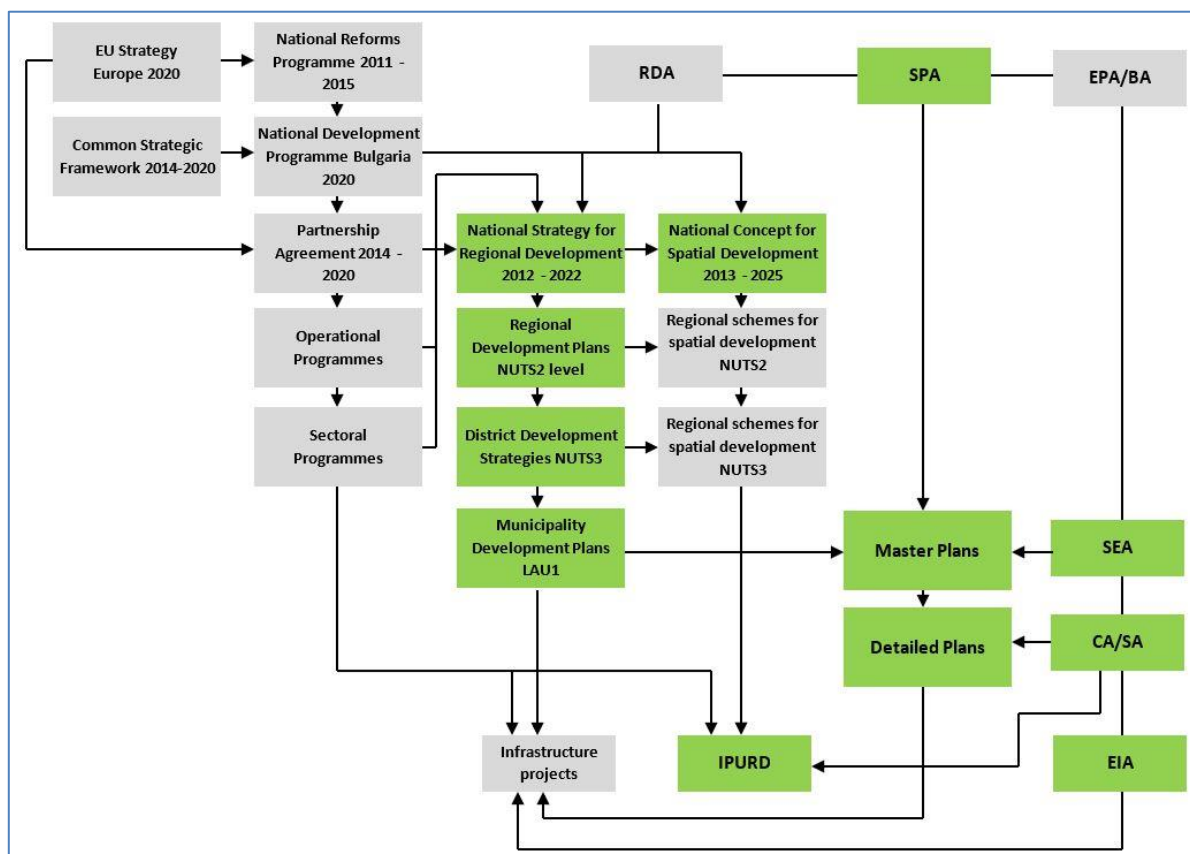
Source: SEA of the Comprehensive Development Plan of Sofia and Sofia municipality amendments, 2009. Troeva Consult Ltd.

239. Planning practice in the country demonstrates many different standards in the elaboration and approval of development plans and their environmental assessments, which speaks of extremely limited administrative and expert capacity. Even if existing legislation is to include additional texts requiring incorporation of integrated risk assessment schemes of the territory and thus to better motivate project proposals, the issue of available professionals with the necessary knowledge and skills to carry out such an assessment remains open. This poses a series of questions not only to lawmakers, but also to academic institutions training staff, professional organizations, and approving units in municipal administrations and specialized bodies.

240. The Regional Development Act⁸⁶ defines the system of hierarchically related documents for regional and spatial development, at the national, regional, district, municipal, and city administrative levels, described in Chapter 1. These documents do not directly address the issues related to temperature and precipitation changes but include sections that set out measures aimed at limiting climate change effects.

241. Both groups of documents have similar analytical parts and differ mainly in their strategic parts. The first group of regional development strategies and plans have also a financial framework and implementation program. The second group of spatial development documents defines the territories and areas for realization of these development proposals with their spatial dimensions. They must include also the areas, threatened by different natural disasters. The scope and content of these documents, and the rules and procedures for their preparation, are determined through bylaws and methodological guidelines. An obligatory part of all of them are the disaster-risk zones and vulnerable groups identification, appropriate measures and projects targeted for risk reduction, and development of an investment program with clear implementation stages, responsibilities, and funding sources.

Figure 14. Hierarchical system of regional and spatial planning in Bulgaria



Source: NCS D 2013–2025.

⁸⁶ Adopted in 2008, last amended SG 58/18.07.2017.

2.4.2. Cross-cutting legislation

242. The Regional Development Act and Spatial Planning Act link to many other laws that directly or indirectly affect the urban environment and safeguard its quality.

Environmental legislation

243. The Protected Areas Act⁸⁷ regulates the categorization of different protected areas and sites, their designation, protection, use, maintenance and management, irrespective of their ownership, status, and location, thus playing an important role in improving urban climate. The provisions of the Biodiversity Act⁸⁸ play an important role in spatial and urban planning for integrated management of Natura 2000 sites, especially the ones within the urban regulation boundaries, as well as for protection of urban biodiversity. The sector-specific laws for air, water, lands, and soil protection are considered in plans' preparation and their EIAs. The environmental assessment of plans and programs (SEA) of the investment projects (EIA), and of the compatibility of plans, programs, projects, and investment proposals with the objectives of the protected areas, are prepared according to the adopted ordinances. The SEA and EIA have a special chapter on climate and quality of air.

Energy legislation

244. The Energy Act⁸⁹ guarantees the delivery and distribution of the energy in the urban environment, its efficiency, and safety use. Most important for the urban environment, especially for bigger cities, are its provisions for cogeneration. In addition, the Energy from Renewable Sources Act⁹⁰ regulates the production and consumption of energy from renewable sources and the implementation of measures in residential, public and commercial buildings, thus reducing greenhouse gas emissions and limiting the negative impacts of climate change. The Energy Efficiency Act⁹¹ in its Chapter III, Section II sets the requirements for energy audit of all types of buildings—residential and non-residential, new and existing ones, which are the subject of reconstruction. Energy characteristics requirements are subject to mandatory periodic inspection once every five years and, if necessary, updated to reflect technological developments in the building sector (Article 31, paragraph. 5). The implementation of the requirements of this act related to design and construction are prescribed by the Spatial Planning Act. The building codes about the energy characteristics and the requirements for projects are determined by Regulation No.7 for Energy Efficiency of Buildings and its last amendment.⁹²

Building codes, particularly concerning extreme temperatures

245. The building codes are incorporated in the Spatial Planning Act and its bylaws. There are no special regulations about extreme temperatures except for constructions and construction materials. The transposition of the Eurocodes⁹³ and harmonization of the existing Bulgarian State Standards for building materials, technologies, and constructions guarantees their seismic and fire resistance, energy efficiency, and other environmental requirements. An integral part of Eurocodes are national applications with nationally defined parameters, including hazard

⁸⁷ Adopted in 1998, last amended SG 96/01.12.2017.

⁸⁸ Adopted in 2002, last amended SG 76/19.09.2017.

⁸⁹ Adopted in 2003, last amended SG 58/18.07.2017.

⁹⁰ Adopted in 2011, last amended SG 38/08.05.2018

⁹¹ Adopted in 2015, amended SG 103/28.12.2017, last amended SG 38/08.05.2018

⁹² Adopted in 2005, last amended SG 93/21.11.2017

⁹³ Eurocodes National Annexes. Bulgarian Institute for Standardization http://www.bds-bg.org/en/pages/page_71.html

maps of Bulgaria's seismic zoning and certain national parameters and applications for seismic building construction, in accordance with Eurocode 8 and climate maps for the impacts of temperature, wind, and snow in accordance with the climatic zones of the country and Eurocode requirements.

Transport regulations

246. The urban mobility planning is subject to Regulation No.2 for Planning and Design of the Transport Communication Systems in Urbanized Areas.⁹⁴ It has no direct link to the CCA. The recent extended provisions for the bicycle network planning and design reflect the overall policy of the country for smarter and environmentally friendly mobility, thus affecting directly the quality of air and human health.

Land use and management laws

247. The Agricultural Lands Protection Act⁹⁵ and the Forest Act⁹⁶ are the two fundamental laws for land use, maintenance, and management of these territories, outside of the urbanized ones. The harmonization of both with the Spatial Planning Act is accomplished to some extent by common provisions and bylaws, regulating permissible constructions. The agricultural and forest land-use transformation into urbanized land is under the jurisdiction of several legislative fields, but despite the complicated procedures, there are poor results in limiting urban sprawl and protection of the fertile land. The Forest Act also determines the rules for fire protection zones maintenance. The land-use planning issues are also related to the Cadaster and Property Register Act,⁹⁷ which identifies among other things the administrative and land-use zones' boundaries, ownership, water resources, and rules for cadaster mapping.

Water supply legislation

248. The Waters Act⁹⁸ transposes the EU Water Directive (2000/60/EC) and regulates the ownership and management of waters and water systems and facilities, aiming at integrated management. Its main objectives are supply of good quality surface and groundwater, reduction of pollution, protection of surface waters, groundwater, and waters of the Black Sea—all related to urban environment and human health. The water supply and sewerage in the human settlements are managed as part of the overall water policy of the country and according to the adopted national strategies. Planning and design of these two systems are regulated by the Spatial Planning Act and by the special regulations on technical issues and norms.

2.4.3. Strategies and plans related to CCA for the urban environment

249. The only national-scale document, directly related to CCA, is the **National Climate Change Risk and Vulnerability Assessment of the Bulgarian Economic Sectors, 2014.**⁹⁹ It includes a thorough analysis of the methodologies, applied in other countries, and a clearly structured common framework for the assessment of different sectors. The assessment separately discusses the urban environment and in particular the construction and infrastructure sectors. The analysis covers the historical development of Bulgarian cities and towns, processes

⁹⁴ Adopted in 2004, last amended SG 33/23.04.2017.

⁹⁵ Adopted in 1996, last amended SG 58/18.07.2017.

⁹⁶ Adopted in 2011, last amended SG 58/18.07.2017.

⁹⁷ Adopted in 2000, last amended SG 58/18.07.2017.

⁹⁸ Adopted in 1999, last amended SG 58/18.07.2017.

⁹⁹ http://www.moew.government.bg/static/media/ups/tiny/file/Climate/Specialna_chat.pdf

of urbanization, housing patterns, and the structure and some norms for urban green areas. The classification of the cities derives from existing regulations with five categories of human settlements. Six types of urban areas are identified—with high, medium, and low-rise housing, public areas, industrial areas, and green areas, considering different types of density and average planning indicators for evaluation of extreme high temperature and precipitation impacts. The assessment of climate change risks and vulnerabilities is based on the IPCC scenarios and determines the urban environment as ‘extremely resilient’ to the expected impacts in the period up to 2035, when no dramatic changes in the climatic conditions are expected. According to the findings and the projections, used in this analysis, the urban environment sector will be one of the potentially most vulnerable to increased average temperatures, especially during summer, as well as increased intensity of expected extreme ‘hot’ events. Climate change will particularly strongly affect ‘the large cities, with substantial (in terms of area and number of buildings) panel housing complexes, the majority of which are not energy refurbished’.

250. Adaptation plans for climate change at the local level are mainly prepared under the Covenant of Mayors Initiative. Good examples are those for the cities of Sofia, Burgas, and Dimitrovgrad.¹⁰⁰

251. Another group of documents has been prepared for the prevention of natural disasters, the reduction of harmful effects on the urban environment, infrastructure, and population, and the recovery of damage:

- The **Disaster Risk Reduction Strategy (2014–2020)**¹⁰¹ identifies the main risks to the country (earthquakes, floods, landslides, forest fires, storms, hailstorms, and so on) and the institutions, responsible for disaster risk reduction, comprising all ministries and their departments, regional administrations, municipalities, emergency medical centers, medical and health care establishments, legal entities and sole traders, voluntary units and units of the Army, and the General Directorate for ‘Fire Safety and Civil Protection’ of the Ministry of Interior (MI).
- The **National Program for Disaster Protection (2014–2018)**¹⁰² specifies the obligations of the Minister of the MRDPW for monitoring landslide areas in the country and the abrasive and erosion processes along the Black Sea and the Danube coasts. Through the RIA, the minister manages national roads and their operational maintenance and provision of evacuation routes for the population. Through state-owned water and sewerage companies, the minister provides protection of water sources and water supply systems, controls the development and implementation of emergency plans for these companies, including water supply for drinking and fire-fighting purposes in disaster areas. (S)he also coordinates the collection of information related to water supply and sewerage, during eradicating the consequences of disasters, accidents, and catastrophes.

252. The documents that follow are indirectly connected with CCA, but important for the

¹⁰⁰ Strategy for Sustainable Energy Development 2011–2020 Burgas Municipality
<http://www.burgas.bg/uploads/3beab17266cba23990bf26a6bd16dcfc.pdf>

¹⁰¹ Disaster Risk Reduction Strategy 2014–2020, http://www.nspbzn.mvr.bg/NR/rdonlyres/DA55BDC6-488B-4223-A81E-7BBE41A548D1/0/DRR_Strategy.pdf

¹⁰² National Programme for Disaster Protection 2014–2020, https://www.mvr.bg/docs/default-source/strategicheskidokumenti/A1E90D5E-08_Nac_Prog_ZB-pdf.pdf

overall Urban Environment, standard of living and vulnerability reduction.

- The **National Strategy for Management and Development of the Water Sector in the Republic of Bulgaria**,¹⁰³ accompanied by an Action plan for the short-term (2013–2015), medium-term (2016–2021), and long-term (2022–2037) perspectives, adopted by the Council of Ministers in 2012 (SG No. 96/06=12=2012). Its main long-term aim is ‘*Sustainable use of water resources, ensuring to the best of the present and future needs of population and economy, as well as water ecosystems*’. The document offers a comprehensive analysis and evaluation of the water sector, the main institutions and services providers’ capacity and the main priorities for the national policy for water resources protection. Among the main threats for the population and the economy are global climate change and drought risks.
- The **Strategy for Development and Management of the Water Supply and Sewerage in the Republic of Bulgaria 2014–2023**¹⁰⁴ is being implemented. Drinking water shortages are monitored and controlled and planned to be reduced after the implementation of the integrated water supply plans in some cities and towns. Water supply systems’ and facilities’ planning is carried out through (a) regional general plans for water supply and sewerage and (b) master plans for the water supply and sewerage system in agglomerations (human settlements) with over 10,000 equivalent inhabitants. The monitoring results of the National Action Plan are envisaged to be reported in 2017 and in 2021.
- The main planning documents for integrated water management at the regional level are the **River Basin Management Plans (2016–2021)**,¹⁰⁵ which have the task to provide enough water of required quality and quantities for the needs of the population, economy, and ecosystems. The **Flood Risk Management Plans (2016–2021)**¹⁰⁶ designate flood hazard and risk zones, which have to be considered when preparing municipal Spatial Development Plans, thus protecting the population and building stock. Both types of plans, elaborated for the four river basins and their Environmental Assessments, were adopted by the Council of Ministers in December 2016. They offer measures for river waters’ and ecosystems’ protection and for managing climate change risks at the municipal level and include all responsibilities for the main actors involved.
- The **National Strategy for Reducing Poverty and Promoting Social Inclusion 2020**¹⁰⁷ targets the most vulnerable population—aging, sick, disabled, poor, Roma, and homeless. It is based on a national target to reduce the number of people living in poverty by 260,000 by 2020. The envisaged measures aim at improving opportunities to find jobs and return to the labor market, education and training, improving of social services and social assistance, providing shelter and decent housing, and providing accessible urban environments. Partnership and interaction in the fields of education,

¹⁰³ <http://www.moew.government.bg/bg/nacionalna-strategiya-za-upravlenie-i-razvitie-na-vodniya-sektor-v-republika-bulgariya/>

¹⁰⁴ <http://www.mrrb.government.bg/bg/strategiya-za-razvitie-i-upravlenie-na-vodosnabdyavaneto-i-kanalizaciyata-v-republika-bulgariya-2014-2023-g/>

¹⁰⁵ http://earbd.org/indexdetails.php?menu_id=609

¹⁰⁶ https://www.bsbd.org/bg/page_purn_bsbd.html

¹⁰⁷ https://www.mlsp.government.bg/index.php?section=POLICIES&lang=_eng&P=279

health, employment, and social services are considered obligatory for pursuing common objectives for social inclusion.

- **Methodology for analysis, assessment, and mapping of the seismic risk of Bulgaria** is under development by the National Institute of Geophysics, Geodesy, and Geography at the BAS, commissioned by the MRDPW, and due by November 2017.

253. All these documents upgrade information, generate new knowledge, and contribute to CCA awareness development.

254. The following documents (see *Figure 14*) are major implementation tools for the Regional Development Act and Spatial Planning Act.

255. The **National Strategy for Regional Development of the Republic of Bulgaria (2012–2022)**¹⁰⁸ aims at social, economic, and spatial cohesion, and reduction of disparities among the regions. It develops the regional profiles of all six Nomenclature of Territorial Units for Statistics (NUTS) II regions and makes proposals for some of the decisions on critical issues, such as concentration of vulnerable and disadvantaged groups, reduction of disaster areas risk, technical infrastructure development and reconstruction, and urban and tourist agglomerations development.

256. The **National Concept of Spatial Development for the period 2013–2025**¹⁰⁹ is the first national-scale document of this type, which reflects the state policy for protection and effective use of the territory of the country and is a first attempt to coordinate sectoral policies. Based on a widely-discussed set of criteria and indicators, the classification of the cities has been provided and their eligibility for European funding determined. The document has been used for the purposes of the OPRG (2014–2020) and in some other operational programs as a source of additional project selection criteria. The ambition to integrate all the natural disaster risk territories and zones was not fulfilled, due to insufficient information availability, limited time, and the obligations of the MoEW to prepare a single national strategy by the end of 2016. The projected institutionalization of the document, monitoring, and control on implementation have not been done yet. The obligatory midterm assessment has not been commissioned.

257. The above national scale strategic documents determine the framework for further development of the priorities on lower hierarchical levels, mainstreaming environmental protection and natural disasters risk management into regional, district, and municipal strategies and plans.

258. Urban management and planning in Bulgaria are done through Spatial Development Plans/Master Plans of municipalities and cities. To stimulate the elaboration of municipal Master Plans, and to ensure controlled development of areas for future investment initiatives and municipal infrastructure (and other) projects – funded under the Regional Development Operational Programme and the Rural Development Programme – the Spatial Planning Act (2012) was amended. Furthermore, the MRDPW set deadlines for the preparation/updating of municipal Master Plans that it financially supports with state budget. According to agreements, signed in 2014 with the former Ministry of Investment Design, funds were transferred to

¹⁰⁸ <http://www.mrrb.government.bg/docs/310bfbe48ed5017ab7b4e386b01ca437.doc>

¹⁰⁹ http://www.bgregio.eu/media/Programirane/NKPR_28012013_Last_en.pdf

beneficiary municipalities to an amount of about BGN 3.7 million. In 2015 and 2016 the MRDPW signed agreements with 188 beneficiary municipalities, transferring BGN 3.1 million in 2015 and BGN 2.1 million in 2016. The transferred funds turned out to be considerably lower than budgeted. Consultancy costs had gone down, while consultation and approval procedures took a long time. The deadline for implementing the agreements concluded in 2015 and 2016 is until the end of the budget year 2018. The projected budget for 2017 is BGN 4.5 million.¹¹⁰

259. Updated City Development Plans have been prepared for some cities such as Sofia, Plovdiv, Varna, Burgas, Ruse, Stara Zagora, Shumen, Velingrad, Asenovgrad, Dobrich, Kardzhali, and Blagoevgrad.

260. Monitoring strategies to ensure that the legal requirements for extreme temperatures, flood/storm, wild/forest fire, and urban water supply/shortage are implemented, are envisaged through specific legally binding documents, for instance on floods prevention monitoring and assessment, according to the Water Act.

261. Over the past years, communication strategies or plans with identified target groups and clear representation at an early stage, were prepared for most EU funded programmes and projects. Public discussions and public consultation with stakeholders are obligatory. For example, the NCS D has regularly been reported upon at informal Council of Ministers meetings and in 38 different audiences and format forums. The Integrated Plan for Urban Regeneration and Development of the capital city of Sofia was presented at over 120 different forums, round table discussions, public discussions, thematic focus groups, exhibitions, and in different media and at all commissions of Sofia Municipality and Sofia Municipality Council. All Spatial Development Plans and SEAs are subject to compulsory public hearings. The culture of dialogue and consensus building, as well as the practice of consultations' results reporting, is gradually evolving, albeit at a slow pace.

262. The review of the national legislation for planning and building the urban environment and the planning practices shows that the main gaps are in the process of monitoring and control on the implementation of the adopted strategies, plans, and projects. Fundamental deficiencies are a result not only of limited administrative capacity at different levels but also of expert capacity and knowledge for better quality strategic regional and spatial development documents, incorporating climate adaptation measures.

2.5. Institutional Framework and Stakeholder Community in Bulgaria

2.5.1. Institutional framework in urban environment sector

263. The regional policy in Bulgaria, part of which is the urban development policy, is governed by the MRDPW. It sets the legal framework for regional development, spatial planning, investment design, construction, and construction supervision. The Minister of the MRDPW carries overall responsibility for the development of the road infrastructure together with the Minister of the Ministry of Transport, Information Technologies and Communication (MTITC), the former supported by the Road Infrastructure Agency (RIA).

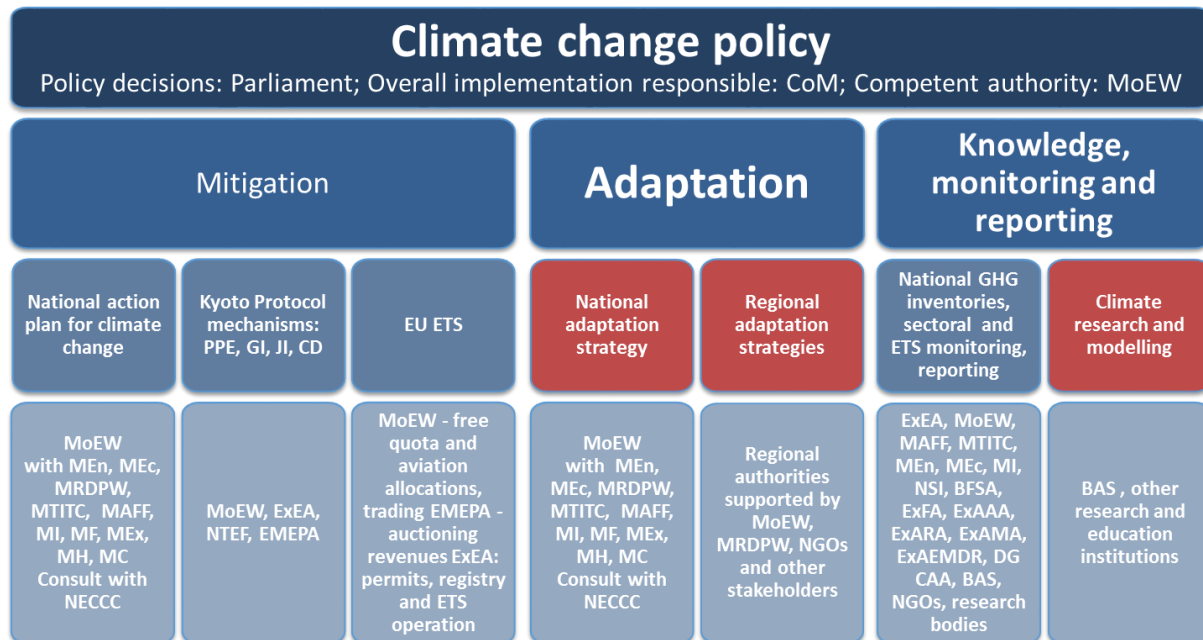
264. The development and management of the water supply and sewerage sector and the

¹¹⁰ <http://www.mrrb.government.bg/bg/normativni-aktove/obsti-ustrojstveni-planove/>

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activities for prevention of the harmful effects of waters within the settlements are carried out with the help of the Water Supply and Sewerage Directorate, which plans and coordinates the water supply and sewerage sector at the national level.

Figure 15. Structure and main actors in implementing the Bulgarian climate change policy



Note: All abbreviations used in this figure could be found within the Abbreviations and Acronyms section.

Source: World Bank design.

265. The public works and geo-protection are managed by the respective specialized directorate. On the territory of the country, there are three state companies for geo-protection - in Varna, Pleven, and Pernik.

266. The Minister of the MRDPW also carries out the state policy on the development of legislation in the field of design and construction and on their harmonization with the EU law. In these activities, (s)he is assisted by the Technical Rules and Regulations Directorate. In addition, (s)he controls the activities of the Managing Authority of the OPRG and all other programs for cross-border cooperation with Romania, Greece, Turkey, the former Yugoslav Republic of Macedonia, and Serbia, and coordinates the implementation of the Danube Strategy. The latter responsibilities are usually transferred to one of the deputy ministers.

267. An important task of the MRDPW in the coming years is to make the Housing Policy an integral part of the regional policy of the country, starting with the adoption of a new National Housing Strategy, based on the World Bank's housing sector assessment. It is envisaged to be accompanied by several programs, focusing on the main identified problems in the sector, including updating the legislation and the institutional framework, energy renovation of residential buildings, affordable housing for young people and for people from vulnerable groups, etc. This policy is implemented by the specialized Housing Policy Directorate.

268. The state policy on limiting climate change impact is determined by the National Assembly through the Climate Change Mitigation Act (CCMA)¹¹¹ and is implemented by the Council of Ministers through the bylaws of Article 5 of this act and the plans and strategies under Articles 8 and 9. The Minister of the MoEW is the competent authority for the overall implementation of the state policy on climate change mitigation, and (s)he may delegate his powers under this act to other officials.

269. **The state policy on water management in Bulgaria is carried out by the MoEW and its Water Management Directorate.** It is aimed at achieving and maintaining good status of all underground, surface, and marine waters and integrated management. In this activity, this ministry is assisted by 4 River Basin Directorates and 16 Regional Inspectorates for Environment and Water, which along with the rest of their activities carry out control over the wastewaters.

270. At the national level, a Disaster Risk Reduction Council was created as a permanent body to the Council of Ministers to ensure coordination and cooperation in implementing the state disaster protection policy. The council performs the functions of a national disaster risk reduction platform in implementation of the Hyogo Framework for Action 2005–2015 and Sendai Framework for Disaster Risk Reduction 2015–2030. The council, consisting of a chairperson and members, is chaired and represented by the Minister of the MI. Members of the council are one representative of each ministry's office; one representative of the National State Security Agency, the State Reserve and Wartime Stocks Agency, the Nuclear Regulatory Agency, the National Association of Municipalities in the Republic of Bulgaria (NAMRB), the Bulgarian Red Cross, the BAS, the Bulgarian Chamber of Commerce and Industry, and the Bulgarian Industrial Association; up to three representatives of higher education institutions; up to three representatives of research institutes; up to three representatives of non-profit organizations; and up to three representatives of legal entities, dealing with disaster risk reduction. The Director of Directorate General of Fire Safety and Civil Protection (DGFSCP) of the MI is the Secretary of the council.

271. District and municipal Disaster Risk Reduction Councils were established at the district and municipal levels based on Article 64a, para. 1 and Article 65a, para. 1 of the Disaster Protection Act.¹¹²

272. Pursuant to Article 29 of the Disaster Protection Act, the coordination of the units of the Unified Rescue System is carried out by the operational centers of the DGFSCP at the MI.

2.5.2. Stakeholder community in Bulgaria

Governmental institutions

273. Urban environment related institutions with respect to CCA are all ministries with their respective units and state agencies, which in some ways are responsible for management of different risks. The MRDPW has a leading role, because of the wide range of activities, related to spatial and regional development policy, housing, water supply, landslides, and construction. The most relevant bodies at the ministry are the following:

¹¹¹ Adopted in 2014, last amended SG 85/24.10.2017.

¹¹² Adopted in 2006, Last amended SG 13/07.02.2017.

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- General Directorate ‘Strategic Planning and Programming Regional Development’
- Directorate ‘Spatial Planning and Administrative and Territorial Structure’
- Directorate ‘Technical Rules and Regulations’
- Directorate ‘Water Supply and Sewerage’
- Directorate ‘Geoprotection and Public Works’
- Directorate ‘Housing Policy’
- Directorate for National Construction Control
- National Building Research Institute (NBRI)
- NCRD
- Geoprotection state companies in Varna, Plevan, and Pernik
- RIA

274. In addition, the MRDPW shares the responsibilities in climate change mitigation and adaptation and DRM with other governmental institutions:

- MoEW
 - EEA
 - River Basins Directorates
 - Regional Inspectorates of Environment and Waters
- Ministry of Energy (MEn)
 - Sustainable Energy Development Agency
- Ministry of Health (MH)
 - Regional Health Inspectorates
- Ministry of Culture (MC)
 - National Institute for Immovable Monuments of Culture
- Ministry of Labor and Social Policy
 - Agency for Social Support
- MTITC
- Ministry of Tourism
- MI
- Ministry of Economy

Professional communities and bodies

275. The main professional bodies involved in transposition of the international standards and codes in Bulgarian spatial and urban planning and in the construction sector are the following:

- Union of Bulgarian Architects
- Chamber of the Bulgarian Architects
- Union of Planners in Bulgaria (UPB)
- Chamber of Engineers in the Investment Design
- Chamber of Surveyors

- Chamber of Civil Engineers
- Bulgarian Construction Chamber

276. They are registered as public non-profit organizations under the Non-profit Legal Persons Act,¹¹³ whereby their status is nongovernmental, and their activities are governed by their respective statutes. Most of them through their representatives participate in different working groups in the international and European professional organizations, including the ones on CCA. They take part in the transposition of the European regulations in the national legislation and provide expertise on the legislative initiatives of the Parliament.

Academic and research institutions

277. Considerable work should be done by the academic and research institutions for the development of CCA strategic documents at the local level. They are responsible for providing the appropriate knowledge and skills and are among the key stakeholders in the process of research, planning, implementation, and evaluation of adaptation options. Currently, involved in this endeavor are the following organizations:

- Institute of Meteorology and Hydrology, BAS
- Institute of Geophysics, Geodesy, and Geography, BAS
- Institute of Oceanology, BAS, Varna
- UACG:
 - Urban Planning Department
 - Faculty of Structural Engineering
 - Faculty of Hydraulic Engineering
- TU, Sofia
- SU ‘St. Kl. Ohridski’
- University of Forestry (UF)

Private sector

278. It is difficult to analyze the private sector due to lack of data of current expert capacity and projects, and the different forms of registration. Many initially registered non-governmental and non-profit companies subsequently registered as commercial companies to carry out commercial activities. The information from both the Registry Agency and the Internet is misleading, because of the lack of any information on the expertise and capacity of the corresponding organizations. Single-party private companies work with part-time consultants, depending on the nature of the procurement and these consultants are highly mobile. This is one of the obstacles to developing knowledge and capacity. The overall conclusion is that in the private sector there are many small consulting companies in the field, which however have very limited capacity to deal with CCA plans and programs.

¹¹³ Adopted in 2001. Last amended SG 103/27.12.2016.

NGO sector

279. The main actor among the NGOs in Bulgaria is the NAMRB,¹¹⁴ which works mainly with mayors and chief architects of the municipalities, supports their initiatives, and represents them in the governmental structures, in the EU and in the Assembly of the European Regions. The specific issues on CCA are within the scope of the regional organizations, such as Association of Danube Municipalities, Association of Black Sea Municipalities, and Association of the Mountainous Municipalities. The establishment of the network of Black Sea NGOs¹¹⁵ is an attempt at better cooperation and capacity building.

280. The representatives of the NGO sector in the country are active on issues related to environment quality, air pollution, and drinking water, as well as green system preservation. They actively participate as consultants during municipal Spatial Development Plans elaboration and their SEAs, in public consultations and expert councils. Among the NGOs with experience in CCA, there are several that deserve mentioning.

281. **The Center for Energy Efficiency - EnEffect**,¹¹⁶ founded in 1992 in Sofia with the initial financial support from the Battelle/Pacific Northwest National Laboratory (United States) in cooperation with the U.S. Environmental Protection Agency, U.S. Department of Energy, and U.S. Agency for International Development. Part of the center's efforts for knowledge and information transfer was the establishment of the Bulgarian municipalities' network for energy efficiency in 1997.

282. **The Agency of Sustainable Development and Eurointegration - Ecoregions (ASDE)**¹¹⁷ was established in 1998. It recently works in the field of integrated data management in support of resilience, harmonization with the UN Land Cover Classification System (LCCS), and the new global standard ISO 19144-2 (Land Cover Meta Language [LCML]), and in some cross-border cooperation projects for the Lower Danube.

283. **The Bulgarian Green Building Council (BGBC)**¹¹⁸ was founded in 2009 as a non-profit organization, focused on sustainable construction. It promotes the implementation of international building standards, design practices and technologies, green building and design policy advocacy, information exchange, and education. In 2011, the council registered a BGBC Academy to provide training on sustainable construction, urban planning and design, energy efficiency, green building materials, and innovative practices. It is an authorized provider for German Sustainable Building Council (DGNB) and Leadership in Energy and Environmental Design (LEED) green building certification systems.

284. **Sofia Energy Agency (SOFENA)**¹¹⁹ was established in 2001 under the 'Multiannual programme for the promotion of energy efficiency in the European Union 1996–2000' (SAVE II). As specified in the contract with the EU, the newly established agencies, ENERGIEBUREAU LIMBURG (Holland) and APEA (Italy) are partners of SOFENA (Bulgaria) and will coordinate their activities during the three years' term of the contract.

¹¹⁴ <http://www.namrb.org/international-cooperation-and-eu>

¹¹⁵ <http://www.bsnn.org/projects.html>

¹¹⁶ <http://www.eneffect.bg/>

¹¹⁷ http://www.asde-bg.org/index_en.php

¹¹⁸ <http://www.bgbc.bg/en/>

¹¹⁹ <http://sofena.com/en/about-us/>

SOFENA is an NGO and a non-profit legal entity. Among the founders are Sofia Municipality and the State Energy Efficiency Agency. Its main aims include assisting Sofia Municipality in developing a sustainable energy policy and models for Sofia Municipality energy planning.

285. **Regional Agency for Entrepreneurship and Innovations Varna (RAPIV)**, established in 2002, is a non-governmental utilitarian non-profit organization carrying out its activities for public benefit, for stimulating regional economy through the development of entrepreneurship and innovations. It works on energy efficiency innovations and CCA.

286. Sofia municipality has a long experience in partnerships. With a view to improving the activities of NGOs, it put forward the idea for better legitimation, which resulted in the formation of the NGOs' coalition. The active environmental NGOs are Green Sofia, Cleantech Bulgaria, Shelter for Humanity Foundation/Habitat Bulgaria, Transformers Association, Spasi Sofia (Save Sofia), For the Earth, Second Chance, Bluelink Foundation, EcoCommunity Foundation, Plovdiv Energy Agency, Alternative Energy (Burgas), and many others throughout the country.¹²⁰

287. The most successful NGOs are those working in close cooperation with the Bulgarian municipalities and those working with the methodological and financial support of international and EU organizations and funds.

288. In cases of emergency, the coordination and communication among the different institutions and structures takes place through the communication-information centers of the MI, according to Article 29 of the Disaster Protection Act.

2.6. Financial and Human Resources in Bulgaria

289. The main sources of funding for adaptation to climate change and for dealing with emerging disasters in the urban environment are the state budget, municipal budgets, and the EU's structural funds.

290. When the financing is at the expense of the state budget, according to the Disaster Protection Act, the financial resources for the implementation of the National Programme for Disaster Protection 2014–2018 are being provided through the budgets of the respective ministries and government departments and through budgetary relations of the municipalities with the central budget, stipulated by the State Budget of the Republic of Bulgaria Act for the respective year.

291. Each ministry and local government authorities responsible for a specific activity under the program must have up-to-date estimates of the necessary costs for activities in the field of their commitments to the program implementation. Each institution is expected to specify which policy and program-related activities will receive financial support.

292. The funds for the implementation of the program need to be budgeted by the respective budget spenders. They must be declared by ministries and agencies each year during the budgetary procedure for the year in question.

293. Pursuant to Article 56 of the Disaster Protection Act, the Interdepartmental Commission

¹²⁰ Portal of the NGOs in Bulgaria <http://www.ngobg.info/en/index.html>

for Restoration and Assistance to the Council of Ministers adopts a decision to allocate funds from the reserve for contingencies and/or emergency expenditures in the part for prevention, containment and overcoming of consequences of disasters and controls their target spending. The decision of the commission is approved by the Council of Ministers.

294. The Council of Ministers sets a limit of no less than 15 percent of the funds under the contingency and/or emergency spending for prevention, containment, and overcoming of consequences of disasters to finance: preventive and preparedness response activities from the disaster risk mitigation programmes as complementary funding to the approved budget of the relevant competent authority and/or to funds provided from other sources.

295. The financial, material and technical ensuring of disaster protection is provided by the budgets of ministries and agencies, municipal budgets, commercial companies and sole entrepreneurs for their properties, the structural funds of the EU, and other sources.

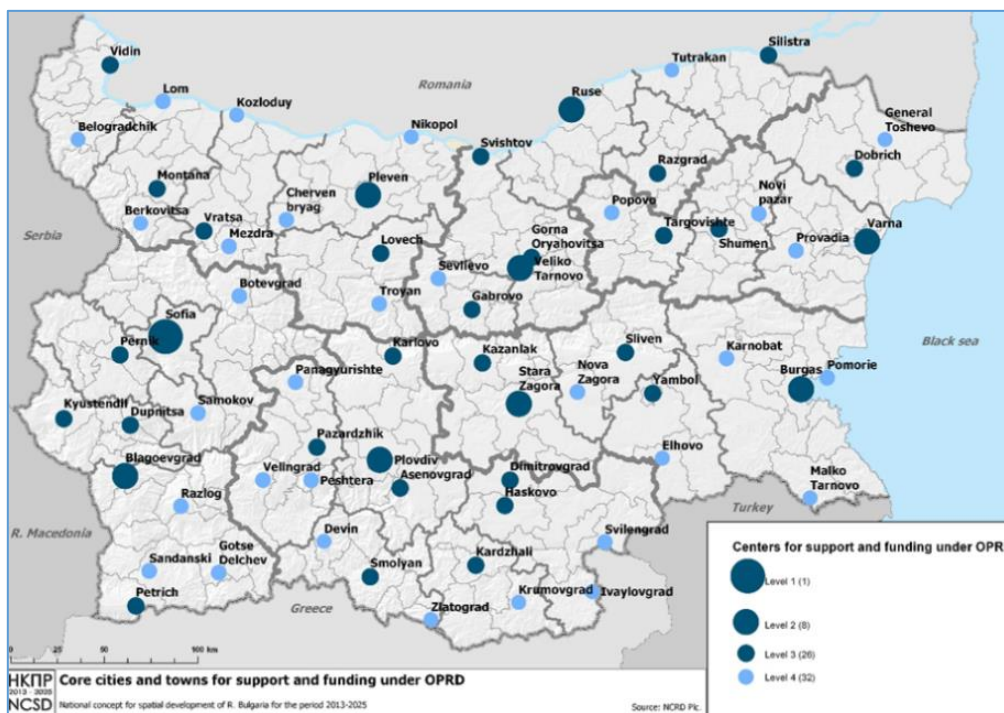
296. One of the strategic priorities for national funding during the 2014–2020 programming period identified in the country's Partnership Agreement with the EU is 'Connectivity and a green economy for sustainable growth'. It has a sub-priority, defined as 'Climate and Climate Change, Prevention, and Risk Management'. In addition, one of the 11 thematic objectives through which Bulgaria participates in the implementation of the Cohesion Policy, the Common Agricultural Policy (CAP), and the Common Fisheries Policy (CFP) 2014–2020, is thematic objective 5, focusing on 'promoting adaptation to climate change and risk prevention and management'. Key areas of funding under this thematic objective are (a) investment activities to prevent and manage the risk of climate change and (b) public policy and building administrative capacity to adapt to climate change.

297. Among the European Structural and Investment Funds (ESIF), the ERDF and the Cohesion Fund can finance activities related to the following:

- Reduced risk of landslides, floods, and droughts;
- Building a National Water Management Center in real time; and
- Capacity building for effective and efficient climate adaptation, prevention, and risk management.

298. The Operational Program 'Regions in Growth' (2014–2020) directs funds for the renovation of the cities under Priority Axis 1 - 'Sustainable and Integrated Urban Development' and allocates it to cities, approved for support by the NCSD.

Figure 16. Bulgarian urban core centers, eligible for funding under Operation Policy ‘Regions in Growth’ 2014–2020



Source: NCSД 2013–2025, OPRG, NCRD 2012.

299. Priority Axis 1 stipulates financing of integrated urban transport projects, which should aim at improving urban mobility and reducing environmental pollution. In addition to the renovation of residential areas and buildings, important cultural assets and economic zones with potential and investment interest will be renovated as well. The IURDP envisages the replacement of the underground infrastructure during renovation of the urban open spaces. The IURDP of Sofia includes among its priorities renovation of two of the biggest urban parks, thus aiming at ‘greening’ the capital city and improved quality of the environment.

300. The other priority axes related to the regional educational, health, and social infrastructure, will also be implemented in settlements that need to update these important sites and buildings and adapt them to climate change. The energy efficiency of buildings is a horizontal priority for which 20 percent of the program's financial resources are allocated. Financial priority 1 is related to “providing support for energy efficiency and the use of renewable energy in public infrastructures, including public buildings and the residential sector.”

301. Other funding opportunities are offered by the LIFE and Horizon 2020 programs. LIFE Climate Action is a new subprogram of the LIFE Program for the Environment and Climate Action 2014–2020, with a budget of €864 million. LIFE Climate Action has four key climate adaptation tools, covering grants for project activities in the member states, including CCA projects. The Framework Programme for Research and Innovation, Horizon 2020, has as one of its six key areas for funding climate, resource efficiency, and raw materials activities (2015 Partnership Agreement).

302. Surveys show that in recent years the largest number of disaster risk prevention activities have been funded and implemented by the municipalities in Bulgaria, despite their limited budgets. Funding the activities of the NIMH-BAS, including its equipment and salaries is one of the bottlenecks. It is not by accident that in 2016 a proposal was made to close down the highest weather station on the Balkan Peninsula at Musala Peak (2,925 m), due to financial shortages and poor working conditions. The wages of the workers in anti-hail stations are also very low. These are important units with unique expertise and experience, needed to provide information and carry out observations and analyses of climate change in the country.

2.7. Urban Environment Sector Participation in CC(A) Specific International Cooperation or Information Exchange

303. The participation of Bulgarian cities in CCA-specific international cooperation in the field of urban environment depends both on the subject of the corresponding international conventions, agreements, and projects, as well as on the requirements toward the size and status of the partner cities. This explains why cities with important administrative functions and which are regional and municipal centers have limited access to international and European programs and projects, when their inhabitants are less than 50,000 or 30,000 people.

304. The participation of the urban environment sector in specialized international cooperation can be considered under different headings:

- Participation of the Bulgarian urban environment sector in international information exchange platform/databases;
- Participation of the Bulgarian urban environment sector in international organizations' reports (including EEA reports);
- Participation of the Bulgarian urban environment sector in international projects, related to environmental issues, or building a network for cooperation and/or information exchange;
- Participation of Bulgarian regional and administrative units in projects, related to environmental issues, collecting data, building international databases, platform, and so on, all with direct aspect or connected to urban environment and climate change; and
- Projects, closely related to environmental issues, territorial aspect, with eligible partners regions, and municipalities.

305. Details about the current networks, programs, and projects in which Bulgaria takes part are given in *Annex 10*.

306. Smaller municipalities and cities are not eligible for participation in EU urban environment programs and projects for developing bilateral cooperation or for participation in cross-border cooperation programs, mainly because of their small population size. Smaller capacity municipalities have mainly tourism and cultural heritage priorities. There are also additional smaller projects and partnerships of which Bulgaria and particularly Bulgarian local authorities are part of, but there is a very limited number of joint projects which integrate both urban environment and CCA policies.

307. In addition to the extensive networking, data, information, and know-how exchange

through partnership, an important role in communication of knowledge on urban environment CCA is played by the professional bodies (European Council of Town/Spatial Planners [ECTP-CEU],¹²¹ Architect's Council of Europe [ACE],¹²² International Society of City and Regional Planners [ISoCaRP],¹²³ International Union of Architects [UIA],¹²⁴ International Federation of Landscape Architects [IFLA] Europe,¹²⁵ Town and Country Planning Association [TCPA]¹²⁶) and academic organizations (Association of the European Schools of Planning [AESOP],¹²⁷ European Association for Architectural Education (EAAE),¹²⁸ European Council of Landscape Architecture Schools [ECLAS]¹²⁹) through their think-tanks, thematic groups and experts, congresses, competitions, and public lectures and publications. They all establish currently their platforms and forums to include the topic and to explore the role of the cities and metropolitan areas in climate change and adaptation options. Bulgarian academic and research society enjoys all the benefits of membership in some of these organizations through access to resources, knowledge, and know-how.

2.8. Bulgarian Urban Environment Sector-Specific Ongoing and Foreseen CCA (Related) Actions

308. The envisaged actions for adaptation to the climate change in the urban environment can be derived from the adopted Third NAPCC 2013–2020, the National Programme for Disaster Protection 2014–2018, and the Action Plan to the National Strategy for Management and Development of the Water Sector in the Republic of Bulgaria. The Third NAPCC 2013–2020 does not have an urban environment sector, so the associated measures are sought in other sectors.

2.8.1. Urban environment sector-specific ongoing and foreseen CCA (related) actions in national documents

309. Urban environment-related specific ongoing and foreseen actions are summarized in terms of the response of other sectors to the extreme weather components and events and their consequences.

Extreme temperatures

310. The measures envisaged under the Third NAPCC 2013–2020,¹³⁰ directly or indirectly related to extreme temperatures and CCA of the urban environment are mainly in the energy sector. The modernized development of the central heating system under the Priority Axis 3, together with rehabilitation of existing and construction of new low-carbon heat supply networks, will reduce the energy consumption and will provide better indoor comfort. Similar energy efficiency measures are undertaken in the services sector for improving energy performance of buildings, efficiency, and savings in final fuel and energy consumption. Indirect

¹²¹ ECTP-CEU <http://www.ectp-ceu.eu/index.php/en/about-us-2/founding-charter>

¹²² ACE <https://www.ace-cae.eu/>

¹²³ International Society of City and Regional Planners <https://isocarp.org/about-isocarp/>

¹²⁴ UIA http://www.uia-architectes.org/en/exercer/nouvelles/10285#.WPxjf_mGPIU

¹²⁵ IFLA - Europe <http://iflaeurope.eu/?s=Climate+change>

¹²⁶ TCPA, United Kingdom <https://www.tcpa.org.uk/>

¹²⁷ AESOP <https://aesopyoungacademics.wordpress.com/tag/climate-change/>

¹²⁸ EAAE <http://www.eaae.be/>

¹²⁹ ECLAS <http://www.eclas.org/>

¹³⁰ <http://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&Id=760>

impact on the urban environment sector will have planned measures for renovation of public and state buildings (with total area over 250 m²), because they will provide better indoor climate in the periods with extreme temperatures. With 3 percent annual renovation, 4,562 buildings should be repaired by 2020.

Table 8. Renovated public and state buildings (2015–2020)

Period	Number of Renovated Buildings, Public, and State Property
2015–2016	1,614
2017–2018	1,519
2019–2020	1,429
Total	4,562

Source: Third NAPCC 2013–2020.

311. Among the energy efficiency measures with indirect impact, considerable attention is given to zero net consumption buildings through a developed national plan, introduction of new technologies, materials and standards, and increased awareness. One of the measures is related to the idea of gradual implementation of the national program ‘1000 solar roofs’. This however requires amendment of the complicated existing regulations to reduce the administrative burden on the population and the businesses involved.

312. Closer to the urban environment is the sector called ‘Land use, land-use change, and forestry’ in the action plan. Most of the proposed measures under Priority Axis 1 ‘Increasing GHGs Capture’ are related to the increase of urban and suburban parks and green areas and improvement of their quality through appropriate maintenance and management. Despite the considerable small share of the newly established green areas, according to **Table 9**, the projected increase of green areas is expected to reduce outdoor temperature and improve the comfort in urban open spaces.

Table 9. New urban and suburban green areas (2014–2020)

Year	Increase in Urban and Suburban Parks and Green Areas (hectares)
2014	20
2016	30
2018	30
2020	20
Total	100

Source: Third NAPCC 2013–2020.

313. The measures in the transport sector with an impact on the urban environment are under Priority Axis 1: ‘Reduction of transport emissions’. They are related mainly to the national road network but concern also the urban transport systems and propose introduction of intelligent transport systems in the urban environment to reduce fuel consumption and to develop and promote ‘hybrid’ and electric transport. The attempts to establish charging points and parking spots for such kind of transport in the city of Sofia met considerable barriers five years ago, due

to the complicated procedures for acquiring planning permissions.

314. Additional measures, proposed for the urban public transport, also aim at the reduction of emissions and air pollution through better developed schemes and increased share of electric transport (rail, tram, trolley, and metro), stimulated bicycle and non-motorized transport, and reduced by half (50 percent) public transport vehicles, using conventional fuels.

315. The measures proposed in the waste sector are also supposed to have an indirect impact on the urban environment because of reduced GHGs emissions. They include further development of separate collection systems and separate ones for the green waste in the municipalities.

316. Most of the measures summarized above are directed toward changing the energy consumption pattern and reduction of the GHG emissions.

Floods

317. The measures envisaged to reduce flood risk in settlements according to the National Programme for Disaster Protection 2014–2018 target the urban environment and directly the urbanized territories.¹³¹ They are divided in two groups—for suburban territories and for the urban environment. The measures in the first group are important for protection of the population in the human settlements, located close to dams, dykes, and rivers. The program proposes the following measures in suburban territories:

- Maintain river bed conductivity, including the 500m zone after dams;
- Maintain and exploit dykes, corrections of rivers and gullies and other hydro-technical and protective facilities, drainage systems and fields, drainage pumping stations;
- Annual spring and autumn technical inspections of the hydro-technical facilities and planning of the repair and investment works for the following year;
- Prepare and test run emergency plans of dam areas and establish emergency depots, equipped with the necessary equipment and materials;
- Develop modern early warning systems (Iskar and Kardzhali dam regions); and
- Demolish potentially dangerous dams.

318. Measures in the urban environment include:

- Construct and maintain rainwater sewerage systems;
- Construct barriers at the entrances of the buildings in the threatened low stretches of the terrain;
- Tightly close vessels in the shafts where polluting materials and hazardous waste are stored;
- Provide necessary resources for protection and rescue activities and for first aid, and periodic checking of their fitness;
- Provide and maintain warning facilities;

¹³¹ <http://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&Id=899> (in Bulgarian)

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- Provide on time information and necessary tools for employees and workers at port terminals to carry out rescue and protection activities;
- Conduct periodic instructions and train population and staff; and
- Provide readiness to perform repair and restoration work on the territory of the municipality (the area, the site), in case of destruction and damage.

319. The document also describes general measures for flood risk management, addressing specific participants and responsible institutions.

Landslides

320. Measures for landslides prevention are drawn from the National Programme for Mitigation and Prevention of Landslides on the Territory of Republic of Bulgaria, Erosion, and Abrasion on the Danube River and Black Sea Coast 2015–2020. Following the classification of the landslides, measures are presented in the tables in the annexes of the document. Additional recommendations are given in the document including the following:

- **Legislative** - protection of the constructed fortifications and constructions for reduction of processes and better landslide support;
- **Education** - development of knowledge base for professional development of the specialists working in the area; provision of accreditation of programs and graduates for better quality;
- **Planning and design** - mapping geological processes, digital formatting of the existing information, production of hazard zones maps;
- **Monitoring** - observation of landslide zones with completed construction works;
- **Research** - observation, analysis, and assessment of the state of the areas close to landslide zones;
- **Information** - creating reliable database for landslides in Bulgaria; and
- **Awareness** - dissemination of new type of culture among population, planning and construction professionals, and entrepreneurs.

321. Additional information for the existing and newly discovered landslides is given in **Table 26** within **Annex 7** [Landslides].

Fires

322. The measures envisaged in the National Disaster Protection Programme 2014–2018 concern mainly forest fires and fires in agricultural land and the most important ones, related to spatial and urban planning, are the proposed mapping and classification of the forest and agriculture territories by degree of fire hazard.

Water resources

323. The measures related to urban waters are described in the current Action Plan to the National Strategy for Management and Development of the Water Sector in the Republic of Bulgaria in the short-term (2013–2015), medium-term (2016–2021), and long-term (2022–2037) perspectives.

324. The most important goal for the urban environment is the first strategic goal—to ensure

provision of the necessary quantities of water for the population and for business in conditions of climate change, leading to droughts.

325. The main medium-term measures for the urban environment aim at protecting the quality of surface and groundwater, design, construction and reconstruction of the water supply networks and reservoirs, construction and rehabilitation of drinking water and wastewater treatment plants, water-saving campaigns, and measures to improve the performance of institutions.

326. The main measures in the area of water supply and sewerage in the settlements are also envisaged in the Strategy for Development and Management of Water Supply and Sewerage in the Republic of Bulgaria 2014–2020 as follows:

- Complete and approve high quality regional master plans;
- Invest in energy and resource efficiency in the sector, based on the overall costs of water and sewerage infrastructure; and
- Provide for and protect vulnerable groups of the population.

327. These measures are also related to the provision of quality services to the population and improvement of the water supply and sewerage networks and facilities, which are among the main strategic objectives.

Disaster risk management

328. There is a total of 26 measures, described in the National Disaster Protection Programme 2014–2018. All of them can also be referred to the urban environment and the construction sector. They cover the following aspects:

- Develop the human resources in the structures of the Bulgarian Red Cross and maintain facilities;
- Train the population and run information campaigns;
- Maintain existing systems for reception and processing of satellite data and increase the possibilities for exchange of information and weather, climate, and disaster related data with international institutions;
- Organize voluntary groups and prepare them for actions in the prevention and management of disasters;
- Upgrade the units of the Unified Rescue System with modern equipment and resources; provide financial support for the military formations for managing and/or overcoming the consequences of disasters;
- Develop, improve, and service the early warning system of marine hazards; and
- Train the executive bodies, their administrations, and the disaster response forces and update school curricula.

329. All summarized measures stated earlier, proposed in different national documents, are directed toward the main gaps and barriers in CCA policy and disaster management practices in the country. The most important ones are connected with the monitoring and control on the implementation of the adopted strategic documents and their action plans and programs, with

the provision and access to reliable information, knowledge development and communication, capacity building, and awareness raising.

2.8.2. Urban environment sector-specific ongoing and foreseen CCA (related) actions in local documents

330. At the municipal level, most directly related to the topic of adaptation of the urban environment to climate change are the CCA strategies prepared by some municipalities. All municipal councils have adopted rules and procedures aimed at reducing the risk of natural disasters.

Box 2. Adaptation to climate change strategy for Sofia Municipality, 2016

The strategy is developed in accordance with the requirements of the initiative Covenant of Mayors. The assessment of the future climate change is based on a set of climatic indices, calculated by the deviation from the baseline period (1971–2000) to the period 2046–2065 and at the end of the century (2081–2099). The moderate scenario suggests a warming of 2.4°C by 2099, while the extreme scenario implies a 4.9°C warming for the same period.

- Indicators for adaptation - urban sector:
- Share of 'green' urban area (percentage)
- Damage to infrastructure, related to extreme climatic factors—storms, hail, flood (years)
- Number of schools, kindergartens, hospitals, institutions, with available measures for risk management in hot weather
- Share of buildings (housing, commercial premises, administration, and so on) not resistant to flooding (m²)
- Index of thermal comfort
- Annual amount of days with maximum temperature >35°C (hot days) and minimum temperature >20°C (tropical nights)
- Sealing (percentage)

Adaptation measures - urban sector:

- Improvement and maintenance of blocks of flats and a network of street landscaping
- Periodic cleaning of urban waterways (river beds and canals) to avoid the release of water from the gutters during heavy rains
- Investments in blue-green infrastructure (for example, green roofs)
- Mapping of the high flood risk areas in Sofia Municipality and preparation of counter measures and responses
- Providing cool centers - public buildings, which during heat waves, offer services for vulnerable people
- Sustainable drainage systems
- Designing adequate drainage systems in new buildings and infrastructure
- Restoration and maintenance of urban and rural water fountains
- Planting infiltrating vegetation (trees, bushes)
- Expansion of existing and construction of new underground car parks
- Introducing cool roofs, which reflect the sunlight and heat, to replace conventional black roofing, which absorbs heat and thereby heats the buildings and other surfaces, such as car parks
- Setting up of temporary water tanks in the form of water areas in parks and gardens or underground facilities

Source: Sofia Municipality 2016 (Strategy on Adaptation to Climate Change)

331. Investments in green infrastructure to reduce disaster risk (including floor coverings, green coverings to absorb rainwater) are still limited to large cities and new constructions. There is no current data about the cities. Still, the planning, design, and engineering process takes formal account of climate change. For example, only large manufacturers of building materials adhere to the EU environmental product declaration requirements—KNAUF for gypsum board and YTONG for bricks.

332. Another type of specific local-level plans are the coastal plans in line with the draft EU Directive of the European Parliament and of the Council for Maritime Spatial Planning and Integrated Coastal Zones Management. The land-use plans drawn up for the 14 Black Sea coast municipalities at the end of the 1990s under the joint program of the MRDPW and World Bank Global Environment Facility Program were not incorporated in a common regional scheme for coordinating the investment plans and reduction of construction pressure. The ‘My Coast’¹³² project, funded by the Dutch Ministry of Spatial Planning, Housing, and Environment (VROM), did not produce a strategic document on the Black Sea coast and ended up with recommendations to key actors in the management of these territories.

333. Since 2016, the MRDPW participates together with three other institutions from Bulgaria and eight from Romania in the project ‘Cross-border Maritime Spatial Planning in the Black Sea - Romania and Bulgaria’ (MARSPLAN - BS),¹³³ aiming at implementation of the Maritime Spatial Planning Directive.¹³⁴ One of the main objectives is to coordinate the spatial planning (for terrestrial and marine areas), transport (including navigation), and environmental protection and integrated coastal zone management (ICZM). It is expected to expand the knowledge base, to further facilitate development of local plans for the most vulnerable parts of the coast, which during the last 20 years have been subjected to constant construction pressure, and to enhance building and environmental control.

334. Ban or restrictions on construction in high-risk flood and/or landslides areas is among the prerogatives of spatial planning and must be stated clearly in the land-use and zoning regulations. The control on buildings in high-risk areas is within the responsibilities of construction control directorates at the national and regional levels. They must deal with two types of buildings—on the one hand with the illegal ones, in most cases of the poorest and most vulnerable groups of the population, and on the other hand, with the luxury buildings and mainly hotels, bypassing regulations and adopted zoning plans.

335. Physical modifications to the environment through adaptive topography and adaptive infrastructure is still only in the opportunities list and very rarely used in the professional practice. It is yet another objective for the academic institutions in the area of planning, engineering, architecture, and landscape architecture.

¹³²http://www.researchgate.net/publication/237259668_MyCOAST_Transferring_the_integrated_area_approach_to_Bulgaria

¹³³ Contract EASME/EMFF/2014/1.2.1.5/2/SI2.707672 MSP LOT 1 /BLACK SEA/MARSPLAN-BS), the project financed by the EC through the European Maritime and Fisheries Fund (EMFF)

¹³⁴ Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning

2.9. Gaps and Barriers Hindering Adequate Response to CCA Action

336. Knowledge gaps related to climate change impacts in the urban environment as analyzed in the framework of the Covenant of Mayors 2016 and utilized in the recommendations for facilitating adaptation measures, can be found at all administrative levels in Bulgaria. The analysis of scientific publications and expert assessments allows for the following summary of existing problems:

- **Information provision** - incomplete information, broken down by individual sectors with little attention to the complex urban environment, which is mostly collected for the whole country, for the individual regions and districts, and less frequently for municipalities and cities; insufficient data on damage and reimbursement; poor access to city-specific data and information; and need for a clear system of indicators for monitoring the effectiveness of the urban adaptation measures as well as information support for this system.
- **Research** - insufficient coverage of the topic in the country's scientific agenda, scarce funding of research on climate change in the area of urban environment, housing, construction and construction materials, and social and economic cost of maladaptation to climate change; lack of multidisciplinary and transdisciplinary studies, particularly important for the urban environment; lack of culture of communicating and sharing of scientific results and knowledge; insufficient presence of the topic in national scientific and academic forums; and unused opportunities for thematic priority funding of postgraduate and post-doctoral research in the area.

Additional gaps both in information provision and research, and barriers for introduction of better risk-based land-use and infrastructure planning are the lack of detailed mapping of hazards that affect urban areas, and lack of risk and vulnerability assessments for floods, landslides, earthquakes, and extreme temperatures on city level.

- **Legislative backing** - the topic of adaptation to climate change is still poorly incorporated in legislation on spatial and urban planning, design and construction; the prevailing regulations are on earthquake, fire safety, and energy efficiency; inadequate presence of the theme of adapting the urban environment, buildings, and people to climate change in the scope and contents of the main spatial and urban planning tools - strategies, plans, and programs at different levels; existence of many and diverging strategies, developed at the municipal level, similar in content but poorly coordinated (for the green system, natural disasters, energy efficiency, and so on), whereby their development and implementation is largely superficial and ineffective.
- **Capacity** - insufficiently developed institutional, administrative, and expert capacity; deficient of adequate knowledge, covering climate change and its impacts on human health and urban environment, transport, technical, social and tourist infrastructure and, at the same time, covering the forecasting, planning, implementation, and monitoring of strategies and adaptation plans; absence of a strategy for changing the curriculum on urban planning and design for planners, architects, engineers, and landscape architects, with additions of appropriate knowledge and skills (the current programs mainly focus on sustainable urban development and energy efficiency); insufficient skills in translating information into effective adaptation actions; lack of flexibility on the part of the educational system in terms

of educational forms and duration, and offering of appropriate formats for politicians, local managerial staff, and specialists in related disciplines.

- **Funding** - lack of information on the financial resources necessary for the mitigation of natural disasters risks and their effects and for adaptation to climate change of buildings and facilities in the urban environment; lack of sufficient knowledge about the possible sources of funding, appropriate methods, and approaches for establishing adequate budgetary frameworks; and shortage of financial resources, especially in small cities and municipalities for retrofitting and for adequate equipment for emergency centers and staff.
- **Awareness of the general public** - lack of adequate and appropriate knowledge among the general public; lack of skills for appropriate response during natural disasters; lack of a well-developed system of public participation despite the large number of environmental and other NGOs in the country; lack of properly developed information materials and interactive platforms, friendly to different audiences; and insufficient participation of the mayors of Bulgarian cities in the EC's Covenant of Mayors Initiative, aimed at better utilization of the created instruments for step-by-step guidance in the implementation of measures.

2.10. Conclusions

337. CCA (but mitigation as well) in the urban environment should be based on an integrated approach at all levels of governance, in line with existing legislation in the different sectors. Accordingly, a thorough review of this legislation and possible creation of new regulations in the area of disaster mitigation planning and action is needed. These changes should clarify the roles and responsibilities at the national, regional, municipal, and urban levels and improve cooperation and communication among all sectors, state, and municipal authorities, NGOs, business representatives, and all other stakeholders.

338. Spatial and urban planning should be based on detailed hazard, vulnerability, and risk assessments. Adaptation strategies, plans, and options should be developed according to the risks specific to the locations. Specific building codes and zoning need to be developed and more stringent regulations on building design need to be applied to ensure that the infrastructure is resilient to local risk and the identified level of risk.

339. Reducing the risk of disasters calls for a solid institutional basis, which should be strengthened by building capacity, good governance, promotion of appropriate policies, facilitating the flow of information, adoption of effective coordination mechanisms, and appropriate education. All these can contribute to the effectiveness of municipal adaptation actions.

Chapter 3. Urban Environment Adaptation Options

340. This chapter presents current knowledge and good practice examples in CCA of the urban environment. The analysis of the experience in Bulgaria and other countries demonstrates the variety of approaches to the evaluation and selection process, reflecting the scope and scale of climate change impacts on cities, population, and human activities. Possible adaptation options for management of extreme climate events and disasters, including care for the most vulnerable groups are examined based on adopted principles and selected groups of criteria. The presentation of adaptation actions and measures integrated in them focuses on their typology, constraints and opportunities, and cross-cutting issues and reflects the complexity of the urban environment and the results from the stakeholders' consultation process.

3.1. Identified Adaptation Options

341. Adaptation options are defined as choices among possible courses of action that can help reduce the degree of climate vulnerability and build resilience. There is a variety of approaches to adaptation options, categorized according to the spatial and temporal scope (Tol 1997), timing (Smithers and Smit 1997), address (Burton 1997, Tol 1997, Smithers and Smit 1997), cost and benefits (Hulme et al. 2002), adaptation measures type (Burton 1997), adaptation capacity (Biagnini et al. 2014), and management planning and behavior (Dixit 2013). Once the options are selected, they are incorporated into plans and activities.

3.1.1. Identified adaptation options for Urban Environment sector

342. CCA options for urban environment include a set of measures and actions, directly or indirectly targeted toward all stages of DRM—identification and assessment, planning, organization, implementation, and control. They also refer to post-disaster measures for recovery, rehabilitation, reconstruction, and coping with consequences and stress. The effectiveness of these adaptation options depends on the proper combination of measures, actions, and resources according to scale, duration, impact nature, environment specifics, institutional and expert capacity, political, legislative, and financial framework, and cultural context.

343. The identified CCA options (see also *Annex 2*) for the urban environment in Bulgaria are the result of the overall analysis and evaluation of the sector and have been systematized in 10 categories in the tables below. They are presented in a logical sequence, reflecting their significance and interdependence.

Category 'Policy'

344. The success of all adaptation options for CCA in the urban environment depends on political engagement, and on their inclusion in regional and urban development policies. The high importance of the 'Policy' category and the actions needed to reach consensus on the overall CCA objectives relate to Bulgaria's preparation for the next programming period, the new approach to regional policy, the updating of sector strategies, and the need to achieve better social, economic and territorial cohesion. Part of the long-term objectives of cohesion policy are also the measures to reduce the impact of climate change on the urban environment, human health and quality of life. A key prerequisite for success is the implementation of the integration approach in formulating and implementing policies. A good example of a coordinating platform

for sectoral spatial policies is the National Concept for Spatial Development (NCSD). In the context of this strategic planning document, CCA policy could become a reference point for all other policies.

CLIMATE CHANGE ADAPTATION OPTIONS	
I.	Policy – Mainstream CCA in regional and urban development
1.	Organize a discussion forum to agree on a common vision and develop common understanding on CCA policy and strategy
2.	Mainstream CCA into policies of regional and urban development, including housing and construction, by revising the Spatial Planning Act
3.	Incorporate CCA into the new National Housing Strategy

Category 'Information'

345. The identification of the main deficiencies and barriers in providing reliable, accurate and up-to-date information on the development and implementation of CCA options and the need for city-level research data make this category second in importance. This will allow for a timely organization of a national metadata and climate change database and for defining information requirements that are specific to the urban environment. Better implementation of the INSPIRE Directive and provision of free access to information on the impact of climate change on the urban environment will facilitate hazard mapping and risk assessment, as well as informed decision-making in the development of all sectoral policies. This category of CCA options has strong links to the category of 'Research', but also to managing the process of adaptation and to capacity development.

CLIMATE CHANGE ADAPTATION OPTIONS	
II.	Information – Secure institutionally regulated exchange of information and data according to INSPIRE directive obligations
4.	Create common standards for the type, structure, scope, and format of metadata and data, harmonized with the EU at the city level
5.	Exchange information with European countries and international institutions
6.	Provide open access to information for the general public

Category 'Research'

346. Adaptation options in the category 'Research' meet the need to put CCA issues in the urban environment among the priorities of the National Research Development Strategy. The best CCA policies and strategies developed in European countries are supported by a solid knowledge base. The application of an interdisciplinary and transdisciplinary approach to scientific studies is indispensable for the urban environment, where the country's predominant population, material assets, social services and urban infrastructure are concentrated and where optimal interaction between the various economic, social and environmental activities needs to be achieved. Renovation and building the urban environment with increased demands for reduced and sustainable use of resources can also be achieved more effectively and efficiently if based on research into new intelligent building technologies, structures and materials. This determines the main relations of these adaptation options with other categories such as 'Information', 'Education', 'Technology/construction' and 'Capacity'.

CLIMATE CHANGE ADAPTATION OPTIONS

III. Research – Provide a common long-term vision and objectives in urban environment CCA research through amendment of the National Scientific Research Development Strategy

7. Identify priority scientific topics, linked with the city, open and green spaces, buildings, infrastructure, construction materials and human health, and their risk resilience assessment
8. Support innovations in construction, technologies and services, relevant to the CCA

Category ‘Institutions’

347. Important conditions for the successful interaction of institutions in implementing CCA policies are the improvement of their sustainability, of coordination in their work and knowledge communication. National institutions and institutions in major cities will play an important role in developing and implementing local CCA strategies. Institutional development is also related to the development of capacity, training and retraining, and to legislative changes for which the initiative is to the MRDPW. By comparison, it is possible to consider the NCSD as a coordinating ‘institution’, like Austria's experience, with their institutionalized national spatial development document and the use of organized expertise in the study of climate change at regional and urban levels. Information and educational efforts to promote and properly understand such institutionalization, as a reference point for all policy decisions related to the urban environment, can prove more effective than the establishment of classical institutions under conditions of financial and administrative constraints and insufficient expertise.

CLIMATE CHANGE ADAPTATION OPTIONS

IV. Institutions - Develop sustainable institutions capable of providing CCA policy at all administrative levels

9. Organize horizontal coordination between MRDPW, MoEW, ME, Ministry of Agriculture, Food, and Forestry (MAFF), MF
10. Organize vertical and horizontal coordination between all directorates in the MRDPW, related to urban environment CCA and DRM
11. Improve cooperation between national, regional, and local levels authorities in CCA policy implementation
12. Develop capacity in the directorates through retraining and additional expert employment
13. Provide guidelines and methodological support to municipalities for the development of local CCA strategies

Category ‘Legislation’

348. Review and analysis of legislation in the field of regional and urban development policy show that the requirements concerning CCA in the existing legal and regulatory framework can be reinforced, together with improved control over their implementation. To do so now is a good moment, given the expected regional and urban policy reform in the EU and Bulgaria and the expiry of a significant number of planning documents. This category strongly relates to the categories of ‘Policy’, ‘Institutions’, and to financial adaptation options.

CLIMATE CHANGE ADAPTATION OPTIONS

V. Legislation - Revise and amend all types of legislative documents to transpose CCA issues after a Regulatory Impact Assessment

14. Mainstream CCA requirements in all legislative documents related to regional and spatial/urban planning (Spatial Development Act, Regional Development Act, Regulations No. 4, 7, and 8 at the SPA, Regulation for spatial development documents preparation, Regulations on EIA and SEA)
15. Revise and update the requirements for the scope and contents of main tools in the above acts and regulations (NCSO, spatial development schemes and plans, detailed plans)

Category 'Financial'

349. The sixth group of adaptation options relates to financial provisions and predetermines the opportunities for developing and implementing all other options. They are seen in the context of Bulgaria's limited financial resources, poverty problems, the increasing relative share of vulnerable groups, requirements for integrating and concentrating investments, and the need for a new and more responsible financial and insurance culture. This category's adaptation options are addressing the most important institutions - the Council of Ministers, certain ministries, financial and insurance institutions, municipal disaster risk management structures, and individual residents, including their most vulnerable representatives. Identified financial deficits link this group of options to information provision, research development, institutional strengthening, technological innovation in construction and urban environment, capacity development, and education.

CLIMATE CHANGE ADAPTATION OPTIONS

VI. Financial - Change financial, social, and insurance policies

16. Revise the existing financial instruments and design new ones for CCA and DRM, including for energy renovation
17. Explore the EU funds' potential for CCA and DRM
18. Plan state budget and provide financial support to municipalities to implement CCA policies
19. Revise the existing DRM fund for better social protection of the most vulnerable groups
20. Expand financial inclusion measures through adaptive safety nets, contingent finance and reserve funds for the poor and most disadvantaged

Category 'Education'

350. In the category CCA education options, the needs for various forms of general information, training and retraining of target groups related to the urban environment – politicians, administrators, experts, academics, and the general public – have been identified. The very name of this group of options suggests the concept of realization through gradual expansion and dissemination of knowledge. This also defines the links of the category with policies, information, research, institutional strengthening, capacity development, technological innovation, as well as partnership building. These links determine also the different types of knowledge and skills that are needed – specialized for the specific impacts of climate change on the urban environment and the population and the potential for mitigation of negative consequences, and general for negotiation, conflict resolution, consensus building, and communication.

CLIMATE CHANGE ADAPTATION OPTIONS

VII. Education - 'Train the trainers' on CCA

21. Organize appropriate format education and training for all levels—from politicians to the public
22. Establish joint multidisciplinary courses for planners, architects, engineers, landscape architects, ecologists, economists, sociologists, and financial management professionals on Master's level
23. Provide tutoring and organize thematic PhD
24. Develop interactive CCA platform for distance and open learning in support of politicians, administrators, professionals, NGOs, and the public, with special apps for the disabled

Category 'Technology/Construction'

351. Innovation in construction provides for opportunities to cope with climate change. Innovative building methods, technologies, materials and structures are applied by an insignificant number of large companies, causing innovation to still be underrepresented in the country. To some extent, applied innovations relate not only to the construction process, but also to all previous and subsequent actions and stages in planning, building, using, and managing the urban environment. The CCA options identified in the category 'Technology/Construction' are not exhaustive and relate to the categories 'Policy', 'Research', and 'Education', and to the development of expert and scientific capacity.

CLIMATE CHANGE ADAPTATION OPTIONS

VIII. Technology/Construction - Implement new Eurocodes and technical norms in planning, design, construction technologies, and building materials

25. Improve construction and maintenance supervision, monitoring and control, and TQM systems on projects and construction
26. Stimulate creative urban design, resilient to climate change
27. Promote green, smart, and innovative cities, buildings and technologies planning, design and certification

Category 'Capacity'

352. The development of institutional, administrative and expert capacity affects all levels and actors in the development and implementation of CCA options for the urban environment. The development of knowledge and capacity have equal weight, both at the highest (central) level of management and at local levels. Regardless the EU's support for the development of national and urban CCA strategies, additional support is needed at the local level. Capacity development, which itself needs well-developed information systems and educational programs, is a precondition for the implementation of CCA options in the other categories.

CLIMATE CHANGE ADAPTATION OPTIONS

IX. Capacity - Develop and upscale institutional, administrative, and expert capacity

28. Build emergency and DRM units' capacity, provide sufficient and modern equipment, and financial support
29. Provide appropriate accurate and updated information
30. Develop awareness, commitment, CCA knowledge and culture among the general public

Category ‘Partnership’

353. Partnership is at the heart of many EU countries’ CCA strategies. The identified adaptation options in this category show full coverage of all stakeholders and target groups, including those most in need of support, who should become part of the interaction networks. A series of EU-funded projects (see *Annex 10*) and built platforms support the development of partnerships. The requirements of part of the EU funds call for partnership in implementing urban projects and involvement of the private and public sectors. This suggests that part of the identified and selected CCA options will evolve on that basis.

354. In the context of resource deficits (financial, human, time, information, technology, and so on), partnerships are the only reserve for multiplying the effect of CCA efforts. This includes partnerships at all levels (neighborhood, city, municipality, region, country, and between all stakeholders). Their emergence, stimulation, and functioning are strongly conditioned by the categories ‘Legislation’ and ‘Finance’.

CLIMATE CHANGE ADAPTATION OPTIONS	
X.	Partnership - Work in partnership and communicate knowledge
31.	Promote partnership, networking, and collaboration among different age, gender, ethnicity, professional, and social groups, including the disadvantaged ones
32.	Promote and support networking
33.	Organize a social network for support of vulnerable groups
34.	Develop public-private partnerships
35.	Support the effectiveness of NGOs
36.	Work with media for promotion of the CCA system

355. Most of the identified CCA adaptation options can be considered ‘horizontal’ because they concern all stakeholders and all elements of the urban adaptation process, from programming and planning to the implementation, operation and use of the urban environment. They are directly related to the ‘vertical’ urban specific adaptation options, that offer a wide range of concrete and realistic actions to adapt to climate change by applying them to all hierarchical levels of strategic and spatial planning, construction and control.

3.1.2. Possible adaptation options for management of extreme climate events and disasters

356. In spatial and urban planning, the choice of CCA options depends also on the scale and scope of the territory that needs to be protected and adapted to climate change and refers to the elements of the affected environment, applied tools, and institutions involved.

357. Possible adaptation options for the urban environment in Bulgaria address risks, identified in Chapter 1 related to extreme events and their impacts (extreme temperatures, intensive precipitation, floods, and landslides) and are considered at supranational, national, and local levels, downscaled to the single building. This corresponds to the hierarchical planning system in the country and to the planning process.

358. **Extreme temperatures** will, in different degrees, affect almost the whole population of Bulgaria, considering the high share of residential areas in the cities and the high share of residential buildings for renovation. Based on the current statistics of the housing sector, it was

estimated that, as of 2016, about 9 percent of the houses, mainly located in the periphery of the country, are highly depreciated and another 70 percent should be renovated and made more energy-efficient and risk-resilient. The government program for renovation of residential areas is under discussion, while further full state financial support is under question. The existing Urban Renovation Fund may cover only 10 percent of the needs for the next five years. Therefore, the MRDPW is exploring new types of financial instruments and possibilities to co-finance energy-efficient modernization of residential buildings and the construction of buildings with near-zero energy consumption through the European Fund for Strategic Investments.¹³⁵ Experience in this area already exists in France, Germany, and Finland. Other options are discussed along the work on the National Housing Strategy and the proposed programs for building stock renovation. All options correspond with Bulgaria’s commitment to achieve the goals of the *Europe 2020* strategy and the EU New Urban Agenda.

359. At the national, regional, and local levels, there are a variety of options to respond to extreme temperatures through legislative, planning, technical, and social measures. Some of the most suitable ones for Bulgaria are presented in **Table 10**.

Table 10. Possible adaptation options to address extreme temperatures, heat/cold waves

Specific Adaptation Options	Relevance to Urban Environment	Participants
Supranational level		
Meet EU standards for GHG emissions reduction and for energy efficiency of buildings	Bulgarian government’s international and EU commitments	MRDPW, MoEW, ExEA, local authorities
National level		
Develop Adaptive capacity	Institutional, administrative, and expert capacity development is important at each step of the CCA and at all levels	MRDPW, universities, research units, NGOs, local authorities
Implement the National Energy Efficiency Strategy and the National Long-term Programme for Promoting Investments for Energy-efficient Public and Private Residential and Commercial Building Stock 2016–2020	Priority in Bulgaria is given to housing because of the high proportion of residential buildings in need of renovation	MRDPW, MF, ME, local authorities, NGOs
Develop and implement National Housing Strategy	Work in progress. ‘Energy’ renovation and construction strengthening of residential buildings in the focus of one of the programs. Need to assess risks and vulnerabilities properly and to improve effectiveness, efficiency and quality control of the existing program	MRDPW, local authorities, housing associations, financial institutions, NGOs

¹³⁵ <http://www.eib.org/projects/pipelines/pipeline/20160039>

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Specific Adaptation Options	Relevance to Urban Environment	Participants
Discuss and amend the National Strategy for Scientific Research	Need CCA of the urban environment and all relevant topics to become a priority	MES, BAS, academic institutions
Prepare and adopt the NAS	Work in progress. More comprehensive approach implemented in the final stage with better coordination among sectors.	MoEW and all relevant ministries for the sectors
Reduce urban sprawl through better urban planning, based on hazard and risk assessment	A need for stronger planning control on urban expansion despite population decline.	MRDPW, Local authorities, planning consultants
Regional level		
NA	The 6 regions (NUTS2) and 26 districts (NUTS3) in Bulgaria have neither administrative power nor financial resources. They may have a consultative role in discussion of documents and programs.	Regional councils
Local level		
Collect data and provide access to information about the extreme temperatures on city level	Need for data on local level for research, education, and practice	NSI, BAS, NIMH, ExEA, RIEWs
Prepare and adopt local adaptation strategies/plans	Only Sofia, Burgas, and Dimitrovgrad have such documents prepared and adopted as part of the Covenant of Mayors initiative.	MoEW, local authorities
Implement smart mobility schemes in cities	Bulgarian cities are among the most air polluted in the EU. The integrated urban transport plans for big cities is in progress. They need to be prepared and implemented for medium cities too.	MRDPW, OPRG, local authorities
Reduce heat waves through smart risk-informed urban planning and design; Introduce stronger development control and higher quality construction	Spatial Development Plans are accompanied by state of the environment schemes, quite often formally prepared. Need for more detailed studies and recommended measures.	Local authorities, expert planning councils, RIEW's, planning consultants
Protect and develop urban green system for reduction of extreme high temperatures, strong winds and air pollution	Spatial Development Plans are accompanied by green system schemes, quite often formally prepared. Need for more detailed studies and better adjustment with the SEA.	Local authorities, expert planning councils, RIEW, planning consultants

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Specific Adaptation Options	Relevance to Urban Environment	Participants
Urban zones		
Give priority to brownfield development instead of green field	Such kind of development should be stimulated through appropriate instruments, especially in cities with large and abandoned industrial zones	MRDPW, OPRG, ME, local authorities
POS/Buildings		
Meet the energy-saving and energy efficiency building standards, thus improving the overall sustainability and safety of the building stock	Preparation of technical passports of buildings with energy efficiency characteristics after structural observation and survey	MRDPW, consulting companies
	Implementation of buildings' renovation programs and innovation projects for more efficient heating/cooling systems	MRDPW, local authorities consulting companies
Apply creative architectural design to improve indoor comfort and to provide natural ventilation/shading; Build extra headroom in new developments to allow for further modifications consistent with temperature projections	Architectural projects are not subject of control for these issues, but to technical norms only. Need better control in the process of approval of projects and for amendments of design norms.	MRDPW, local authorities, expert councils, architectural consulting and design companies
Produce and use construction materials for buildings and POS with good insulation characteristics	Eurocodes and national regulations should be updated to reflect climate change projections in terms of extreme temperatures	MRDPW, Bulgarian Institute for Standardization (BIS)

Note: MES = Ministry of Education and Science; MF = Ministry of Finance; RIEW = Regional Inspectorate of Environment and Water.

360. The increased number of days with **intensive precipitation**, often accompanied by wind storms or hail, are the cause for more frequent floods and considerable damage over the past years (**Table 5**). Specific options for coping with heavy precipitation in cities aim at adapting to increased storm water in a short period of time, reducing the risk for population, infrastructure, and property. European and other international documents describe a variety of adaptation options and good practice examples for green architecture (green roofs, walls, parking lots, and other green structures), linear parks, and urban rivers (Seoul, Paris, New York, Copenhagen, and so on). The most relevant options for Bulgaria's urban environment have been systematized in **Table 11**.

Table 11. Possible adaptation options to address intensive precipitations

Specific Adaptation Options	Relevance to Urban Environment	Participants
Supranational level		
Exchange information and knowledge with WMO and 'World Weather Watch' program for early actions.	National Institute for Meteorology and Hydrology has well-established cooperation with WMO and European institutions.	NIMH-BAS IO-BAS

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Specific Adaptation Options	Relevance to Urban Environment	Participants
National level		
Incorporate precipitation projections in updated national, regional, and spatial development documents – National Concept for Spatial Development (2013–2025) and National Strategy for Regional Development (2012–2022).	The NCSD (2013–2025) does not present the intensive precipitation zones with cities in risk. Mapping these areas will support local CCA actions.	MRDPW, OPRG, River Basins Directorates NCRD
Further develop national early warning and disclosure system 'module' on precipitation for remote areas.	National early warning and disclosure system is functioning well but needs additional development for smaller and remote cities.	MI, governors, mayors, local companies
Discuss and amend the National Strategy for Scientific Research development, giving priority to CCA.	Need of CCA in the urban environment and all relevant topics to become a priority. Could be used as a PhD priority.	MES, BAS, academia
Prepare and adopt the NAS with clear messages to stakeholders at all levels	Work in progress.	MoEW and all relevant ministries for the sectors
Regional level		
Incorporate precipitation projections in the regional level spatial development schemes.	The six regional spatial development schemes have not yet been commissioned by the MRDPW. Expected commissioning in 2018 after a revision of the NUTS2 regions.	MRDPW, NCRD, Regional Councils
Local level		
Collect data and provide access to information about intensive precipitation at the city level.	Need for precipitation data at the local level for research, education, and practice.	NIS, BAS, NIMH, ExEA, RIEWs
Prepare and adopt local CCA strategies/plans and bind them with the municipal programs for risk assessment and disaster risk reduction.	Only Sofia, Burgas, and Dimitrovgrad have such documents prepared and adopted as part of the Covenant of Mayors Initiative.	MoEW, local authorities
Plan and implement separate sewerage systems in the new/revised Master Plans or upgrade the capacity of the renovated ones.	The existing mixed sewerage systems in the cities need reconstruction and/or replacement.	MRDPW, OPE, local authorities
Maintain and upgrade drainage systems according to the precipitation projections.	Floods are among the most frequent consequences of intensive precipitation in Bulgarian cities.	Local authorities, consulting engineering companies

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Specific Adaptation Options	Relevance to Urban Environment	Participants
Expand natural landscape areas with higher capacity for storm waters absorption and reduce zones for new development with a higher share of 'sealed' surfaces.	In most cases, Spatial Development/Master Plans are prepared under the pressure of local authorities and municipal councils for urban expansion despite the declining population in most cities.	MRDPW, Local authorities planning professionals and consulting companies
Improve disaster preparedness and response system in local and urban zones	The most important ones are the units for small cities, especially the ones located in remote areas	Local MI structures, Local authorities, NGOs
Urban zones		
Stimulate and apply creative urban and architectural design, providing sufficient space for storm water temporary storage (urban reservoirs, pools, sport fields, and so on).	There is no information about such examples in planning and design in Bulgaria, which considerably reduce the risk of flooding.	Local authorities, planning professionals and consulting companies
Protect and develop urban green systems with sufficient space for storm waters absorption.	Spatial Development/Master Plans are accompanied by Green system schemes, quite often formally prepared. Need for more detailed studies and recommended measures.	Local authorities, expert planning councils, RIEW, planning consultants
POS/Buildings		
Build extra headroom in new developments to allow for further modifications, consistent with intensive precipitations and floods.	Architectural projects are not a subject of control for these issues, but of technical norms only. Better control in the process of approval of projects and of amendments of design norms needed.	MRDPW, local authorities, expert councils, architectural consulting and design companies
Produce and use water proof constriction materials for buildings and POS.	Eurocodes and national regulations should be enforced to reflect climate change projections in terms of intensive precipitation.	MRDPW, BIS

Note: WMO = World Meteorological Organization; IO-BAS = Institute of Oceanology, Bulgarian Academy of Sciences

361. Adaptation options, addressing **floods** in urban areas, are among the most important for Bulgaria because of the higher risks for population, urban infrastructure, and property. Statistical data on damage show that in these areas is the biggest share of estimated costs for the period 2010–2015. Flood Risk Management Plans, a responsibility of the MoEW, cover the territories of the River Basins Directorates. These plans link with Spatial Development Plans and their EIAs, but not with the previously adopted NCSD. The latter should be reviewed, evaluated, and updated by 2018 at the latest.

362. CCA options are addressed in some cross-border cooperation projects, in which Bulgaria participates with Romania, Greece, the former Yugoslav Republic of Macedonia, Serbia, and Turkey. Some of the cities within the eligible areas are at risk of floods, predominantly those along the transborder rivers—Danube, Struma, and Maritza. Although

climate change is a priority in most of the programs, an insignificant part of the joint projects is currently devoted to adaptation.

363. The MRDPW lags with the implementation of the EU initiative for Joint ICZM and Maritime Spatial Planning (MSP). It must coordinate relevant policies, affecting coastal areas in the integrated coastal management strategy to ensure sustainability, environmental health, and CCA.¹³⁶ Having in mind the limited expert and financial capacity, the ministry could consider implementing knowledge through the existing trans-border cooperation with Romania in the maritime MARSPLAN-BS project (*Annex 10*), by incorporating CCA options in an integrated strategic document for the Black Sea. A National Maritime Spatial Plan, which must be adopted by 2021, would support local adaptation plan development for cities along the Danube River and the Black Sea coast.

364. The potential of the urban environment for adaptation and the experience of other countries with flood risk management offers a considerable number of possible adaptation options at the national and local levels as summarized in *Table 12*.

Table 12. Possible adaptation options to address floods

Specific Adaptation Options	Relevance to Urban Environment	Participants
Supranational level		
Exchange monitoring and survey information for introduction of ICZM and Integrated River Basin Management.	Implementation of Bulgaria's EU commitments for the Danube River Strategy and Black Sea Coast Integrated Maritime Policy.	MRDPW, MoEW, MTITC, IO-BAS
National level		
Elaborate integrated strategic document, according to the ICZM and MSP requirements for the Black Sea area – National MSP.	The coastal urban areas protection will be incorporated in the strategic documents.	MRDPW, IO-BAS, MoEW, local authorities
Build and strengthen river floods defense along the Danube and other big rivers for protection of urban areas and population.	The information from the River Basins Directorates Flood Risk Management Plans to be properly used in Spatial Plans and proposed measures to be implemented.	MRDPW, IO-BAS, MoEW, local authorities
Regional level		
Create or reestablish flood plains in the suburban areas, according to the hazard and flood assessment of the river basins.	To be considered in the regional spatial development schemes for the NUTS2 regions of the country.	MRDPW Regional Councils, district authorities
Maintain river beds outside urban areas through green system maintenance and proper control on waste management.	Lack of maintenance of the river beds increased the flood risk for urban areas.	RIEWs local authorities
Revise the existing irrigation system and canal infrastructure, used for drainage in case of flooding.	Lack of maintenance of the irrigation canal system on the Sofia plains additionally increased the flood risk.	Local authorities

¹³⁶ http://ec.europa.eu/environment/iczm/prop_iczm.htm

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Specific Adaptation Options	Relevance to Urban Environment	Participants
Local level		
Plan and implement separate sewerage systems and expand the capacity of the existing ones.	The existing mixed sewerage systems in the cities need reconstruction and/or replacement.	MRDPW, local authorities
Expand natural landscape areas with higher capacity for water absorption and reduce zones for new development to avoid urban sprawl.	In most cases, Spatial Development Plans are prepared under the pressure of local authorities and municipal councils for urban expansion despite declining population in most cities	MRDPW
Ban on construction in flood-prone areas and removal of the illegal buildings from these areas.	Illegally constructed buildings in flood-prone areas create additional risk for urban areas.	MRDPW, NCCD, Control authorities of the municipal administrations
Improve disaster preparedness and response system in local and urban zones	The most important ones are the units for small cities, especially the ones located in remote areas and close to rivers and dams	Local MI structures, Local authorities, NGOs
Urban zones		
Protect and develop urban green systems and balance between 'soft' and 'sealed' areas, according to functions and site-specific situation.	Detailed plans are accompanied by a green system scheme, quite often formally prepared. Need for more detailed studies and recommended measures.	Local authorities, design professionals, consulting companies
Create water storage places and reservoirs in the urban areas using the existing facilities and open spaces.	Spatial practice needs to explore better this option for retention of additional water because of flood.	Local authorities, expert planning councils, planning consultants
POS/Buildings		
Stimulate and apply creative architectural design to provide natural drainage. Build extra headroom in new developments to allow for further modifications consistent with flood risks.	Architectural projects are not a subject of control for these issues, but of technical norms only. This practice should be changed with better quality design control.	MRDPW, local authorities, expert councils, consulting and design companies

365. The monitoring of the landslide processes and maintenance of the register of the **landslides** in Bulgaria fall to the responsibilities of MRDPW. The control on issuance of preliminary consents for geoprotection activities and the construction in landslide areas is exercised by the Minister of regional development and public works. For the execution of his/her functions, the Minister is assisted by three specialized geoprotection companies in Varna, Plevan, and Pernik, and the Directorate Geoprotection and Public Works at the specialized administration of MRDPW. The expert staff of the Directorate is insufficient, considering the increasing number of landslides and the execution of control on the implementation of the investment projects for landslides consolidation. The financial resources

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for geoprotection activity are insufficient, and some of the sites require significant funding to carry out all proposed activities and to limit landslide processes.

366. Possible adaptation options to address landslides, in most cases activated after intensive precipitation and floods, include mainly national, regional, and site-specific measures.

Table 13. Possible adaptation options to address landslides

Specific Adaptation Options	Relevance to Urban Environment	Participants
National level		
Include the geological risks zones and registered landslides in the NCSD synthesis scheme.	The registered landslides and risk zones will be incorporated in the revised and updated strategic documents – NCSD (2013–2025).	MRDPW, OPRG, Geo-protection state companies
Regional level		
Maintain the well-established system for monitoring of geological risks zones.	The national program suggests different monitoring systems according to the degree of risk	MRDPW, OPRG, Geo-protection state companies
Local level		
Fully restrict and better control the risk zones and demolish illegal buildings.	Most conflicting are the areas populated by Roma in landslide risk zones on public land, requiring additional measures for rehousing.	MRDPW, NCCD, local authorities
Improve disaster preparedness and response system in local and urban zones	The most important ones are the units/modules for small cities, especially the ones located in remote areas, close to landslides risk zones	Local MI structures, Local authorities, NGOs
Urban zones		
Integrate geo-protection facilities and construction in the detailed and landscape plans.	Despite higher cost of such projects, this option should not be underestimated, because of higher aesthetical value.	Local authorities, consulting companies

367. Most of the adopted documents for CCA and DRM in Bulgaria are based on the strategic management approach, identifying the vision, strategic goal, priorities, specific objectives and measures, followed by an Action Plan. The National Disaster Risk Reduction Strategy 2014–2020¹³⁷ sets the framework for adaptation options and addresses all major groups of measures and activities:

- Sustainable national policy;
- Legislative framework;
- Institutional capacity;
- Risk analysis and assessment;
- Monitoring and early warning systems;
- Research and innovations;
- Disaster protection culture;

¹³⁷ http://www.nspbzn.mvr.bg/NR/rdonlyres/DA55BDC6-488B-4223-A81E-7BBE41A548D1/0/DRR_Strategy.pdf

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- Public participation and awareness;
- Efficient management;
- Critical infrastructure protection;
- Disaster recovery;
- International cooperation.

368. Measures have been developed further in the National Disaster Protection Programme 2014–2018.¹³⁸ The adaptation options envisaged for the urban environment, summarized and distributed along national, regional, and local levels, all the way down to the individual buildings, include political, legislative, informational, education, planning, design, and control measures. (*Annex 12*)

369. Adaptation options for landslides and geological risks protection are proposed in the National Programme for Landslides Prevention and Reduction on the Territory of the Republic of Bulgaria, Erosion, and Abrasion along the Danube River and Black Sea coasts 2015–2020.¹³⁹ It offers adaptation options according to their temporal scope:

- Urgent actions - landslide consolidation (engineering and technological), preventive measures, instrumental monitoring, and periodic survey;
- Priority actions - information provision, analysis and research, observations and monitoring, prevention, education, design, and construction and reconstruction works; and
- Actions for consolidated landslides - monitoring and control.

370. The limited expert, administrative and financial capacity of almost all Bulgarian institutions requires additional generic adaptation options to be considered, covering information and research, professional practice and management, capacity building, and awareness raising. Most of them are developed alongside urban transport, urban water and energy infrastructure, urban tourism, and human health (*Annex 12*) The proposed integrated approach in natural disasters management and adaptation planning will reduce costs and losses and will further reinforce the synergy effect.

371. A similar approach is applied in the ‘Guidelines for Integration of Environmental and Climate Change Policy into the Cohesion Policy, Common Agricultural Policy, Common Fisheries Policy funds for the 2014–2020 Phase,’ included in ‘Programming the Funds to the Common Strategic Framework’ (2013) by the Bulgarian government. It has been assessed as good practice by the EC.¹⁴⁰ The guidelines, developed at the initiative of the MoEW, aim to improve the consistency and effectiveness of the environmental and climate change policy measures, both within the framework of the Partnership Agreement and under the individual EU-funded operational programs. Each operational program should “*identify the adequate number of objectives aimed at meeting the requirements for integrating environmental change*

¹³⁸ National Disaster Protection Programme 2014–2018, available at http://www.nspbzn.mvr.bg/NR/rdonlyres/317033AA-E99D-4C51-AC8E-DB37272F2866/0/NPZB_20142018.pdf

¹³⁹ <http://www.mrrb.government.bg/nacionalna-programa-za-prevenciya-i-ogranichavane-na-svlachistata-na-teritoriyata-na-republika-bulgariya-eroziyata-i-abraziyata-po-dunavskoto-i-chernomorskoto-krajbrejje-2015-2020-g-i-dopulnenie-kum-neya-s-novovuzniknali-77199/>

¹⁴⁰ <https://www.eufunds.bg/archive/documents/1364214990.pdf>

and climate change policies into the Common Strategic Framework Fund” (p.22). Urban environment related recommendations, included in the OPRG, refer to reduction of the flood risk by transferring regional forecasts to the flood risk management plans at the city level, improvement of energy efficiency and efficient use of water in buildings for renovation, funded under the program. Another objective is the introduction of integrated urban transport for reduction of air pollution and emissions in the cities. Many of these recommendations refer to the IURDP and most of them, especially those for bigger cities, were developed by the date of preparation of the document. The required changes should be reflected either in the individual projects, during the call for proposals, or in the process of updating the plans foreseen for 2018.

3.1.3. Adaption options for the poor and vulnerable groups

372. The issues of social assistance for vulnerable and socially disadvantaged groups in Bulgaria are dealt with in the Social Assistance Act.¹⁴¹ It guarantees the right of citizens to social assistance through benefits and services without affecting their human dignity. Social assistance in Bulgaria is provided through cash and/or in-kind assistance to meet basic living needs or through social services.

373. The most vulnerable people in Bulgaria, which in the case of a natural disaster are targeted with specific measures and aid, include ethnic minorities and, particularly, Roma, poor, elderly, children, disabled, isolated groups, and those deprived from access to services. The latter two groups cover those living in remote depopulated settlements, where social and health care institutions have been closed and roads are poorly maintained. This calls for planning budget for local roads in the national periphery that are crucial to provide access to these areas.

374. Roma are most vulnerable to extreme temperatures and floods as they inhabit poorly constructed dwellings that are often located in flood-prone areas in the outskirts of cities or just outside their borders. Also, the elderly, particularly those with chronic diseases and disabled persons are less able to cope with natural disasters. Most of them live below the poverty line, which means that if they lose their shelter, they lose almost everything. In case of emergency, these groups face problems leaving their hospitals and hospices, due to the generally limited possibilities to evacuate poor and older people from isolated areas. Private cars are lacking, and rescue teams are not primarily targeted to remote and depopulated areas. In addition, small settlements lack warning systems. In areas with a concentration of the elderly and sick, additional transport should be provided, like the existing ‘green ambulance’ service.

375. A policy to resolve Roma housing problems is important to address illegally built Roma neighborhoods, with a view on reducing the risks that people run from extreme weather events, thus adapting to the changing climate circumstances. Until now, one national strategy as well as multiple strategies for Roma integration at the regional and municipal levels have been implemented, as well as several programs and action plans. The approach adopted envisages measures specifically targeting socially vulnerable groups to be included in the integrated sustainable urban development common policy. In the framework of the National Program for Improving Housing Conditions for the Roma in the Republic of Bulgaria for the period 2005–2015, activities related to the construction of social housing, improvements to the technical

¹⁴¹ Adopted 1998, Last amended SG 85/24.10.2017.

infrastructure and development of cadastral maps and registers have been implemented. It is expected that the outcomes achieved will be upgraded with the implementation of the new National Housing Strategy. In addition to existing mechanisms, material support is provided via the Red Cross, donor programs, volunteering, and NGOs.

376. The complexity of the above circumstances calls for integration of several measures:

- Budget transfer to such municipalities for disaster risk prevention and management;
- Reconstruction of local roads in remote areas of the national periphery with a concentration of old population with limited mobility for better accessibility in case of emergency;
- Better integration of such areas in the national early warning system;
- Provision of specialized transport to enable evacuation;
- Financial measures for better social integration through disaster risk and health insurance, social protection and adaptive safety nets, additional financial support from the reserve funds in case of disaster;
- Partnership development with NGOs and business communities;
- Provision of shelter and dislocation for the most vulnerable; and
- Behavioral measures, including education and motivation of appropriate behavior before, during, and after natural disasters.

377. Because the Social Assistance Act also provides other options, recovery and reconstruction following disasters can be done with the help of the poor and unemployed, thus creating job opportunities. Fast recovery depends on established social support networks, on the organization and readiness of local authorities for quick response and on the relationships within the local communities (Flanagan et al. 2011). In the event of a natural disaster, assistance for the prevention and recovery of damage is provided through the Natural Disaster Act, under the guidance of an Interdepartmental Commission for Reconstruction and Assistance to the Council of Ministers. This commission is assisted by the DGFSCP from the MI. Emergency relief is provided to victims and damage is restored, with priority given to major roads, electricity, and water supply. The mayors of the municipalities are responsible for providing food, clothing, and shelter. There is priority rehabilitation aid for the most vulnerable population groups.

3.2. Experience with Selecting Urban Environment Adaptation Options in Other (EU) Countries

378. Considerable research and publications exist on CCA options, prioritization, and selection, according to local characteristics, vulnerability, existing capacity, and needs. The review and analysis show varied understandings and approaches. The described measures and actions that make up the adaptation options and classifications are often based on different criteria but common principles.

3.2.1. Principles for CCA options selections

379. The selection of CCA options for the urban environment are mainly based on general principles, recommended in EC guidelines and some EU member countries' research, analyses, and reports. They include the guiding principles for good CCA in Europe.¹⁴²

380. The proposed 10 adaptation principles are based on a comprehensive literature review.¹⁴³ Underlined is the interrelation between the principles and the need for their integrated implementation, while the importance of each principle depends on the stage in the adaptation process, the level of decision-making, and specific regional conditions.

381. The Austrian Strategy for Adaptation to Climate Change, adopted in 2012 and updated in 2015,¹⁴⁴ lays down the basis for all other documents in the hierarchical planning system and sets a list of principles and key indicators meant to facilitate the process of adaptation options selection. The guiding principles in **Box 3** can be considered while dealing with the urban environment in Bulgaria.

Box 3. Guiding Principles for Adaptation

- **'Assume responsibility'** - The implementation of this principle means commitment and willingness to accept the climate adaptation challenge and to build the missing institutional, administrative, and expert capacity in the long run.
- **'Share information'** - This is connected in the first place to the common understanding of the concept, terminology, and methodology, and then to the mutual learning, exchange of information and knowledge in an environment without a fully developed communication culture.
- **'Foster cooperation'** - The rules and regulations in successful partnership and public participation are well developed in the behavioral theory, but in spatial/urban, as well as in adaptation planning, they must start with identification of relevant representatives, affected, and involved.
- **'Work with uncertainties'** - To deal with uncertainty, an integral part of each planning process requires development and implementation of flexible measures, which are easy to change and improve when needed to upscale the resilience of the urban environment with a variety of settings.
- **'Prioritize climate change impacts'** - This principle relates to the former and to be properly implemented needs well-identified goals and priorities, a reliable database, analysis of the current state, and projection of climate change.
- **'Employ a wide range of adaptation options'** - This is one of the most important principles for adaptation options selection. The recommended portfolio in the Austrian CCA Strategy includes 'technological, behavioral, informative, organizational, ecosystem-based, and socioeconomic adaptation measures, both sector-specific and cross-cutting'.
- **'Prioritize adaptation measures'** - The criteria proposed for the assessment and prioritization of adaptation measures include 'efficiency, effectiveness, urgency, flexibility, side effects', and so on. The main role is assigned to measures leading to a synergy effect and added value and pursuing of a 'win-win' scenario.
- **'Integrate into existing instruments and structures'** - Yet another principle important for spatial/urban planning practice, if the CCA policy is to be successful and not a formal

¹⁴² Study led by the UBA-V, in cooperation with the Potsdam Institute for Climate Impact Research (PIK) and the Environment Agency Germany (UBA-D) at the European Topic Center on Air and Climate Change (ETC/ACC)

¹⁴³ http://acm.eionet.europa.eu/docs/ETCACC_TP_2010_6_guiding_principles_cc_adaptation.pdf

¹⁴⁴ https://www.bmlfuw.gv.at/umwelt/klimaschutz/klimapolitik_national/anpassungsstrategie/strategie-kontext.html

exercise in one more strategy elaboration. There is a recommendation, where appropriate, to consider new instruments to manage CCA issues.

- **'Avoid conflicts of objectives and interests'** - A very important detail while implementing this principle is to avoid conflicts between measures in different sectors as well as to avoid contradiction between prevention, adaptation, mitigation, and sustainability objectives and measures. It is applicable to the participatory process as well, where all interested parties with conflicting interests meet.
- **'Establish a system for M&E'** - This essential element of the overall CCA process is compulsory and must be considered at an early stage.

Source: UK-CIP 2013.

382. The U.K. Climate Impacts Programme is based on similar principles.¹⁴⁵ In addition to the ones discussed earlier, the document emphasizes a balanced approach to managing climate and non-climate risks. A phased approach is recommended to cope with one of the most important problems—uncertainty. The set of guiding principles is based on recognition of the importance of cost-effectiveness and multiple benefits in the process of selecting climate change adaptation options. All actions in the selected option should not “foreclose or limit future adaptations or restrict adaptive actions of others.”

383. These principles, applied in most of the national adaptation documents of different EU countries, are appropriate for implementation at the local level for different Bulgarian cities.

3.2.2. Criteria for CCA option selections

384. The Guidelines on Developing Adaptation Strategies (Brussels 2013)¹⁴⁶ of the EC provide methodological support to the member states to identify barriers and gaps, assess the current risks, and select appropriate CCA options for their national strategies. The guidelines offer a set of criteria for ranking and selecting preferred options, including the following:

- Urgency with respect to already existing threats
- Early preparatory action (to avoid future damage costs)
- Range of effect (options covering multiple risks might be favored)
- Cost-benefit ratio
- Time-effectiveness
- Robustness under a broad range of likely future impacts
- Flexibility for adjustments or reversibility in case of diverging developments
- Political and cultural acceptability¹⁴⁷

385. The Austrian CCA Strategy gives a set of criteria for adaptation options' selection, which include similar ones—significance/relevance, urgency, robustness, effectiveness, efficiency, equity, flexibility and reversibility, sustainability, practical, legitimate, cost-benefit

¹⁴⁵ U.K. Climate Impacts Programme (UK-CIP) Identifying Adaptation options, 2013 http://www.ukcip.org.uk/wp-content/PDFs/ID_Adapt_options.pdf See also

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/209866/pb13942-nap-20130701.pdf

¹⁴⁶ EC staff working document Guidelines on Developing Adaptation Strategies Accompanying the document Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, An EU Strategy on adaptation to climate change: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52013SC0134>

¹⁴⁷ <http://climate-adapt.eea.europa.eu/adaptation-support-tool/step>

ratio, and coherence.

386. The Dutch experience presents a more complicated system in assessing adaptation options. The applied multiple criteria approach is based on the following criteria: importance, urgency, ‘no-regret’ characteristics, co-benefits, and effect on mitigation. These are then being weighted according to another set of feasibility criteria (technical, social, and institutional complexity) for prioritization of the suggested adaptation options and measures for all relevant sectors (De Bruin et al 2009). The ranking and prioritization of the adaptation options were discussed with researchers from several universities and main stakeholders. All relevant quantitative and qualitative assessment methods, together with the cost-benefit analysis (CBA), were applied to ensure integrated ‘nature and water’ management.

387. The principles and criteria listed earlier, compiled from different EU member states’ documents, could be easily used for the Bulgarian urban environment sector, provided there is a reliable information system, with accurate climate related data at the city level. One of the main constraints is the fact that each city is a unique symbiosis of people (with different social status, age, gender, beliefs, values, lifestyles, and behaviors), nature, anthropogenic constructions and activities, cultural variety, and atmosphere. To the comprehensive character of the climate change process, one should add the understanding of the complex nature of cities. Together with the implementation of a holistic approach to the urban environment and the principles of integrated planning, each city/town will need an individual approach and thorough local specific knowledge. In this context participation and communication, and the use of indigenous knowledge are crucial elements in adapting the urban environment to climate change.

3.2.3. Constraints and opportunities for implementation

388. Based on the analysis and assessment of the status quo, the Bulgarian and EU member states’ experience, the recommended urban environment adaptation options apply a similar approach as the one used in several studies since the end of 1990s (Basher 1999, Burton 1997, Klein et al. 1999, Pittock 1999, Rayner and Malone 1998, Smit et al. 1999, Smit 2000, 2015, Tol et al. 1998). The selection is compliant with the institutional and expert capacity, political and legislative framework, and with the spatial/urban planning system in Bulgaria. The proposed adaptation options for the Bulgarian urban environment with their prescribed scope and contents consider the basic elements and measures in the CCA system (*Annex 12*).

Table 14. Possible adaptation options – constraints and opportunities

Adaptation Options Types	Constraints	Opportunities
Policy	<ul style="list-style-type: none"> • CCA not included in the political agenda and no political will 	<ul style="list-style-type: none"> • Stimuli for progressive regional policy reform
Information	<ul style="list-style-type: none"> • Professional competitiveness and ethics • Lack of sufficient resources 	<ul style="list-style-type: none"> • Facilitation of research, education, planning, and design
Research	<ul style="list-style-type: none"> • Lack of sufficient knowledge and common understanding of the core CCA objectives, methodology, and terms 	<ul style="list-style-type: none"> • Valuable theoretical evidence-based support for professional practice and education in planning

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Adaptation Options Types	Constraints	Opportunities
Institutions	<ul style="list-style-type: none"> • Management and communication practices in the country • Resistance to change 	<ul style="list-style-type: none"> • Improved expert capacity and effectiveness of the authorities
Legislation	<ul style="list-style-type: none"> • Slow procedures of the overall process of legislation revision, amendment, and adoption • Fear of additional administrative burden 	<ul style="list-style-type: none"> • A chance to consider more effective planning system and planning tools
Financial	<ul style="list-style-type: none"> • Financial and economic crises and lack of financial support • Social tension 	<ul style="list-style-type: none"> • Chances for better use of EU funding
Education	<ul style="list-style-type: none"> • Lack of interest by academia • Severe competition for students in the existing demographic crisis • Inadequate retraining policy 	<ul style="list-style-type: none"> • New horizons for academic professional development • Improved knowledge and skills • Creativity stimuli
Technology/ Construction	<ul style="list-style-type: none"> • Professionals' resistance for change • Small number of powerful construction companies able to invest in R&D, smart cities initiatives, and LEED certificate buildings 	<ul style="list-style-type: none"> • More coherent planning and design tools • Healthier and safer environment • Better quality of life
Capacity	<ul style="list-style-type: none"> • State policy for administration optimization • Lack of finance • Lack of staff 	<ul style="list-style-type: none"> • Improved DRM system • Safer urban environment • Developed consciousness, commitment, and proper social behavior
Partnership	<ul style="list-style-type: none"> • Insufficiently developed public-private partnership regulations • Resistance to social policy in support of Roma and immigrants 	<ul style="list-style-type: none"> • Expanded capacity • Communication of knowledge • Promotion of new types of community attitudes and values • Better social inclusion in long term

389. All identified CCA options for the urban environment are interconnected. They are not weighted in terms of their importance and urgency as most of them must be implemented in parallel. The list of urban environment specific adaptation options from the Bulgarian and EU countries experience (*Tables 10 to 13*, first column) follows the typical logic of actions and measures. Thus, the most important option for the successful implementation of any suggested option is capacity. Information is important for almost all other adaptation options, but vital for scientific and applied research and knowledge base development. Research itself will support all other options and actions and is important for education and professional practice.

390. The suggested urban environment adaptation options are broadly formulated to leave space for their further development in time and tuning according to the local climate and urban environment characteristics. They carry different weights at the territorial and administrative levels, due to different capacity and experience of the local authorities. The latter must decide how to place the options in a time frame.

3.3. Adaptation Options Assessed

3.3.1. Preliminary assessment of time, efforts, institutional arrangements

Time

391. The implementation of measures leading to CCA in the urban environment in Bulgaria, in line with the recommended adaptation options, should be considered as part of the country's overall policy for sustainable and integrated urban development. This falls in the scope of Priority Axis 1 of the OPRG (2014–2020). The program envisages a 2018 revision of projects and investment programs of the municipalities that adopted the IURDP. The municipal investment programs, revised in 2016, include measures for introduction of integrated urban transport and for renovation of residential and public buildings with energy efficiency measures. Approved projects must be completed by the end of the programming period with a possibility of reimbursement until 2022.

392. Depending on the programming of the strategic planning, an interim evaluation of all strategic documents is due. As the update of the NCSD 2013–2025 has not been assigned yet, it should be synchronized with the MoEWs' work on the assessment of the risk of natural disasters and the latest data about zones under threat. The MRDPW is currently in demand for an interim evaluation of the Regional Development Plans for all six level 2 regions (NUTS2), which define profiles of respective areas and development guidelines, while priority is given to important infrastructure projects. The expected revision of the regional policy will most probably require elaboration of a new type of regional and spatial development documents for a reduced number of regions where the climate change adaptation options could be properly incorporated.

393. The municipalities also started to assign interim evaluations of the Municipal Development Plans (2014–2020). Interim evaluations of Regional Development Strategies for 28 districts are due by the end of 2018. The General Urban Development Plans/Master Plans, developed since 2014 and co-financed by the state budget under the program of the MRDPW, are expected to be approved by the end of 2018.

394. The proposed adaptation options will be at the heart of the National Climate Adaptation Strategy and the NAP to be completed by mid-2018. Parallel to their development, some of the adaptation options could start being implemented, such as updating of curriculum content, capacity building, and start-up of legislative changes with Regulatory Impact Assessments, which are essential for the realization of all other adaptation options.

395. It will be realistic to provide a minimum of 20 years for the country to successfully address urban climate challenges, whereby this period should cover all activities from preliminary studies and surveys of buildings and facilities to the execution of construction, assembly, and renovation works. Refinement of this time frame can be made after a detailed depiction of measures to be broken down into several groups, depending on the time horizon—urgent, short, medium, and long term. For the most important and large-scale projects, especially those related to technical infrastructure, this period may be extended to 30 years.

Efforts

396. Implementation of the proposed adaptation options in the urban environment and construction sector will require considerable efforts, time, and resources as they are complex and most of them need to be implemented simultaneously and in the short term. This exacerbates even more pressure on the participants in this process, given Bulgaria's constraints in expertise and information base.

397. Proper implementation of adaptation plans and projects in the urban sector will require enhanced efforts and accountability from educational institutions regarding staff training by the professional bodies responsible for recognition of competences and by each individual professional. A major effort will also be needed in changing the overall concept in the construction sector toward finding smarter solutions for sustainable and robust buildings and facilities, resource-saving, manufacturing of building materials, and more efficient construction waste utilization. A significant part of these efforts will fall on those engaged in research, staff training, and construction supervision. The burden will land on both construction and real estate companies and will reach every owner, tenant, or potential property client.

Institutional arrangements

398. The institutions and participants involved in CCA are described in detail in Section 2.5 and are subject to the Natural Disaster Act. This act details the commitments of the Council of Ministers, the individual ministries and their regional structures, regional and municipal authorities, research organizations, NGOs, and volunteers for the protection of natural and built environment and human health and life. The main commitments on urban adaptation falls on the responsibility of the MRDPW with its relevant directorates and the municipalities that need to make CCA an integral part of the regional and urban development policy. In this respect, the MoEW and its regional structures—the River Basin Directorates and the RIEW as well as the MH and the Regional Health Inspectorates have a role in providing a healthy urban environment and in supervising the implementation of the approved plans and projects with their EIA and SEA.

399. At the local level, municipalities must reorganize their work such that they create capacity for development and implementation of urban plans for CCA with a view on environmental protection, spatial planning, development, and green system maintenance. This includes increased responsibilities for not only mayors, but also for chief architects in the approval and implementation of spatial plans as their proposals determine the quality of life in the cities.

400. CCA should not require the creation of new structures, but rather the improvement of coordination between existing ones as well as the enhancement of capacities and a change in attitudes, including overcoming of skepticism. Changes in institutional arrangements and the introduction of new functions and duties, like any significant change, will encounter resistance, especially if they are not supported by the provision of necessary human and financial resources. Most affected by these changes will be regional and municipal authorities, especially those in lagging areas due to severe social, demographic, and financial problems and this includes small and depopulated settlements with a high relative share of poor, aging, and generally vulnerable inhabitants.

3.3.2. Cost-benefit analysis

401. The costs of adaptation are a key element in selecting and carrying out CCA measures. It is difficult to assess the cost of various adaptation activities in Bulgaria, it is even harder in the urban environment sector. The complexity of the evaluation stems from the fact that, in addition to the cost of the implementation of generic adaptation options, the cost of the implementation of the specific adaptation options, related to the urban transport and infrastructure, the existing building stock, public open spaces, urban services and population must be considered in terms of both direct and indirect impacts.

402. The most urgent adaptation options identified for the urban sector include the development of policies, legislation, and institutional strength, combined with research, information sharing, and capacity building actions.

403. National and local institutions with their infrastructure, staff, and resources are already in place. Therefore, the development of strategies, policies and legislation, as core institutional activities, are not likely to cause a significant need for additional budget. It can be argued though, that improved public sector material, financial, and management conditions will attract more professionals interested to work and continue to work in the public sector. That would be a form of internal strengthening that would gradually reduce the need for budget for public sector awareness raising and capacity building. It would furthermore increase the attractiveness of the research sector. At the level of the citizens and the private sector education and training will normally require investment at the medium level. Where policies and legislation lead to infrastructural adjustments, a sharp increase in costs may occur. Although, also without adaptation policies and legislation such costs would likely need to be made to serve the interests of other policy fields. In that case the CCA aspect may only cause additional costs. Whereas smart solutions may at the same time provide for cost savings, improved citizens' well-being, and (business) opportunities.

404. In most cases budgets only cover direct cost of services necessary for planning and preparation of the implementation of the adaptation options. For example, in the case of proposed stimulation of creative urban design, only the cost of the stimulation action is indicated. The exact costs for the realization of the design depend on many external factors and are therefore extremely difficult to determine. This is the case with many adaptation options, the costs of which incur over long periods of time and are subject to a lot of uncertainty, like for example building stock renovation, social support for vulnerable groups living in low standard housing, rehousing, development of information and communication technology, and other.

405. Allocation and distribution of financial resources among priority actions is to be based on the assessment of needs and through economic and financial analysis. For many adaptation actions existing resources can be used. The need to adapt policies and budgets to priorities has always existed. It's a matter of allocating and reallocating existing financial and human resources. Main sources for financing adaptive action are national (state budget), local (municipal budgets), EU (grants, subsidies of current and future instruments), and private funding from financial institutions.

406. A comprehensive and accurate CBA in the urban environment sector is difficult to be made because of the specific characteristics and the different scales and needs of the urban areas. Therefore, the CBA for the sector (further explained in *Annex 3*) focuses mainly on the assessment of soft adaptation measures and only on those investment measures for energy renovation of residential stock and infrastructure, for which the information from monitoring and forecasts is available. The benefits gained as a result of their implementation are best exemplified through the quantification of saved costs in main performance indicators (energy consumption in households; thermal energy consumption in households; and others). Considering the complex impact of the adaptation options on urban development, these were not separately quantified in the current CBA. The net present value (NPV)¹⁴⁸ in *Table 15* illustrates the monetary value of avoided losses as a result of implemented adaptation measures, while the cost effectiveness quantifies the benefits achieved in relation to the required investments/costs.

Table 15. Benefits of adaptation measures in the Urban Environment sector under different climate scenarios until 2050 (in €, million)

Climate scenarios	NPV (€, million)	Cost-effectiveness (Benefit/Cost ratio)
Realistic scenario +2°C	8,786.11	1.57
Optimistic scenario +2°C	13,285.08	1.87
Pessimistic scenario 2°C	4,287.14	1.28
Realistic scenario +4°C	20,522.60	2.34
Optimistic scenario +4°C	29,741.08	2.94
Pessimistic scenario +4°C	11,304.11	1.74

407. The projection shows that on average, under the +2°C realistic scenario, the total cash flow in NPV is €8.7 billion, and €20.5 billion under the realistic scenario at +4°C. Under the optimistic scenario, the projected cash flow in NPV is €13.2 billion under the +2°C scenario and €29.7 billion – under the +4°C scenario. Even under the pessimistic scenario, the future cash flow in NPV is projected at €4.2 billion at +2°C and €11.3 billion at +4°C.

408. Within the current analysis, the cost-effectiveness of the adaptation measures is used to quantify the effect of investments under each scenario.¹⁴⁹ Under the +2°C realistic scenario, the benefit/cost ratio is €1.57 (that is, the benefits achieved per Euro spent), and €2.34 under the +4°C realistic scenario. The benefit is higher at +4°C temperature rise. In that case, the benefit is €2.94 per one Euro of investment under the optimistic scenario and €1.74 per one Euro of investment under the pessimistic scenario.

¹⁴⁸ The NPV of an adaptation option is given by the present value of the estimated benefits and costs. If NPV is more than zero, this indicates that the investment is efficient and incremental benefits of adaptation exceed the incremental resource costs. If NPV is <0 or B/C is <1, then the adaptation measures add no net benefit to the Urban Environment sector. If NPV is >0 or B/C is >1, then it adds positive benefits. The positive value of NPV confirms that investments for adaptation are efficient.

The benefit-cost ratio (B/C) is the ratio of the present value of benefits to the present value of costs. When the B/C ratio is more than one, the present value of the option's benefits is larger than the present value of its costs.

¹⁴⁹ The cost-effectiveness refers to all measures.

3.3.3. Urban environment specific indicators

409. Indicators to assess selected adaptation options must meet basic requirements, while considering the resources used, the expected or achieved results, and the reduced impacts of climate change. At the same time, they must be clearly formulated, applicable and supported by necessary data. To be applicable to the process of CCA in the urban environment, they should encompass the built environment of cities with their main buildings and facilities, open spaces, and population. The risk of climate change and its impact on the urban environment are complex issues with spatial dimensions and depend on specific local characteristics, urban structure and fabric, building parameters, and development scale.

410. To specifically assess climate impacts on the urban environment and the adaptation to them, an approach to select indicators was adopted, oriented on the main levels and scope of spatial/urban planning in Bulgaria. It considers the specificities of the different scales of planning and design to assess expected changes that should reduce the area and the number of the population at risk of climate change. Such approach was applied in existing strategies and plans for urban adaptation, but in most cases, it partially affects elements of the urban territory regarding green areas and energy efficiency (Downes et al. 2011).

411. The proposed system includes five sets of indicators related to spatial planning, urban planning, urban design, construction design, buildings, and urban population.

Table 16. Spatial, demographic, and socioeconomic indicators

Indicators	Measurements
Spatial planning indicators	
Degree of polycentric urban development	<ul style="list-style-type: none"> • Concentration of population, migration • Regional disparities • Investment pressures
Limitations on urbanization of disaster risks zones	<ul style="list-style-type: none"> • Liquidation of illegal residential areas • Reduced urban sprawl
Ratio of public land property	<ul style="list-style-type: none"> • Private and public property Ratio
Access to critical infrastructure	Time for access to <ul style="list-style-type: none"> • Transport infrastructure • Health care • Disaster relief centers
Urban planning indicators	
Spatial and functional structure	<ul style="list-style-type: none"> • Area and percentage of the overall urban territory • Land-use balance
Residential areas	<ul style="list-style-type: none"> • Territories with high-rise buildings • Residential complexes • Individual buildings
Public and business zones	<ul style="list-style-type: none"> • Area and percentage of total area
Industrial zones	<ul style="list-style-type: none"> • Area and percentage of total building area
Green and open spaces	<ul style="list-style-type: none"> • Area and percentage of urban territory • Area per inhabitant

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Indicators	Measurements
Zones for technical infrastructure	<ul style="list-style-type: none"> • Area and percentage of total territory
Detailed urban planning and urban design related indicators	
Urban fabric and utilization of urban space	<ul style="list-style-type: none"> • Plot ratio • Gross plot ratio • Height of buildings in meters • Minimum mandatory green area in percent • Type of building
Distribution of urban population	<ul style="list-style-type: none"> • Population density—Number of people per ha • Number of buildings (housing) per ha
Share of prefabricated housing	<ul style="list-style-type: none"> • Number of renovated and retrofitted (energy efficiency and structural strengthening measures) prefabricated residential buildings • Number of renovated and retrofitted dwellings • Number of retrofitted nonresidential buildings
Buildings/Construction indicators	
Surface coverage and type of greenery	<ul style="list-style-type: none"> • Built/non-built areas ratio • Percentage of the area covered with high vegetation—trees and shrubs
Residential and public buildings age and degree of adaptation	<ul style="list-style-type: none"> • Number of new or renovated housing and public buildings (percentage) • Age of housing stock • Number of new buildings certified for sustainable architecture (percentage of total new)
Heating/cooling systems	<ul style="list-style-type: none"> • Type of heating/cooling systems—percentage of housing with air-conditioning
Socio-economic indicators	
Demographic structure and dynamics	<ul style="list-style-type: none"> • Number and percentage of urban population ages 65+ • Number and percentage of urban population with no education
Employment and unemployment	<ul style="list-style-type: none"> • Number of employed • Number of permanently unemployed
Income	<ul style="list-style-type: none"> • Household income
Poverty and vulnerability	<ul style="list-style-type: none"> • Number of population (percentage) under poverty line • Number (percentage) of population on social funds • Number (percentage) of disabled and with limited mobility

412. These groups of general indicators do not include specific indicators for urban structures/buildings, such as imperviousness, robustness, albedo, and so on, which some of the specialists in the field consider essential for urban resilience and CCA and that are also related to extreme temperatures, heat islands, and surface water runoff. They are more appropriate for CCA documents at the local level and for assessment of individual architectural projects.

413. Grouped in this way, the indicators allow for greater flexibility in their application and for opportunities for further development, depending on their level of application (national, regional, city, or a single building) and on the purposes of the relevant assessment (resources, impacts, results). Their information support is ensured by links with spatial and urban planning documents—Spatial Development Plans/Master Plans, IURDP, and Municipal Development Plans. A significant part of these indicators is also used for assessment of investment programs or Action Plans.

414. This approach will result in greater efficiency in gathering and processing the information needed for their implementation. An important advantage of these indicators is the possibility for application of GIS as a tool, which will link CCA planning to spatial planning.

3.3.4. Constraints and benefits, consequences of no action/maladaptation

415. Following the publication of the Fourth Assessment Report of the UN IPCC in 2007, there is increased interest in studying adaptation constraints and benefits, as well as the consequences of maladaptation.

Constraints

416. The above report, among others, deals with the assessment of adaptation practices, options, constraints, and capacity (Adger et al. 2007), defines constraints as “the conditions or factors that render adaptation ineffective as a response to climate change” and considers five groups of constraints: (a) physical and ecological limitations; (b) technological limitations; (c) financial barriers; (d) informational and cognitive barriers; and (e) social and cultural barriers.

417. In other studies and publications, an approach oriented toward the main actors was chosen, because all constraints originate from institutions or persons, responsible for implementation of the adaptation options (Rosenzweig et al. 2011). These types of assessment also mention limitations resulting from poor coordination in multilevel urban governance within certain administrative boundaries, while air and water pollution do not recognize boundaries. For example, water management of Iskar dam, the catchment area of which falls within the municipality of Samokov, supply drinking water to the capital city of Sofia. Accordingly, the municipality of Sofia can hardly control the violation of building restrictions in this part of the protection zone, water quality, and the state of sewerage of the urbanized territories close-by.

418. Physical and environmental constraints are linked to the capacity of the urban environment to implement adaptation measures without disturbing other functions. The most striking example in the urban environment are the green areas in the big cities where the vegetation suffers from severe air and soil pollution and ceases to play its role in air purification and temperature reduction. The use of buffer vegetation around busy urban highways, part of the urban green system for better aeration and ventilation, also suffers from harmful emissions and from anti-icing treatment of streets during the winter season. Corrections of riverbeds used to combat floods are detrimental to their natural character and often cause resistance on the part of nature conservationists. In Bulgaria, many attempts have been made to determine the ecological capacities of recreational areas, and urban and suburban parks to preserve their ecological balance, but it is difficult to monitor compliance with such norms. This type of constraints creates additional conflicts of interest, which in Bulgaria stems from the restitution

of large parts of landscaped areas, where appropriate adaptation measures could be implemented to increase their ecological capacity.

419. The most serious physical constraint for urban adaptation to climate change are the neighborhoods with overbuilt high density and high gross plot ratio. The overall destruction of the urban structure, fabric, and character results in total transformation of the urban ecology and climate. An example is Lozenetz, in Sofia—transformed from the greenest and most prestigious neighborhood of the city into a negative example of destruction of the natural environment.

Figure 17. Capital city of Sofia, urban sprawl Figure 18. Sofia (capital city), urban fabric types



Source: SEA of the Sofia municipality Comprehensive Development Plan, 2009.

Source: Google Earth, Satellite image 2012.

420. There are similar examples from the cities at the Bulgarian Black Sea coast, where sand dunes, protected fjords, and bays are destroyed by apartment hotels used as second homes. Whatever adaptation measures are applied, in such cases, they will hardly improve the microclimate and the psychological and ecological comfort.

421. Technological constraints, particularly those in the urban environment and construction sectors, are difficult to reduce by ready-made models and technologies' transfer. In the face of a long-lasting economic crisis, the use of new technologies to adapt to climate change becomes difficult, mainly for financial reasons. The number of new office, commercial, or production/warehouse buildings that use modern technologies for better climate comfort, tailored to meet both high and low extreme temperatures, is negligible.

422. Financial constraints are expected to remain the most serious barrier to CCA as the success of implementing adaptation options in many cases depends on their financial backing. Capacity building, education, and training, the creation of a unified database, research, refurbishment, and energy rehabilitation of buildings will require vast financial resources. The very preparation of municipalities and cities to move from planning to action will require financial support from the state. This financial burden increases in the case of natural disasters, when the state is relied upon to take care of the victims and to recover damage due to the poor insurance culture.

423. Information constraints in Bulgaria are also significant, regardless of the actions taken and the resources spent on creating databases and introducing e-government. The chance of overcoming these barriers lies with the availability of well-trained staff who, to find their way into the public administration, must be offered competitive salaries compared to the information

technology sector.

424. The introduction of new technologies in the management of state and municipal administrations is subject to the e-Government Act.¹⁵⁰ To speed up the process and to help with creating information registers and project databases, the State e-Governance Agency (SeGA) was established. Access to spatial data, the development, maintenance, and use of the infrastructure for spatial information, and the provision of environmental information are regulated by the Access to Spatial Data Act¹⁵¹ which stipulates the creation of a National Portal for Spatial Data¹⁵² and thus implements the INSPIRE Directive.¹⁵³

425. Accelerating the work of these units is extremely important for spatial and urban planning, especially if adaptive planning is to be incorporated therein. Information constraints are also related to the financial ones, due to the high cost of hard- and software and to technology costs due to insufficient equipment in institutions, municipalities, and companies in the field of urban planning.

426. Social and cultural constraints relate to personal and social attitudes toward climate change and risk, the low reliability of information, and the mistrust in institutions to effectively implement adaptation measures. There is also skepticism about the need for new types of documents for strategic risk management and CCA.¹⁵⁴ Culture, behavior, responsiveness, and decision-making as well as skillful management are essential to limiting the impact of these constraints. For that reason, the adaptation options in this report include appropriate measures for raising awareness, through education, capacity building, and partnership.

Benefits

427. The benefits from the identified adaptation options include the expected synergistic and cumulative effect of their simultaneous or sequential implementation. Mainstreaming CCA into regional and urban development policies, including housing and construction, will increase the effectiveness of regional policies and will ensure land protection in spatial and urban planning and development.

428. Improving information provision, accelerating the implementation of the Access to Spatial Data Act, and exchanging information will facilitate the development of scientific research, will make the decision-making process for urban development and environmental protection more transparent and reliable and will increase the capacity of scientific institutions and different experts.

429. The development of urban research will provide new arguments for protecting public interests and improve the living and recreation environment. Research on innovative building technologies, construction, and materials will help designers and builders to create intelligent buildings and facilities, which are better resistant to climate change and extreme events.

¹⁵⁰ Adopted 2007, Last amended SG 98/09.12.2016.

¹⁵¹ Adopted 2010, Last amended SG 98/01.07.2016.

¹⁵² See <http://www.inspirebg.eu/>

¹⁵³ European Directive 2007/2/EC, establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

¹⁵⁴ Evidenced by a series of studies in the field of public attitudes and social psychology, conducted by Alpha Research Agency and the Open Society

430. Institutional development, improved horizontal, and vertical coordination and integration, cooperation between national, regional, and local levels authorities, will enhance the quality and effectiveness of their work, while linking sectoral policies with spatial planning. This will also contribute to the successful implementation of an integrated and more comprehensive approach to urban renewal and development.

431. Legislative change, envisaged to incorporate the requirements for climate-resilient cities, will enhance the relevance of regional, spatial, and urban planning and investment projects, as well as of the accompanying strategic and EIAs. Increasing control over the quality and implementation of these documents is expected to contribute to a general reduction of adverse impacts and improvement in the quality of the urban environment and hence, the quality of life. The proposed modification of urban planning norms will limit the urban sprawl and overbuilding, will preserve fertile land, improve the city image, and make urban areas safer in the event of natural disasters.

432. Adaptation options envisaged in the field of financial policy are expected to change the general attitude toward insurance and property, and accordingly, alleviate the burden on municipalities and the state in eliminating natural disaster damages. The creation of new financial instruments is expected to increase social protection of the poor, the most disadvantaged and marginally vulnerable groups of society, who are affected most by natural disasters and extreme climatic events.

433. Educational adaptation options reveal new opportunities for schools, universities, professional organizations, and private companies to improve their curricula and to introduce new methods of training and new programs. This will increase the knowledge level and quality of work. The mandatory interface with information and communication technologies will allow cities that are remote from academia to receive badly needed educational services. Partnership and cooperation among NGOs and municipalities will improve urban adaptation work toward climate change, increase expertise, and limit the impact of cultural barriers.

434. Technological options and measures envisaged in them for planning and design of more sustainable, smart, green, and healthy cities, will improve the quality of the urban environment, building comfort and quality of life, while increasing opportunities for better contact with nature through recreation, reduction of morbidity, and improvement of human health.

435. Adaptation options for building institutional, administrative, and expert capacity are of key importance for the successful implementation of all other options. They are directly related to them and will lead to awareness, commitment, CCA knowledge, and a culture of communication among politicians, administrators, urban planners, and designers, and the general public.

436. Promotion of partnerships, networking, and collaboration among different ages, genders, ethnicities, professional, and social groups, including the disadvantaged ones, and successful work with media and NGOs, will increase the synergy and impact of the joint efforts to implement CCA measures. Good interaction, among all the above actors, including disaster relief units, will reduce damage, speed up corrective measures, and ease stress relief.

437. Success of actions aimed at adapting the urban environment to climate change, reducing barriers, and increasing benefits, depends also on effective leadership, well-coordinated multilevel governance of cities, and active citizenship, all of which are of crucial importance for Bulgaria.

Consequences of no action/maladaptation

438. Consequences of non-implementation of proposed adaptation options can affect health and lives of urban populations, buildings and facilities, green and open spaces, transport and technical infrastructure, cultural and natural values, and all human activities, including living, labor, recreation, mobility, and services.

439. The approach to assessing the consequences of maladaptation or non-application of adaptation options should be based on projected expectations of extreme events (extreme temperatures, floods, storms, landslides, fires, urban waters, and so on) and their impacts on all elements of the urban environment.

440. Failure to take measures reducing the impact of extreme temperatures (high and low) or improper adaptation of the urban environment will cause harm to human health and increase the risk of loss of life. Bypassing Eurocodes or weak controls on their implementation will increase energy costs for businesses and households for heating and/or cooling. The same effect will occur in cases of delayed or poorly implemented renovations and energy-saving provisions in residential and public buildings.

441. In cases of poorly implementing the measures for reduction of risks of floods, storms, and hail, damage to the material environment (buildings, facilities, transport infrastructure, green and open urban spaces) will be significantly higher, and their recovery will require more time and efforts.

442. Inadequately planned cities and urban areas, including disregard for high-risk zones as defined in the River Basin Directorates' Flood Management Plans, will increase the risk to loss of lives. Neglect of preventive actions to liquidate illegal constructions near rivers and gullies, to clean river beds and to repair dam walls in the immediate vicinity of cities may likely result in the same consequence. Delaying the construction of a separate sewerage system for storm waters in the cities will increase the flood risk during heavy rains due to the state and capacity of the outdated urban infrastructure. Flooding of POS and transport infrastructure can paralyze city life and compromise power supply for long periods, causing considerable economic damage at both the private and company levels.

443. The increased number of days with torrential rain, untypical for the region, activates landslides. Un-built or old and depreciated plumbing and drainage networks are also a factor for systematic terrain wetting and activating landslide processes. The lack of significant resources for implementation of geoprotection activities is a reason for delaying the consolidation of some landslides, which in turn leads to the expansion of the affected territory over time. Large landslides along the North Black Sea Coast damage recreational resources, thus reducing the attractiveness of the resorts and their competitiveness.

444. The delay in introducing measures to reduce the risk of fires in forests and agricultural land and limited human resources to exercise effective control in forests increases the likelihood

of fires being transferred to nearby urbanized territories. This risk is greater for cities where the urban sprawl has reached forest areas (Sofia, Plovdiv, Varna, and so on).

445. With a view to the anticipated climate change, poor management of urban water supply systems will increase the risk for the urban population on shortages of good quality water. Delaying the reconstruction of the water supply network in some cities will put the population in water stress for longer periods of time. Most drastic is the case of Dobrich, where, according to experts working on the Master Plan, water losses are estimated at more than 70 percent.

446. Delaying the supply of necessary equipment and capacity building of the natural disasters risk management units and disaster recovery centers will greatly hamper their work, lead to loss of staff, make emergency interventions inadequate, and potentially increase the number of victims and the scope of damage.

447. In addition to specific measures, it is necessary to follow up the consequences of the non-implementation of regional and spatial development policies, set out in the National Regional Development Strategy and the NCSD, which are indirectly related to climate change and impacts on the urban environment and natural and human resources. This is the very reason behind the proposed national- and regional-level indicators for adaptation options assessment. The delay or non-implementation of the necessary policies and measures to curb monocentric development creates the danger of concentrating population in major cities. This concentration of people will put enormous pressure on these cities and their social systems, traffic and mobility, and urban and green spaces. The concentration of investments in these cities will enhance competition for resources and lead to their sprawl on fertile land.

448. The non-application of the polycentric urban development model in Bulgaria will make the uniform network of cities in the country, developed over the years, break-up and will leave behind many deserted territories. This will increase regional disparity, leave the aging and helpless population in small and peripheral cities without sufficient and adequate care and at higher risk of climate change. The poorly maintained transport and technical infrastructure in these cities is at the risk of being further affected by natural disasters.

3.4. Cross-Cutting Issues, Trade-offs, and Synergies of Adaptation Options

449. Traditional and modern urban hygiene and ecological actions consider expected climatic change associated with high temperatures and heat waves, rapid temperature changes, cold winter months, icy weather, intensive precipitation and storms, floods, and other natural phenomena. The means to tackle these phenomena are of a different nature and fall to the responsibilities of the various sectors (transport, water, energy, industry, and so on). In the urban environment, however, they should be appropriately combined with urban planning tools and approaches (*Annex 12*).

450. The organization of urban transport exerts decisive influence on the development of the urban structure, supports functional links among the urban structural parts, and ensures their effective functioning. On the other hand, urban transport has a negative impact on the environment components and human perceptions, as it causes air pollution, noise, vibration, stress, and traumatism. Climate change is likely to complicate urban environment issues and to increase the negative effects of transport. Hence, efficient risk-based planning and management

of urban transport is essential to climate change impacts reduction. The proposed adaptation option for integrated urban transport planning and management in the Bulgarian cities will also reduce GHG emissions, which is a climate change mitigation target and air pollution and consequently, on the impacts on human health.

451. Water management and water balance in the urban environment is an important activity with a direct relationship to the urban environment and urban planning. It is important for the prevention of floods that are characteristic of cities with rivers, steep gullies, and those near artificial water areas (reservoirs, dams, and canals). Climate change can enhance the negative effects associated with heavy rains and floods. Therefore, preventive actions as part of water management, combined with risk-based urban planning are essential. The regular provision of quality drinking water requires coordination of water supply with urban planning and improvement of water supply and distribution networks in the urban environment.

452. Energy supply to the urban environment is a prerequisite for the normal functioning of modern cities and the realization of their functions in the fields of production, household, transport, and communications. Energy consumption in the urban environment increases progressively with the development of society. This is accompanied by negative environmental effects, while climate change implies an increase of these negative effects. Technological improvements in production, transport, and households, on the one hand reducing energy consumption, while on the other hand society's needs for more energy are recognized. Therefore, energy conservation in urban areas is of importance and directly related to risk-based urban planning and building design.

453. Urban development is closely related with human health, biodiversity, agriculture, and tourism. Cities in the world host 53.8 percent of the global population (World Bank 2015) and in addition to their leading role in the economy, they are places for self-actualization and personal development, for joy and inspiration. In Bulgaria, the share of urban population is even higher (73.2 percent). The health status and the working capacity of the urban population depends on the state of the environment, level of pollution, and urban stress factors. Appropriate CCA of cities and risk-based urban planning will reduce the pressure on human health, will make people live longer, and provide them with a better life.

454. The urban environment provides habitats for a variety of species and their protection is important for global sustainability. Preserved habitats and biodiversity improve the overall quality of the urban environment, making cities healthier, and supporting implementation of green city policies. Flora and fauna in big cities provide attraction, not in the least for children. Preservation of local species is among the environmental aims of the recently developed municipalities' Master Plans and their green systems schemes.

455. Agricultural lands are most affected by uncontrolled development and urban sprawl. Almost all recently completed Spatial Development Plans/Master Plans envisage extension of the urbanized areas at the expense of fertile land, even in the situation of demographic crisis and urban population shrink in smaller cities. Ribbon-type industrial developments along motorways also occupy agricultural land, thus making food supply more complicated by hindering access to food production fields. In response to this phenomenon, nowadays there is a considerable movement toward urban agriculture. Rural-urban relations will be even more

important under future climate change circumstances and should be enforced through risk-based spatial and urban planning tools.

456. Currently, urban tourism is an essential part of city marketing strategies, addressing the local population, investors, as well as visitors and tourists. The latter, when offered high-quality tourist products, can make a valuable contribution to the urban economy. In addition to a friendly and hospitable population, municipalities need a clean and green environment, well-organized public transport, high-quality properly located accommodation, protected heritage, and well-developed attractions. Protection of vulnerable cultural attractions, open archeological sites, and old listed buildings are a main concern during, floods, storms, and fires, that is why they need a risk-based planning approach. This is even more important in the situation of climate change because under unfavorable climate conditions, visitors are likely to be inclined to spend more time (and money) in the cities.

457. These and some additional relations between the urban environment and other sectors are summarized in **Table 17**.

Table 17. Sectoral Interdependency

Affecting →		Urban Environment	
CC effect in ... (see below) ↑	Positively	Negatively	
Agriculture	<ul style="list-style-type: none"> Stimulate alternative production and supply of food for urban population Urban Agriculture development 	<ul style="list-style-type: none"> Competition for water resources between rural areas for irrigation and urban areas for water supply Fire threat to urban areas close by in case of fire 	
Biodiversity & Ecosystems	<ul style="list-style-type: none"> Green infrastructure and preserved biodiversity improve the overall quality of Urban Environment Recreation and leisure Attraction for Children 	<ul style="list-style-type: none"> Impact on total biodiversity in the region Alien species and pest breeding 	
Energy	<ul style="list-style-type: none"> Lower electricity supply cost in warmer winter Less flood hazard in drought 	<ul style="list-style-type: none"> Higher electricity supply cost in hot summer Damages on electricity supply network due to storms, icing More solar energy production for urban needs 	
Forestry	<ul style="list-style-type: none"> More construction sites and recreation sites for urban dwellers after a fire and deforestation 	<ul style="list-style-type: none"> Green corridors interruption after deforestation Water sources less protected Fire threat to urban areas close by in case of fire 	
Human Health	<ul style="list-style-type: none"> Longer season for open area activities and better health More options for cycling 	<ul style="list-style-type: none"> Pressure on health and social urban services More stress on urban population 	

Affecting →		Urban Environment
Tourism	<ul style="list-style-type: none"> • More visitors and higher revenues for the cities attracting tourists from the resorts in bad weather 	<ul style="list-style-type: none"> • All heritage sites, archeology and listed buildings threatened by fire, floods, earthquakes, and so on
Transport	<ul style="list-style-type: none"> • Less municipality costs for streets maintenance and snow collection in public open spaces in winter • More Metro passengers and less traffic in heavy snowfalls • More mobility options in warmer seasons (pedestrian, bicycle) and less traffic and pollution 	<ul style="list-style-type: none"> • Bad urban transport services in extreme weather – rainfalls, storms, heavy snowfalls, hail. • Closure of airports and lack of connections with other cities • Flooded pedestrian underpasses
Water	<ul style="list-style-type: none"> • In case of more snowfalls – more water for all urban needs • Reduced use of water for recreation and water sports in the cities 	<ul style="list-style-type: none"> • Water shortages and stress • Bad quality drinking water • Flooding due to old sewerage • More competition for water resources – drinking water, water attractions in public open spaces and parks, for green system irrigation, for bathing and swimming.

458. Risk-based urban planning, in synergy with sectoral urban activities, can well mitigate negative climate change effects. It should take proper account of the negative impact of some urban planning predictions and realizations, and above all, of the over-intensive construction and technology saturation of residential areas in the major cities.

459. The long-lasting transition period in Bulgaria has created conditions for unsustainable urban development, particularly in the housing areas of the cities and for urban sprawl (Slaev and Kovachev 2014). The permissible building density (for example, in the Sofia Municipality Territorial Planning and Building Act ¹⁵⁵ with gross plot ratio values of 2, 2,5, 3, 3,5) is in contradiction with all environmental principles. Combined with additional regulatory requirements, such as the requirement to provide parking spaces, it leads to destruction of areas with a natural vegetation cover due to underground construction throughout the plot area. This leads to deterioration of the quality of the environment and the climate comfort, while compromising sustainability of the urban environment in the area of phenomena that are enhanced by climate change. The CCA strategy should focus particularly on the risk-based urban planning activity, combined with sectoral actions in the urban environment. That is why the selected adaptation options and actions include the following:

- Urban studies conducted in cross-sectoral partnership geared to expected climate change
- Adaptation of urban planning principles to expected climate change
- Adaptation of urban development laws and norms to climate change
- Adaptation of urban plans to expected climate change
- Adaptation of the construction norms for buildings and facilities in the urban environment to the expected climatic change

¹⁵⁵ Adopted 2006. Last amended SG 98/28.11.2014

460. These findings show the need for concerted implementation of CCA options in terms of research, policy, legislation, urban planning practice, design, and construction.

3.5. Priority-Setting Approach

461. The selected approach to priority setting for the urban environment CCA takes into consideration the sector-specific objectives of the proposed adaptation options and uses a set of criteria, interpreted for the aim.¹⁵⁶ Specific objectives are related to the overall spectrum of the urban environment from its planning to building, management, and use, aiming at reducing the adverse effects of climate change on buildings and facilities, transport, technical and social infrastructure, green and POS, urban population, and health.

462. The selected criteria include the following:

- (a) **Urgency** - the need for urgent activities and measures to immediately start implementation of CCA and/or to stop degradation in the urban environment of certain structures or buildings;
- (b) **Significance** - the importance of the option for achieving adaptation quality of the urban environment;
- (c) **Effectiveness** - the degree to which the option is successful in meeting the objectives to reduce the vulnerability of the urban environment and is relevant to the allocated resources;
- (d) **Efficiency** - the achieved state or quality of the urban environment with the least time and effort;
- (e) **Flexibility** - the propensity of the urban environment adaptation options for easy modification and adjustment to the level and degree of climate change;
- (f) **Sustainability** - the degree to which the adaptation measures avoid the depletion of natural resources to maintain or restore the ecological balance of the urban environment;
- (g) **Costs** - the specified value of financial, material, information, and human resources required for implementation of the adaptation measures;
- (h) **Benefits** - the advantages or profits gained from adapting the urban environment to climate change;
- (i) **Acceptability** - the degree of political, cultural, and social acceptability of the urban environment adaptation options; and
- (j) **Coherence** - the quality of being logical and consistent, bringing co-benefits, and added-value by the synergy achieved with other implemented measures.

463. This list of criteria is not exhaustive, but flexible and could be applied in different configurations according to the scale of adaptation and its time frame. The interpretation of the criteria depends also on the selected adaptation scenario and the target—national- or regional-scale urban network, city or a functional zone, urban infrastructure or green system, and different building types. At the same time, the chosen 10 criteria reflect the status quo of the

¹⁵⁶ UNFCCC 2005 Compendium on methods and tools to evaluate impacts of, and vulnerability and adaptation to, climate change; https://unfccc.int/files/adaptation/methodologies_for/vulnerability_and_adaptation/application/pdf/consolidated_version_updated_021204.pdf

urban environment CCA, comprehensive character of the sector, identified needs, and expected results.

464. The relevance of the criteria was evaluated by a triple scale and the highest score was given to the adaptation options related to information, followed by education and capacity building, equally important for all options.

465. There are two more issues to be considered while evaluating CCA options—uncertainty and subjectivity. To deal with the first issue, preliminary individual weights to options and criteria could be given, while subjectivity calls for application of appropriate group decision-making techniques.

466. In support of the priority setting, a prioritization meeting was organized in Sofia in October 2017, inviting a variety of stakeholders from the sector. The meeting used a basic version of the multi-criteria analysis (MCA) approach. MCA is an approach as well as a set of techniques that aims at providing an overall ordering of options, ranging from the most preferred to the least preferred. It represents a way of looking at complex problems that are characterized by a mix of monetary and non-monetary objectives. MCA breaks down options into more manageable pieces by using a set of criteria. The two groups of criteria used for the analysis were those of ‘Net Benefits,’ further broken down into economic, social, and environmental benefits, and ‘Implementation Risks’, further broken down into financial, social, institutional, technical, and technological risks. This approach allows data and judgements to focus on the separate pieces that are then reassembled to present a coherent overall picture.

467. In carrying out the MCA (that is, ‘scoring the different adaptation options’), the meeting benefited from the presence of stakeholders with professional knowledge and experience in the sector. Nevertheless, this priority setting effort must be considered as indicative and tentative, for three main reasons. First, the effort was carried out at an early stage in the process of developing a strategic view and planning of sector-specific CCA options. Second, not all those who were invited to the prioritization meeting used this invitation to attend. And third, a broader understanding of underlying information and notions at the side of the stakeholders would be beneficial to allow them to make more founded scores. Therefore, the current priority list only serves as a ‘first feel’ about the main direction of the actions to be taken first.

468. At a later stage, further attention should be paid to the priority setting process, both for this sector as across all economic sectors that play a role in the planning of Bulgaria’s CCA actions.

469. The five main priority adaptation options that were tentatively and indicatively identified for the urban environment sector are listed in the following paragraphs.

Category Policy - Mainstream CCA into the policy of regional and urban development, including housing and construction

Adaptation option - *Incorporate CCA into the National Housing Strategy (2017–2030)*

470. The option is considered of highest priority because it could be decisive for the overall regional policy reform of the country. Debates on this are expected to start in early 2018. This concerns both national- and local-level policies and actions. The implementation results will

directly affect the urban population, living with better standard housing, improved microclimate comfort, and higher resilience to extreme weather events.

471. The priority will be implemented through the National Program for Energy Efficiency of Multifamily Residential Buildings, led by MRDPW and implemented by the municipalities in Bulgaria since 2015, as well as through a new housing renovation program as part of the National Housing Strategy (2017–2030). The proposals for improving its social and economic effectiveness and efficiency are undergoing public and expert consultations. The expected benefits of the implementation of the prioritized options are reduced energy consumption and emissions, improved sustainability of building stock and quality of life, and implemented political commitments to increase energy efficiency by 25 percent by 2020. The main stakeholders are the MRDPW, ME, MF, Construction Chamber, and construction companies and municipalities. This adaptation option will require considerable human and financial resources and considerable time, but will bring additional social, environmental, and economic benefits in the longer term.

Category Legislation - Revise and amend legislative documents to transpose the CCA issues (after RIA when applicable and necessary)

Adaptation option - Mainstream the CCA requirements in all related legislative documents, relevant to regional and spatial/urban planning and environmental protection (SPA, RDA, Regulations No. 4, 7, and, 8, Regulation for Spatial Development Documents, for EIA, and SEA)

472. The option with the proposed actions refers to the national level and all expected climate changes and extreme weather events. The Spatial Planning Act addressed climate characteristics in Article 169 paragraph 4 in 2014 amendment, but will need additional minor amendments in Article 104, 106, 107, and 112 to incorporate CCA into the spatial planning tools together with disaster risk zoning. More detailed requirements for the scope and content of the Spatial Development/Master Plans, detailed plans, and investment/architectural projects will be given in the Regulation No. 4 for the scope and content of the investment projects and Regulation No. 8 for the scope and content of the spatial plans. Regulation No. 7 for rules and norms for different types of territories and development zones needs much deeper study and evaluation to reduce the parameters of building in critical areas of major cities. A revision of the related spatial planning legislation for the capital city and for the Black Sea coast will reduce conflicts and will increase resilience of the local urban environment.

473. The legislation for the EIA—the Environment Protection Act and its regulations—also need minor amendments to enforce the implementation control on measures for reduction of the significant impact of climate change and waters on the components of the environment and human health in plans and projects.

474. The Regional Development Act refers to the topic of CCA in Article 11, and needs minor amendments of Article 76, 7B, and 7Г and relevant paragraphs, regarding the content of the spatial planning documents at the national, regional, and district levels.

475. The main responsibility for these legislative changes will lay upon the MRDPW, MoEW, and professional bodies such as the UAB, CAB, Chamber of Engineers in Investment

Design, UPB, and Construction Chamber.

476. The implementation of this adaptation option will require minimum efforts, resources and time, but will improve the quality of plans and projects, the cooperation, and control, as well as the interrelations between the various regional and spatial development documents with those for CCA, thus reducing the risks and losses in the future.

Category Information - Secure institutionally regulated exchange of information and data according to INSPIRE directive obligations

Adaptation option - *Create common standards for the type, structure, scope, and format of metadata and data, harmonized with the EU at the city level*

477. The option corresponds to the identified needs for accurate and up-to-date information for scientific-based decisions concerning CCA actions. Bulgaria is lagging behind in implementation of the INSPIRE Directive and e-government in regional development policy and spatial planning. Without this option, the establishment of the climate adaptation platform, as an EU and national priority, will not be possible. This is even more important for the local authorities, which need methodological support for preparation of their local adaptation strategies, in addition to the Covenant of Mayors' ADAPT initiative and support. The option will facilitate information and knowledge exchange, networking, capacity building, and awareness development. The reliable information system will justify the exchange of information with other countries and international institutions, will support education, research, and CCA practices at the national and local levels. The main stakeholders in adaptation option implementation are the MoEW, MRDPW, MTITC, SeGA, BAS, and municipalities.

Category Research - Provide common long-term vision and objectives in the urban environment CCA research through amendment of the National Scientific Research Development Strategy 2020

Adaptation option - *Identify priority scientific topics, linked with the city, open and green spaces, buildings, infrastructure, construction materials, and human health*

478. The adaptation option is connected to the Task 1, Measure 2 of the National Strategy for Scientific Research Development 2020 for prioritization of scientific research and establishment of thematic priorities until 2020. The amendments of priorities 1. Energy, energy efficiency, and transport; 3. New materials and technologies; and 4. Heritage could bring more focus on the urban environment and adaptation to climate change. The main responsibility for the implementation will then be better shared between the MES and the respective academic institutions, working in the fields of planning, architecture, civil engineering, DRM, and environment. The adaptation option and its priority actions should be incorporated in the scientific research strategies and plans of the universities and the respective institutes of the BAS. The start-up companies, working in the area of smart and green technologies, have a role to play in the implementation of this option. The expected results could bring more efficiency to R&D, better informed decisions, more innovative construction technologies and materials for the urban environment, and even better-quality education.

Category Education – ‘Train the trainers’ for CCA

Adaptation option - *Organize appropriate format education and training for all levels—from politicians to the general public*

479. A broader insight into this adaptation option will foster unification of all priority actions under this category in a single framework or platform, corresponding to a shrinking pool of expertise in the country, education decline, and unfavorable demographic characteristics. Upgrading of knowledge in such a specific field like CCA will require rapid assessment of needs and intensive training of trainers, who are to take the lead in the proposed interdisciplinary short- and long-term courses, in masters, doctoral, and open learning programs. They should be targeted toward the politicians and decision makers, state and local governments representatives, experts, and professionals involved in urban environment building and management and the public. None of the proposed actions in this category should be neglected, having received such a high score for expected social and economic benefits in the evaluation and consultation process.

480. Although targeted at all levels and participants in the CCA, implementation of this option will place the main burden and responsibility on the academic institutions and professional bodies. These include the MES, the National Evaluation and Accreditation Agency, UACG, TU, UF, UNWE, SU, BAS, Chambers of Architects and Engineers, private higher education schools, and training and retraining provision companies. The results of the implementation are expected to build expert and institutional capacity, to improve communication of knowledge between architects, planners, engineers, landscape architects, economists, sociologists, and environmentalists, and to bring better quality and higher value to all further adaptation actions. Along with the social and environmental benefits, this will bring financial benefits, creativity stimulation, and academic developments to educational institutions.

481. Most of the above prioritized adaptation options will hardly be implemented without financial support. The considered financial, social, and insurance policies refer to all weather events and disasters, to all levels from national to individual and not only to the urban environment but also to all other sectors—transport, tourism, agriculture, forestry, energy, waters, and human health.

Category Finance - Change financial, social, and insurance policy

Adaptation option - *Revise the existing financial instruments and design new ones for CCA and DRM, including for energy renovation*

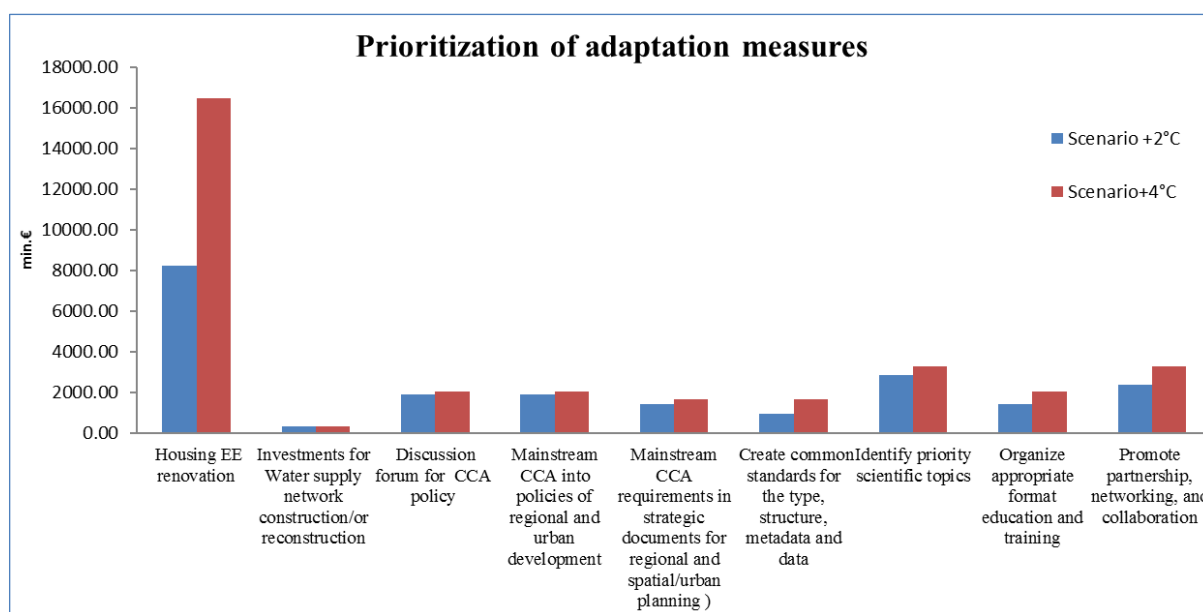
482. Applied to the urban environment, the prioritized adaptation options and actions require appropriate financial engineering tools for attracting investments for housing stock renovation, energy efficiency measures implementation, revision of the spatial planning documents and their legislative framework. In addition to the methodological support, the new responsibilities of the local authorities for CCA will badly need state budget support. The proposed new approach to the housing property will require legislative changes in the Condominium Property Management Act, the Insurance Code and Local Taxes and Fees Act. The main stakeholders in the implementation of these actions are the MF, the National Revenue Agency, municipalities,

and individual citizens and owners. The expected results of the implementation are greater social justice, better distribution of the responsibilities and financial burden among the state, local authorities, and individuals, and increased awareness and commitment.

483. The selected priority options create the common framework for CCA of the urban environment. More specific ones are recommended for local adaptation strategies, which need an approach, based on the local resources, needs and microclimate, consistent with the size and location of the city, its population, economic, and functional characteristics, and spatial development and density (*Annex I2*).

484. The results of the CBA identify the most economically efficient adaptation actions and allow for their ranking. The adaptation measures for which the benefit exceeds the cost can be ranked as follows: Housing EE renovation; Identify priority scientific topics; Promote partnership, networking, and collaboration; Mainstream CCA into policies of regional and urban development, and others. The figure below shows the estimated contribution of selected adaptation measures in reaching the overall positive effects of climate change adaptation.

Figure 19. Prioritization of adaptation measures in the Urban Environment sector (total PV effect in € million)



3.6. Conclusions

485. The National Strategy for Climate Change Adaptation in Bulgaria is a new type of strategic document which presents the framework for further actions and implementations. There are no simple and unambiguous solutions to climate change related problems in the urban environment. They all require comprehensive actions and consistent policies for implementation of a system of legislative, planning, technological, construction and social measures. In view of the applicability of the prioritized options and identified adaptation actions, the adaptation process in the Bulgarian urban environment will require considerable time, budget, and other resources. Gaps and barriers facing adaptation to climate change can be overcome but are likely to meet resistance of institutions with limited expert and financial capacity as well as that of the professionals that will face new challenges and responsibilities.

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Similarly, the construction business sector will have to invest in new technologies and materials. The approach to the latter should not emphasize expenses but focus on the additional benefits that a high-quality living environment, with higher comforts and degree of protection could bring in the long term, which in economic terms adds value and may support profit development. In this context, it is important that the attitude toward adaptation to climate change turns into a new way of thinking and lifestyle, thus becoming the new reality.

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Annex 1. Potential Climate Change Impacts on the Urban Environment Sector in Bulgaria

Table 18. Potential climate change impacts on the urban environment sector in Bulgaria by size and location of cities

Affected Urban Environment Sector Aspects	High Temperature		Low Temperature		Prolonged Rainfall		Drought		Water Table Rise		Sea Level Rise		Specific Effects of Climate Change Relevant for Urban Environment				Extreme Weather Events													
													Earth-quakes	Hail Storms		Air Pollution	Electric Storms	Fog		Floods	Avalanches	Land slides		Storms						
	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P				
Cities by size																														
Big – over 100,000	H	H	H	H	M	M	L	L	M	M	L	L	H	L	H	H	H	H	M	M	M	M	H	H	U	U	H	H	M	H
Medium – 30,000 – 100,000	H	H	M	M	M	M	M	L	M	M	M	L	H	L	H	H	M	M	L	M	L	L	H	H	U	U	H	H	M	H
Small – below 30,000	M	L	M	M	M	M	L	L	M	M	L	L	H	L	H	H	L	L	L	L	L	L	H	H	U	U	H	H	M	H
Cities by location																														
Coastal																														
Including River Danube	M	H	H	H	H	M	L	L	M	L	L	L	H	L	H	H	H	M	M	L	H	H	H	H	U	U	H	H	M	M
Black Sea	M	H	M	M	M	M	L	L	L	L	M	M	H	L	H	H	H	H	M	L	L	M	H	H	U	U	H	H	H	H
Plain	H	H	H	M	M	M	M	L	L	L	L	L	H	L	H	H	M	M	M	M	M	M	H	H	U	U	M	M	H	M
Mountain and semi mountain	L	H	H	H	H	H	L	L	L	L	-	-	H	L	H	M	L	L	M	M	H	H	H	H	U	U	H	H	H	H

Legend: D = damage; P = probability of occurrence by 2050 at latest; U = unknown; H = high; M = medium; L = low; red = negative impact; green = positive impact; blank = neutral impact.

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Table 19. Potential climate change impacts on the Urban Environment Sector in Bulgaria

Affected Urban Environment Sector Aspects	High Temperature		Low Temperature		Prolonged Rainfall		Drought		Water Table Rise		Sea Level Rise		Specific Effects of Climate Change Relevant for Urban Environment						Extreme Weather Events												
													Earth-quakes		Hail Storms		Air Pollution		Electric Storms		Fog		Floods		Avalanches		Landslides		Storms		
	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D
URBAN ZONES																															
Residential areas	H	H	H	H	M	M	L	L	M	M	L	L	H	L	H	H	M	M	M	H	L	L	H	H	U	U	H	H	M	H	
Public and business zones	H	H	H	H	M	M	L	L	M	M	L	L	H	L	H	H	H	M	M	M	L	L	H	H	U	U	H	H	M	H	
Industrial zones and production facilities (incl. SME)	H	H	M	M	M	M	M	L	M	M	M	L	H	L	H	H	M	M	L	M	L	L	H	H	U	U	H	H	M	H	
Mixed use zones/Multifunctional	M	M	M	M	M	M	L	L	M	M	L	L	H	L	H	H	M	M	L	L	L	L	H	H	U	U	H	H	M	H	
Public open spaces (POS)	H	H	H	M	H	M	H	M	L	L	L	L	M	L	H	H	M	M	M	H	M	M	H	H	U	U	M	H	M	H	
Green system/parks and gardens	M	M	M	M	L	M	H	H	M	L	L	L	L	L	H	H	L	L	M	H	L	L	M	H	U	U	M	H	M	H	
Suburban parks and recreation	L	L	L	L	L	M	H	M	M	L	L	L	L	L	M	H	U	U	H	H	L	L	L	H	U	U	M	H	L	M	
Heritage sites and listed buildings	L	L	L	L	H	M	L	L	M	M	M	M	H	L	M	H	L	L	L	L	L	L	H	H	U	U	H	H	M	H	
Tourism facilities	M	L	L	L	M	L	L	L	L	L	M	M	H	L	M	H	L	L	M	M	M	M	H	H	H	M	H	H	M	H	
SERVICES																															
Health services	M	M	M	M	L	L	L	L	L	L	L	L	H	M	M	H	M	M	M	M	M	M	H	H	U	U	H	H	M	H	
Social services	M	L	M	M	M	L	L	L	L	L	L	L	H	M	L	H	L	L	L	L	L	L	H	H	U	U	H	H	M	H	
Education services	L	L	M	L	L	L	L	L	L	L	L	L	H	L	M	H	M	L	M	M	L	L	H	H	U	U	H	H	M	H	
Food supply	M	L	H	H	M	L	M	M	L	L	L	L	H	L	M	M	U	U	L	L	L	L	H	H	U	U	H	H	H	H	
DRM facilities	M	M	M	M	L	L	M	M	L	L	L	L	H	M	M	M	M	L	M	M	L	L	H	H	H	M	H	H	H	H	
TRANSPORT INFRASTRUCTURE																															
Urban roads network	L	L	M	M	M	M	U	U	L	L	L	L	H	L	M	M	L	L	L	L	L	L	H	H	U	U	H	H	L	H	
Cycling network	H	M	H	M	H	M	U	U	L	L	M	L	M	L	L	L	H	M	M	H	M	L	H	H	U	U	M	M	M	M	
Public transport system	L	L	L	M	M	M	U	U	L	L	L	L	H	L	M	M	L	L	M	M	M	L	H	H	U	U	H	H	H	H	
Metro system	L	L	L	L	L	L	U	U	M	M	-	-	H	L	L	L	L	L	L	L	L	L	H	M	U	U	M	L	U	U	
Transport stations and hubs	L	L	L	L	M	L	U	U	L	L	M	L	H	L	H	H	L	L	M	L	M	L	M	M	U	U	M	L	M	M	

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Affected Urban Environment Sector Aspects	High Temperature		Low Temperature		Prolonged Rainfall		Drought		Water Table Rise		Sea Level Rise		Specific Effects of Climate Change Relevant for Urban Environment						Extreme Weather Events													
													Earth-quakes		Hail Storms		Air Pollution		Electric Storms		Fog		Floods		Avalanches		Landslides		Storms			
	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P
TECHNICAL INFRASTRUCTURE																																
Water Supply system	H	M	M	M	L	L	H	H	L	L	M	M	H	L	L	L	M	M	L	L	U	U	H	H	U	U	H	H	L	L		
Sewerage System, incl. surface water drainage	L	L	H	M	H	M	L	L	M	L	M	M	H	L	M	M	L	L	L	L	U	U	H	H	U	U	H	H	L	L		
Electricity supply system	M	M	H	M	M	L	L	L	M	L	L	L	H	L	M	M	U	U	M	L	L	L	H	H	U	U	H	H	H	H		
Central Heating system	L	L	H	H	L	L	L	L	L	L	L	L	H	L	L	L	U	U	L	L	U	U	M	H	U	U	H	H	L	L		
Gas Supply system	M	M	H	M	L	L	L	L	L	L	L	L	H	L	L	L	U	U	L	L	U	U	M	H	U	U	H	H	L	L		
ICT functions	U	U	M	M	L	L	L	L	M	L	M	L	M	L	M	M	U	U	M	L	L	L	H	H	U	U	H	H	H	H		
CONSTRUCTION																																
Buildings – housing	H	H	H	M	M	M	L	L	M	M	M	L	H	L	H	M	L	L	L	L	L	L	H	H	U	U	H	H	M	L		
Buildings - commercial	M	M	M	M	M	L	L	L	M	M	M	L	H	L	H	M	L	L	L	L	L	L	H	H	U	U	H	H	M	L		

Legend: D = damage; P = probability of occurrence by 2050 at latest; U = unknown; H = high; M = medium; L = low; red = negative impact; green = positive impact; blank = neutral impact.

Annex 2. Climate Change Adaptation Options in Detail

Table 20. Adaptation options presented in detail

CLIMATE CHANGE ADAPTATION OPTIONS						
I. Category Policy						
Mainstream CCA in regional and urban development						
1. ORGANIZE A DISCUSSION FORUM TO AGREE ON A COMMON VISION AND DEVELOP COMMON UNDERSTANDING ON CCA POLICY AND STRATEGY						
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
		X	X	X		
Description	<p>A discussion forum to agree on a common vision and develop common understanding on CCA policy and strategy should address the following topics:</p> <ul style="list-style-type: none"> • Common terminology • Common vision for adaptive environment • Common strategic goals and links with SDG • Priorities <p>In addition to the plenary, thematic sector-oriented sessions should clarify further specific topics and relevant issues. Cross cutting issues could be addressed through a more complicated logistic. Considering all advantages and disadvantages of such a large-scale forum, specific communication technology could be applied, at least for foreign participants.</p>					
Option's relevance						
Economic	Ecologic	Social				
+	++	+++				
Opportunities that arise						
Institutional commitment. Communication of information, knowledge and ideas.						
Cross-cutting relevance						
YES Multidisciplinary approach important for the CCA process.						
Risks addressed						
All risks						
2. MAINSTREAM CCA INTO POLICIES OF REGIONAL AND URBAN DEVELOPMENT, INCLUDING HOUSING AND CONSTRUCTION, BY REVISING THE SPATIAL PLANNING ACT						
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
	X	X	X			
Description	<p>The forthcoming regional policy reform on EU and national level, as well as on urban policy, will further support the integrated approach to social, economic and territorial/spatial cohesion. This integrated approach, instead of a sectoral one, promoted both by the MRDPW and MoEW in the Partnership Agreement will be a major principle for the period after 2020. In addition to linking sectoral policies to national territory, urban and housing policy, spatial planning and infrastructure building should be better incorporated in the regional policy and CCA. This will require supplementing the SPA and updating the political strategic documents and governmental programs.</p>					
Option's relevance						
Economic	Ecologic	Social				
++	+	++				
Opportunities that arise						
Better and more efficient land use, concentration of resources and more effective regional and urban policies.						
Cross-cutting relevance						
YES Regional and urban policies affect various human activities, the environment and human health.						
Risks addressed						
All risks						

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3. INCORPORATE CCA INTO THE NEW NATIONAL HOUSING STRATEGY						
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
		X		X		X
Description	An important task of the MRDPW in the coming years is to make the Housing Policy an integral part of the regional policy of the country, starting with the World Bank Housing Sector Assessment and the assignment of the National Housing Strategy. It is envisaged to be accompanied by several programs, focusing on the main identified problems in the sector, including legislation, renovation of panel buildings, accessible housing for young people and people from vulnerable groups, improvement of planning of the areas subject to complete renovation. The renovation of the building stock will require a considerable amount of resources (time, financial, human).					
Option's relevance						
Economic	Ecologic	Social				
+/- -	++/-	+++				
Opportunities that arise	Improving quality of life, urban environment and comfort as well as reducing energy consumption costs.					
Cross-cutting relevance	YES	Energy, Human health, Water.				
Risks addressed	Risk to buildings and human health as a result of extreme temperature					

II. Category Information

Secure institutionally regulated exchange of information and data according to INSPIRE directive obligations

4. CREATE COMMON STANDARDS FOR THE TYPE, STRUCTURE, SCOPE, AND FORMAT OF METADATA AND DATA, HARMONIZED WITH THE EU AT THE CITY LEVEL

Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
	X	X	X	X		
Description	Access to spatial data, the development, maintenance, and use of the infrastructure for spatial information, and the provision of environmental information are regulated by the Access to Spatial Data Act which stipulates the creation of a National Portal for Spatial Data and thus implements the INSPIRE Directive. The latter aims to create an EU spatial data infrastructure for the purposes of EU environmental policies and policies or activities with an impact on the environment. The Directive came into force in 2007 and will be fully implemented by 2021. The new way of data exchange requires standardization of metadata and data in terms of thematic clusters, type, structure, scope and format.					
Option's relevance						
Economic	Ecologic	Social				
++/- -	+++	++				
Opportunities that arise	Enables environmental spatial information exchange among public sector organizations, facilitates public access to spatial information on national and local levels and assists in policy-making. Improves the quality of research.					
Cross-cutting relevance	YES	Human health, Water, Energy, Transport, Tourism, Agriculture, Forestry, Biodiversity.				
Risks addressed	All risks					

5. EXCHANGE INFORMATION WITH EUROPEAN COUNTRIES AND INTERNATIONAL INSTITUTIONS

Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
	X	X		X		X
Description	The option aims at better coordination of the CCA efforts of the EU Member States and at expanding networks of professionals and scientific communities. In implementing this option, the main stakeholders must determine the most important relations for further development and to provide data about reliable partners for future cooperation. Working in close cooperation with leading					

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Option's relevance			institutions will increase capacity and knowledge. For this option EU funds could be used as well as other programs for cooperation, including transborder ones and programs for territorial cooperation.
Economic	Ecologic	Social	
++/- -	+++	+++	
Opportunities that arise			Facilitates public access to spatial information across Europe and assists in policy-making across boundaries. Provides information about cross-border CC risks.
Cross-cutting relevance			YES Human health, Water, Energy, Transport, Tourism, Agriculture, Forestry, Biodiversity.
Risks addressed			All risks

6. PROVIDE OPEN ACCESS TO INFORMATION FOR THE GENERAL PUBLIC

Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
		X		X		
Description	Despite all efforts to unify information systems and to provide relevant information to the general public, additional actions are still needed to provide free access to CCA platforms at national and local levels. The information about environment, climate change, extreme weather events and impacts must be integrated into one single 'package' as part of the NAS. The lead institution must be the MoEW and its units – RIEW, River Basin Directorates – with support of the MRDPW and its state companies. Having in mind the complexity of the urban environment and the uniqueness of each city and urban zone, additional CCA platforms must be created at the local level as part of the local CCA strategies/plans. To avoid mal-functioning of created databases and platforms, as is the case of most EU funded projects, it is necessary to ensure at least two IT professionals for data processing and maintenance.					
Option's relevance						
Economic	Ecologic	Social				
++/- -	+++	+++				
Opportunities that arise			Raising awareness and commitment. General public environmental culture development and more opportunities for informed participation in the CCA process.			
Cross-cutting relevance			YES Human health, Water, Energy, Transport, Tourism, Agriculture, Forestry, Biodiversity.			
Risks addressed			All risks			

III. Category Research

Provide a common long-term vision and objectives in urban environment CCA research through amendment of the National Scientific Research Development Strategy

7. IDENTIFY PRIORITY SCIENTIFIC TOPICS, LINKED WITH THE CITY, OPEN AND GREEN SPACES, BUILDINGS, INFRASTRUCTURE, CONSTRUCTION MATERIALS, HUMAN HEALTH, AND THEIR RISK RESILIENCE ASSESSMENT

Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
	X	X		X		X
Description	The National Scientific Research Development Strategy sets the thematic priorities until 2020. Among them the ones connected with the urban environment are: 1. Energy, energy efficiency, and transport – energy saving, renewable energy, and energy efficiency, as well as 'zero' energy buildings are among the priorities of the urban environment which need additional research-based justification and innovative ideas. The same topics are in the basis of the integrated urban mobility concept. 2. New materials and technologies – these topics, in addition to the new infrastructure and intelligent facilities management will create a better environment and will reduce climate change risks. 3. Heritage – constructions and materials' behavior under extreme weather conditions, together with additional topics on building materials and constructions behavior will further develop knowledge about listed buildings and archaeological					

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Option's relevance			sites' protection.
Economic	Ecologic	Social	The above three topics require a scientifically-based approach to assessing hazards and risks. The consequences of maladaptation and financial analyses of the options' implementation results will bring more focus on the urban environment.
++/- -	+++	++	
Opportunities that arise			Opportunities to mainstream the Urban Environment CCA topic in the national scientific research agenda.
Cross-cutting relevance			YES Human health, Water, Energy, Transport, Tourism, Agriculture, Forestry, Biodiversity.
Risks addressed			All risks connected with the health of the urban population, quality of life and safety.

8. SUPPORT INNOVATIONS IN CONSTRUCTION, TECHNOLOGIES AND SERVICES, RELEVANT TO THE CCA

Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
			X	X	X	
Description	<p>The option to support development of innovations in construction provides opportunities to cope with climate change, which is still underrepresented in the country. The innovations not only relate to the construction process, but also to all previous and subsequent actions and stages in planning, building, using, and managing the urban environment. Creative options are also related to policies, research, education, and the development of expert and scientific capacity. The support for innovations could be provided through:</p> <ul style="list-style-type: none"> • Research and Development (R&D) appropriate funding • Transdisciplinary projects, stimulating creative thinking • Networking and communication of knowledge and ideas • Science festivals and awards (https://www.britishcouncil.bg/en/sofia-science-festival) • Design competitions in all fields (planning, architecture, design, landscape architecture, engineering, ICT, social services, urban smart mobility and so on) http://ec.europa.eu/growth/industry/innovation/policy/social/competition_en • Publicity, promotion of ideas, and dissemination of innovative urban projects • Organized events and interactive games for innovative ideas stimulation among young researchers • Exhibitions, video productions for creative ideas • Scholarships, internships, and study visits 					
Option's relevance						
Economic	Ecologic	Social				
+++/- -	+++	++				
Opportunities that arise			Innovative ideas for Urban environment developed, new entrepreneurial culture stimulated, innovations in urban environment planning and design promoted.			
Cross-cutting relevance			YES	Human health, Water, Energy, Transport.		
Risks addressed			All risks			

IV. Category Institutions							
Develop sustainable institutions capable of providing CCA policy at all administrative levels							
9. ORGANIZE HORIZONTAL COORDINATION BETWEEN MRDPW, MOEW, ME, MAFF, AND MOF							
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/ POS	
		X					
Description	<p>Important part of this adaptation options and the actions involved in the category 'Institutions' is a well-developed system for coordination and collaboration between higher level institutions in a period with a reduced number of priorities and severe competition for limited resources. 'Team work' is the buzzword for this option. The main institutions involved are presented in part 2.5.2. of the current Analysis:</p> <ul style="list-style-type: none"> • MoEW – ExEA, River Basins Directorates, RIEWs • Ministry of Energy (MEn) - Sustainable Energy Development Agency • Ministry of Health (MH) - Regional Health Inspectorates • Ministry of Culture - National Institute for Immovable Monuments of Culture • Ministry of Labor and Social Policy - Agency for Social Support/Aid • MTITC • Ministry of Tourism • MI • Ministry of Economy 						
Option's relevance							
Economic	Ecologic	Social					
+++	+	+					
Opportunities that arise	Institutional development, improved coordination and cooperation.						
Cross-cutting relevance	YES	Human health, Water, Energy, Transport, Tourism, Agriculture, Forestry, Biodiversity.					
Risks addressed	All risks						
10. ORGANIZE VERTICAL AND HORIZONTAL COORDINATION BETWEEN ALL DIRECTORATES IN THE MRDPW, RELATED TO URBAN ENVIRONMENT CCA AND DRM							
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS	
		X		X		X	
Description	<p>The option aims at better 'internal' coordination of the work of all directorates, related to CCA and DRM, based on a well-explored and evaluated organizational scheme. In the MRDPW such coordination exists, but there are still undeveloped links and relations in the CCA and DRM field.</p> <ul style="list-style-type: none"> • General Directorate 'Strategic Planning and Programming Regional Development' • Directorate 'Spatial Planning and Administrative and Territorial Structure' • Directorate 'Technical Rules and Regulations' • Directorate 'Water Supply and Sewerage' • Directorate 'Geoprotection and Public Works' • Directorate 'Housing Policy' • Directorate for National Construction Control <p>The state consulting companies of the MRDPW also must be part of this process, providing additional expertise:</p> <ul style="list-style-type: none"> • Road Infrastructure Agency (RIA) • National Building Research Institute (NBRI) • National Centre for Regional Development (NCRD) • Geoprotection state companies in Varna, Pleven, and Pernik 						
Option's relevance							
Economic	Ecologic	Social					
++/-	++	++					
Opportunities that arise	Sustainable institutions' development and better coordination system established.						
Cross-cutting relevance	YES	Human health, Water, Energy, Transport, Biodiversity, Agriculture, Forestry, Tourism.					
Risks addressed	All risks						

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11. IMPROVE COOPERATION BETWEEN NATIONAL, REGIONAL, AND LOCAL LEVELS AUTHORITIES IN CCA POLICY IMPLEMENTATION

Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
			X	X	X	
Description	<p>The option is part of the set of measures for institutional and administrative capacity building and coordination and cooperation improvement. In addition to option 9 this is a lower level ‘external’ coordination. All institutions, involved in CCA policy implementation are in the target group:</p> <ul style="list-style-type: none"> • Council of Ministers – DRM Council • MRDPW – Regional policy Council, National Expert Council of Spatial Planning, Working group Housing • Regional Development Councils on NUTS2 level, River Basins Directorates • District administrations and District development councils on NUTS3 level, Regional Inspectorates of Environment and Waters, Regional Health Inspectorates • Municipalities’ administrations, Municipality Councils and Spatial Planning Expert Councils; Municipal Disaster Protection Councils • Local administration units in the big cities with their Expert Councils and planning administration 					
Option’s relevance						
Economic	Ecologic	Social				
+/-	+	+				
Opportunities that arise	Improved institutional capacity, cooperation and collaboration in the field of urban environment CCA.					
Cross-cutting relevance	YES	Human health, Water, Energy, Transport, Biodiversity, Forestry, Agriculture, Tourism.				
Risks addressed	All risks					

12. DEVELOP CAPACITY IN THE DIRECTORATES THROUGH RETRAINING AND ADDITIONAL EXPERT EMPLOYMENT

Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
			X		X	
Description	<p>The options aim at strengthening the expert capacity in the directorates and units within the MRDPW, working in the field of regional/spatial and urban planning and construction. These units are:</p> <ul style="list-style-type: none"> • DG ‘Strategic Planning and Programming Regional Development’ • Directorate ‘Spatial Planning and Administrative and Territorial Structure’ • Directorate ‘Technical Rules and Regulations’ • Directorate ‘Water Supply and Sewerage’ • Directorate ‘Geoprotection and Public Works’ • Directorate ‘Housing Policy’ • Directorate for National Construction Control <p>MRDPW state companies:</p> <ul style="list-style-type: none"> • Road Infrastructure Agency (RIA) • National Building Research Institute (NBRI) • National Centre for Regional Development (NCRD) • Geoprotection state companies in Varna, Plevna, and Pernik 					
Option’s relevance						
Economic	Ecologic	Social				
++/- -	+	+				
An institutional and organizational analysis will show the bottlenecks in the structure. The retraining of the staff will be carried out in parallel with activities in options 21 and 24.						

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Opportunities that arise	Developed administrative and expert capacity. Better coordinated work.	
Cross-cutting relevance	YES	Human health, Water, Energy, Transport.
Risks addressed	All risks related with urban waters, urban transport, floods and landslides.	

13. PROVIDE GUIDELINES AND METHODOLOGICAL SUPPORT TO MUNICIPALITIES FOR THE DEVELOPMENT OF LOCAL CCA STRATEGIES

Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
		X		X		X
Description	This option targets at Bulgarian municipalities with limited administrative and expert capacity and stringent budgets. It tries to find support for those that are not signatories to the Covenant of Mayors, to secure the quality of their local CCA documents, as alternative for leaving this task to randomly selected consultants. Small municipalities need more methodological support which is better organized at a central level. For their CCA action planning municipalities could find online support through a national interactive platform (see options 6 and/or 24), additional to the one provided by the EU and the Mayors Adapt Initiative.					
Option's relevance						
Economic	Ecologic	Social				
++/-	+++	++	The EU Climate ADAPT platform provides good examples for local CCA strategies from different Member States.			
Opportunities that arise	Adopted modern, consistent and applicable documents for CCA of the cities. Clear tasks and plans to cope with disasters and extreme weather events. http://climate-adapt.eea.europa.eu/countries-regions/cities					
Cross-cutting relevance	YES	Human health, Water, Energy, Transport, Biodiversity, Agriculture, Forestry, Tourism.				
Risks addressed	All urban built environment related risks.					

V. Category Legislation

Revise and amend all types of legislative documents to transpose CCA issues after a Regulatory Impact Assessment

14. MAINSTREAM CCA REQUIREMENTS IN ALL LEGISLATIVE DOCUMENTS RELATED TO REGIONAL AND SPATIAL/URBAN PLANNING

Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
		X	X	X		
Description	The first step to implement this option is a Regulatory Impact Assessment (RIA), to justify the need for amendment. The Spatial Planning Act and the Regional Development Act have their RIAs, done in 2011 and in 2012. www.mrrb.government.bg/static/media/.../29f1fc40949e8732a8a83b1cc0e4930e.doc As mentioned in the current analysis, texts, concerning CCA have already been provided in some legislative documents, but need slight adjustment and updating. The forthcoming revision of the hierarchical planning system in Bulgaria will be an opportunity for better legislative harmonization in terms of CCA major objectives in the urban environment. A deeper analysis and assessment for possible amendments will be required for the secondary legislation:					
Option's relevance						
Economic	Ecologic	Social				
++/-	+++	++	<ul style="list-style-type: none"> • Regulation No. 7 on the rules and norms for the development of the different types of territories and zones • Regulations No. 8 on the scope and contents of the Spatial Development Plans • Regulation No. 4 on the scope and contents of the investment projects • Regulations on the terms and procedures for SEA of plans and programs • Regulations on the terms and procedures for EIA of investment projects 			

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Opportunities that arise	Better harmonized legislation.	
Cross-cutting relevance	YES	Human health, Water, Energy, Transport, Tourism, Agriculture, Forestry, Biodiversity.
Risks addressed	All risks threatening the urban population, urban infrastructure, building stock and services.	

15. REVISE AND UPDATE THE REQUIREMENTS FOR THE SCOPE AND CONTENTS OF MAIN TOOLS IN THE ABOVE ACTS AND REGULATIONS (NCSD, SPATIAL DEVELOPMENT SCHEMES AND PLANS, DETAILED PLANS)

Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
		X		X		X
Description	This option could be developed after the completion of the analysis for the Bulgarian regional policy reform and administrative structure reform, the latter concerning the NUTS2 regions and their boundaries. The administrative structure reform must be completed by the end of September 2018 and will determine the types and scope of the documents for regional and spatial planning. Only then option 15 could be better and more accurately elaborated.					
Option's relevance						
Economic	Ecologic	Social				
++/-	+++	++	At the same time in the current spatial planning regulations there is some room for improvement of the quality of investment projects and respectively – of the urban environment.			
Opportunities that arise	Documents for regional, spatial and urban planning better coordinated with the CCA aims and with the DRM objectives.					
Cross-cutting relevance	YES	All Urban Environment related sectors.				
Risks addressed	All risks					

VI. Category Finance

Change financial, social, and insurance policies

16. REVISE THE EXISTING FINANCIAL INSTRUMENTS AND DESIGN NEW ONES FOR CCA AND DRM, INCLUDING FOR ENERGY RENOVATION

Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
		X		X		X
Description	The existing financial framework of the CCA includes funding from the state budget, from the ESIF through the OPs (2014–2020) and from international donor organizations and programs. The national scale programs of the MRDPW, addressing some of the CCA and DRM issues in regional and urban development, are the Targeted Investment Program (2016) – aiming to provide support for lagging regions in the country – and the National Program for Energy Efficiency of Residential Buildings. This option aims at providing a better, fairer, and socially acceptable distribution of the burden between the state, municipalities, and homeowners. The new financial instruments have to take into consideration the requirements of Regulation No. 1303/2013 of the European Parliament and of the Council of 17 December 2013, about EU funding http://eur-lex.europa.eu/legal-content/BG/TXT/?uri=celex:32013R1303 , the State Aid Act (SG No 85/24.10.2017), the Social Assistance Act (Last amended SG No.7/19.01.2018) and the Fund for European Aid to the most Deprived (FEAD) http://ec.europa.eu/social/main.jsp?catId=1089&langId=en					
Option's relevance						
Economic	Ecologic	Social				
+/--	+	+++	Financial instruments innovation.			
Opportunities that arise	Financial instruments innovation.					
Cross-cutting relevance	YES	Human health, Water, Energy, Transport, Agriculture, Forestry.				
Risks addressed	All disaster risks.					

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17. EXPLORE THE EU FUNDS' POTENTIAL FOR CCA AND DRM						
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
		X		X		X
Description	This option relates to the previous, aiming at attracting additional financial resources for CCA and DRM in a situation of increasing social and economic disparities. The financial resources must support development and implementation of all other options: to create information and a modern scientific environment, to introduce technological innovations in the urban environment and construction sector, to develop capacity, to educate and train, and to support all other options for implementation of CCA strategies and plans. Among the most urgent needs during the process of consultations the poor equipment of the meteorological stations and of the rescue units and teams have been underlined.					
Option's relevance						
Economic	Ecologic	Social				
+/- -	++	+++				
Opportunities that arise	Well-equipped meteorological stations throughout the country for climate change observations, data collection and analyses; better and safer equipped rescue units and brigades.					
Cross-cutting relevance	YES	Human health, Water, Energy, Transport.				
Risks addressed	All risks.					
18. PLAN STATE BUDGET AND PROVIDE FINANCIAL SUPPORT TO MUNICIPALITIES TO IMPLEMENT CCA POLICIES						
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
		X		X		
Description	The option targets Bulgarian municipalities facing financial problems in dealing with urban environment maintenance, social services and aids provision, and DRM. Having in mind their limited administrative and expert capacity and stringent budgets, the option aims at supporting those municipalities that are not signatories to the Covenant of Mayors, and to secure the quality of their local CCA documents, instead of leaving that to randomly selected consultants. Small municipalities need additional methodological support (option 13) which is better organized at central level. For their CCA action planning municipalities could find online support through a national interactive platform (options 6 and/or 24), in addition to the one provided by the EU and the Mayors Adapt initiative. http://www.covenantofmayors.eu/Adaptation.html http://eur-lex.europa.eu/legal-content/BG/TXT/PDF/?uri=CELEX:52015IR2592&from=BG					
Option's relevance						
Economic	Ecologic	Social				
+/-	++	+				
Opportunities that arise	Reduced financial burden to the municipalities.					
Cross-cutting relevance	YES	Human health, Water, Energy, Transport, Agriculture.				
Risks addressed	All risks.					

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19. REVISE THE EXISTING DRM FUND FOR BETTER SOCIAL PROTECTION OF THE MOST VULNERABLE GROUPS						
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
		X		X		
Description	<p>Social assistance for vulnerable and socially disadvantaged groups in Bulgaria are dealt with through the Social Assistance Act. The Act guarantees <i>'the right of citizens to social assistance through benefits and services without affecting their human dignity'</i>. Social assistance is provided through cash and/or in-kind assistance to meet basic living needs or through social services. Additional option for these groups on the European level offer the Solidarity Fund http://ec.europa.eu/regional_policy/en/funding/solidarity-fund/ and the Fund for European Aid to the most Deprived (FEAD) http://ec.europa.eu/social/main.jsp?catId=1089&langId=en.</p> <p>The option is addressing groups identified in the analysis in this report: <i>'The share of the poor during 2015 was 22 percent, with 25 percent of the poor in the ages of 0 to 17. Most vulnerable are single-person households of ages 65+ (53 percent) and adults with three or more dependent children (66 percent). Current data on poverty were provided also by the analysis of the World Bank.'</i></p>					
Option's relevance						
Economic	Ecologic	Social				
---	+	+++				
Opportunities that arise	To explore more and better ideas for social support and for reduction of poverty.					
Cross-cutting relevance	YES	Human health, Water, Energy, Transport, Agriculture, Forestry.				
Risks addressed	All risks threatening human health and life, property, and food supply.					

20. EXPAND FINANCIAL INCLUSION MEASURES THROUGH ADAPTIVE SAFETY NETS, CONTINGENT FINANCE AND RESERVE FUNDS FOR THE POOR AND MOST DISADVANTAGED						
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
				X	X	
Description	<p>The option reflects the EU priority for social cohesion, addresses the poorest population in the EU and was inspired by the World Bank report, published in November 2016 <i>'Unbreakable: Building the Resilience of the Poor in the Face of Natural Disasters'</i> (https://reliefweb.int/report/world/unbreakable-building-resilience-poor-face-natural-disasters). Community safety nets can reduce vulnerability of communities by strengthening community cohesion and collective actions in addressing local problems. There are initiatives, connected with DRM, including traditional food production practices.</p> <p>The option could be developed alongside with options 16 and 19.</p>					
Option's relevance						
Economic	Ecologic	Social				
+/- -	++	+++				
Opportunities that arise	Fight against poverty and better social support.					
Cross-cutting relevance	YES	Human health, Water, Energy, Transport.				
Risks addressed	All risks threatening human health and life, property, and food supply.					

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VII. Category Education							
'Train the trainers' on CCA							
21. ORGANIZE APPROPRIATE FORMAT EDUCATION AND TRAINING FOR ALL LEVELS—FROM POLITICIANS TO THE GENERAL PUBLIC							
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/ POS	
		X					
Description	<p>The option could be easier developed if based on a strategy with clear goals, objectives and target groups. The responsibility for educational needs assessment, for defining a strategic framework and for leadership must be with the main information holder – the Ministry of Education and Science (MES) – with the assistance of the academia. The identified target groups for education, training and retraining include:</p> <ul style="list-style-type: none"> • Politicians and decision makers • Regional institutions and local administrations • Planners, architects and engineers, landscape architects and related to the Urban environment professionals (urban sociologist, urban geographers, urban economists and others) • Implementers – administrations staff, rescue teams, volunteers • Managerial, supervision and control bodies • General public 						
Option's relevance			<p>The option should generate a consolidated document on the rationale, goals and objectives; knowledge, skills, and attitudes requirements; format of teaching; education methods and tools; and a set of minimum criteria for teaching and learning standards and control.</p>				
Economic	Ecologic	Social					
++/-	+	+					
Opportunities that arise	Potential for educational institutions to introduce new programs, majors and modules.						
Cross-cutting relevance	YES	Human health, Water, Energy, Transport, Tourism, Agriculture, Forestry, Biodiversity.					
Risks addressed	All risks.						
22. ESTABLISH JOINT MULTIDISCIPLINARY COURSES FOR DIFFERENT PROFESSIONALS ON MASTER LEVEL							
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS	
		X		X		X	
Description	<p>Once the general framework for education and training is established and the main stakeholders are defined, a variety of combinations can be discussed to achieve better results and the appropriate knowledge, skills, and attitude. Having in mind the multidisciplinary and holistic approach, the full intellectual potential from the educational institutions in the fields of architecture, planning, civil engineering, landscape architecture, and environment should be used. For managerial knowledge and skills development, the participation of universities in the field of economics will be useful. Additional knowledge is required in the fields of social sciences and new technologies. The integration of resources will add value and bring economy of scale.</p>						
Option's relevance			<p>Added value to the final educational results from an inter- and multidisciplinary approach, stimulated creativity by a transdisciplinary approach, better-quality education.</p>				
Economic	Ecologic	Social					
++/- -	+++	++					
Opportunities that arise	Added value to the final educational results from an inter- and multidisciplinary approach, stimulated creativity by a transdisciplinary approach, better-quality education.						
Cross-cutting relevance	YES	Human health, Water, Energy, Transport, Tourism, Agriculture, Forestry, Biodiversity.					
Risks addressed	All risks.						

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23. PROVIDE TUTORING AND ORGANIZE THEMATIC PHD						
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
	X	X				
Description	PhD research for the urban environment in Bulgaria is not carried out in organized courses, but through individual tutorials and on a specific topic, selected by the student. These educational and scientific degrees are financed by the MES and by EU programs for student mobility. Mainstreaming the CCA theme in the individual PhD research will provide new and innovative ideas for reduction of weather hazards in the urban environment and for improving its resilience. The success of the option depends on the capacity of the educational institutions, the knowledge and experience of the senior academic staff for tutoring and on the access to resources and data. Possible topics for research could be selected from the identified impacts and threats in the urban environment (Chapter 1 of this report).					
Option's relevance						
Economic	Ecologic	Social				
+++/-	+++	++				
Opportunities that arise	New horizons for young researchers; scientific support for the education and professional practice.					
Cross-cutting relevance	YES	Human health, Water, Energy, Transport, Tourism, Agriculture, Forestry, Biodiversity.				
Risks addressed	All risks.					
24. DEVELOP INTERACTIVE CCA PLATFORM FOR DISTANCE AND OPEN LEARNING IN SUPPORT OF POLITICIANS, ADMINISTRATORS, PROFESSIONALS, NGOs, AND THE GENERAL PUBLIC, WITH SPECIAL APPS FOR THE DISABLED						
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
		X		X		X
Description	The option is part of the overall package of educational options within the category 'Education'. It could be developed as part of the Universities' network for Open/Distance Learning or as part of the National CCA platform. It could be commissioned to a private company with experience and capacity in ICT and education, capable to develop the idea and to maintain the site 24/7. The academic supervision and teaching could be delegated to a multidisciplinary team of academics, researchers and professionals. The program and the staff must be accredited and, to attract potential candidates for training and retraining, some of the modules could be linked with sustainable urban planning certification. Professional chambers in the country also must take part, meeting their obligations for knowledge upgrading and Life Long Learning.					
Option's relevance						
Economic	Ecologic	Social				
+/- -	+	++				
Opportunities that arise	Improved access to information and knowledge; Improved networking; faster communication of data, results and lessons learned.					
Cross-cutting relevance	YES	All urban environment related sectors, policies, and services.				
Risks addressed	All risks affecting human health, urban environment, urban infrastructure, urban transport, urban POS and buildings, urban green system, and urban services.					

VIII. Category Technology/Construction						
Implement new Eurocodes and technical norms in planning, design, construction technologies, and building materials						
25. IMPROVE CONSTRUCTION AND MAINTENANCE SUPERVISION, MONITORING AND CONTROL, AND TQM SYSTEMS ON PROJECTS AND CONSTRUCTION						
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/ POS
		X		X	X	X
Description	<p>The total quality management (TQM) system in planning, design, and building has a new framework, reflecting ICT developments and globalization of planning and design services and the construction industry. The option could be developed and implemented in conjunction with</p> <ul style="list-style-type: none"> • Planning and design supervision and control • Implementation of the adopted policies, plans, programs, and projects • Management of the built urban environment <p>An essential part of the improved TQM system should be the established sustainable cities and green building certifications. Part of these systems are the Bulgarian organizations for sustainable planning and design (https://new.usgbc.org/leed).</p>					
Option's relevance						
Economic	Ecologic	Social				
+++/-	++	++				
Opportunities that arise	Improved construction and maintenance supervision, monitoring and control, leading to more resilient and healthier environment.					
Cross-cutting relevance	YES	Human health, Water, Energy, Transport.				
Risks addressed	All risks affecting buildings, urban infrastructure, urban services.					
26. STIMULATE CREATIVE URBAN DESIGN, RESILIENT TO CLIMATE CHANGE						
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
	X	X		X		
Description	<p>This option offers good examples for urban planning and design, resilient to climate change, to stimulate professional practices and to encourage construction business communities in promoting creativity. Such initiatives are some of the world, European (ECTP http://www.ectp-ceu.eu/index.php/en/9-news/news-archive/244-the-9th-planning-awards-29 and RTPI awards http://www.rtpi.org.uk/events/awards/), national, and local (Sofia, Plovdiv, Varna, Burgas, Stara Zagora) design competitions, organized by respectful professional organizations with media and business support. Financial stimuli or scholarships for young and promising architects, engineers and planners also fall in this category (http://www.scholars4dev.com/20513/go-green-in-the-city-2017/) Some of the events could be thematically oriented towards the main elements of the Cities Resilience Framework. Most appropriate for urban planning and design are 'Health & Wellbeing' and 'Infrastructure and Environment'. http://www.100resilientcities.org/resources/</p>					
Option's relevance						
Economic	Ecologic	Social				
+++/- -	+++	+++				
Opportunities that arise	The expected results could bring more efficiency to the overall planning and design of professional practices, thus making cities more resilient to climate change.					
Cross-cutting relevance	YES	All Urban environment connected sectors				
Risks addressed	All risks.					

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27. PROMOTE GREEN, SMART, AND INNOVATIVE CITIES, BUILDINGS AND TECHNOLOGIES PLANNING, DESIGN AND CERTIFICATION						
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
		X		X	X	X
Description	<p>The 'Green' concept in urban development covers a wide range of options targeted toward global Sustainable Development Goals (SDGs). According to the institutions involved CCA options address the stages of planning, design, building, and utilization. They have a great potential for innovations in</p> <ul style="list-style-type: none"> • Technologies and constructions • Building materials • Urban and buildings' infrastructure • Urban Environment/Real estate management <p>Green, smart and innovative cities mean also green urban infrastructure, green urban transport, ecoservices, preserved parks, gardens, and biodiversity. The international professional planning and design practice have already plenty of inspiring examples for green roofs and walls, green parking places, urban rivers, and waterfronts converted into recreational places, linear parks and many others.</p> <p>https://www.nycgovparks.org/park-features/parks-list?boro=M https://www.star2.com/living/2017/11/11/restoration-cheonggye-stream-seoul/ https://www.citylab.com/design/2015/05/in-paris-plans-for-a-river-seine-reinvention/392639/</p>					
Option's relevance						
Economic	Ecologic	Social				
+++/-	+++	+++/-				
Opportunities that arise	Better quality of life, healthier population, reduced climate change and disaster risks, more attractive and safer urban environment, reduced health services costs, less non-renewable resources used.					
Cross-cutting relevance	YES	Human health, Water, Energy, Transport, Biodiversity.				
Risks addressed	All risks.					

IX. Category Capacity						
Develop and upscale institutional, administrative, and expert capacity						
28. BUILD EMERGENCY AND DRM UNITS' CAPACITY, PROVIDE SUFFICIENT AND MODERN EQUIPMENT, AND FINANCIAL SUPPORT						
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
		X	X	X		
Description	<p>The category includes institutional, administrative and expert capacity, meaning</p> <ul style="list-style-type: none"> • Sufficient number of reliable and sustainable institutions for CCA • Well-equipped institutions with sufficient administrators and experts to carry out CCA and DRM activities • Well-developed updated professional, science-based knowledge and skills <p>Relevant to the Capacity building CCA option are the following elements:</p> <ul style="list-style-type: none"> • Professional knowledge and skills of those involved in planning, design and building – involves educational institutions and professional bodies • Managerial skills – DRM, skills for financial management and public services management, for managing change and to deal with uncertainty • Technical skills – of the staff involved in all activities for risk reduction and disaster management, responsible for operation system in Urban Environment <p>The focus of this option is on the DRM units' capacity, with identified urgent needs in the consultation process of this report's analysis.</p>					
Option's relevance						
Economic	Ecologic	Social				
++/--	+	+++				
Opportunities that arise	Reduced losses (people affected, buildings, infrastructure), institutional development, better and more reliable emergency services provision.					
Cross-cutting relevance	YES	Human health, Water, Energy, Transport.				
Risks addressed	All risks connected to human life, property, and infrastructure.					

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29. PROVIDE APPROPRIATE ACCURATE AND UPDATED INFORMATION						
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
		X		X		X
Description	<p>Accurate and up-to-date information is important for the CCA process but is most important for DRM. This option could be developed and implemented jointly with options 6 and 30. Linked with the ‘capacity building’ category the option aims at providing different sets of information for:</p> <ul style="list-style-type: none"> • researchers involved in CCA studies on urban environment • decision makers and politicians • rescue and emergency units and early warning systems • the general public 					
Option’s relevance						
Economic	Ecologic	Social				
+/-	+	+				
Opportunities that arise						
Reduce disaster risks, resulting from extreme weather events.						
Cross-cutting relevance						
YES		Human health, Water, Energy, Transport, Agriculture, Biodiversity, and Forestry.				
Risks addressed						
All risks.						

30. DEVELOP AWARENESS, COMMITMENT, CCA KNOWLEDGE AND CULTURE AMONG THE GENERAL PUBLIC						
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
				X		
Description	<p>The option addresses the need for building resilient communities through information campaigns and education. There are several important messages that should be communicated among the population including:</p> <ul style="list-style-type: none"> • Climate change and impacts of extreme weather events – general and site-specific information • Possible gains and losses in case of emergency and disaster • Self-support, rescue systems and community support • General survival rules – pre-, during and post-disaster behavior <p>Information campaigns for the general public are best organized at the local level, with the support of NGOs, targeted toward a specific audience, and tailored to their needs with carefully selected communication events and tools. The Climate ADAPT Platform published recommendations as part of the attempts to increase the share of people informed in the EU states. (55 percent in 2009, 49 percent in 2011). (http://climate-adapt.eea.europa.eu/metadata/adaptation-options/awareness-campaigns-for-behavioural-change) The WHO provides open access to an online information portal, and UNEP recommends an eco-based approach for CCA of coastal areas. http://web.unep.org/coastal-eba/capacity-building-mainstreaming. However, the main challenge to deal with uncertainty remains.</p>					
Option’s relevance						
Economic	Ecologic	Social				
+/-	+	+				
Opportunities that arise						
Improved social behavior and culture; developed awareness and knowledge about climate change impact on urban environment; self-support skills stimulated; more effective use of scarce resources – water, energy, food; better use of local knowledge.						
Cross-cutting relevance						
YES		Human health, Water, Energy, Transport, Agriculture, Forestry, Biodiversity, Tourism.				
Risks addressed						
All risks.						

X. Category Partnership							
Work in partnership and communicate knowledge							
31. PROMOTE PARTNERSHIP, NETWORKING, AND COLLABORATION AMONG DIFFERENT AGE, GENDER, ETHNICITY, PROFESSIONAL, AND SOCIAL GROUPS, INCLUDING THE DISADVANTAGED ONES							
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/ POS	
		X		X			
Description	The first option in the category aims at the identification of target groups and main stakeholders, participants in the CCA process, and at exploring their capacity, readiness and preparedness to network and collaborate. Once identified, these representatives must be assigned clear roles and responsibilities in CCA and DRM. Important is also to identify the special needs of vulnerable and disadvantaged groups in line with their specific mental and physical characteristics. This option should be fully developed at the local level with the support of the NGO sector.						
Option's relevance							
Economic	Ecologic	Social					
+/-	++	+++					
Opportunities that arise	Institutional development; improved coordination; economy of scale, time and resources; identified problems, needs, and stakeholders.						
Cross-cutting relevance	YES	Human health, Water, Energy, Transport, Tourism, Agriculture, Forestry, Biodiversity.					
Risks addressed	All risks						
32. PROMOTE AND SUPPORT NETWORKING							
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS	
		X		X		X	
Description	The role of networking in the urban environment CCA process is crucial and aims at: <ul style="list-style-type: none"> • Exchange of data and communications of knowledge • Know-how and good practice examples implementation • DRM and post-disaster recovery support • CCA ideas generation The EU Climate ADAPT platform and the Covenant of Mayors Initiative are good examples for networking. (http://climate-adapt.eea.europa.eu/ http://www.covenantofmayors.eu/Adaptation.html). MRDPW and local authorities, as well as the academic community have, as a main aim, to support networking, using ICT solutions.						
Option's relevance							
Economic	Ecologic	Social					
++	++	++					
Opportunities that arise	Developed awareness and improved communication, enhanced coherence of the knowledge base and policies, capacity development.						
Cross-cutting relevance	YES	Human health, Water, Energy, Transport.					
Risks addressed	All risks.						
33. ORGANIZE A SOCIAL NETWORK FOR SUPPORT OF VULNERABLE GROUPS							
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS	
		X		X	X		
Description	The target groups of this option are ethnic minorities, in particular Roma, and poor, elderly, children, disabled, isolated groups, and those deprived from access to services in remote depopulated settlements, where social and health care institutions have been closed and roads are poorly maintained. The support is carried out under the regulations of the Social Assistance Act. In addition to the financial support and emergency services and proper living conditions provision integrated measures are recommended. An important element of these						

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Option's relevance			integrated measures are social support groups. Social networks could help victims of disasters to get information, support, and other resources during and after disasters, which increases their resilience.
Economic	Ecologic	Social	
++/-	+++	+++	
Opportunities that arise			Additional support for most vulnerable population, strengthened societal relations, change of social behavior, and voluntary work stimulation.
Cross-cutting relevance			YES Human health, Water, Energy, Transport.
Risks addressed			Disaster risks, poverty, and social exclusion.

34. DEVELOP PUBLIC-PRIVATE PARTNERSHIPS

Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
		X		X		X
Description	<p>The Public Private Partnership (PPP) Act (2013), which has been criticized for not facilitating partnership for more than four years, was abolished in 2017 (Last amended SG No 96/01/12.2017). Regulation (EU) No 1303/2013 of the European Parliament and of the Council of 17 December 2013 lays down the common rules applicable to the ESI funds and stimulates PPP. (http://eur-lex.europa.eu/legal-content/BG/TXT/?uri=celex:32013R1303).</p> <p>Bulgaria has limited experience with PPP due to the poor business culture, lack of trust in institutions, and financial restrictions. The CCA process with all proposed options and actions badly needs such kind of partnership, especially to manage disasters and recovery. Some rules for partnership are set in the Disaster Protection Act (Last amended SG 97/05.12.2017).</p>					
Option's relevance						
Economic	Ecologic	Social				
+++	+	++				
Opportunities that arise	Improved collaboration with the private sector, attracted private investments, better business management, private business financial support for DRM.					
Cross-cutting relevance			YES	Human health, Water, Energy, Transport, Biodiversity, DRM.		
Risks addressed			All risks.			

35. SUPPORT THE EFFECTIVENESS OF NGOS

Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
		X	X	X	X	
Description	<p>According to the State Register of Non-Profit Legal Entities at the Ministry of Justice in mid-2017 there were about 15,600 NGOs registered in Bulgaria, concentrated mostly in the big cities. The publication of the Open Society Institute 'The Active NGOs in Bulgaria in 2017' http://osi.bg/downloads/File/2017/active%20NGOs.pdf presents the major findings of the study, among which the limited capacity and resources and the small share of active ones. This adaptation option will address the problems with effectiveness of the work of the NGO sector and will attract the most reliable partners, with experience in the urban environment sector, green infrastructure, ecoservices, social policy, housing renovation, Roma, and vulnerable groups in joint initiatives and DRM.</p>					
Option's relevance						
Economic	Ecologic	Social				
+/-	+++	+++				
Opportunities that arise	Increased confidence in NGOs, better networking and mediation for conflict resolution. Stronger support in case of emergency.					
Cross-cutting relevance			YES	Human health, Water, Energy, Transport.		
Risks addressed			All risks, post-event stress.			

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36. WORK WITH MEDIA FOR PROMOTION OF THE CCA SYSTEM						
Relevant to:	Supranational level	National level	Regional level	Local level	Urban zones	Buildings/POS
		X	X	X		
Description	<p>As a comparatively new area, urban environment CCA will need additional promotion and professional PR actions. In the case of EU funding the actions must follow the rules for transparency and accountability. The main aim of the option will be to inform the public and to attract interest to stimulate cooperation, awareness, and development of new CCA ideas. Following the general rules for communication with the media there will be a few steps:</p> <ul style="list-style-type: none"> • Identification of the target groups and interested parties – internal (MRDPW) and external public (CCA partners, local authorities, beneficiaries, NGOs, businesses, depending on the level of communication), mediators (media representatives, PR professionals in the Ministry, and other organizations) • Identification of media channels – Printed media, TV channels, Radio stations, Type of Promotional materials • Communication Strategy/Plan and Schedule elaboration • Financial plan 					
Option's relevance						
	Economic	Ecologic	Social			
	+++/-	++	+++			
Opportunities that arise	<p>Better informed society; CCA messages, vision, and goals clearly distributed among different public and communication channels; increased interest among business community; achieved goals for transparency, accountability, and information.</p>					
Cross-cutting relevance	YES	All sectors.				
Risks addressed	All risks.					

Annex 3. Cost-Benefit Analysis

1. General Description

With increasing numbers of Bulgarian citizens living in urban areas and many economic activities being concentrated there, these areas are of growing importance in the framework of adapting to climate change. Urban areas are places where climate change can have large impacts, including economic consequences. The conceptual framework of this CBA was developed based on the effects that climate change has on the Urban Environment sector.

The purpose of this work is to:

- Estimate the parameters of the relationship between key performance indicators and climate change indicators for the urban sector (temperature +2°C and +4°C rise, and precipitation changes). It is considered that climatic drivers associated with the impact assessment are average temperature and average precipitation.
- Develop a CBA model appraising the costs and benefits of adaptation actions, thus measuring the efficiency of investments. It quantifies the anticipated costs and benefits of adaptation options with the aim of comparing them and determining whether the benefits outweigh the costs. Benefits are the advantages or positive effects of adaptation measures. Costs are the resources required to deliver adaptation measures. The effects are expressed as a decrease in costs because of adaptation measures taken.
- Evaluate and rank the adaptation measures in terms of economic efficiency.

1.1. Description of the methodology

Climate effects were evaluated in an integrated assessment model, which combines a regression (or sensitivity) analysis with CBA, that is, assesses the value of the costs and benefits of each adaptation action - giving a net present value (NPV) - and compares the costs (investment expenditure) and benefits (costs avoided)¹⁵⁷. Costs and benefits are expressed in monetary terms and a discount rate was used to determine the NPV of the adaptation measures.

The regression analysis - as a technique to assess adaptation measures under uncertainty - identifies those factors that have the most influence on main sectoral indicators.¹⁵⁸ The effect can be positive or negative.

Regression analysis was used to determine the effect of climatic variables on the performance of the urban environment indicators. This function is normally used when both the dependent and the explanatory variables are linear. The dependent variables are the main sectoral indicators where the independent variables are climatic (temperature and precipitation). Linear extrapolation of the key indicators was accounted aiming at identifying how the sector would develop under each scenario. Extrapolation quantified each individual indicator.

¹⁵⁷ The NPV of an adaptation option is given by the present value of the estimated benefits and costs. If NPV is more than zero, this indicates that the investment is efficient and incremental benefits of adaptation exceed the incremental resource costs. If NPV is <0 or B/C is <1, then the adaptation measures add no net benefit to the Urban Environment sector. If NPV is >0 or B/C is >1, then it adds positive benefits. The positive value of NPV confirms that investments for adaptation are efficient.

The benefit-cost ratio (B/C) is the ratio of the present value of benefits to the present value of costs. When the B/C ratio is more than one, the present value of the option's benefits is larger than the present value of its costs.

¹⁵⁸ The regression is linear; the dependent and the explanatory variables are linear.

The estimation of the negative and positive effects of climatic change was developed according to distinct scenarios at +2°C and +4°C temperature rise by 2050. These main scenarios are divided into sub-scenarios: optimistic, realistic, and pessimistic. The sub-scenarios are considered in the context of efficient and effective implementation of the proposed climate change adaptation measures.

The projected effects of adaptation measures are expressed as a logarithmic function, which is a tool to measure the effects of investments that would be gradually made until 2050.

An assessment was carried out of the NPV and the benefits until 2050, holding all other aspects constant. The monetary value of the effects was discounted by 4.5 percent for public funding and by 8 percent for private funding.

The benefits are defined as the positive effect of the implementation of climate change adaptation measures in the urban sector.

1.2. Data collection procedure

The primary data used for the CBA was obtained from the Action Plan that is part of the draft proposal for a National Climate Change Adaptation Strategy and Action Plan for Bulgaria, and from official statistical data.

The correlation determined whether there is a relationship between the performance indicators and climate factors. The relationship indicates which indicators are significantly dependent on climate change. Estimation of the correlation coefficient (dependence between each sectoral indicator and climate change factors [temperature and precipitation]) is used to stand out and select the critical variables (variables, which are highly sensitive to climate factors).

1.3. Model specifications - assumptions and limitations

- The projected trend value of each sector indicator is based on historical data (2010–2015).
- The main sectoral indicators include in the analysis are: energy consumption in households, thermal energy consumption in households, total electrical and thermal energy consumption in households, water losses.
- Climate projections (temperature and precipitation) were applied to historical variances experienced in Bulgaria (1991–2015). The observations are from monthly weather variables: monthly temperature (maximum, minimum, and average) and precipitation (maximum, minimum, and average).
- A baseline scenario is used to evaluate the development trend of the performance indicators under the +2°C and +4°C temperature rise scenarios. The baseline scenario reflects a continuation of current policies and plans, that is, a future in which no new measures are taken to address climate change.
- The pressure of extreme events, such as floods and landslides, on the key performance indicators are not accounted for, they are indirectly included, but have not been analyzed separately. Non-climatic factors (natural, material, economic, social, and political factors) and their cumulative effect have been taken into consideration.

2. Results of the Regression Analysis

A differential assessment was carried out by comparing the climate change effects on key performance indicators in all climate scenarios against the baseline scenario. The results display negative or positive effects to the indicators per scenario.

It was considered that adaptation options have a complex impact on key performance indicators and are sensitive to urban development. The correlation between sectoral performance indicators and climate change factors (temperature and precipitation) is substantially negative.

The correlation shows that household energy consumption is statistically dependent on temperature rise. Similar was found in relation to thermal energy consumption. There is a negative relationship between water losses and climate factors. The correlation between water losses and precipitation is significantly higher than the dependency on temperature. Precipitation directly affect water losses because the water balance is improved, and it compensates for losses from the damaged water supply infrastructure. However, the regression dependency is low showing that the precipitation influence is not strong.

The correlation between thermal energy and climate factors is substantially negative. Thermal energy consumption decreases because of rising temperatures. An increase in temperature influences electricity supply systems for heating and cooling (temperature and precipitation are extrapolated and calculated annually, not monthly). The bias of the population to consume energy for cooling has not been considered. In this regard, the calculation considers the current dependencies and not the probabilities of future change in the preferences of the population.

The cumulative sector effects presented in *Table 21* illustrate the difference between the baseline scenario (that is, without implementing selected adaptation options), and the +2°C and +4°C temperature rise scenarios until 2050.

Table 21. Expected cumulative sector effects from climate change in the urban sector until 2050 without adaptation measures (baseline scenario)

Performance indicators	2°C scenario (percentage)	4°C scenario (percentage)	Precipitation (percentage)
Electrical energy consumption in households (million kWt/hours)	0.26	0.51	0.54
Thermal energy consumption in households (million kWt/hours)	1.57	3.14	3.51
Total electrical and thermal energy consumption in households (million kWt/hours)	0.47	0.94	1.02
Water losses (million m ³ /annum)	1.11	2.21	2.09

Overall, the effects of climate change on the performance indicators are positive. According to the logarithmic function increased temperatures do not put pressure on increased energy consumption. However, the population in cities could be expected to start consuming more energy for cooling, which will significantly increase the need of energy supply.

Heat consumption will be most affected by temperature rise and the need for thermal electricity will decrease. Therefore, the adaptation measures could be directed at saving costs of decreasing the thermal electricity consumption.

The extrapolation indicates an upward trend in losses of water, as a negative impact of rising temperatures, in the field of water supply. Investments in the urban sector are decisive in reducing the effects of the deterioration of the water balance.

3. Results of the Cost-benefit Analysis

The CBA is a combination of assessing investment in soft adaptation measures. Their effects on the main performance indicators (energy consumption in households, thermal energy consumption in households, total electrical and thermal energy consumption in households, water losses) are assumed to be positive.

Table 22. Benefits of adaptation measures in the urban sector until 2050 (in €, million)

Climate scenarios	NPV (€, million)	Cost-effectiveness ¹⁵⁹ (Benefit/Cost ratio)
Realistic scenario +2°C	8,786.11	1.57
Optimistic scenario +2°C	13,285.08	1.87
Pessimistic scenario 2°C	4,287.14	1.28
Realistic scenario +4°C	20,522.60	2.34
Optimistic scenario +4°C	29,741.08	2.94
Pessimistic scenario +4°C	11,304.11	1.74

The projection (see **Table 22**) shows that on average, under the +2°C realistic scenario, the total cash flow in NPV is €8.7 billion and €20.5 billion under the realistic scenario at +4°C. Under the optimistic scenario the projected cash flow in NPV is €13.2 billion at +2°C average and €29.7 billion at +4°C average. Even in the pessimistic scenario the future cash flow in NPV is projected at €4.2 billion at +2°C and €11.3 billion at +4°C.

Within the current analysis, the cost-effectiveness of the adaptation measures is used to quantify the effect of investments under each scenario.¹⁶⁰ Under the +2°C realistic scenario the benefit/cost ratio is €1.57 (that is, the benefits achieved per Euro spent), and €2.34 under the +4°C realistic scenario. The benefit is higher at +4°C temperature rise. In that case, the benefit is €2.94 per one Euro of investment under the optimistic scenario and €1.74 per one Euro of investment under the pessimistic scenario. A higher effect of investments is observed under the +4°C scenario because the average air temperature during 1991–2015 has already increased by +1.6°C. Thus, to date, the level of the +2°C scenario has already almost been reached.

3.1. Prioritization of adaptation measures according to the cost-benefit analysis

CBA can be used for decision making, as a tool to identify measures that efficiently use financial resources. CBA identifies the most economic adaptation actions and allows for their

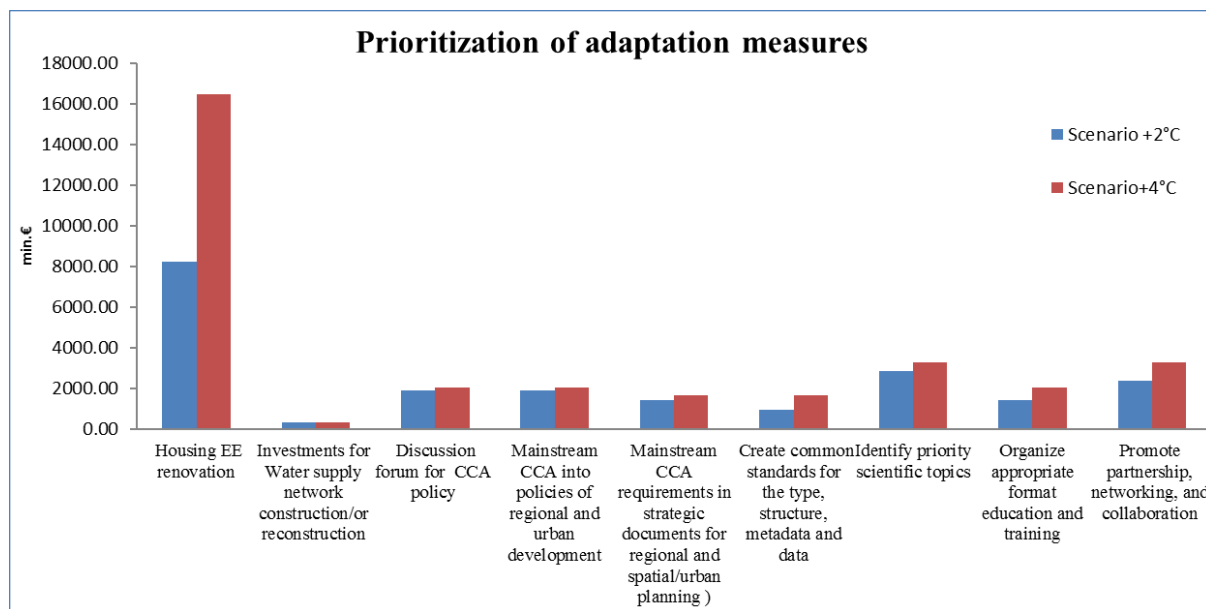
¹⁵⁹ Cost effectiveness is a coefficient which quantifies the benefits achieved as a result of the application of selected adaptation options in relation to the required investments/costs.

¹⁶⁰ The cost-effectiveness refers to all measures.

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ranking based on economic efficiency. The adaptation measures for which the benefit exceeds the cost can be ranked as follows: Housing EE renovation, secure funds for CCA research and implementation of CCA); identify priority scientific topics; Mainstream CCA into policies of regional and urban development, Promote partnership, networking, and collaboration, and others.

Figure 20. Prioritization of the adaptation measures (total NPV effect in € million) in the Urban Environment sector

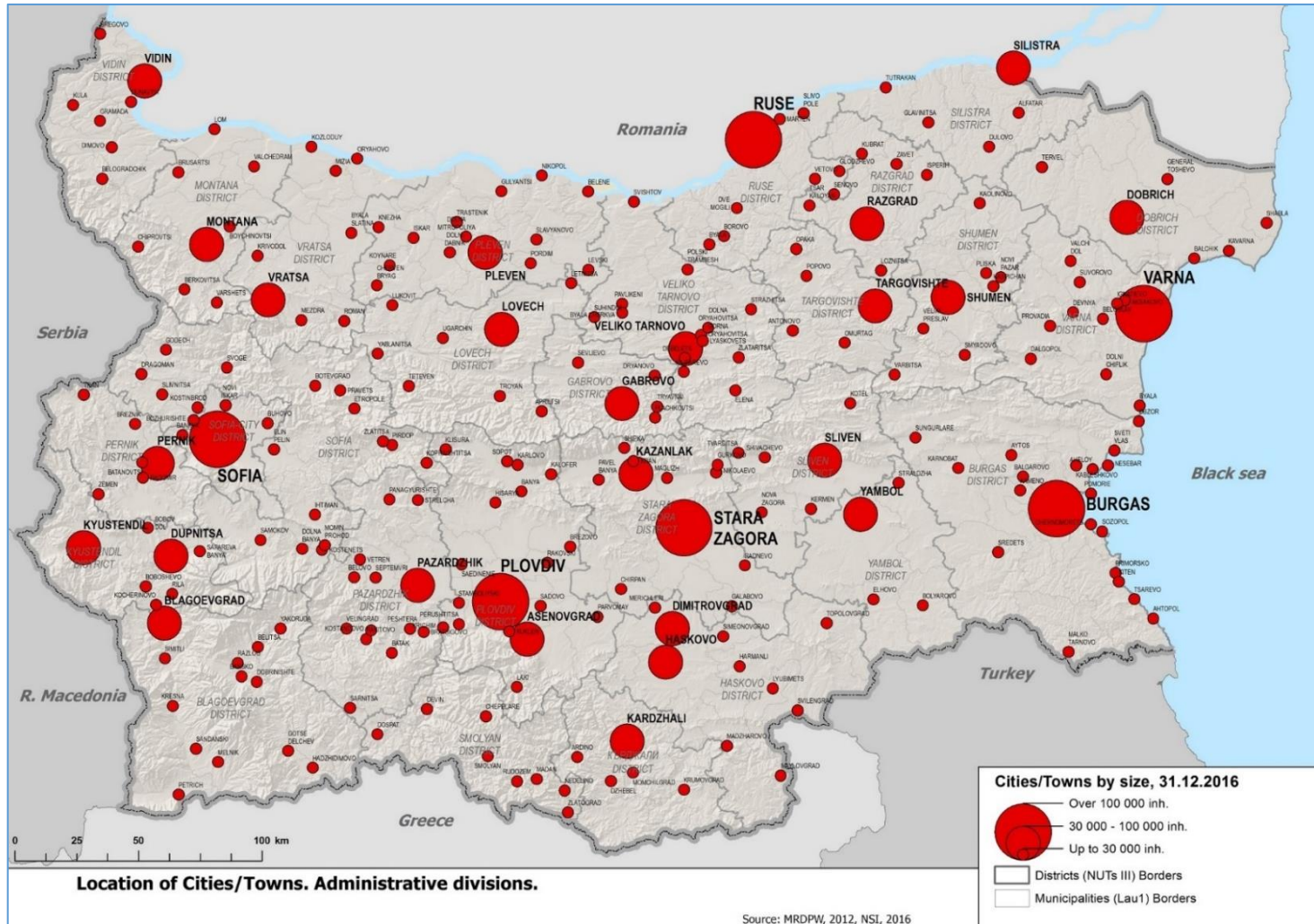


4. Conclusions

The effect of increased temperature is positive, and it leads to energy saving and decreased thermal energy consumption in households. The multiplier effect, after applying soft adaptation measures, shows a positive return on investment. NPV calculations show that investment in climate change adaptation measures in the Urban Environment sector is economically efficient. The monetary value of household costs for energy consumption has the tendency to slightly decrease, due to a change in thermal and electric energy consumption as a result of adaptation measures. A higher benefit value proves the financial argument for initiating adaptation measures.

Annex 4. Location of Emergency Services

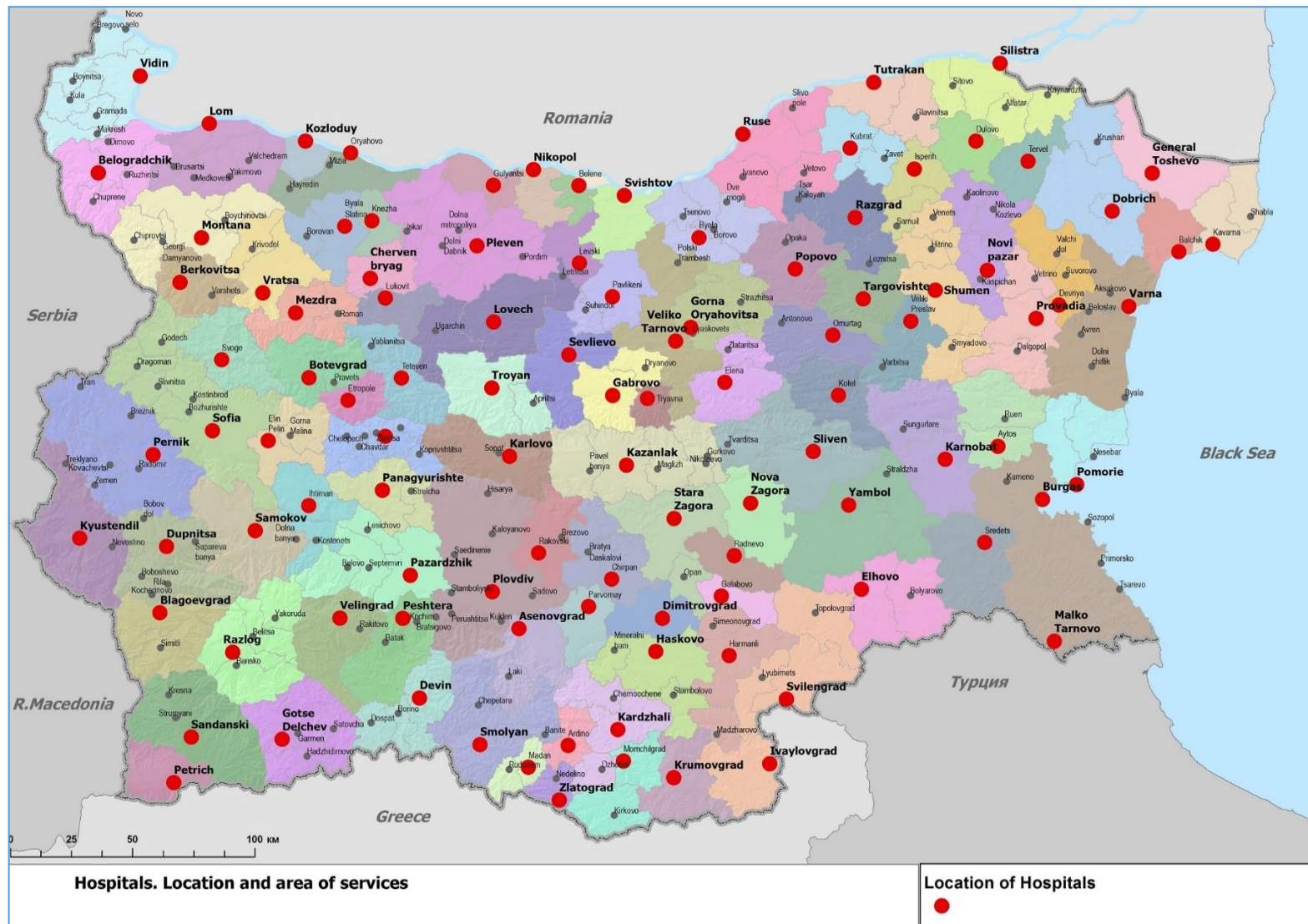
Figure 21. Location of cities by size groups



Source: NSI (number of population), NCRD (data compilation and map) 2017.

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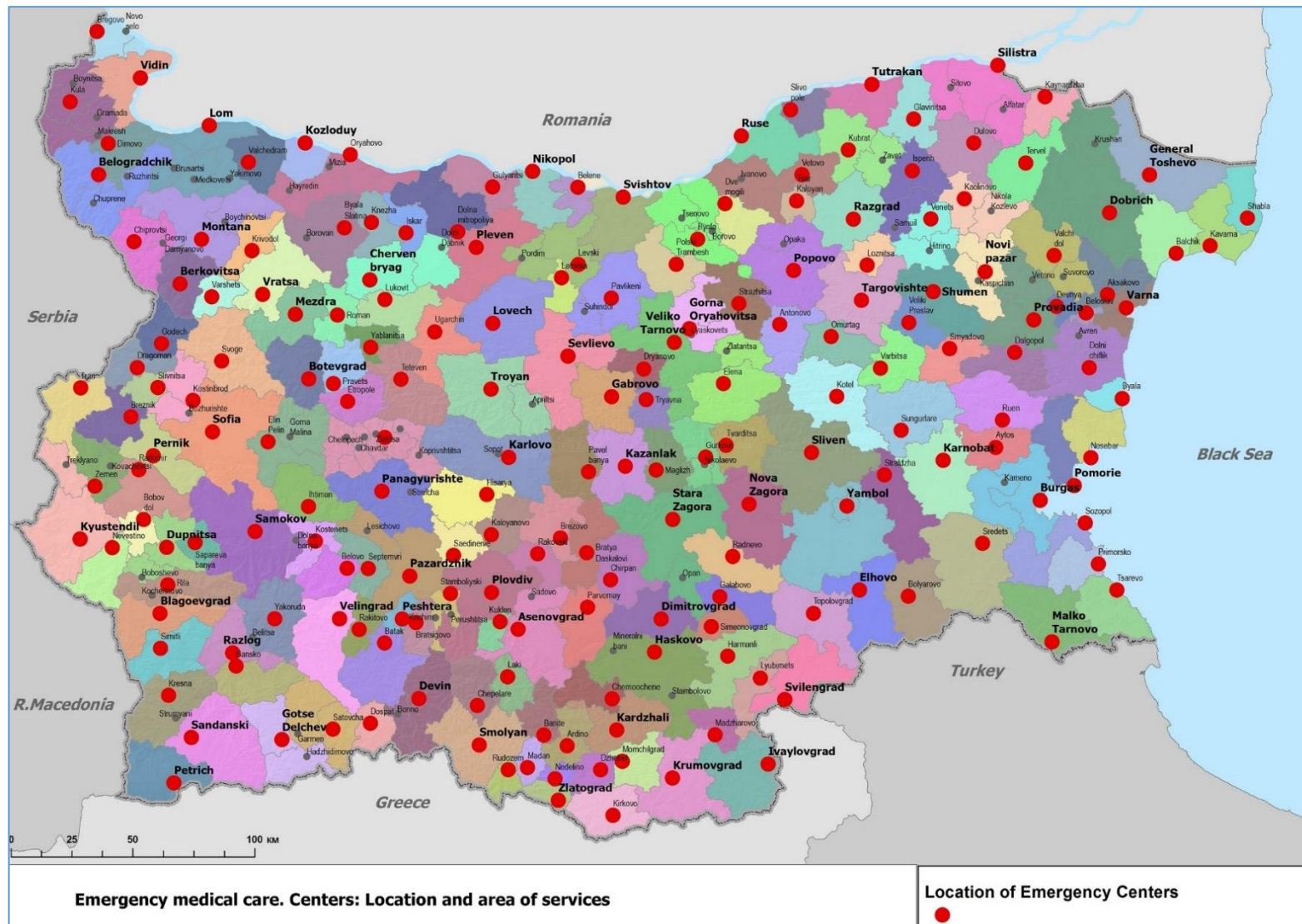
Figure 22. Location of hospitals - areas of service



Source: Ministry of Health (Location of hospitals and areas of service), NCRD (data compilation and map), 2017.

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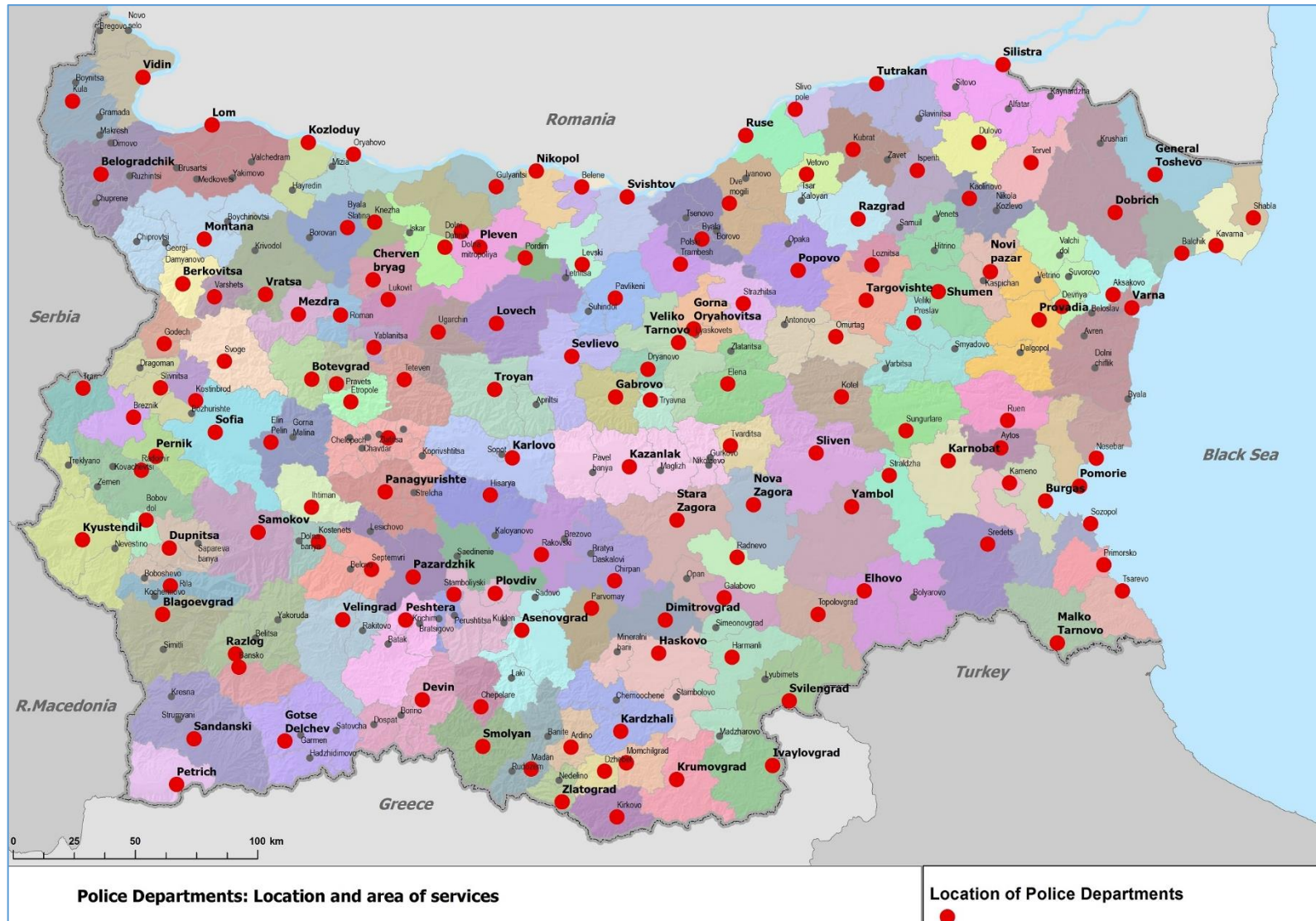
Figure 23. Location of centers for emergency care - areas of service



Source: Ministry of Health (Location of centers for emergency medical care and areas of service), NCRD (data compilation and map) 2017.

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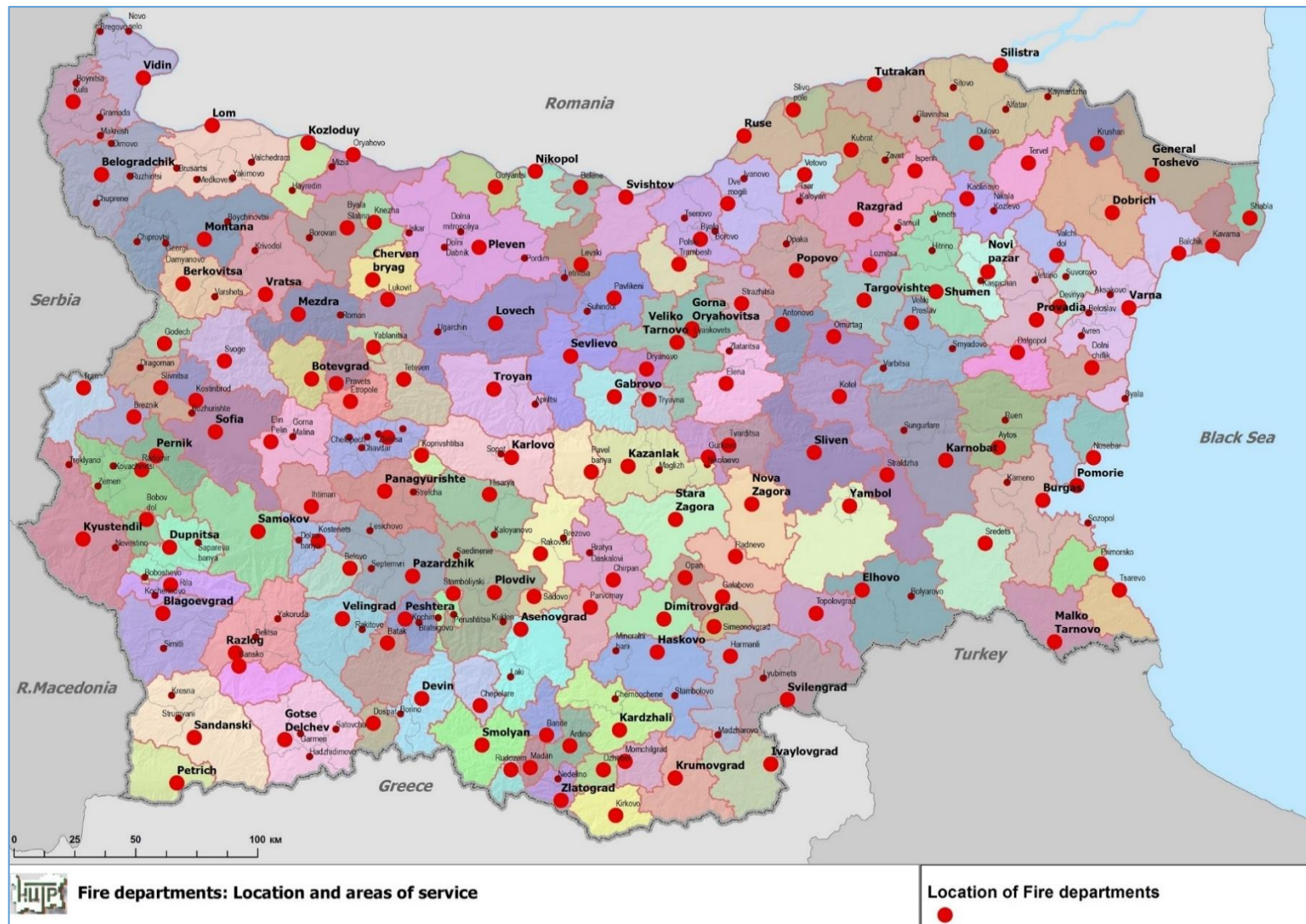
Figure 24. Location of police offices - areas of service



Source: Ministry of Interior (Location of police offices and areas of service), NCRD (data compilation and map), 2017.

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Figure 25. Location of fire department stations - areas of service



Source: Ministry of Interior (Location of fire department stations and areas of service), NCRD (data compilation and map), 2017.

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Table 23. Location of offices and services by cities

Name	Size-Type	Population December 31, 2015	Hospitals	Emergency Center	Police Office(s)	Fire Office(s)	Type by Location
Sofia	Big	1,236,047	Y	Y	Y	Y	Mountain/semi mountain
Plovdiv	Big	343,424	Y	Y	Y	Y	In the plains
Varna	Big	335,177	Y	Y	Y	Y	Black Sea coast
Burgas	Big	202,766	Y	Y	Y	Y	Black Sea coast
Ruse	Big	144,936	Y	Y	Y	Y	On Danube River
Stara Zagora	Big	136,781	Y	Y	Y	Y	in the plains
Pleven	Medium	98,467	Y	Y	Y	Y	in the plains
Sliven	Medium	87,322	Y	Y	Y	Y	mountain/semi mountain
Dobrich	Medium	85,402	Y	Y	Y	Y	in the plains
Shumen	Medium	76,967	Y	Y	Y	Y	in the plains
Pernik	Medium	74,110	Y	Y	Y	Y	mountain/semi mountain
Haskovo	Medium	71,686	Y	Y	Y	Y	in the plains
Blagoevgrad	Medium	69,567	Y	Y	Y	Y	in the plains
Yambol	Medium	69,542	Y	Y	Y	Y	in the plains
Pazardzhik	Medium	68,963	Y	Y	Y	Y	in the plains
Veliko Tarnovo	Medium	68,478	Y	Y	Y	Y	mountain/semi mountain
Gabrovo	Medium	54,004	Y	Y	Y	Y	mountain/semi mountain
Vratsa	Medium	53,570	Y	Y	Y	Y	mountain/semi mountain
Asenovgrad	Medium	49,250	Y	Y	Y	Y	in the plains
Kazanlak	Medium	45,076	Y	Y	Y	Y	in the plains
Kardzhali	Medium	43,022	Y	Y	Y	Y	mountain/semi mountain
Vidin	Medium	42,801	Y	Y	Y	Y	on Danube River
Kyustendil	Medium	40,682	Y	Y	Y	Y	in the plains
Montana	Medium	39,838	Y	Y	Y	Y	in the plains
Targovishte	Medium	35,536	Y	Y	Y	Y	in the plains
Dimitrovgrad	Medium	35,074	Y	Y	Y	Y	in the plains
Lovech	Medium	33,426	Y	Y	Y	Y	mountain/semi mountain
Silistra	Medium	32,400	Y	Y	Y	Y	on Danube River
Razgrad	Medium	31,301	Y	Y	Y	Y	in the plains
Dupnitsa	Medium	30,627	Y	Y	Y	Y	in the plains
Gorna Oryahovitsa	Small	29,478	Y	Y	Y	Y	in the plains
Smolyan	Small	28,160	Y	Y	Y	Y	mountain/semi mountain
Petrich	Small	27,587	Y	Y	Y	Y	mountain/semi mountain
Svishtov	Small	26,869	Y	Y	Y	Y	on Danube River
Samokov	Small	25,382	Y	Y	Y	Y	mountain/semi mountain
Sandanski	Small	25,054	Y	Y	Y	Y	in the plains
Karlovo	Small	21,612	Y	Y	Y	Y	mountain/semi mountain

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Name	Size-Type	Population December 31, 2015	Hospitals	Emergency Center	Police Office(s)	Fire Office(s)	Type by Location
Velinograd	Small	21,558	Y	Y	Y	Y	mountain/semi mountain
Nova Zagora	Small	21,270	Y	Y	Y	Y	in the plains
Sevlievo	Small	20,898	Y	Y	Y	Y	in the plains
Lom	Small	20,508	Y	Y	Y	Y	on Danube River
Harmanli	Small	20,216	Y	Y	Y	Y	mountain/semi mountain
Troyan	Small	19,785	Y	Y	Y	Y	mountain/semi mountain
Aytos	Small	19,490	Y	Y	Y	Y	in the plains
Botevgrad	Small	19,456	Y	Y	Y	Y	mountain/semi mountain
Gotse Delchev	Small	18,552	Y	Y	Y	Y	mountain/semi mountain
Svilengrad	Small	17,754	Y	Y	Y	Y	in the plains
Karnobat	Small	17,472	Y	Y	Y	Y	in the plains
Panagyurisht e	Small	16,359	Y	Y	Y	Y	mountain/semi mountain
Peshtera	Small	16,189	Y	Y	Y	Y	mountain/semi mountain
Rakovski	Small	14,799	Y	Y	Y	Y	in the plains
Popovo	Small	14,411	Y	Y	Y	Y	in the plains
Chirpan	Small	14,377	Y	Y	Y	Y	in the plains
Novi Iskar	Small	14,159	N	Y	N	N	in the plains
Pomorie	Small	13,607	Y	Y	Y	Y	Black Sea coast
Radomir	Small	13,279	N	Y	Y	Y	mountain/semi mountain
Ihtiman	Small	12,723	Y	Y	Y	Y	mountain/semi mountain
Nesebar	Small	12,548	Y	Y	Y	Y	Black sea coast
Parvomay	Small	12,371	Y	Y	Y	Y	in the plains
Berkovitsa	Small	12,360	Y	Y	Y	Y	mountain/semi mountain
Kozloduy	Small	12,235	Y	Y	Y	Y	on Danube River
Provadia	Small	12,151	Y	Y	Y	Y	in the plains
Radnevo	Small	11,847	Y	Y	Y	Y	in the plains
Cherven bryag	Small	11,618	Y	Y	Y	Y	in the plains
Razlog	Small	11,590	Y	Y	Y	Y	mountain/semi mountain
Kostinbrod	Small	11,546	N	Y	Y	Y	in the plains
Novi pazar	Small	11,520	Y	Y	Y	Y	in the plains
Balchik	Small	11,328	Y	Y	Y	Y	Black Sea coast
Bankya	Small	11,234	N	Y	N	N	mountain/semi mountain
Stamboliyski	Small	10,994	Y	Y	Y	Y	in the plains
Kavarna	Small	10,982	Y	Y	Y	Y	Black Sea coast
Byala Slatina	Small	10,200	Y	Y	Y	Y	in the plains
Etropole	Small	9,849	Y	Y	Y	Y	mountain/semi mountain
Pavlikeni	Small	9,735	Y	Y	Y	Y	in the plains
Knezha	Small	9,665	Y	Y	Y	Y	in the plains

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Name	Size-Type	Population December 31, 2015	Hospitals	Emergency Center	Police Office(s)	Fire Office(s)	Type by Location
Elhovo	Small	9,618	Y	Y	Y	Y	in the plains
Mezdra	Small	9,547	Y	Y	Y	Y	in the plains
Levski	Small	9,148	Y	Y	Y	Y	in the plains
Teteven	Small	8,990	Y	Y	Y	Y	mountain/semi mountain
Bansko	Small	8,881	N	Y	Y	Y	mountain/semi mountain
Sredets	Small	8,759	Y	Y	Y	Y	in the plains
Tryavna	Small	8,543	Y	Y	Y	Y	mountain/semi mountain
Lukovit	Small	8,519	Y	Y	Y	Y	in the plains
Sopot	Small	8,284	Y	N	N	N	mountain/semi mountain
Isperih	Small	8,253	Y	Y	Y	Y	in the plains
Krichim	Small	8,077	N	N	N	N	mountain/semi mountain
Tutrakan	Small	7,998	Y	Y	Y	Y	on Danube River
Rakitovo	Small	7,974	N	Y	N	N	mountain/semi mountain
Devnya	Small	7,898	Y	Y	Y	Y	in the plains
Aksakovo	Small	7,865	N	Y	Y	N	in the plains
Lyaskovets	Small	7,713	N	N	N	N	in the plains
Byala	Small	7,705	Y	Y	Y	Y	in the plains
Svoge	Small	7,666	Y	Y	Y	Y	mountain/semi mountain
Momchilgrad	Small	7,639	Y	Y	Y	Y	in the plains
Galabovo	Small	7,613	Y	Y	Y	Y	in the plains
Septemvri	Small	7,485	N	Y	Y	N	in the plains
Beloslav	Small	7,483	N	Y	N	N	in the plains
Belene	Small	7,449	Y	Y	Y	Y	on Danube River
Veliki Preslav	Small	7,275	Y	Y	Y	Y	in the plains
Omurtag	Small	7,263	Y	Y	Y	Y	mountain/semi mountain
Slivnitsa	Small	7,159	N	Y	Y	Y	mountain/semi mountain
Lyubimets	Small	7,071	Y	Y	N	N	in the plains
Pirdop	Small	6,919	Y	Y	Y	Y	mountain/semi mountain
Dryanovo	Small	6,887	N	Y	Y	Y	mountain/semi mountain
Elin Pelin	Small	6,884	Y	Y	Y	Y	in the plains
Kubrat	Small	6,597	Y	Y	Y	Y	in the plains
Hisarya	Small	6,574	Y	Y	Y	Y	mountain/semi mountain
Zlatograd	Small	6,514	Y	Y	Y	Y	mountain/semi mountain
Simitli	Small	6,486	N	Y	N	N	mountain/semi mountain
Dolni chiflik	Small	6,471	Y	Y	N	Y	in the plains
Dulovo	Small	6,392	Y	Y	Y	Y	in the plains
General Toshevo	Small	6,344	N	Y	Y	Y	in the plains

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Name	Size-Type	Population December 31, 2015	Hospitals	Emergency Center	Police Office(s)	Fire Office(s)	Type by Location
Simeonovgrad	Small	6,226	N	Y	N	Y	in the plains
Devin	Small	6,223	Y	Y	Y	Y	mountain/semi mountain
Kostenets	Small	6,202	Y	N	Y	Y	mountain/semi mountain
Tsarevo	Small	5,935	N	Y	Y	Y	Black Sea coast
Varshets	Small	5,816	Y	Y	Y	N	mountain/semi mountain
Tervel	Small	5,781	N	Y	Y	Y	in the plains
Kuklen	Small	5,770	N	Y	N	N	in the plains
Straldzha	Small	5,688	N	Y	Y	Y	in the plains
Tvarditsa	Small	5,681	N	Y	Y	Y	mountain/semi mountain
Bozhurishte	Small	5,543	N	N	N	N	in the plains
Saedinenie	Small	5,502	N	Y	N	N	in the plains
Madan	Small	5,455	Y	Y	Y	Y	mountain/semi mountain
Yakoruda	Small	5,385	N	Y	N	N	mountain/semi mountain
Kotel	Small	5,329	Y	Y	Y	Y	mountain/semi mountain
Bobov dol	Small	5,177	N	Y	Y	Y	mountain/semi mountain
Elena	Small	5,054	N	Y	Y	Y	mountain/semi mountain
Topolovgrad	Small	4,986	Y	Y	Y	Y	mountain/semi mountain
Chepelare	Small	4,944	N	Y	Y	Y	mountain/semi mountain
Perushtitsa	Small	4,851	N	N	N	N	in the plains
Belogradchik	Small	4,694	Y	Y	Y	Y	mountain/semi mountain
Zlatitsa	Small	4,687	N	N	N	N	mountain/semi mountain
Krumovgrad	Small	4,631	Y	Y	Y	Y	mountain/semi mountain
Suvorovo	Small	4,546	N	N	N	N	in the plains
Dolna banya	Small	4,531	N	N	N	N	mountain/semi mountain
Dalgopol	Small	4,506	N	Y	N	Y	in the plains
Oryahovo	Small	4,495	N	Y	Y	Y	on Danube River
Sozopol	Small	4,342	N	Y	Y	N	Black sea coast
Strazhitsa	Small	4,322	N	Y	Y	Y	in the plains
Vetovo	Small	4,241	N	Y	Y	Y	in the plains
Kameno	Small	4,185	N	N	Y	N	in the plains
Trastenik	Small	4,072	N	N	N	N	in the plains
Kostandovo	Small	4,063	N	N	N	N	mountain/semi mountain
Godech	Small	4,039	N	Y	Y	Y	mountain/semi mountain

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Name	Size-Type	Population December 31, 2015	Hospitals	Emergency Center	Police Office(s)	Fire Office(s)	Type by Location
Polski Trambesh	Small	4,015	N	Y	Y	Y	in the plains
Ignatievo	Small	4,004	N	N	N	N	in the plains
Nedelino	Small	3,978	N	Y	N	N	mountain/semi mountain
Breznik	Small	3,935	N	Y	Y	Y	mountain/semi mountain
Dve mogili	Small	3,927	N	Y	Y	Y	in the plains
Dolni Dabnik	Small	3,927	N	N	Y	N	in the plains
Bratsigovo	Small	3,870	N	Y	N	N	mountain/semi mountain
Debelets	Small	3,860	N	N	N	N	in the plains
Strelcha	Small	3,821	N	N	N	N	mountain/semi mountain
Ardino	Small	3,799	Y	Y	Y	Y	mountain/semi mountain
Sveti Vlas	Small	3,714	N	N	N	N	Black Sea coast
Slavyanovo	Small	3,674	N	N	N	N	in the plains
Pravets	Small	3,636	N	Y	Y	Y	mountain/semi mountain
Shivachevo	Small	3,627	N	N	N	N	mountain/semi mountain
Smyadovo	Small	3,601	N	Y	N	N	in the plains
Sapareva banya	Small	3,595	Y	Y	N	N	mountain/semi mountain
Belovo	Small	3,530	N	Y	N	Y	mountain/semi mountain
Rudozem	Small	3,462	Y	Y	N	Y	mountain/semi mountain
Marten	Small	3,461	N	N	N	N	on Danube River
Sarnitsa	Small	3,452	N	N	N	N	mountain/semi mountain
Kresna	Small	3,425	N	Y	N	N	mountain/semi mountain
Ivaylovgrad	Small	3,385	N	N	Y	Y	mountain/semi mountain
Tsar Kaloyan	Small	3,377	N	Y	N	N	in the plains
Koynare	Small	3,359	N	N	N	N	in the plains
Varbitsa	Small	3,300	N	Y	N	N	mountain/semi mountain
Banya	Small	3,259	Y	N	N	N	in the plains
Valchedram	Small	3,238	N	Y	N	N	in the plains
Kran	Small	3,228	N	N	N	N	mountain/semi mountain
Glodzhevo	Small	3,218	N	N	N	N	in the plains
Shabla	Small	3,214	N	Y	Y	Y	Black Sea coast
Dragoman	Small	3,161	N	Y	N	N	mountain/semi mountain
Maglizh	Small	3,128	N	Y	N	N	mountain/semi mountain
Belitsa	Small	3,107	N	N	N	N	mountain/semi mountain

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Name	Size-Type	Population December 31, 2015	Hospitals	Emergency Center	Police Office(s)	Fire Office(s)	Type by Location
Dzhebel	Small	3,101	N	Y	Y	Y	mountain/semi mountain
Sungurlare	Small	2,998	N	Y	Y	N	in the plains
Nikopol	Small	2,994	Y	Y	Y	Y	on Danube River
Gulyantsi	Small	2,988	Y	Y	Y	Y	in the plains
Primorsko	Small	2,966	N	N	Y	Y	Black Sea coast
Valchi dol	Small	2,962	N	Y	N	Y	in the plains
Iskar	Small	2,939	N	N	N	N	in the plains
Batak	Small	2,924	N	Y	N	Y	mountain/semi mountain
Slivo pole	Small	2,895	N	Y	Y	Y	in the plains
Kableshkovo	Small	2,888	N	N	N	N	in the plains
Vetren	Small	2,886	N	N	N	N	mountain/semi mountain
Dolna Mitropoliya	Small	2,871	N	Y	Y	N	in the plains
Kalofer	Small	2,846	N	N	N	N	mountain/semi mountain
Kaspichan	Small	2,833	N	N	N	N	in the plains
Mizia	Small	2,803	N	N	N	N	in the plains
Zavet	Small	2,802	N	N	N	N	in the plains
Nikolaevo	Small	2,728	N	N	N	N	in the plains
Gurkovo	Small	2,722	N	Y	N	Y	mountain/semi mountain
Kula	Small	2,720	N	Y	Y	Y	in the plains
Krivodol	Small	2,719	N	Y	N	N	in the plains
Dolna Oryahovitsa	Small	2,689	N	N	N	N	in the plains
Dobrinishte	Small	2,688	N	N	N	N	mountain/semi mountain
Yablanitsa	Small	2,681	N	Y	Y	Y	mountain/semi mountain
Buhovo	Small	2,624	N	N	N	N	mountain/semi mountain
Apriltsi	Small	2,623	N	N	N	N	mountain/semi mountain
Roman	Small	2,570	Y	Y	Y	N	in the plains
Pavel banya	Small	2,554	Y	Y	N	Y	in the plains
Opaka	Small	2,547	N	N	N	N	in the plains
Hadzhidimov o	Small	2,539	N	N	N	N	mountain/semi mountain
Letnitsa	Small	2,479	N	Y	N	N	in the plains
Sadovo	Small	2,476	N	N	N	Y	in the plains
Ugarchin	Small	2,448	N	Y	Y	N	in the plains
Obzor	Small	2,442	N	N	N	N	Black Sea coast
Tran	Small	2,315	N	Y	Y	Y	mountain/semi mountain
Aheloy	Small	2,310	N	N	N	N	Black Sea coast
Bregovo	Small	2,291	N	Y	N	N	in the plains
Rila	Small	2,217	N	Y	Y	Y	mountain/semi mountain

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Name	Size-Type	Population December 31, 2015	Hospitals	Emergency Center	Police Office(s)	Fire Office(s)	Type by Location
Dospat	Small	2,191	N	Y	N	Y	mountain/semi mountain
Malko Tarnovo	Small	2,139	N	Y	Y	N	mountain/semi mountain
Koprivshitsa	Small	2,135	N	N	N	Y	mountain/semi mountain
Batanovtsi	Small	2,134	N	N	N	N	mountain/semi mountain
Kilifarevo	Small	2,131	N	N	N	N	in the plains
Kocherinovo	Small	2,130	N	N	N	N	in the plains
Chernomoret s	Small	2,125	N	N	N	N	Black Sea coast
Byala	Small	2,102	N	N	N	N	Black Sea coast
Loznitsa	Small	2,102	N	Y	Y	Y	in the plains
Zlataritsa	Small	2,101	N	N	N	N	in the plains
Dunavtsi	Small	1,975	N	N	N	N	in the plains
Laki	Small	1,918	N	Y	N	N	mountain/semi mountain
Pordim	Small	1,889	N	N	Y	N	in the plains
Borovo	Small	1,836	N	N	N	N	in the plains
Brezovo	Small	1,734	N	Y	N	N	in the plains
Byala cherkva	Small	1,727	N	N	N	N	in the plains
Suhindol	Small	1,697	N	N	N	N	in the plains
Chiprovtsi	Small	1,656	N	Y	N	N	mountain/semi mountain
Balgarovo	Small	1,581	N	N	N	N	in the plains
Plachkovtsi	Small	1,572	N	N	N	N	mountain/semi mountain
Kermen	Small	1,569	N	N	N	N	in the plains
Zemen	Small	1,543	N	Y	N	N	mountain/semi mountain
Merichleri	Small	1,541	N	N	N	N	in the plains
Kaolinovo	Small	1,501	N	Y	Y	Y	in the plains
Momin prohod	Small	1,462	Y	N	N	N	mountain/semi mountain
Antonovo	Small	1,455	N	Y	N	Y	in the plains
Alfatar	Small	1,437	N	N	N	N	in the plains
Glavinitsa	Small	1,393	N	Y	N	N	in the plains
Gramada	Small	1,366	N	N	N	N	in the plains
Boychinovtsi	Small	1,323	N	N	N	N	in the plains
Senovo	Small	1,286	N	N	N	N	in the plains
Ahtopol	Small	1,283	N	N	N	N	Black Sea coast
Shipka	Small	1,189	N	N	N	N	mountain/semi mountain
Boboshevo	Small	1,166	N	N	N	N	mountain/semi mountain
Bolyarovo	Small	1,132	N	Y	N	N	in the plains
Dimovo	Small	1,071	N	Y	N	N	in the plains
Brusartsi	Small	1,012	N	N	N	N	in the plains
Klisura	Small	966	N	N	N	N	mountain/semi mountain

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Name	Size-Type	Population December 31, 2015	Hospitals	Emergency Center	Police Office(s)	Fire Office(s)	Type by Location
Kiten	Small	947	N	N	N	N	Black Sea coast
Pliska	Small	853	N	N	N	N	in the plains
Madzharovo	Small	587	N	Y	N	N	mountain/semi mountain
Melnik	Small	199	N	N	N	N	mountain/semi mountain

Notes: City size by population: Big cities - over 100,000 inhabitants, Medium - 30,000 to 100,000 inhabitants, Small - below 30,000 inhabitants

Y = Yes; N = No.

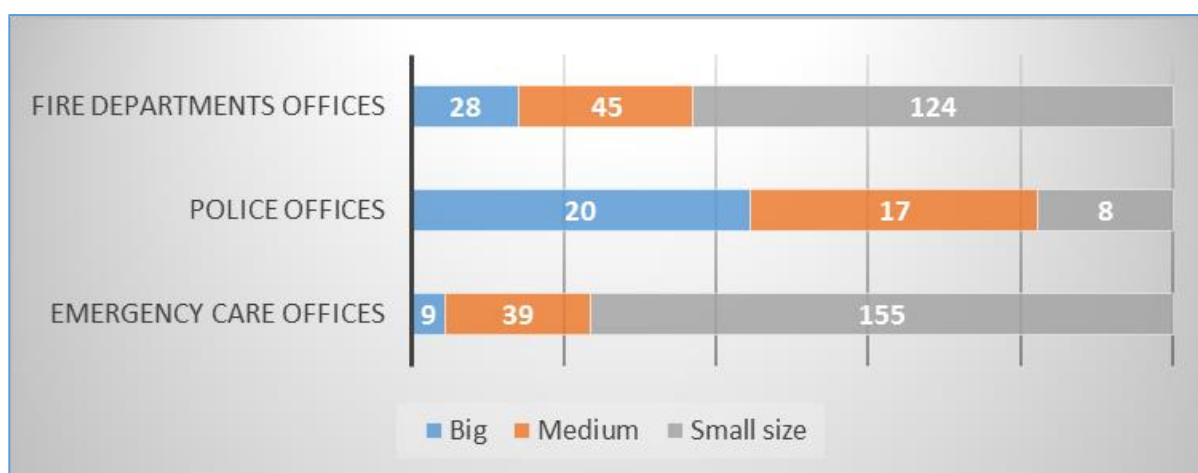
Source: NSI 2016 (population), Ministry of Health (Location of Hospitals and Emergency centers), Ministry of Interior (Location of police and fire offices), NCRD (data compilation and map), 2017.

Table 24. Location of offices and services by type of the cities

Type by Number of Population (inhabitants)	Number of Cities/Towns	Total Number of Hospitals (All types)	Total Number of Emergency Centers	Total Number of Police Offices	Total Number of Fire Departments Offices
Big	6	153	9	20	28
Medium	24	78	39	17	45
Small size	227	107	155	8	124
Totals	257	338	203	45	197

Source: NSI, 2016 (population), Ministry of Health (Location of Hospitals and Emergency centers), Ministry of Interior (Location of police and fire departments), NCRD (data compilation and map), 2017.

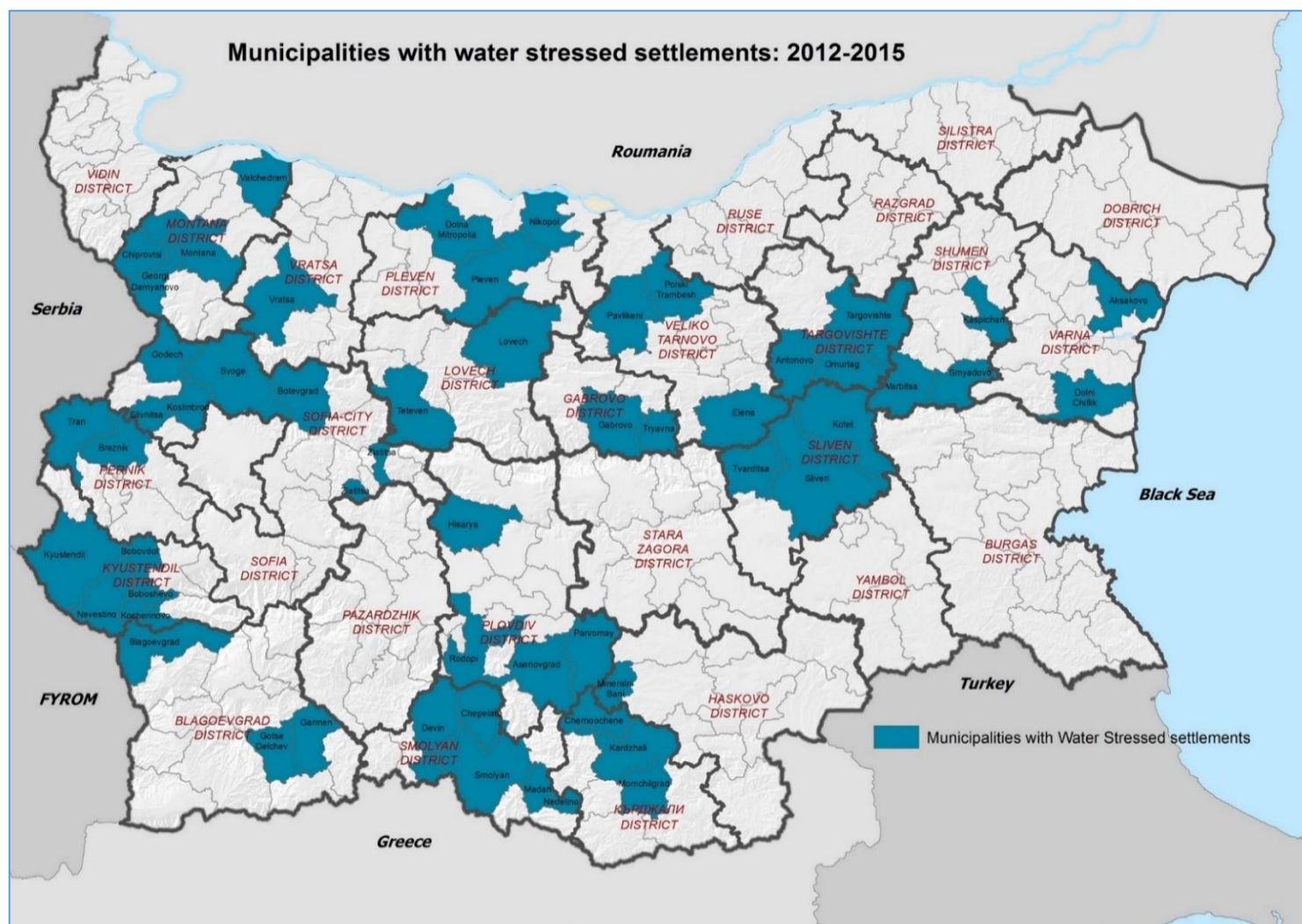
Figure 26. Location of offices and services by type of the cities



Source: NSI 2016 (population), Ministry of Health (Location of Hospitals and Emergency centers), Ministry of Interior (Location of police and fire offices), NCRD (data compilation and map), 2017.

Annex 5. Municipalities with Cities in Water Stress

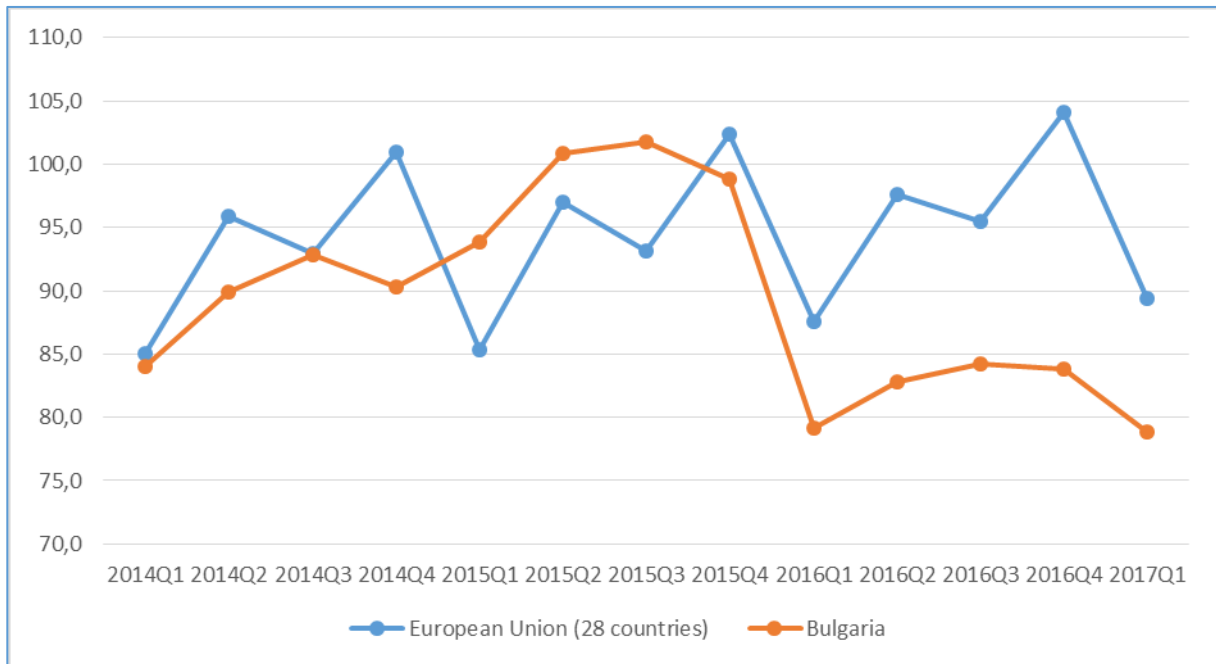
Figure 27. Municipalities with cities in water stress (2012–2015)



Source: Ministry of Regional Development and Public Works (Municipalities with settlements in water stress), NCRD (data compilation and map), 2017.

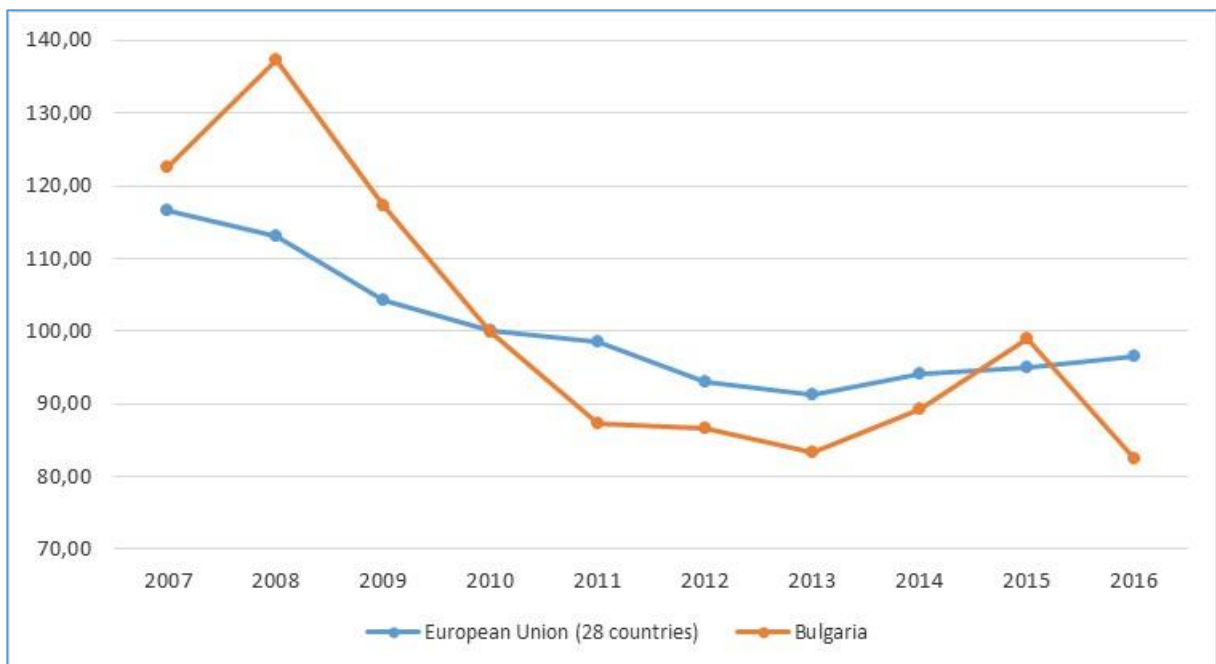
Annex 6. Construction Sector

Figure 28. Production in construction - quarterly data, volume index of production, index, 2010=100



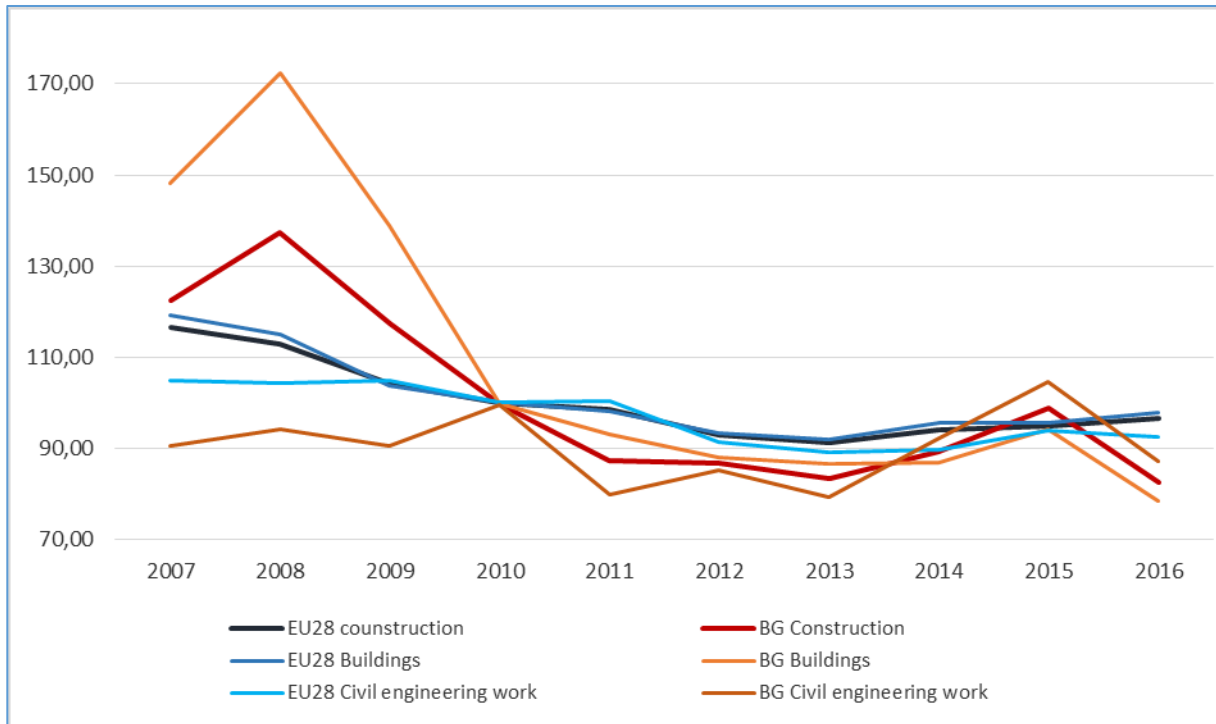
Source: Eurostat 2017.

Figure 29. Production in construction - yearly data, volume index of production, index, 2010=100



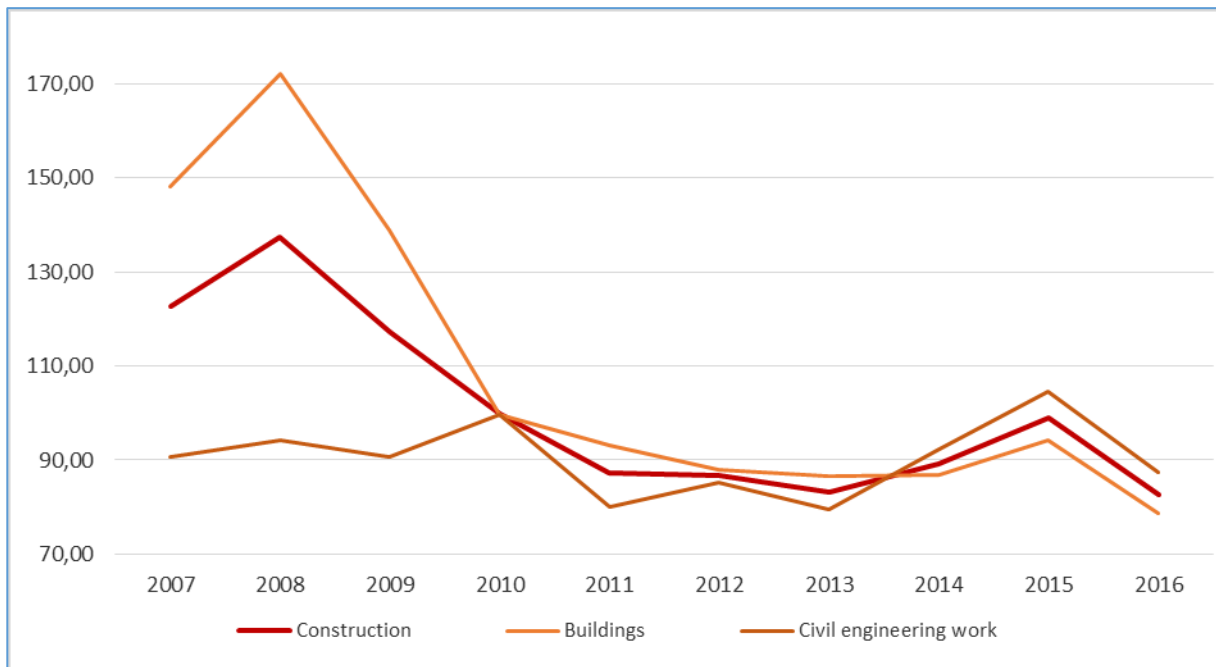
Source: Eurostat 2017, http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sts_copr_a&lang=en

Figure 30. Production in construction (total, buildings, civil engineering work) - yearly data, volume index of production, index, 2010=100



Source: Eurostat 2017, <http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do>

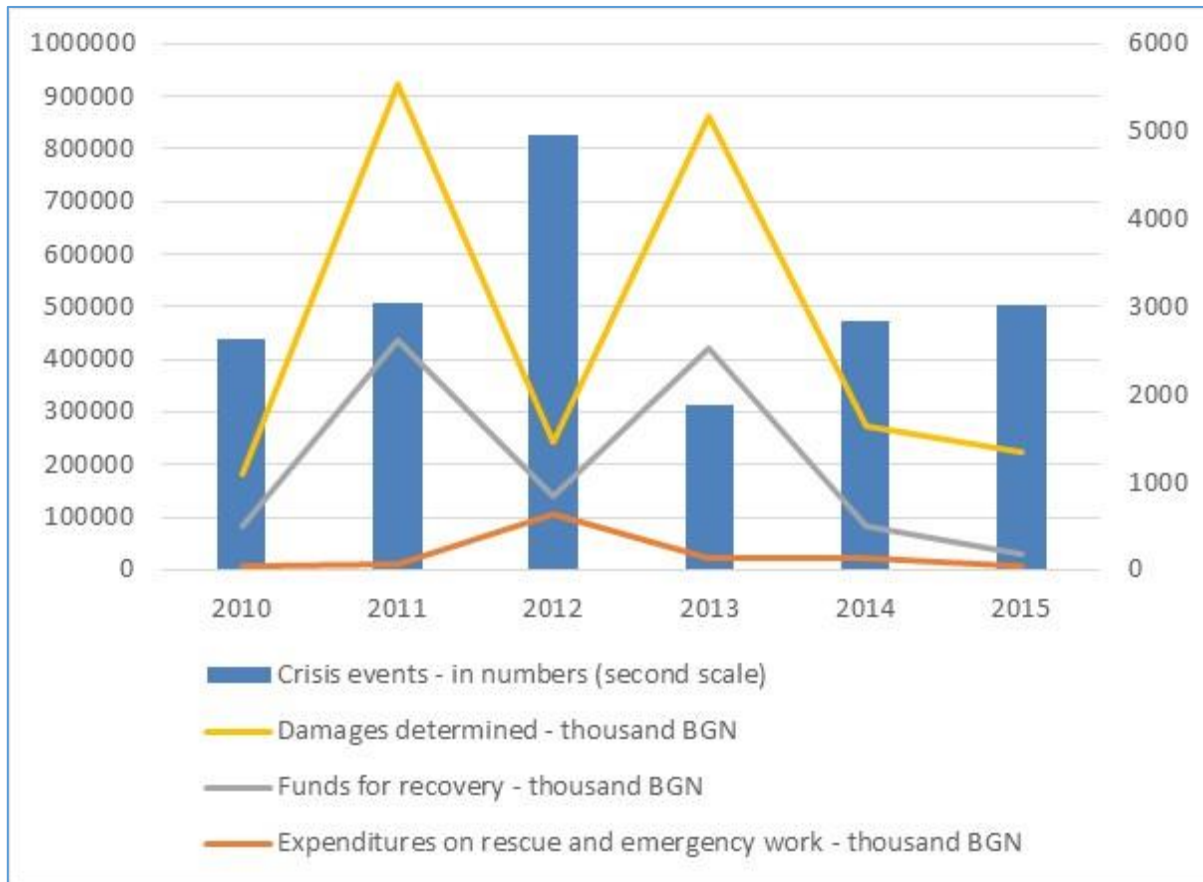
Figure 31. Production in construction in Bulgaria (total, buildings, civil engineering work) - yearly data, volume index of production, index, 2010=100



Source: Eurostat 2017.

Annex 7. Crisis Events and Losses (2010–2015)

Figure 32. Crisis events and losses in the period 2010–2015 - total for the country



Note: **Type of crises** included—fires, landslides, earthquakes, droughts, floods, storms, tornado, wind spout, whirlwind, hailstorms, snowstorms (snowfall), icings, frosts, accidents, pollutions (with chemical materials, dangerous waste, municipal waste and other); epidemic human diseases, epidemic animal diseases (including birds), calamity, other crisis, natural disasters, and events. Data are based on annual reports submitted by the permanent municipal commissions for protection of population against natural disasters, accidents and catastrophes as follows: for 2010, by 119; for 2011 by 127; for 2012, by 128; for 2013, by 100; for 2014, by 141; and for 2015, by 115 commissions.

Source: data: NSI, data processing and diagram: NCRD.

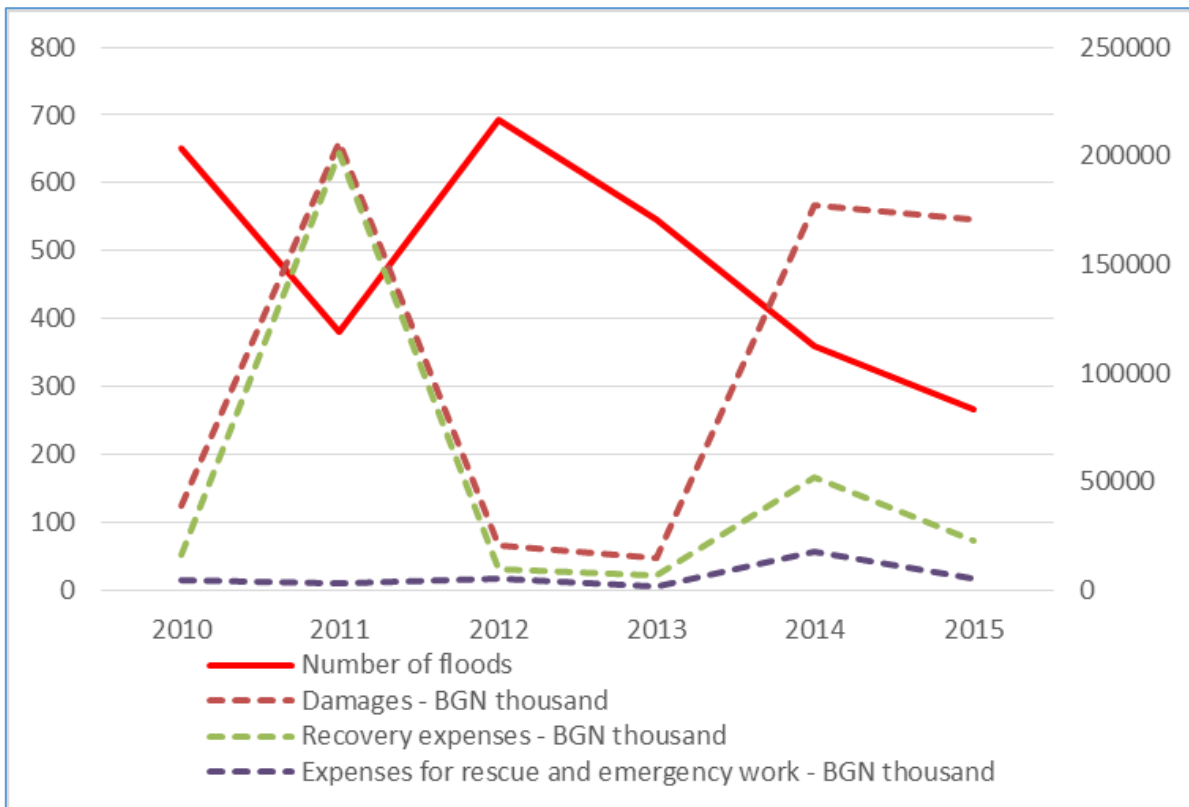
Floods

Table 25. Characteristics of floods by districts: summary for the period 2010–2015

Districts	Number of Floods	Damages (BGN, thousands)	Recovery Expenses (BGN, thousands)	Expenses for Rescue and Emergency Work (BGN, thousands)
Floods - total	2,898	630,360	309,142	38,780
Blagoevgrad	50	14,358	2,579	1,039
Burgas	251	153,364	26,103	5,276
Varna	147	47,870	11,698	5,495
Veliko Tarnovo	125	29,042	6,044	4,764
Vidin	8	876	595	0
Vratsa	26	26,679	4,097	1,782
Gabrovo	39	7,732	1,628	523
Dobrich	42	10,926	4,203	1,777
Kardzhali	78	6,088	1,571	616
Kyustendil	37	4,453	2,514	131
Lovech	9	633	220	0
Montana	67	12,548	2,005	1,413
Pazardzhik	53	2,351	1,332	217
Pernik	30	939	993	3
Pleven	75	5,885	2,451	664
Plovdiv	62	23,772	9,589	896
Razgrad	16	1,903	561	50
Ruse	52	6,902	2,934	1,626
Silistra	7	2,954	940	19
Sliven	816	3,343	3,692	4,978
Smolyan	534	43,216	20,419	4,092
Sofia (capital)	2	224	177	47
Sofia	104	198,147	195,368	1,202
Stara Zagora	146	10,440	749	1,524
Targovishte	3	55	38	0
Haskovo	32	9,495	5,884	633
Shumen	26	4,677	275	0
Yambol	61	1,488	483	13

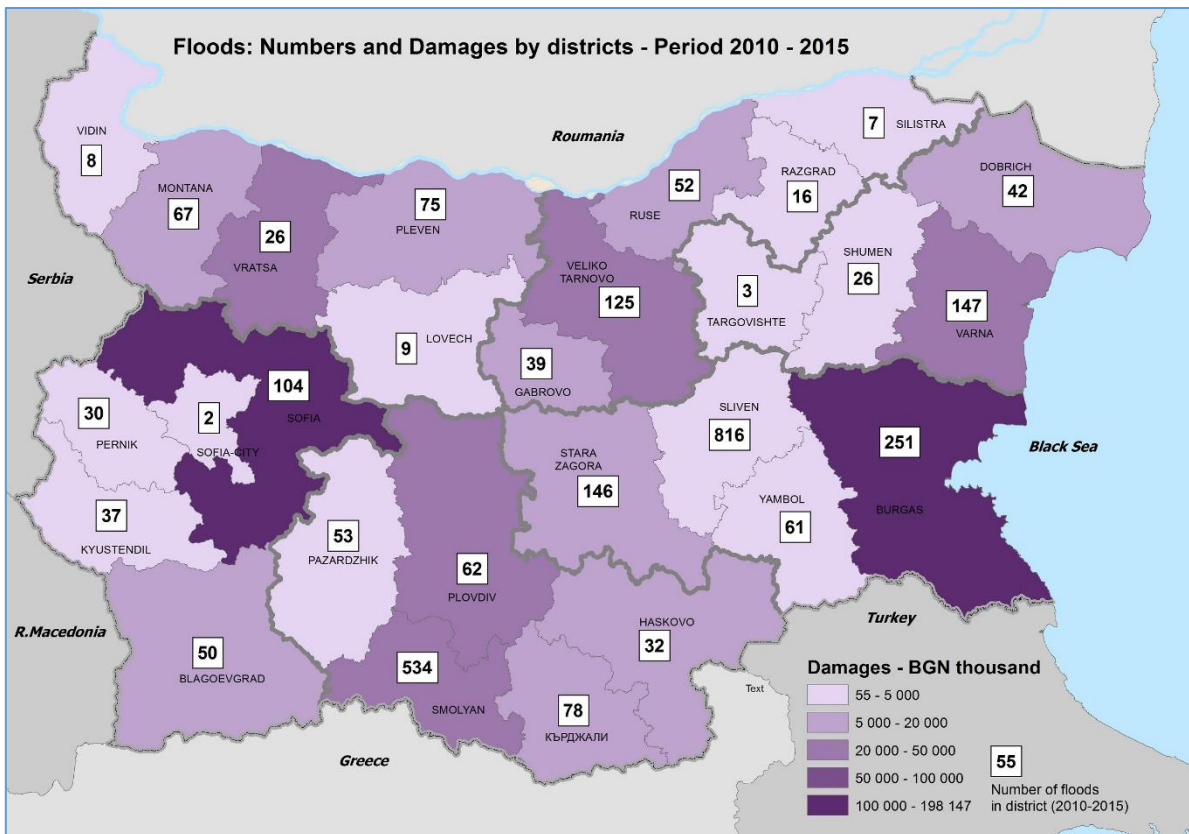
Source: NSI 2017.

Figure 33. Characteristics of floods – totals for the country for the period 2010–2015



Source: NSI (data) NCRD (data compilation and diagram).

Figure 34. Characteristics of floods by districts: summary for the period 2010–2015



Source: NSI (data) NCRD (data compilation and map).

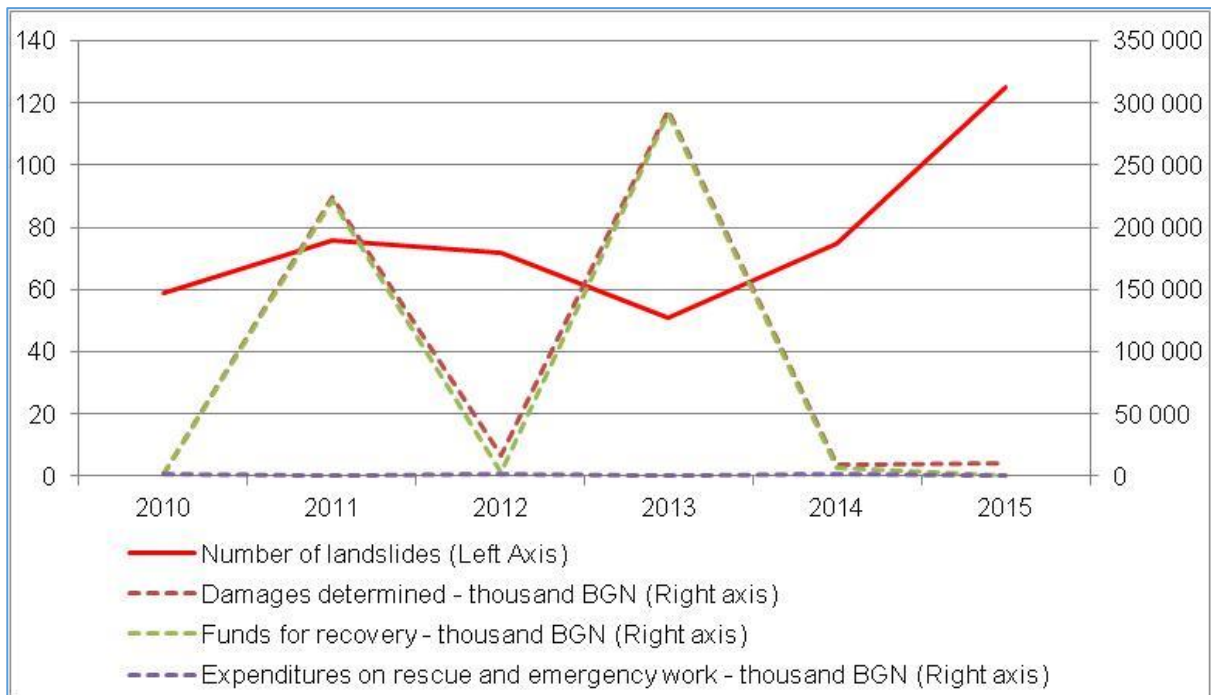
Landslides

Table 26. Characteristics of landslides by districts: summary for the period 2010–2015

Districts	Number of Landslides	Damages (BGN, thousands)	Recovery expenses (BGN, thousands)	Expenses for Rescue and Emergency Work (BGN, thousands)
Landslides - total	458	558,117	526,701	8,033
Blagoevgrad	24	1,334	189	0
Burgas	32	296,418	293,605	1,207
Varna	12	428	90	33
Veliko Tarnovo	21	2,306	2	455
Vidin	9	885	471	375
Vratsa	30	56	136	130
Gabrovo	15	676	130	130
Dobrich	5	20	0	2
Kardzhali	93	7,008	2,700	1,935
Kyustendil	40	622	2,529	105
Lovech	3	1,297	213	0
Montana	3	325	0	0
Pazardzhik	18	6,094	745	260
Pernik	14	31	26	266
Pleven	5	271	0	0
Plovdiv	12	3,051	0	977
Razgrad	0	0	0	0
Ruse	5	460	15	15
Silistra	0	0	0	0
Sliven	30	1,352	416	337
Smolyan	56	13,604	5,181	1,388
Sofia (capital)	4	481	306	175
Sofia	17	220,776	219,707	0
Stara Zagora	0	0	0	0
Targovishte	4	247	240	243
Haskovo	2	245	0	0
Shumen	4	130	0	0
Yambol	0	0	0	0

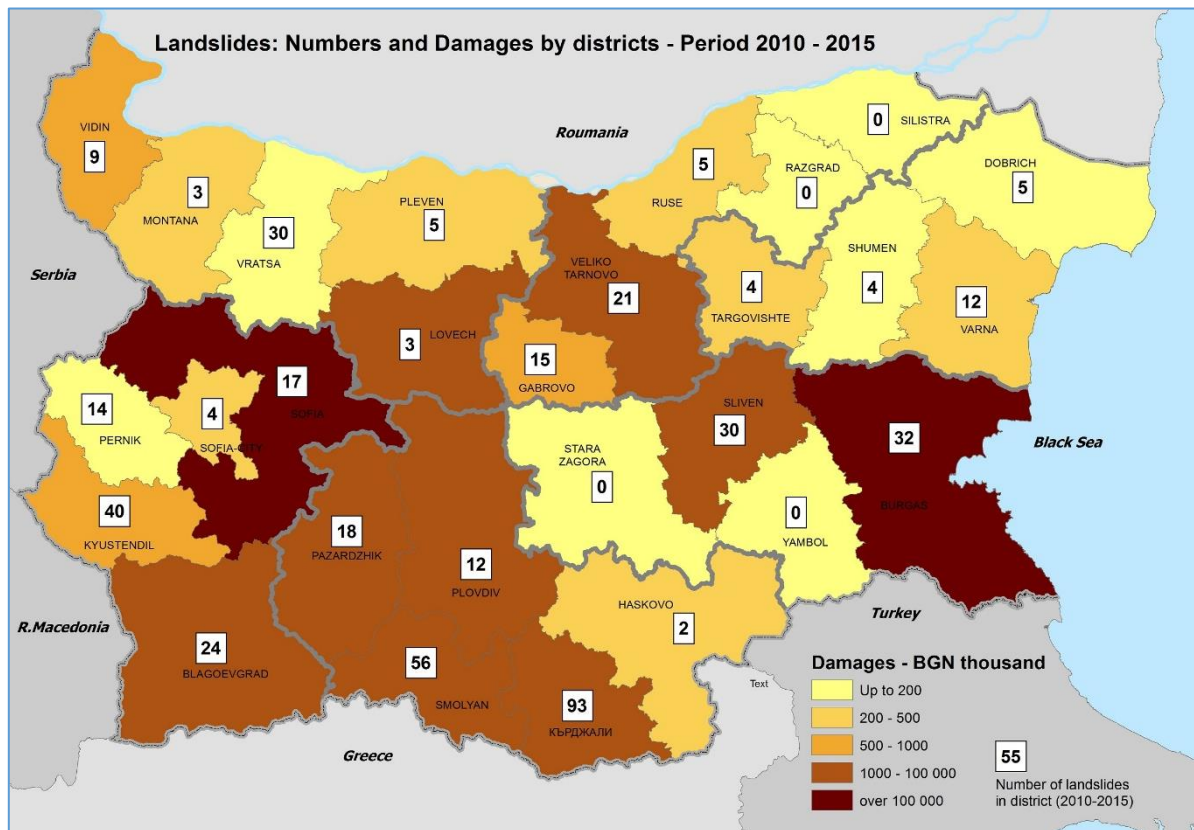
Source: NSI 2017.

Figure 35. Characteristics of landslides – totals for the country for the period 2010–2015



Source: NSI (data) NCRD (data compilation and diagram).

Figure 36. Characteristics of landslides by districts: summary for the period 2010–2015



Source: NSI (data) NCRD (data compilation and map).

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Table 27. Landslides characteristics (cutting date 31 December 2017)

	Number	Area (km ²)
Total for the country	2,137	254.02
<i>Non-urbanized areas</i>	857	89.09
<i>Urbanized areas</i>	1,280	164.93
Detailed for urbanized areas		
In cities and towns (urban areas)	603	67.06
In villages	624	72.89
Resorts and recreational areas	53	24.98
Condition of landslides in urbanized areas:		
Stabilized		
Total for urbanized areas	297	54.66
In cities and towns (urban areas)	177	22.75
In villages	103	8.59
Resorts and recreational areas	17	23.32
Potentially dangerous		
Total for urbanized areas	523	77.05
In cities and towns (urban areas)	229	34.25
In villages	279	42.30
Resorts and recreational areas	15	0.50
Activated		
Total for urbanized areas	451	33.21
In cities and towns (urban areas)	189	10.05
In villages	241	22.00
Resorts and recreational areas	21	1.16
Periodically active		
Total for urbanized areas	9	0.02
In cities and towns (urban areas)	8	0.01
In villages	1	0.00
Resorts and recreational areas	0	0.00

Source: Ministry for Regional Development and Public Works (data) NCRD (data compilation).

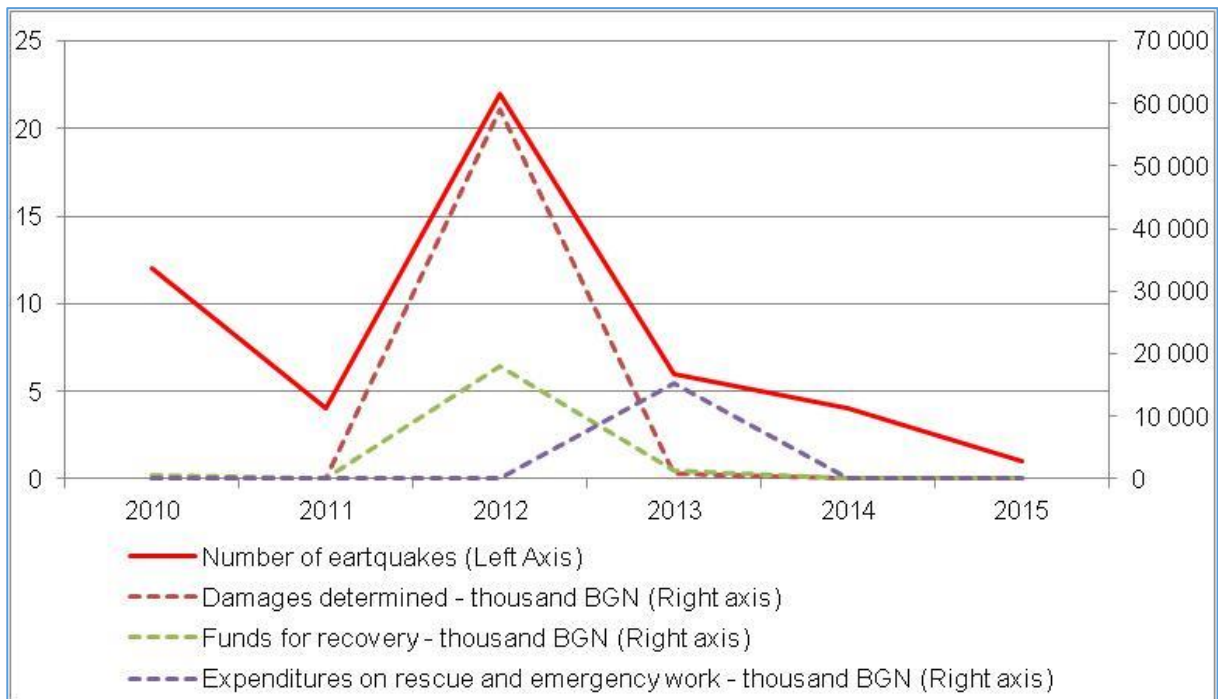
Earthquakes

Table 28. Earthquakes by districts: summary for the period 2010–2015

Districts	Number of Earthquakes	Damages (BGN, thousands)	Recovery Expenses (BGN, thousands)	Expenses for Rescue and Emergency Work (BGN, thousands)
Earthquakes - total	49	60,238	20,042	15,238
Blagoevgrad	2	2	0	0
Burgas	2	0	0	0
Varna	6	386	442	0
Veliko Tarnovo	1	0	0	0
Vidin	0	0	0	0
Vratsa	0	0	0	0
Gabrovo	0	0	0	0
Dobrich	0	0	358	0
Kardzhali	0	0	0	0
Kyustendil	1	0	0	0
Lovech	0	0	0	0
Montana	2	3	0	0
Pazardzhik	7	2,000	0	0
Pernik	9	52,379	17,179	15,238
Pleven	0	0	0	0
Plovdiv	1	0	0	0
Razgrad	0	0	0	0
Ruse	0	0	0	0
Silistra	0	0	0	0
Sliven	6	0	0	0
Smolyan	4	0	0	0
Sofia (capital)	3	5,424	2,024	0
Sofia	3	43	39	0
Stara Zagora	1	1	0	0
Targovishte	0	0	0	0
Haskovo	1	0	0	0
Shumen	0	0	0	0
Yambol	0	0	0	0

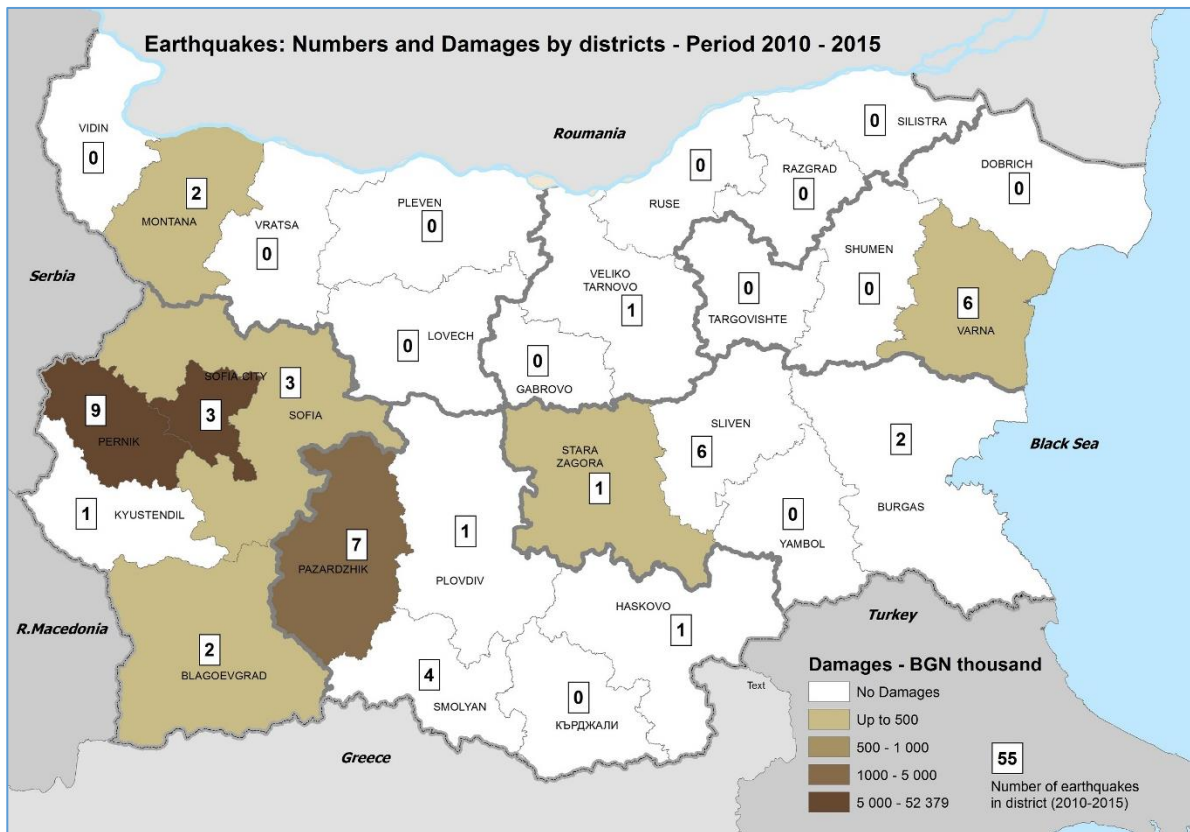
Source: NSI 2017.

Figure 37. Characteristics of earthquakes - totals for the country for the period 2010–2015



Source: NSI (data) NCRD (data compilation and diagram)

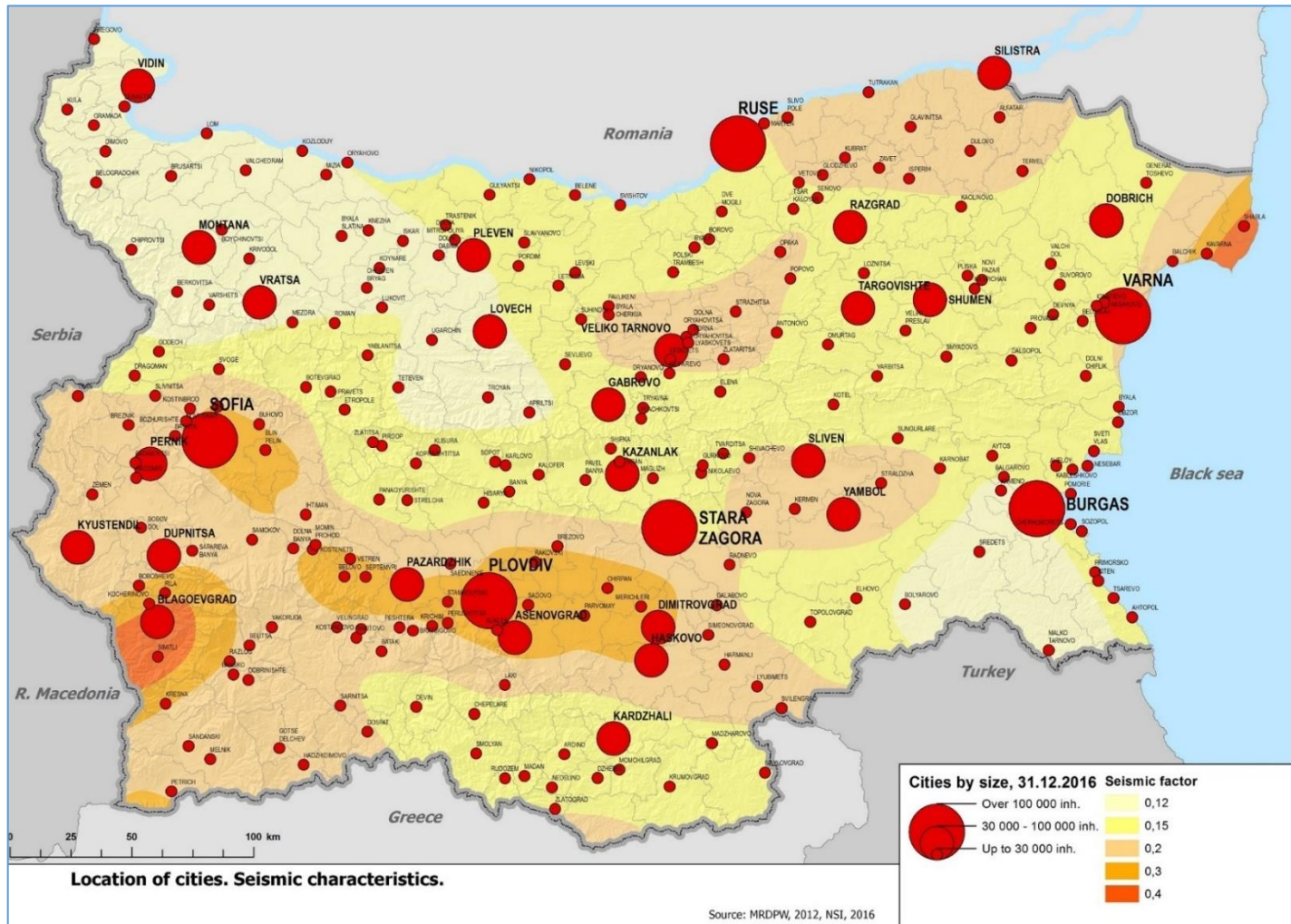
Figure 38. Characteristics of earthquakes by districts: summary for the period 2010–2015



Source: NSI (data) NCRD (data compilation and map)

Potential Seismic Risk

Figure 39. Seismic risks/characteristics in the country



Source: NSI (population), MRDPW and BAS (seismic data), NCRD (data compilation and map)

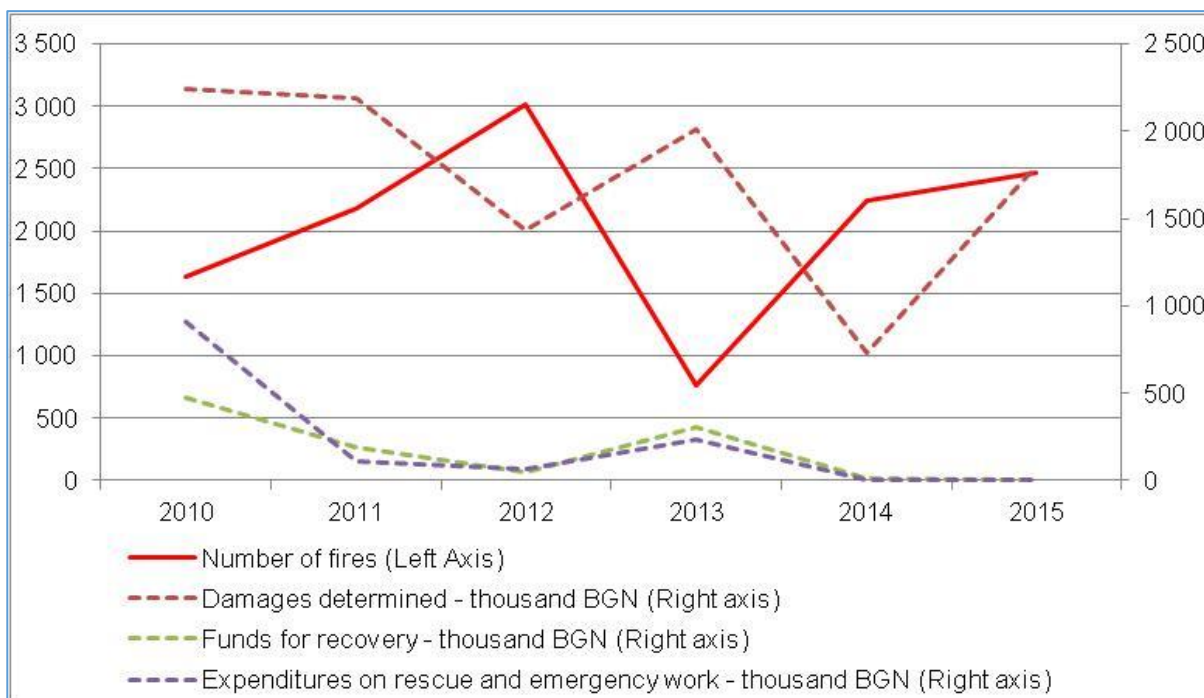
Fires

Table 29. Fires by district: summary for the period 2010–2015

Districts	Number of Fires	Damages (BGN, thousands)	Recovery Expenses (BGN, thousands)	Expenses for Rescue and Emergency Work (BGN, thousands)
Fires - total	12,308	10,399	1,036	1,330
Blagoevgrad	550	637	19	22
Burgas	1,479	319	0	68
Varna	661	1,204	9	—
Veliko Tarnovo	508	99	0	5
Vidin	6	0	0	—
Vratsa	295	872	363	1
Gabrovo	747	842	0	—
Dobrich	1,520	356	65	—
Kardzhali	69	420	0	—
Kyustendil	706	112	10	48
Lovech	1	1,163	443	720
Montana	228	186	0	2
Pazardzhik	72	250	0	11
Pernik	70	20	28	1
Pleven	117	8	0	—
Plovdiv	116	114	9	9
Razgrad	236	1,411	0	—
Ruse	174	28	28	—
Silistra	43	36	17	—
Sliven	611	2	0	—
Smolyan	400	218	0	40
Sofia (capital city)	14	149	10	139
Sofia	1,054	1,461	23	34
Stara Zagora	2,059	287	0	202
Targovishte	2	12	12	—
Haskovo	27	152	0	28
Shumen	399	—	0	—
Yambol	144	41	0	1,330

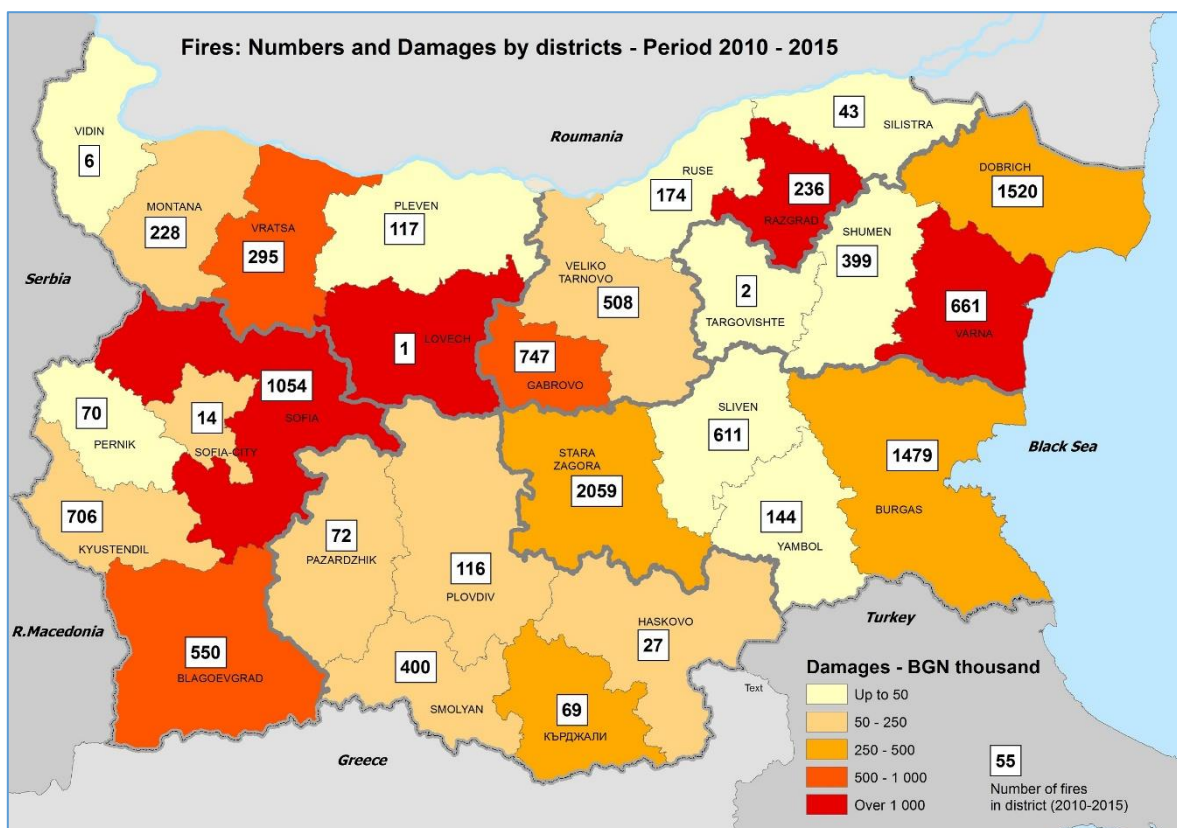
Source: NSI 2017.

Figure 40. Characteristics of fires - totals for the country for the period 2010–2015



Source: NSI (data), NCRD (data compilation and diagram).

Figure 41. Characteristics of fires by districts: summary for the period 2010–2015



Source: NSI (data), NCRD (data compilation and map).

Annex 8. Urban Environment Vulnerability by Size and Location of Cities

Table 30. Vulnerability and capacity assessment

Factor Factor/Climate Change Impact/By Size and Location of Cities	Vulnerability		Capacity
	Exposure (scaled)	Sensitivity (scaled)	
Extreme temperature			
Cities located in the plains			
Big (over 100,000 inhabitants)	H	H	M
Middle size (> 30,000 and < 100,000 inhabitants)	H	M	M
Small (< 30,000 inhabitants)	M	M	L
Cities located in mountain and semi mountain areas			
Big (over 100,000 inhabitants)	M	M	M
Middle size (> 30,000 and < 100,000 inhabitants)	L	L	L
Small (< 30,000 inhabitants)	0	0	L
Cities located on Black Sea coast			
Big (over 100,000 inhabitants)	M	M	H
Middle size (> 30,000 and < 100,000 inhabitants)	L	L	M
Small (< 30,000 inhabitants)	0	0	M
Cities located on Danube River			
Big (over 100,000 inhabitants)	M	M	M
Middle size (> 30,000 and < 100,000 inhabitants)	M	L	L
Small (< 30,000 inhabitants)	L	L	L
Flood/storm			
Cities located in the plains			
Big (over 100,000 inhabitants)	H	H	M
Middle size (> 30,000 and < 100,000 inhabitants)	H	H	M
Small (< 30,000 inhabitants)	H	H	L
Cities located in mountain and semi mountain areas			
Big (over 100,000 inhabitants)	M	M	H
Middle size (> 30,000 and < 100,000 inhabitants)	M	M	M
Small (< 30,000 inhabitants)	L	M	L
Cities located on Black Sea coast			
Big (over 100,000 inhabitants)	M	M	M
Middle size (> 30,000 and < 100,000 inhabitants)	M	M	M
Small (< 30,000 inhabitants)	M	L	L
Cities located on Danube River			
Big (over 100,000 inhabitants)	H	H	M
Middle size (> 30,000 and < 100,000 inhabitants)	H	H	M
Small (< 30,000 inhabitants)	H	H	L
Wild/forest fire			
Cities located in the plains			
Big (over 100,000 inhabitants)	L	H	M
Middle size (> 30,000 and < 100,000 inhabitants)	M	H	M
Small (< 30,000 inhabitants)	H	H	L
Cities located in mountain and semi mountain areas			
Big (over 100,000 inhabitants)	M	M	M
Middle size (> 30,000 and < 100,000 inhabitants)	M	H	M
Small (< 30,000 inhabitants)	H	H	L
Cities located on Black Sea coast			
Big (over 100,000 inhabitants)	M	L	M
Middle size (> 30,000 and < 100,000 inhabitants)	M	M	M

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Factor Factor/Climate Change Impact/By Size and Location of Cities	Vulnerability		Capacity
	Exposure (scaled)	Sensitivity (scaled)	
Small (< 30,000 inhabitants)	M	H	M
Cities located on Danube River			
Big (over 100,000 inhabitants)	M	M	M
Middle size (> 30,000 and < 100,000 inhabitants)	M	H	L
Small (< 30,000 inhabitants)	H	H	L
Urban water issues			
Cities located in the plains			
Big (over 100,000 inhabitants)	L	M	H
Middle size (> 30,000 and < 100,000 inhabitants)	M	M	M
Small (< 30,000 inhabitants)	H	H	L
Cities located in mountain and semi mountain areas			
Big (over 100,000 inhabitants)	L	M	H
Middle size (> 30,000 and < 100,000 inhabitants)	M	M	M
Small (< 30,000 inhabitants)	H	H	L
Cities located on Black Sea coast			
Big (over 100,000 inhabitants)	L	L	H
Middle size (> 30,000 and < 100,000 inhabitants)	M	M	M
Small (< 30,000 inhabitants)	H	H	L
Cities located on Danube River			
Big (over 100,000 inhabitants)	L	M	H
Middle size (> 30,000 and < 100,000 inhabitants)	M	M	M
Small (< 30,000 inhabitants)	H	H	L
Earthquakes			
Cities located in the plains			
Big (over 100,000 inhabitants)	M	H	M
Middle size (> 30,000 and < 100,000 inhabitants)	M	H	L
Small (< 30,000 inhabitants)	M	H	M
Cities located in mountain and semi mountain areas			
Big (over 100,000 inhabitants)	H	H	M
Middle size (> 30,000 and < 100,000 inhabitants)	M	H	L
Small (< 30,000 inhabitants)	M	H	L
Cities located on Black Sea coast			
Big (over 100,000 inhabitants)	L	M	M
Middle size (> 30,000 and < 100,000 inhabitants)	M	M	M
Small (< 30,000 inhabitants)	M	M	L
Cities located on Danube River			
Big (over 100,000 inhabitants)	M	H	M
Middle size (> 30,000 and < 100,000 inhabitants)	M	H	L
Small (< 30,000 inhabitants)	M	H	L

Notes: Exposure group expert assessment based on population and area affected in cities with different size and location; Sensitivity group expert assessment based on communities, building stock and infrastructure resilience to urban environment climate change stress factors; Capacity group expert evaluation based on abilities to cope with and to adapt to climate change.

H = high; M = middle; L = low; 0 = none.

Source: NSI 2016 (population data), NCRD (data compilation and expertise).

Annex 9. Austrian Strategy for Adaptation to Climate Change

Table 31. The Austrian Strategy for Adaptation to Climate Change - Urban Environment Sector Objectives and Recommended Actions

SPATIAL PLANNING	
Objectives	Recommended Actions and Measures
<ul style="list-style-type: none"> • Generation, deployment, and transfer of improved spatial planning-relevant knowledge on climate impacts that is useable in spatial planning decision making • Increasing the willingness and ability to act among spatial planning actors and affected citizens in coping with climate change 	Development and provision of practice relevant data and information bases, awareness raising, and improved networking of actors
<ul style="list-style-type: none"> • Protection of residential areas from floods by securing and recovering natural flood plains and water retention areas • Improvement of water retention in the catchment areas of rivers • Protection from flood-related damage by reducing peak flows and slowing flood waves 	Establishment and protection of flood retention and drainage zones and clear regulation of zoning prohibitions and restrictions
<ul style="list-style-type: none"> • Protection of residential areas and infrastructure from natural hazards • Reservation of areas threatened by natural hazards through prohibition of construction and usage involving high damage potential • Ensuring proactive hazard prevention 	Increased legal interconnections between zoning and hazard mapping
<ul style="list-style-type: none"> • Lowering the damage potential of natural hazard events • Ensuring proactive hazard prevention 	Regulations for the management of existing zoning and buildings in hazard zones
<ul style="list-style-type: none"> • Protection of large-scale 'solidarity' areas for flood retention and hazard prevention • Introduction of compensation mechanisms and risk transfer models of between municipalities or bodies under public law according to the Water Rights Act (for example, water cooperatives/water boards) for the compensation of mutual land use between upstream and downstream communities 	Promotion of inter-municipal cooperation
<ul style="list-style-type: none"> • Improvement in microclimates in densely built areas, prevention of overheating and heat-island effects, and compensation for increased bioclimatic stress on human health, ensuring fresh/cold air supply in densely built areas • Prevention of heat-related health risks 	Protection of fresh/cold air production areas, ventilation paths, and 'green' and 'blue' infrastructure within residential areas
<ul style="list-style-type: none"> • Improvement of microclimates in densely populated areas, prevention of overheating and heat-island effects, and compensation for increased bioclimatic stress on human health • Prevention of heat-related health risks 	Review and (if necessary) adjustment of bioclimatic measures in development plans
<ul style="list-style-type: none"> • Protection of groundwater and drinking water resources and support for groundwater recharge • Guarantee of quantitative and qualitative water supply security 	Increased protection of water resources and improved integration of spatial planning, water management planning, and usage with water demand

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SPATIAL PLANNING	
Objectives	Recommended Actions and Measures
<ul style="list-style-type: none"> • Maintenance and improvement of a functional (even under changing natural conditions) network of protected areas and habitats • Establishment and maintenance of non-fragmented areas of retreat for animal and plant species and prevention of further habitat fragmentation 	Increased protection of ecologically important open spaces (non-fragmented natural areas, habitat corridors, biotope networks), and minimization of further habitat fragmentation
<ul style="list-style-type: none"> • Strengthening the spatial dimension of the energy system • Reducing energy consumption and improving energy efficiency • Improved achievement of climate change mitigation objectives through reduction in GHG emissions • Increasing the contribution of renewable energy sources in the regional fulfilment of energy demand 	Promotion of energy-efficient spatial structures
<ul style="list-style-type: none"> • Ensuring the resilience and adaptive capacity of plans, programs, and development concepts to the current and future effects of climate change • Systematic consideration of potential consequences of climate change in future spatial development strategies, spatial plans, and planning processes 	'Climate-proofing' of spatial plans and instruments
<ul style="list-style-type: none"> • Consideration of soil functions in spatial planning procedures to ensure the ecosystem services of the soil 	Promotion of quantitative soil protection

CONSTRUCTION AND HOUSING	
Objectives	Recommended Actions and measures
<ul style="list-style-type: none"> • Ensuring thermal comfort indoors through structural measures, especially with regard to the increased incidence of hot days 	Structural measures (in new buildings and in renovations) to ensure thermal comfort
<ul style="list-style-type: none"> • Ensuring thermal comfort inside new buildings, in renovations, and in existing buildings by means of passive and alternative ('active') cooling strategies 	Passive and active cooling with alternative, energy-efficient, and resource-saving technologies
<ul style="list-style-type: none"> • Optimization of living conditions, conditions of human and wind comfort, as well as reduction in the heat-island effect through urban and open space planning 	Climatological improvement of urban spaces, with particular emphasis on micro- and meso-climatic conditions in urban and open space planning
<ul style="list-style-type: none"> • Structural adaptation of buildings (new and existing buildings) for protection from extreme weather events 	Structural measures in buildings as protection from extreme weather events
<ul style="list-style-type: none"> • Prevention of local flooding through structural measures around buildings 	Increase of water retention
<ul style="list-style-type: none"> • Consideration and integration of adaptation requirements in construction standards and norms 	Revision of building standards and norms considering climate change
<ul style="list-style-type: none"> • Increased emphasis on adaptation needs in the funding of new construction and the renovation of residential and nonresidential buildings 	Development of funding instruments for the consideration of climate change aspects in new constructions and renovations
<ul style="list-style-type: none"> • Improvement of the knowledge base for optimized adaptation to the effects of climate change 	Research on adaptation to the consequences of climate change in construction and housing

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CONSTRUCTION AND HOUSING	
Objectives	Recommended Actions and measures
<ul style="list-style-type: none"> • Demonstration of the feasibility and advantages of 'climate change-adapted architecture' 	Pilot projects on 'climate change adapted architecture'
<ul style="list-style-type: none"> • Awareness raising and dissemination of knowledge about adaptation to the effects of climate change and the necessary adaptation measures 	Publicity and awareness raising about adaptation to the consequences of climate change in the area of construction and housing
<ul style="list-style-type: none"> • Creation of a sound knowledge base for the implementation of measures for adaptation to the consequences of climate change 	Training and further education on issues of adaptation to the consequences of climate change in the area of construction and housing

CITIES – URBAN GREEN AND OPEN SPACES	
Objectives	Recommended Actions and measures
<ul style="list-style-type: none"> • Ensuring the water supply and retention functions of green and open spaces 	Adaptation of the water management strategy for green and open spaces
<ul style="list-style-type: none"> • Maintenance of soil functions, especially their water storage and water filtration functions 	Adaptation of soil management in urban green and open spaces
<ul style="list-style-type: none"> • Maintenance of ecosystem services and species diversity in urban green and open spaces 	Conservation and promotion of biodiversity in urban green and open spaces
<ul style="list-style-type: none"> • Consideration of climate change in urban planning instruments 	Adaptation of planning strategies for urban green and open spaces
<ul style="list-style-type: none"> • Consideration of climate change in the design, implementation, and maintenance of urban green 	Adaptation of green and open space planning and maintenance
<ul style="list-style-type: none"> • Preservation and creation of green and open spaces as recreational area to promote human well-being under changing climatic conditions 	Promotion and adaptation of green and open spaces for recreation and leisure uses under changing climatic conditions
<ul style="list-style-type: none"> • Advancement of knowledge and improvement of networking among affected actors 	Awareness-raising, improved networking, and adaptation of the training and further education
<ul style="list-style-type: none"> • Adaptation of urban green and open spaces to climate change through multilevel interdisciplinary studies and maintenance 	Improvement of the knowledge base through inter- and transdisciplinary research on urban green and open spaces

Source: The Austrian Strategy for Adaptation to Climate Change,¹⁶¹ compilation by NCRD, Sofia.

¹⁶¹ The Austrian Strategy for Adaptation to Climate Change¹⁶¹ Part 1. Strategic Framework, Adopted by the Federal Government in October 2012 and by the Federal States in May 2013.
https://www.bmlfuw.gv.at/umwelt/klimaschutz/klimapolitik_national/anpassungsstrategie/strategie-kontext.html

Annex 10. Platforms, Networks, and Projects, related to International Cooperation or Information Exchange

A. Participation of Bulgarian Urban Environment Sector in International Information Exchange Platform/Databases

➤ EUROSTAT Urban Audit

Description: Provides urban statistics for cities across 27 European countries, with more than 320 EU cities and more than 40 cities in Norway, Switzerland, and Turkey. Contains more than 300 statistical indicators presenting information on matters such as socioeconomic and demographic data, but also related to the environment.

Data are collected for (a) cities, (b) functional urban area (formerly known as larger urban zone [LUZ]), and (c) the Greater city (an approximation of the urban center when this stretches far beyond the administrative city boundaries)

Population size limitations: 50,000 inhabitants.

Website: <http://ec.europa.eu/eurostat/web/cities/data/database>

Source: EUROSTAT

Data are collected in thematic groups, in which some important indicators for climate change issues are in (a) demographic characteristics, (b) living conditions, and (c) environment

Indicators, important for CCA

Data set: Demographic characteristics (a lot of indicators, main characteristics of cities)

Data set: Living conditions

EC3065V	Share of persons at risk of poverty after social transfers - percentage
EC3066V	Share of severely materially deprived persons - percentage
EC3067V	Share of persons at risk of poverty or social exclusion - percentage

Data set: Environment

EN1002V	Total number of hours of sunshine per day
EN1003V	Average temperature of warmest month - degrees
EN1004V	Average temperature of coldest month - degrees
EN1005V	Rainfall - liter/m ²
EN2002V	Number of days ozone O ₃ concentrations exceed 120 µg/m ³
EN2003V	Number of hours nitrogen dioxide NO ₂ concentrations exceed 200 µg/m ³
EN2005V	Number of days particulate matter PM ₁₀ concentrations exceed 50 µg/m ³
EN2025V	Accumulated ozone concentration in excess 70 µg/m ³
EN2026V	Annual average concentration of NO ₂ (µg/m ³)
EN2027V	Annual average concentration of PM ₁₀ (µg/m ³)
EN3003V	Total use of water - m ³
EN3012V	Share of population connected to potable drinking water system – percentage
EN3013V	Share of population connected to sewerage treatment system - percentage

EN3011V	Share of the urban wastewater load (in population equivalents) treated according to the applicable standard - percentage
EN4008V	Municipal waste generated (domestic and commercial), total - 1000 t

Bulgaria entered into Urban Audit in 2004. There are 18 Bulgarian cities, participating in the EUROSTAT project, all with more than 50,000 inhabitants (according to population figures 2009) Sofia, Plovdiv, Varna, Burgas, Pleven, Ruse, Vidin, Stara Zagora, Sliven, Dobrich, Shumen, Pernik, Yambol, Haskovo, Pazardzhik, Blagoevgrad, Veliko Tarnovo, Vratsa. Not all of the indicators are supported regularly (year by year) by the NSI of Bulgaria.

➤ [EUROSTAT Urban Atlas](#)

Description: The European Urban Atlas is part of the local component of the Global Monitoring for Environment and Security project/Copernicus land monitoring services. It provides reliable, intercomparable, high-resolution land-use maps for 305 LUZs and their surroundings (more than 100,000 inhabitants as defined by the Urban Audit) for the reference year 2006.

Population size limitations: 100,000 inhabitants

Covered countries: 27 countries

Bulgarian participation: 8 cities: Sofia, Plovdiv, Burgas, Varna, Ruse, Stara Zagora, Pleven, Vidin

Website: <http://www.eea.europa.eu/data-and-maps/data/urban-atlas>

Source: EEA, EUROSTAT.

B. Participation of Bulgarian Urban Environment Sector in International Organizations' Reports (including EEA) Reports

➤ [EEA Report 2012: Urban Adaptation to Climate Change in Europe](#)

Description: EEA Report No 2/2012. Urban Adaptation to Climate Change in Europe - Challenges and opportunities for cities together with supportive national and European policies.

Data and information: The report includes several indicators and thematic maps such as on heat waves, flooding, social sensitivity, and factors of adaptive capacity.

Website: <http://www.eea.europa.eu/publications/urban-adaptation-to-climate-change>

Source: EEA.

➤ [EEA Report 2016: Urban Adaptation to Climate Change in Europe 2016 - Transforming Cities in a Changing Climate](#)

Description: EEA Report No. 12/2016.

The report builds on and complements existing products and initiatives on urban adaptation in Europe. It focuses on the state of actions in the field and progress achieved since the first EEA report in 2012 and it considers this analysis in relation to current challenges in transforming the cities in more attractive, climate-resilient places. The report aims to broaden perspectives and provide input to a review and subsequent adjustment of urban adaptation to climate change by

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local governments and by supporting regional, national, and European institutions, researchers, and other relevant stakeholders.

Data and information: Report includes several indicators and thematic maps such as on heat waves, flooding, social sensitivity, and factors of adaptive capacity.

Website: <http://www.eea.europa.eu/publications/urban-adaptation-2016>.

Source: EEA.

C. Participation of Bulgarian Urban Environment Sector in International Projects, Related to Environmental Issues, or Building a Network for Cooperation or/and Information Exchange

➤ [URBACT Network: Resilient Europe](#)

Description: Resilient Europe considers how cities could be supported to become more shock-proof. Its focus is on climate change resilience of the cities. It underlines the importance of equipping cities to effectively manage the energy transition process. Their approach reflects URBACT's emphasis on multi-stakeholder involvement and participatory methods. There is also an emphasis on innovation, but not only of the technical variety. Increasingly in the transition management field, there is explicit acknowledgment of the need to meaningfully involve a wide range of social actors.

Partners and cities involved: 11 cities from 9 countries

Bulgarian participation: City of Burgas

Website: <http://urbact.eu/resilient-europe>

Source: URBACT NETWORK.

➤ [Project: Adaptation Strategies for European Cities](#)

Funding: EU: Directorate General for Climate Action

Description: The aims of this project were to provide capacity building and assistance for cities in developing and implementing an adaptation strategy, and additional technical support to DG CLIMA on the state of play of urban adaptation. The project also intended to raise awareness throughout Europe of the importance of preparing for climate change in cities. Exchange of knowledge and good practice and development of tools and guidance on how cities can adapt to climate change were also important aspects of the project.

Partners and cities involved: 17 countries, 21 cities

Bulgarian participation: City of Burgas

Website: <http://climate-adapt.eea.europa.eu/repository/11156095.pdf/view>

Source: DG CLIMA.

- [PROJECT: European Spatial Planning Observation Network \(ESPON\) CLIMATE - Climate Change and Territorial Effects on Regions and Local Economies in Europe \(EU\)](#)

Description: This project analyzed how and to which degree climate change will impact the competitiveness and cohesion of European regions and Europe as a whole. In addition, it investigated in which way policy can contribute to mitigate climate change and to adapt to and manage those effects of climate change that cannot be avoided, while making sure that synergies of mitigation and adaptation policies are being exploited.

Website:

http://www.espon.eu/main/Menu_Projects/Menu_ESPON2013Projects/Menu_AppliedResearch/climate.html

D. Participation of Bulgarian Regional and Administrative Units in Projects, Related to Environmental Issues, Collecting Data, Building International Databases, Platform, and so on, all with Direct Aspect or Connected to Urban Environment and Climate Change Thematic

- [Eurocity Network](#)

Description: Main areas of cooperation and research: urban planning, regeneration, Conference of the Parties (COP 21), *Europe 2020*, employment, smart cities, migration and integration, culture and creativity, inclusion, energy efficiency, energy union, demographic change, jobs, entrepreneurship, innovation, cohesion policy, climate adaptation, accessibility, air quality, climate, digital, housing, homelessness, mobility, skills and education, social innovation funding and investment, open data, innovation governance, economic development, participation, procurement public services.

Partners and cities involved: 39 countries

Bulgarian participation: Cities of Sofia, Varna, Burgas—full members; City of Kardzhali—associated partner

Website: <http://www.eurocities.eu/eurocities/home>

- [Covenant of Mayors for Climate and Energy. Project and Network](#)

Description: The Covenant of Mayors for Climate and Energy brings together local and regional authorities voluntarily committing to implementing the EU's climate and energy objectives on their territory. Signatories submit a SECAP—covering both mitigation and adaptation—within two years following the formal signing. The SECAP is based on a Baseline Emission Inventory and a Climate Risk and Vulnerability Assessment. Signatories report progress every two years.

Partners involved: 62 countries, 6,787 cities (Mayors)

Bulgarian participation: 25 cities: Aksakovo, Asenovgrad, Burgas, Chepelare, Dimitrovgrad, Dobrich, Gabrovo, General Toshevo, Ihtiman, Karlovo, Kostinbrod, Kozloduy, Krivodol, Krushari, Lom, Mezdra, Mizia, Oryahovo, Pavlikeni, Petrich, Smolyan, Sofia, Tran, Varna, Vratsa

Website: http://www.covenantofmayors.eu/about/covenant-of-mayors_en.html

➤ [The Green Digital Charter. Project and Network](#)

Description: The Green Digital Charter commits cities to (a) reducing emissions through ICT; (b) promoting progress in tackling climate change through the innovative use of digital technologies in cities.

Who can sign: Major cities from EU, European Free Trade Association, acceding, candidate, and potential candidate countries, preferably with population over 250,000 inhabitants or international and regional importance.

Partners involved: 50 European cities from 21 countries with 14 capital cities among them. Representing more than 26 million European citizens.

Bulgarian participation: City of Burgas

Website: <http://www.greendigitalcharter.eu/>

➤ [PROJECT NiCE – Networking Intelligent Cities for Energy Efficiency](#)

Funding: 7th Framework Programme for Research and Technological Development (FP7)

Description: Project supports cities in the achievement of their goals as outlined by the Green Digital Charter on reducing emissions through ICT and promoting progress in tackling climate change through the innovative use of digital technologies in cities.

Partners involved: Cities from the Green Digital Charter Network

Bulgarian participation: City of Burgas

Website: <http://www.greendigitalcharter.eu/projects/niceproject>

E. Projects, closely related to Environmental Issues, Territorial Aspect, with eligible Partners Regions, Municipalities

➤ [Romania - Bulgaria CBC \(Cross-border Cooperation\) Programme](#)

Funding: The Interreg V-A

Description: The program has six priority axes two of them closely related to the current research: “A green region,” “A safe region”. An important issue is the fact that the program gives a chance to smaller cities, illegible mainly because of the number of population for other bigger projects and networks, to participate in EU Urban Environment programs.

The eligible partners: Regional and/or local authorities, institutions, and so on. Project location or focus on territory of the program.

Eligible Bulgarian area: 8 Bulgarian districts in the Danube area: Vidin, Vratsa, Montana, Pleven, Veliko Tarnovo, Ruse, Silistra, Dobrich.

Website: http://www.fpdd.bg/en/page/cbc_bg-ro

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➤ [Bulgaria – Serbia CBC \(Cross-border Cooperation\) Programme](#)

Funding: The Interreg V-A

Description: Interreg-Instrument for Pre-Accession Assistance (IPA) CBC Bulgaria-Serbia Programme will finance projects related to development of sustainable tourism, youth, and environment. The total amount of the programs' budget is €34,102,256.

The eligible area: The eligible area of the program covers NUTS III regions or equivalents, situated on the border between the both partnering countries.

Eligible Bulgarian area: 6 Bulgarian districts: Vidin, Montana, Vratsa, Sofia, Pernik, and Kyustendil.

Website: <http://www.ipacbc-bgrs.eu/>

➤ [Bulgaria – Macedonia CBC \(Cross-border Cooperation\) Programme](#)

Funding: The Interreg V-A

Description: Interreg-IPA CBC Bulgaria-Macedonia Programme focuses on measures aiming at mitigating the effects of climate change and at addressing issues related to the conservation of nature and biodiversity, the sustainable use of natural resources, environmental protection, and risk management at the cross-border level.

The eligible area: The eligible area of the program covers NUTS III regions or equivalents, situated on the border between the both partnering countries.

Eligible Bulgarian area: Two Bulgarian districts: Kuistendil, Blagoevgrad.

Website: <http://www.ipa-cbc-007.eu/>

➤ [Bulgaria – Turkey CBC \(Cross-border Cooperation\) Programme](#)

Funding: The Interreg V-A

Description: Interreg-IPA CBC Bulgaria-Turkey Program will finance projects related to development of sustainable tourism and environment.

The eligible area: The eligible area of the program covers NUTS III regions or equivalents, situated on the border between the both partnering countries.

Eligible Bulgarian area: 3 Bulgarian districts: Burgas, Yambol, and Haskovo.

Website: <https://www.ipacbc-bgtr.eu/>

➤ [Danube Transnational Programme \(DTP\)](#)

Funding: Interreg ERDF, IPA II, European Neighborhood Instrument (ENI)

Description: The DTP aiming at achieving higher degree of economic, social, and territorial cohesion in the Danube region through policy integration in selected fields. It is a complex program with wide geographic coverage and political context. It has five priority axes thematically connected with the EU Strategy for the Danube Region (EUSDR).

The eligible area: 9 EU countries (Austria, Bulgaria, Croatia, Czech Republic, Germany - Baden-Württemberg and Bavaria, Hungary, Romania, Slovakia, Slovenia) and 5 non-EU

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countries (Bosnia and Herzegovina, the Republic of Moldova, Montenegro, Serbia, Ukraine – 4 provinces: Chernivetska Oblast, Ivano-Frankiviska Oblast, Zakarpatska Oblast and Odessa Oblast).

Eligible Bulgarian area: All 6 NUTS II regions.

Website: <http://www.interreg-danube.eu/about-dtp>

- [Bulgaria – Romania Cross-Border MARitime Spatial PLANning in the Black Sea MARSPLAN-BS](#)

Funding: EU DG MARE

Description: The main aim of the MARSPLAN-BS Project is to support the implementation of the EU Directive for Maritime Spatial Planning in the Black Sea Basin, starting with its member states, Romania and Bulgaria, to create institutional framework for cooperation and information exchange. The final objective is to elaborate a MSP Plan for the Romania-Bulgaria cross-border area.

The eligible area: Romanian and Bulgarian Black Sea coastal and maritime areas. Pilot project areas Eforie area and Sfantul Gheorghe (Romania) and Bourgas Port (Bulgaria)

Eligible Bulgarian area: Pilot project areas Burgas municipality.

Website: <http://msp-platform.eu/projects/cross-border-maritime-spatial-planning-black>

Annex 11. Climate Change Impacts on the Urban Environment, Relevant Regulations, and Activities

Table 32. Climate Change Impacts on the Urban Environment, Relevant Regulations, and Activities

Climate Change Impact	Degree of Impact	Regulations Relevant to the Impact	Potential Risks due to Impact	Activities for Risk Reduction
1. Extreme temperatures	High	<ul style="list-style-type: none"> • Climate Change Mitigation Act • Clean Air Act • Disaster Protection Act • Regulation No.2 on fire protection technical construction norms • Regional Development Act • Spatial Planning Act • Regulations No.2 for planning and design of transport communication systems in urbanized areas • Regulation No. 7 on the rules and norms for the development of the different types of territories and zones • Regulations No.8 on the scope and contents of development plans • Regulation No. 2/22.03.2004 on the minimum requirement for health and safety in carrying out construction works • Eurocodes Constructions and building materials – extreme temperature 	Medium	<ul style="list-style-type: none"> • Increase green areas; • Rehabilitate and retrofit buildings; • Improve public transport; • Reduce private cars trips; • Reduce motor vehicles - 50 percent use conventional fuels; • Develop cycling networks; • Rehabilitate urban road network; • Develop and protect urban green system and biodiversity; • Implement urban ecology knowledge in planning and design of POS; • Use appropriate materials for urban hard landscaping; and • Introduce standards for sustainable/green buildings and energy management.
2.Floods/storms	High	<ul style="list-style-type: none"> • Disaster Protection Act • Regulation No.12 on design of geo-protection buildings and constructions and facilities in landslide risk regions • Waters Act • Regulation No.2 on design, construction and operation of water supply systems • Regulation No. RD-02-20-8 on design, construction and operation of sewerage systems • Regional Development Act • Spatial Planning Act • Regulation No. 7 on the rules and norms for the development of different types of territories and zones 	High	<ul style="list-style-type: none"> • Maintain the conductivity of corrected river beds in cities; • Expand the flood protection system and zones; • Clean the unadjusted sections along the urban rivers; • Balance hard and soft landscaping areas for better surface water drainage; • Update threat and flood risk maps; • Control building in high-risk flood zones; and • Communicate knowledge for flood risk and cultivate proper behavior;

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Climate Change Impact	Degree of Impact	Regulations Relevant to the Impact	Potential Risks due to Impact	Activities for Risk Reduction
		<ul style="list-style-type: none"> Regulations No.8 on the scope and contents of development plans Red Cross Act 		
3. Fires/wild fires	High	<ul style="list-style-type: none"> Disaster Protection Act Clean Air Act Forestry Act Rules for implementation of the Forestry Act Regulation No. 2 on fire protection technical construction norms Regional Development Act Rules for implementation of the Regional Development Act Spatial Planning Act Regulation No. 4 on the scope and contents of the investment projects Regulations No. 8 on the scope and contents of the development plans Eurocodes constructions and building materials—fire resistance, high temperatures, and so on Regulation No. 6 on technical rules and standards for design, construction and use of facilities and equipment for transmission, storage, distribution, and supply of natural gas Regulation No. 3 for minimum safety and health of workers using personal protective equipment at work 	High	<ul style="list-style-type: none"> Maintain the forest firebreaks and belts; Place signs with information, regulations and behavior pattern; Construct water sources and control the water supply; Purchase fire-fighting equipment and protective clothing, and so on); Provide aircraft for extinguishing forest fires; Provide normal access and water for fire-fighting purposes to all parts of the cities; and Educate and train people and volunteers to raise awareness
4. Urban waters	Medium	<ul style="list-style-type: none"> Waters Act Regulation No. 3 on the conditions and terms for research, design, approval, and operation of sanitary protection zones around water sources and facilities for drinking water and sources of mineral waters Regulation No. 1 for exploration, use, and protection of groundwater Regulation No. 2 on design, construction, and operation of water supply systems Regulation No. RD-02-20-8 on design, construction, and operation of sewerage systems 	Medium	<ul style="list-style-type: none"> Protect forests and control land-use transformations in forestry areas; Control development close to water catchment areas; Design, build, and reconstruct the water supply network and reservoirs; Build and rehabilitate drinking water treatment stations and wastewater treatment stations; Organize water-saving campaigns; Organize afforestation campaigns; and

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Climate Change Impact	Degree of Impact	Regulations Relevant to the Impact	Potential Risks due to Impact	Activities for Risk Reduction
		<ul style="list-style-type: none"> • Nature Protection Act • Regulation No. 6 on the emission standards for permissible levels of harmful and dangerous substances in wastewater discharge in water bodies • Forestry Act • Rules for implementation of the Forestry Act • Regional Development Act • Spatial Planning Act • Regulation No. 7 on the rules and norms for the development of the different types of territories and zones • Regulations No. 8 on the scope and contents of the Spatial Development Plans 		<ul style="list-style-type: none"> • Implement measures to improve the performance of the institutions.
5. Disaster Risk management	Medium	<ul style="list-style-type: none"> • Disaster Protection Act • National Emergency Call System with Single European number 112 Act • Budget Act • Regulation No. 25 on emergency medical assistance • Regulation No. 3 for minimum safety and health of workers using personal protective equipment at work • Red Cross Act 	Medium	<ul style="list-style-type: none"> • Support the Bulgarian Red Cross; • Train the population; • Organize information campaigns; • Enhance the opportunities for exchange of information with international institutions; • Organize voluntary formations and their training; • Re-equip the units of the unified rescue system with modern equipment; • Provide financial and human resources for the military formations to address the consequences of disasters; • Further develop the early warning system; • Train the executive authorities; and • Update training programs for the young.

Annex 12. Urban Environment Relevant Adaptation Options and Generic Measures for CCA in Bulgarian Strategic Documents

Table 33. Urban Environment Relevant Adaptation Options in Bulgarian Strategic Documents

Extreme Weather/Climate Change Impacts	CCA Options			
	National Level	Regional Level	Local/City Level	Buildings/Infrastructure
Extreme temperature	Development of the Housing Policy Strategy with supportive programs			Stimulation of green buildings 0-energy consumption buildings design and construction
	Revision and amendment of the spatial planning regulations and norms		Implementation of reduced planning norms in areas with higher density	Design building codes and norms, appropriate for the microclimate of the city
	Revision and amendment of the SEA and EIA contents		Implementation of climate change assessment and adaptation measures in the SEA and EIA	
		Reduction of urban sprawl through better spatial planning	Priority development of 'brownfields' instead of green fields	Renovation of the building stock and implementation of the EU energy efficiency standards
		Preservation of forests and green corridors for better urban areas ventilation close by	Control or ban on construction in public open and green spaces, school yards, and so on	Green walls and green roofs implementation in new buildings
			Implementation of integrated urban mobility plans in bigger cities and transposition of their principles in smaller ones	Further construction of the metro lines in Sofia; Bicycle network development in urban and suburban areas
		Establishment of links between regional and urban transportation systems	Green transport and electro-mobility development	Innovations in production and construction of new buildings;

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Extreme Weather/Climate Change Impacts	CCA Options			
	National Level	Regional Level	Local/City Level	Buildings/Infrastructure
				Implementation of appropriate materials and insulations;
Flood/storm	Elaboration of flood-prone areas for the whole country based on river basins flood risk assessment	Integrated coastal zones and river basins management for territories along the Danube River and Black Sea	Mapping the flood risk zones and restriction on constructions in the land-use plans	Use of flood resistant materials and appropriate insulation
	Including natural disaster risks synthesis scheme in the NCSD	Transfer the information about flood-risk zones from the river basins plans into the regional spatial development schemes	Balance the hard and soft urban landscape and implement better drainage systems and surfaces	Rehousing of vulnerable groups
		Control on reservoirs and canals, maintenance, and cleaning of river beds	Development and implementation of integrated plans for urban infrastructure	Infrastructure reconstruction, especially sewerage for surface waters
		Inspection of dam walls	Development of modern early warning systems. including for the zones around Iskar Dam and Kardjali Dam	Building flood protection facilities and barriers construction
Landslides	Include the geological risks zones and registered landslides in the NCSD synthesis scheme	Maintenance of the well-established system for monitoring of geological risks zones	Full restriction and better control on the risk zones and demolition of illegal buildings	Geoprotection facilities and construction, integrated in the landscape plans
Wild/forest fires and fires in urban areas	Integration of forests management plans with the NCSD	Integration of forests management plans with the regional spatial development schemes	Identification of the fire-prone zones in the urban Spatial Development Plans/Master Plans	
			Demolition of illegal housing and rehousing of inhabitants in risk	Building stock revision and implementation of the current fire protection norms and facilities

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Extreme Weather/Climate Change Impacts	CCA Options			
	National Level	Regional Level	Local/City Level	Buildings/Infrastructure
	Classification and mapping of the fire prone agricultural lands	Maintenance of forest fight protection corridors	Appropriate location of fire-fighting facilities	Fire protection equipment of building revision
	Maintenance of the main transport infrastructure for better access in case of emergency	Water reservoirs maintenance and water collection for emergency needs	Early warning systems and emergency facilities appropriate location	Maintenance of machines and technique, including buildings' alarm systems
Urban water issues	Maintain and monitor water supply needs	Control on drinking water quality	Integrate the reconstruction of the water supply infrastructure with the urban regeneration: (IUPRD)	Low water consumption facilities and culture
	Afforestation for better snow/water retention	Local water sources exploration and development of infrastructure and facilities	Use of recycled water for urban waterscaping	Collect and reuse rain waters
			Reconstruction of water supply network and facilities	
Earthquake	Develop better planning regulations for seismic risk zones	Road transport network maintenance for better accessibility in case of emergency	Protection of POS, school yards, and courtyards for emergency escape	Eurocodes implementation in construction design
	Prevention measures for the archeological sites and heritage of national significance		Control on higher buildings location and regulation lines along the main urban transport corridors in detailed plans	Construction observation and structural reinforcement of the building stock and infrastructure
	Seismic risk scenario development for		Seismic risk protection of the important public buildings (schools, hospitals), critical infrastructure	Ban on reconstruction with changes in the structural elements of the ground floors of buildings

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Extreme Weather/Climate Change Impacts	CCA Options			
	National Level	Regional Level	Local/City Level	Buildings/Infrastructure
	the big cities in the country			
	International cooperation and data exchange for the seismic activity	Seismic risk scenario development for the big cities	Development and maintenance of the early warning system	Emergency staff and population training for adequate behavior before, during, and after earthquake

Sources: National Disaster Protection Programme 2014–2018, http://www.nspbzn.mvr.bg/NR/rdonlyres/317033AA-E99D-4C51-AC8E-DB37272F2866/0/NPZB_20142018.pdf and National Programme for Landslides Prevention and Reduction on the Territory of the Republic of Bulgaria, Erosion and Abrasion along the Danube River and Black Sea Coasts 2015–2020, <http://www.mrrb.government.bg/nacionalna-programa-za-prevenciya-i-ogranichavane-na-svlachistata-na-teritoriyata-na-republika-bulgariya-eroziyata-i-abraziyata-po-dunavskoto-i-chernomorskoto-krajbrejje-2015-2020-g-i-dopulnenie-kum-neya-s-novovuzniknali-77199/>, compiled by the NCRD, Sofia.

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Table 34. Generic Measures for CCA in Bulgarian Strategic Documents

Adaptation Options	CCA Measures			
	National Level	Regional Level	Local/City Level	Buildings/Infra-structure
Information	Improvement of access to data bases at national level on weather and climate change	Surveying and mapping the illegal building sites throughout the districts	Collection, communication, and provision of access to information at city level about weather, climate change, past disaster events and current hazards and risks.	Implementation of the regulations and EU standards for construction materials
	Improved communication of information and data			
Research	Mainstreaming the CCA in the National Strategy for Scientific Research	Regional landscape protection for climate change risks mitigation; Establishment of regions/zones in risk in spatial development documents for coastal, mountainous, big and medium cities	The climate change impacts on urban environment and implementation relevant policies for risk mitigation and adaptation	Consider human health and social behavior under stress; Climate change impacts on vulnerable groups in local adaptation policies
	Implementation of remote sensing methods for the urban environment observations and satellite data comparison			Introduction of innovative distance methods for observations and energy efficiency assessment

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Adaptation Options	CCA Measures			
	National Level	Regional Level	Local/City Level	Buildings/Infra-structure
Education	Development of knowledge for CCA on all levels—from politicians to the general public and children and among all stakeholders; Retraining the academic staff for curricula upgrading and on CCA topics, developed for spatial/regional/urban planners, architects, civil engineers, landscape architect’s education; Development of teaching materials and/or interactive educational platforms for different age groups, incl. disadvantaged ones; and Specific training for emergency staff;			
Capacity building	Dissemination of information to decision makers, stakeholders, and general public	Training for knowledge/skills development; Identification of best practices		
Partnership	Establishment of scientific labs and permanent expert working groups in research organizations, NGOs, commercial companies, with participation of experts from different fields			
Awareness	Development of culture and commitment of the population; Work in Partnership; Improvement of communication and social behavior, including coping with post-disaster losses and stress; Working with media			

Sources: National Disaster Protection Programme 2014–2018, http://www.nspbzn.mvr.bg/NR/rdonlyres/317033AA-E99D-4C51-AC8E-DB37272F2866/0/NPZB_20142018.pdf and National Programme for Landslides Prevention and Reduction on the Territory of the Republic of Bulgaria, Erosion and Abrasion along the Danube River and Black Sea Coast 2015–2020, <http://www.mrrb.government.bg/nacionalna-programa-za-prevenciya-i-ogranichavane-na-svlachistata-na-teritoriyata-na-republika-bulgariya-eroziyata-i-abraziyata-po-dunavskoto-i-chernomorskoto-krajbrejie-2015-2020-g-i-dopolnenie-kum-neya-s-novovuzniknali-77199/>,
compiled by the NCRD, Sofia.