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GREEN CITY ACTION PLAN

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List of abbreviations

Abbreviation	Description
AD	Anaerobic Digestion
AFD	Agence Française de Développement
AMD	Armenian Dram
ANPR	Automatic Number Plate Recognition
ArmElNet	Armenian Electric Networks CJSC
AUA	American University of Armenia
BOT	Build Operate Transfer
CAPEX	Capital Expenses
CCTV	Closed Circuit Television
CIM	City Information Model
CNCO	Community Non-Commercial Organization
CNG	Compressed Natural Gas
CO_2	Carbon Dioxide
CPI	Consumer Price Index
CSO	Civil Society Organisation
DG	Directorate General
DRR	Disaster Risk Reduction
EaP	Eastern neighbourhood Programme
EBRD	European Bank for Reconstruction and Development
EEA	European Environment Agency
EIB	European Investment Bank
EE	Energy Efficiency
EPC	Energy Performance Contracting
ESCO	Energy Service Company
ESF	Energy Saving Foundation
EU	European Union
EUR	Euro

Abbreviation	Description
FTE	Full time equivalent
GCA	Green City Action
GCAC	Green City Awareness Centre
GCAP	Green City Action Plan
GCP	Green Commodities Programme
GDP	Gross Domestic Product
GEFF	Green Economy Financing Facility
GFDRR	Global Facility for Disaster Reduction and Recovery
GHG	Greenhouse Gas(es)
GIS	Geographic Information System
GPS	Global Positioning System
HW	Hazardous Waste
ICLEI	International Council for Local Environmental Initiatives
IFI	International Financial Institution
IoT	Internet of Things
IMP	Impact Monitoring Plan
IT	Information Technology
Kg	Kilogram
Km^2	Square Kilometers
LED	Light Emitting Diode
LEZ	Low Emission Zone
LPG	Liquified Petroleum Gas
LRAP	Leak Reduction Action Plan
MAB	Multi-Apartment Building
MBT	Mechanical Biological Treatment
MoF	Ministry of Finance
MSW	Municipal Solid Waste
MWh	Megawatt Hour
MNP	Ministry of Nature Protection
MRF	Material Recovery Facility

Abbreviation	Description
MRV	Monitoring, Reporting and Verification
MTAD	Ministry of Territorial Administration and Development
NGO	Non-governmental organisation
NH_4	Ammonium
NIP	Neighbourhood Investment Platform
NRW	Non-Revenue Water
NSS	National Statistical Service
OECD	Organisation for Economic Co-operation and Development
OPEX	Operational Expenditure
PMP	Progress Monitoring Plan
PPP	Public Private Partnership
R2E2	Armenia Renewable Resources and Energy Fund
RE	Renewable Energy
REC	Regional Environmental Centre
RECP	Resource Efficient and Cleaner Production
RES	Renewable Energy Source(s)
RES	Renewable Energy Systems
RoA	Republic of Armenia
RTPI	Real Time Passenger Information
RYG	Red, Yellow, Green
SEAP	Sustainable Energy Action Plan
SECAP	Develop Sustainable Energy and Climate Action Plan
SEMIC	State Environmental Monitoring and Information Centre
SME	Small and Medium Sized Enterprises
SNCO	State Non-Commercial Organisation
SUMP	Sustainable Urban Mobility Plan
TOD	Transit-Oriented Development
TSP	Total Suspended Particles
UN	United Nations
UNDP	United Nations Development Programme

Abbreviation	Description
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNIDO	United Nations Industrial Development Organisation
USD	US Dollar
WB	World Bank
WHO	World Health Organization
WtE	Waste-to-Energy
WTP	Waste Treatment Plant
WW	Wastewater
WWF	World Wildlife Fund
WWTP	Wastewater Treatment Plant
WWTW	Wastewater Treatment Works

Executive summary

Introduction

This Green City Action Plan (GCAP) is a strategic document that presents Gyumri's environmental vision for 2035 and provides a cost-efficient and financially sustainable roadmap for realising this ambition that has also been developed to maximise economic and social co-benefits. The vision is:

"To make Gyumri's environment healthier and more liveable for its citizens by improving air quality, water resource and land use, preserving ecosystems and implementing climate change mitigation and adaptation measures. It is also to enable economic and technological growth, creating jobs and improving livelihoods for the citizens of Gyumri, while ensuring the adoption of green economy, sustainability and resilience principles with the overall goal of making Gyumri's environment safe, clean and green and of innovating to ensure the prosperity and happiness of the entire Gyumri community."

The GCAP was developed by a team of local and international experts in close cooperation with the Gyumri Municipality and has been formally adopted by the Council of Elders. It was prepared using an internationally recognised methodology, tailored to Gyumri, that required the adoption of a rigorous evidence-based and participatory approach to identify environmental challenges to be addressed and to formulate a roadmap (consisting of visions, strategic objectives, targets and actions) for doing so.

Priority environmental challenges faced in Gyumri

The priority challenges that the GCAP describes were identified using a process of technical assessment, stakeholder consultation and political prioritisation. This activity was heavily informed by a review of performance against a broad range of indicators and benchmarks. Three sets of indicators were considered, 'State,' 'Pressure' and 'Response.' This model enabled the assessment of the negative impacts of human activities ('Pressure' indicators) on environmental assets ('State' indicators) and the identification of associated gaps in the policy framework ('Response' indicators). The data is presented in an Indicator Database and the challenges that were identified for State and Pressure indicators are summarised in the two tables that follow. The Response indicators are discussed in the body of the GCAP.

Green city priority environmental challenges by topic ('State')

Environmental topic	Challenges
Air quality and mitigation of Greenhouse Gas (GHG) emissions	High level of dust pollution Emerging threat from daily concentration of sulphur dioxide High level of per capita carbon dioxide (CO_2) emissions and Gross Domestic Product (GDP) carbon intensity Limited air quality data and monitoring
Water resource	High ammonium (NH_4) concentration in rivers and lakes – Akhuryan River Inefficient surface water quality monitoring
Soils	Number of polluted and potentially polluted areas Limited soil data availability and lack of monitoring
Green space, biodiversity and ecosystems	Insufficient size of green areas/low green area/inhabitant ratio Insufficient biodiversity data/lack of monitoring
Adaptation and resilience to natural disasters	Economic damage from natural disasters floods droughts earthquakes as a share of GDP High percentage of public infrastructure at risk High percentage of households at risk Limited awareness and preparedness to natural disasters

Green city priority environmental challenges by sector ('Pressure')

Sector	Challenges
Water	High water consumption per capita and per unit of city GDP Inadequate wastewater collection network and wastewater treatment capacity Low percentage of residential, industrial and commercial and from energy generation activities, that is treated according to applicable national standards Excessively high levels of non-revenue water in the water supply network Inefficient water usage behaviours and limited data availability and monitoring
Buildings, energy and lighting	High levels of electricity and heating consumption in non- and residential buildings High electricity use for streetlighting per kilometer of road Lack of public awareness on energy efficiency and renewable energy Lack of green building practice and certification Limited investment in energy efficiency and renewable energy
Solid waste	High percentage of Municipal solid waste (MSW) which is disposed of in open dumps, controlled dumps, or bodies of water or is burnt (Percentage of MSW which is disposed of in expired landfill sites) High percentage of MSW and other waste (including Hazardous Waste (HW)) disposed of and landfilled in European Union (EU)-compliant sanitary landfills Low percentage of collected MSW composted Low proportion of MSW and industrial waste that is sorted and recycled Limited remaining life of current landfills
Transport	High average age (total and by vehicle type), level of maintenance and amount of use of car fleet Inadequate fuel standards for light passenger and commercial vehicles (Euro 4) High and increasing modal share of private vehicles Low kilometres of road dedicated exclusively to public transport or non-motorised transport) Poor public transport infrastructure and services Inefficient transport sector management
Industry	Low industrial material efficiency High levels of waste and pollution Lack of policy/ regulatory tools to promote or mandate industrial resource efficiency and cleaner production Lack of dialogue and information flow between industry and the city
Land use	Lack of integrated land use planning and urban planning Lack of planning guidance, tools and capacity Limited land use data collection process or monitoring; Sporadic land use development leading to urban sprawl Insufficient provision of green areas and disconnected network of green Infrastructure Destruction of nursery-gardens due to illegal construction and expansion of constructed areas Average annual growth rate of built up areas Percentage of urban development that occurs on existing urban land rather than on greenfield land

Environmental aspirations

The key environmental challenges were used as the starting point for developing a vision statement for each associated environmental topic and urban sector in close consultation with key stakeholders. These visions summarise what Gyumri wants to achieve with this GCAP. The same approach was used to develop strategic objectives, one per environmental topic area, and corresponding operational objectives and targets. These are listed below.

Vision statements by environmental topic

Air quality and mitigation of GHG emissions: "*Gyumri will have clean, healthy air quality throughout the city and will promote the adoption of lower carbon solutions across all sectors to lower GHG emissions. The city will have better collection, analysis and management of data to better understand and manage air quality.*"

Water resource: *"Gyumri will have a clean water supply and an efficient wastewater and stormwater collection system that are accessible to everyone and that comply with EU standards. The water usage behaviours of domestic and non-domestic users will also be improved."*

Soils: *"The soil quality in Gyumri will be remediated, maintained and enhanced to support human and natural life."*

Green space and biodiversity and ecosystems: *"Gyumri will be the green capital of Armenia, with connected green space delivered in line with international best practice, which will support the enhancement of biodiversity and ecosystems. Green infrastructure will be used for amenity as well as function."*

Resilience and adaptation to natural disaster risk: *"Gyumri will increase resilience to weather extremes and other natural disasters (such as earthquakes) and in so doing secure sustainable development gains."*

Vision statements by sector

Transport: *"Gyumri will have a transport sector that promotes the increased use of public transport and non-motorised modes, has resilient infrastructure, and that adopts new technology and efficiently uses transport data."*

Buildings, energy and lighting: *"Gyumri will minimise its energy and carbon footprint, manage its energy demand and reduce energy bills for streetlighting and public and residential buildings by encouraging the application of energy efficient and renewable energy technologies, planning and managing municipal energy use, promoting low-carbon public procurement, and raising the awareness and engagement of all players in clean, smart and innovative energy solutions."*

Industry: *"Gyumri will revive its industrial sector to spur economic growth and create jobs with a focus on clean production (water, air, land), resource efficiency, innovative and knowledge-intensive areas of production, attraction of investors in light industry, Information Technology (IT) and innovation and services, and the application of best available technologies. Gyumri Municipality will build a platform for promoting, featuring and showcasing local green businesses."*

Solid waste: *"Gyumri will be served by a modern integrated waste-management system that employs international standards and that directs Gyumri towards a circular economy where all recyclable waste is sorted, collected and recycled."*

Water: as per the 'water resource' environmental topic.

Land use: *"Land use development in Gyumri will adopt a fully integrated and holistic approach to ensure that there is a balance between urban development and regeneration and the protection and enhancement of green spaces."*

Objectives and targets

One strategic objective, a high-level and long-term environmental goal that will need to be achieved to realise the GCAP's vision, was set for each environmental topic area for the period 2030 to 2035. These are listed in the table overleaf along with supporting operational objectives. Mid-term and long-term targets have been formulated and will be used to monitor progress towards achieving the strategic objectives. The objectives and targets, which are detailed in this GCAP, are necessarily ambitious but their appropriateness and the feasibility of achieving each has been ascertained and validated via a review of current performance, benchmarks, experience in other areas/ countries, and stakeholder consultation.

GCAP objectives

Environmental topic	Strategic objectives	Operational objectives
Air quality and GHG emissions	SO_AQGHG: Reduced volume of dust and other air pollutant emissions (local and global)	• Increase the modal share of walking, cycling and public transport • Enhance the energy efficiency of the vehicle fleet • Reduce air pollutant emissions from, and carbon intensity of, energy generation • Reduce the energy consumption of all buildings and streetlighting • Promote green procurement and performance contracting practices • Improve the scope and quality of air quality data collection and procedures for monitoring
Water resources	SO_WR: Enhanced water supply, quality (including surface water) and efficiency of use, and reduced overall wastage of Non-Revenue Water (NRW)	• Develop and promote initiatives to manage water consumption • Enhance the water supply system and reduce overall wastage of NRW • Increase Wastewater (WW) (including sewerage), stormwater and MSW control, collection and treatment capacity • Improve the protection of freshwater sources • Improve data availability, quality and monitoring relating to waste and surface water
Green space and biodiversity	SO_GSBIO: Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city	• Improve the scope and quality of biodiversity related data collection and procedures for monitoring • Enhance the extent, quality and diversity of green spaces and other green infrastructure • Apply a sequential approach (brownfield, infill, greenfield) to urban development to avoid sporadic development
Soils	SO_SL: Protected, enhanced and rehabilitated soil quality across the city	• Improve the control (including by recycling) and treatment of solid and hazardous waste and WW • Remediate abandoned industrial lands and construction sites • Increase data collection, measurement and monitoring of soil quality
Resilience and adaptation to climate change	SO_AR: Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters	• Increase the resilience of water infrastructures to disasters • Promote sequential development of green infrastructures for enhanced resilience to extreme weather events • Assessment of climate risks, planning of disaster risk reduction actions

Actions

A long-list of 64 actions collectively capable of achieving the GCAP's strategic objectives were developed by local and international experts, in consultation with Gyumri Municipality and key stakeholders. The actions considering their potential to maximise social and economic benefits, as well as their environmental impacts. These actions were validated and prioritised using a process of technical assessment and consultation with government officials and wider stakeholders. This resulted in the identification of 46 'priority actions'. The priority action costs by sector are presented in the table below, with the table overleaf showing the action title, classification and implementation timescales.

Priority GCAP actions: Costs and number of priority actions by sector[1]

Sector	Total CAPEX (EUR)	Total CAPEX (AMD)	Mid-term CAPEX (EUR)	Mid-term CAPEX (AMD)	Annual OPEX (EUR)	Annual OPEX (AMD)	Number of actions
Transport	27,440,000	14,543,200,000	20,440,000	10,833,200,000	2,327,500	1,233,575,000	8
Buildings, energy and lighting	22,630,000	11,993,900,000	15,270,000	8,093,100,000	405,000	214,650,000	10
Industry	250,000	132,500,000	250,000	132,500,000	20,000	10,600,000	1
Solid waste	53,220,000	28,206,600,000	38,220,000	20,256,600,000	5,500,000	2,915,000,000	5
Water	80,200,000	42,506,000,000	75,200,000	39,856,000,000	2,140,000	1,134,200,000	10
Land use	5,550,000	2,941,500,000	5,550,000	2,941,500,000	145,000	76,850,000	7
Cross-cutting	16,700,000	8,851,000,000	16,700,000	8,851,000,000	20,000	10,600,000	5
Totals	**205,990,000**	**109,174,700,000**	**171,630,000**	**90,963,900,000**	**10,557,500**	**5,595,475,000**	**46**

[1] The process used to derive these estimates is described in Chapter 7.

Priority GCAP actions listed by sector

Action reference	Action title	Action classification	Implementation timescale
TRANSPORT			
A_TR_01	New public transport network operator model and integrated tariffs and ticketing	Capital investment in new city assets	2020 - 2024
A_TR_02	Upgrading bus stop infrastructure including with Real Time Passenger Information (RTPI)	Capital investment in new city assets	2020 - 2024
A_TR_04	New cycle lanes and cycle parking infrastructure	Capital investment in new city assets	2020 - 2024
A_TR_05	City-wide pedestrian wayfinding signage network	Capital investment in new city assets	2021 - 2023
A_TR_06	Promotional campaigns for walking and cycling	Awareness, demonstration and capacity building	2020 - 2021
A_TR_09	Sustainable Urban Mobility Plan (SUMP) for Gyumri	Strategies, plans and programmes	2020 - 2021
A_TR_12	City-wide data collection programme and transport model	Monitoring and data collection and studies	2020 - 2022
A_TR_14	Renewal of public bus fleet with low emission vehicles	Capital investment in new city assets	2021 - 2024
BUILDINGS, ENERGY AND LIGHTING			
A_BEL_01	Residential energy efficiency awareness raising and outreach	Awareness, demonstration and capacity building	2020 - ongoing
A_BEL_02	Low-income LED transformational programme and campaign	Capital investment in new city assets	2020 - 2025
A_BEL_03	Residential building thermal modernisation PPP programme	Capital investment in existing city assets	2020 - 2030
A_BEL_04	Municipal energy information system and management	Monitoring and data collection and studies	2022 - 2027
A_BEL_05	Energy Performance Contracting (EPC) and Energy Service Company (ESCO) contracts	Public procurement	2020 - 2022
A_BEL_06	Public building thermal modernisation programme	Capital investment in existing city assets	2022 - 2027
A_BEL_07	Development of framework for enhancing energy efficiency in public procurement	Public procurement	2020 - Ongoing
A_BEL_08	Promoting green building	Strategies, plans and programmes	2021 - Ongoing
A_BEL_09	Energy efficient Municipal streetlighting upgrades	Capital investment in existing city assets	2020 - 2022
A_BEL_10	Deployment of medium and large-scale Renewable Energy Systems (RES)	Monitoring and data collection and studies	2020 - 2022
INDUSTRY			
A_IN_04	Screening and de-risking of contaminated industrial sites	Monitoring, data collection and studies	2020 - 2022

Action reference	Action title	Action classification	Implementation timescale
SOLID WASTE			
A_SW_02	Removal of illegal open dumps and remediation of contaminated areas	Capital investment in existing city assets	2020 - 2024
A_SW_03	Review of current waste collection and waste fee systems and implementation of a separate collection system for recyclables	Capital investment in new city assets	2020 - 2022
A_SW_04	Construction of new MSW disposal and treatment infrastructure	Capital investment in new city assets	2020 - 2027
A_SW_05	Market study for recyclable materials and establishment of waste quality protocols	Monitoring, data collection and studies	2020 - 2024
A_SW_06	Establish a Municipality Waste Department and conduct regular waste management awareness campaigns	Awareness, demonstration and capacity building	2020 - 2024
WATER RESOURCES			
A_WR_01	Prepare an inventory and GIS of Gyumri's water supply network infrastructure and assets	Monitoring and data collection and studies	2020 - 2022
A_WR_02	Enhanced water supply and demand data and analysis	Monitoring and data collection and studies	2020 - 2023
A_WR_03	Leak Reduction Action Plan (LRAP) development	Strategies, plans and programmes	2021 - 2022
A_WR_04	Legal and financial mechanisms for enforcement of LRAP	Standards, guidelines and regulations	2020 - 2022
A_WR_05	Repair and rehabilitation of supply system parts with highest leakages	Capital investment in existing city assets	Step 1: 2020 – 2022; Step 2: 2022 – 2025; Step 3: 2022 - 2026
A_WR_06	Prepare an inventory and GIS for WW infrastructure	Monitoring and data collection and studies	2020 - 2022
A_WR_07	Preparation of a Wastewater Action Plan and tender documentation for recommended infrastructure upgrades	Strategies, plans and programmes	2021 - 2022
A_WR_08	Rehabilitation and extension of drainage systems	Capital investment in existing city assets	2021 - 2025
A_WR_09	Rehabilitation and extension of the WW treatment system	Capital investment in existing city assets	2021 - 2025
A_WR_10	Upgrading public water infrastructure in green spaces	Capital investment in existing city assets	2021 - 2025

Action reference	Action title	Action classification	Implementation timescale
LAND USE			
A_LU_01	Develop a Sustainable Urban Planning Framework for the city of Gyumri and develop an updated master plan and zoning regulations	Strategies, plans and programmes	2020 - 2021
A_LU_02	Develop a GIS based land use database and City Information Model (CIM) for Gyumri	Monitoring and data collection and studies	2021 - 2023
A_LU_03	Create targeted urban planning guidance and tools	Standards, guidelines and regulations	2022 - 2023
A_LU_04	Enforce planning policy and building regulations	Standards, guidelines and regulations	2021 – 2030
A_LU_05	Urban planning and sustainable development public-sector capacity building	Awareness, demonstration and capacity building	2020 - Ongoing
A_LU_06	Management strategy for public parks and green spaces	Monitoring, data collection and studies	2020 – 2029
A_LU_07	Provision of green infrastructure, parks and open space	Capital investment in new city assets	2022 - 2025
CROSS CUTTING ACTIONS			
A_AQGHG_01	Develop a municipal air quality monitoring system	Monitoring and data collection and studies	2021 - 2023
A_AR_01	Conduct a Climate Risk Assessment of infrastructure in the water, transport, solid waste and building, energy and lighting sectors	Strategies, plans and programmes	2020 - 2021
A_AR_02	Prepare an Action Plan for enhancing the climate resilience of Gyumri's infrastructure	Strategies, plans and programmes	2021 - 2022
A_AR_03	Develop an Emergency Preparedness Action Plan	Strategies, plans and programmes	2023 - 2024
A_AR_04	Investment in climate change adaptation and resilience measures	Capital investment in new city assets	2024 - Ongoing

Next steps

The GCAP is to be adopted by the Council of Elders and the City Administration and will be used it as the basis for elaborating Gyumri's annual budgets and mid-term and long-term development plans. A concerted effort will be made to help to ensure that this first stage of the Green City Implementation period, Step 3 of the GCAP process, begins in early 2020. This will mark the start of the 60-month implementation period, over which time a series of GCAP actions will be delivered using a holistic and carefully structured approach that is fully aligned with, and embedded in, its wider framework.

The implementation progress and impact of the GCAP will need to be monitored in order to understand opportunities for improvement and to identify any necessary corrective measures that need to be adopted. It will also enable GCAP challenges, objectives, actions and targets to be periodically revisited and potentially refined. Implementation and the contribution of GCAP actions towards achieving mid-term and long-term targets will therefore be monitored and subject to regular reporting, with findings cascaded to all relevant stakeholders. This GCAP outlines the monitoring process that will be used, as well as associated governance arrangements, but this will be revisited and refined by those accountable. This is reflected in the following figure, which provides an overview of next steps in the GCAP process.

Type of Activity	Activity	Year					
		2020	2021	2022	2023	2024	2025
	Confirm GCAP Coordinator						
	Engage politicians, other decision-makers and their bodies						
	Include the GCAP actions in annual budgets and mid-term and long-term development plans						
	Review and mitigate GCAP implementation risks						
	Commission feasibility studies for GCAP actions						
	Pursue sources of funding						
	Select key GCAP measures and prepare a detailed Implementation Plan						
	Establish and formalise implementation partnerships						
	Implement GCAP actions						
	Agree and refine monitoring process						
	Monitor GCAP implementation						
	Monitor contribution of GCAP towards targets						
	Report GCAP implementation progress and plan and implement any necessary corrective measures						
	Report contribution of GCAP actions towards targets and plan and implement any necessary corrective measures						
	Identify and report on changes in State, Pressure and Response indicators						
	Prepare for the next GCAP cycle						

Internal engagement
Finance / budgeting
Execution
Reporting
Step 3: Green City Implementation
Internal and external engagement
Feasibility
Monitoring
Step 4: Green City Reporting

Programme of activities for GCAP next steps - GCAP Step 3 (Green City Implementation) and 4 (Green City Reporting)

1. Introduction

1.1. Background

This Green City Action Plan (GCAP) sets out a list of 'green' city actions that if implemented could realise Gyumri's ambition to become a prospering, green, resilient and sustainable city that makes rational use of resources, while creating conditions for a healthy, innovative and happy life of its citizens.

Cities cause many negative environmental impacts, for example relating to air quality, land use, municipal solid waste generation, and pressure on water resources. They are also often particularly vulnerable to the effects of climate change, such as increased earthquake risks. Such environmental issues are acute in Gyumri. The purpose of this GCAP is to present Gyumri's sustainable development vision and strategic objectives, all of which have been developed through the GCAP process, along with priority actions and investments across all sectors to meet the GCAP objectives. This will enable the priority environmental issues identified to be addressed cost-effectively via targeted investments and reforms whilst raising awareness of sustainability.

The approach that this GCAP sets out for addressing the complex network of environmental challenges and opportunities that face Gyumri has been developed by following the GCAP Methodology developed by the Organisation for Economic Co-operation and Development (OECD) and the International Council for Local Environmental Initiatives (ICLEI). This GCAP supplements, and is aligned with, existing urban planning instruments and policies. The policy framework of the GCAP reflects Armenia's growing domestic commitment to the green city agenda and Gyumri's proactive participation.

1.2. Contributors to the GCAP

The European Bank for Reconstruction and Development (EBRD) joined forces with the City of Gyumri to develop this GCAP as part of the EBRD's Green Cities programme. In a growing number of cities across the EBRD region, the programme seeks to preserve the quality of environmental assets and promote sustainable resource use and help mitigate and adapt to climate change related risks, while ensuring that these efforts contribute to enhancing social and economic well-being of urban citizens.

The development of the GCAP has been led by a team of local and international consultants and developed in close coordination with the Gyumri Municipality and wider city stakeholders. The GCAP has been subject to several stages of stakeholder engagement and public consultation, with the full list of participants listed in Appendix B.

1.3. GCAP structure

The structure of the rest of this GCAP is outlined below.

Chapter 2 Green City Action Plan methodology: presents the approach and methodology adopted to develop the GCAP, which is followed by the results of baseline technical assessment and mapping based on key indicators for State, Pressure and Response, terms which are described in the chapter. The chapter also provides an overview of the outcomes of the study.

Chapter 3 Introduction to Gyumri: introduces Gyumri as a city, giving a brief overview of its geography, urban fabric, demographics, economy and infrastructure. The chapter also outlines the local governance landscape and decision-making processes, which were used to validate the GCAP.

Chapter 4 Green City Action Plan environmental baseline: highlights the key outputs from the baseline technical assessment and identifies the environmental challenges facing the city based on a comparison with benchmarked international indicators.

Chapter 5 Green City vision, objectives and actions: presents the Green City vision, set of strategic objectives and recommended actions and targets for each urban sector (transport; buildings, energy and lighting; industry; solid waste Management; water; land use) as well as adaptation and resilience actions that are not limited to a specific sector.

Chapter 6 Monitoring: sets out the approach that will be followed to measure the effectiveness of the GCAP in relation both to actions taken and outcomes achieved. It also outlines governance arrangements for managing implementation of the process and an overview of stakeholder engagement conducted in the course of the project.

Chapter 7 GCAP costs and funding options: provides a summary of the CAPEX and OPEX costs of the GCAP actions, as well as commentary on the potential options for funding.

Chapter 8 Next steps: sets out the next steps and timelines for implementation of the GCAP and its associated actions.

The Appendices contain additional detail on additional actions (**Appendix A**) and a complete GCAP stakeholder list (**Appendix B**).

2. Green City Action Plan methodology

The GCAP is a strategic document that presents Gyumri's environmental vision for 2035. Its aim is to enhance the City's environmental performance in a cost-efficient and financially sustainable manner, while at the same time seeking to maximise economic and social co-benefits. This section introduces the methodology used to develop the GCAP and that will continue to be applied to review the progress of its implementation.

2.1. Overview of approach

The Gyumri GCAP has been developed according to the EBRD's Green Cities Programme Methodology, as defined by OECD and ICLEI. It is the outcome of the GCAP process, which has been tailored to the Gyumri context.

The GCAP Methodology guides the development of environmentally sound actions and is based on the key principles of:

- Evidence-based technical analysis;
- Stakeholder participation and engagement; and
- Political commitment to the green agenda.

The EBRD's Green Cities Programme Methodology defines a Green City as a city "which shows high environmental performance relative to established benchmarks in terms of i) **quality of environmental assets** (air, water, land/soil and biodiversity), ii) **efficient use of resources** (water, energy, land and materials) and iii) **mitigating and adapting to risks deriving from climate change**, while maximising the **economic and social co-benefits** and considering its context (population size, socio-economic structure and geographical and climate characteristics)."[2]

Figure 2-1 - GCAP cycle overview

The GCAP process consists of the four main steps listed in Figure 2-1. It is an integrated, multi-sector process where Gyumri's environmental challenges are periodically identified, prioritised and addressed through short-term actions such as targeted investments and services, regulations and other relevant policy instruments, which sit in a structural framework of visions, long-term strategic objectives with corresponding mid-term and long-term targets.

The GCAP is the outcome of a detailed study of the local context of political frameworks, policies and planning documents, as well as a technical assessment of environmental indicators. This process is highly participatory. In the course of the development of the GCAP, for example, workshops and discussions were held with the City Municipality and wider stakeholders (listed in Appendix B) in order to minimise data gaps, enhance the understanding of local social, cultural, historical challenges and community needs, allow for the participatory identification of green city challenges, ensure that urban issues were addressed systematically, prioritise actions that would have maximum impact and be ready to attract donor co-financing, and ultimately develop capacities to ensure the sustainability of the project beyond the timeframe of this assignment. The value of sustained stakeholder engagement with the City Municipality is increased further by its responsibility for steps three and four of the GCAP process (see Figure 2-1). Table 2-1 lists all formal stakeholder engagement events, which have been supplemented by a number of informal

[2] OECD and ICLEI (2016) Green Cities Programme Methodology. Available at http://www.ebrd.com/documents/technical-cooperation/green-city-action-plan-in-tirana.pdf.

discussions between the local consulting team, city representatives and other stakeholders throughout the GCAP process.

Table 2-1 - List of formal stakeholder engagement meetings and workshops

Date	Engagement Type	Title
September 2018	Stakeholder Workshop	Formal Kick-off and Inception Workshop *A workshop to present the GCAP aims, objectives and methodology, as well as initiate engagement with key stakeholders.* *50 Participants*
December 2018	Municipality Meeting	Green City Political Framework and Emerging Challenges *An internal workshop with the Municipality on the findings from the political framework assessment and the emerging environmental challenges.*
June 2019	Stakeholder Workshop	Green City Challenges, Visions, Strategic Objectives and Actions Workshop A workshop to present and discuss the GCAP vision, strategic objectives and long list of actions. Feedback on the long list of actions was received and incorporated into the GCAP briefing paper. 55 Participants
August 2019	Municipality Meeting	Political Prioritisation of Actions
		An internal workshop with the Municipality to go through the long list of actions generated as part of the visioning and actions workshop. The outcome of the workshop was a shortlisting and prioritisation of actions from 87 to a prioritised list of 46.
December 2019	Municipality Meeting	Council of the Elders *Brief summary presentation of the GCAP findings, key challenges and remedy actions proposed, indicative timeline, needs for future planning. GCAP presented for voting and approval by elected city council members (Elders).*
December 2019	Information Dissemination	Final GCAP Presentation Presentation of the final GCAP to the Municipality and external GCAP stakeholders.

Figure 2-2 shows the tasks that either have been, or will be, completed at each stage in the process, delineating the sequential dependencies (blue arrows) between them. As indicated by Task 4, it is a circular process that requires periodic review and the consequent updating of the strategic framework to reflect the green projects' implementation progress as well as other relevant national, regional or local developments.

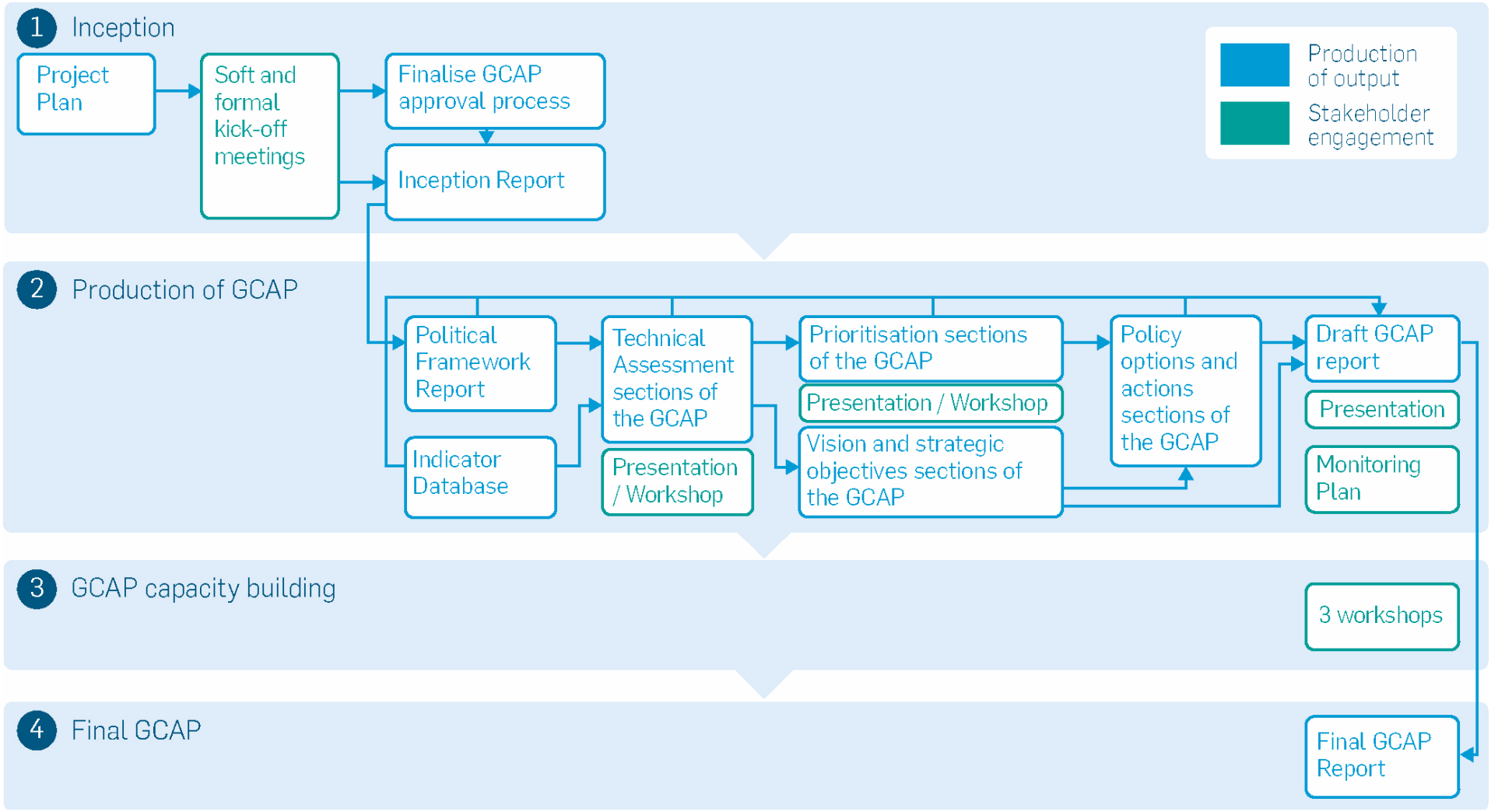


Figure 2-2 - GCAP process and tasks

2.2. Methodology

This sub-section introduces each of the four GCAP process steps, introduced in Figure 2-1, in more detail.

2.2.1. Step 1: Green City Baseline Assessment and Scoping

This Step involved the development and analysis of an evidence-base to identify the most pressing environmental challenges facing Gyumri and their causes. It involved the delivery of three outputs, specifically:

- **Political Framework Report** (the output of a multi-sector review and evaluation of existing instruments and plans that can inform and influence the GCAP's direction);
- **Indicator Database** (a repository containing data for Gyumri in relation to environmental State, Pressure and Response, a model that is explained in this sub-section, and international benchmarks of the same); and
- **Technical Assessment Report** (this accompanies the Indicator Database and contains prioritised Green City Challenges, which were identified via a process of technical assessment, stakeholder prioritisation and political prioritisation).

The Green City Baseline is the evidence base of the GCAP. It aims to inform policy and strategic decision-making throughout the GCAP process and provides the reference for the identification and prioritisation of challenges as well as the monitoring of the success of the implantation of GCAP actions. It was informed by an analysis of the political framework and by identifying, collecting and processing environmental data related to Gyumri with the results presented in an Indicator Database. These two elements are detailed below.

The first component of the Green City Baseline, the analysis of the **political framework**, extended to an analysis of the national legal and regulatory framework as well as Gyumri's previous and existing strategies, reports and actions. The purpose was to identify, review and evaluate existing instruments and plans that can inform and influence the GCAP's direction across all the sectors covered. The policy framework is referenced throughout the GCAP and more detail is provided where necessary.

The second component of the Green City Baseline, the **Indicator Database**, is a collection of relevant city environmental data. The data is presented as three sets of indicators – State, Pressure and Response. The **State-Pressure-Response Model** (see Figure 2-3) was applied as it enables the assessment of the negative impacts of human activities (Pressure indicators) on environmental assets (State indicators) and identifies associated gaps in the policy framework (Response indicators).

In this context, the 'state' of the environment data is presented in relation to the following environmental topic areas:

- Air quality and mitigation of GHG emissions;
- Water resource;
- Soils;
- Green Space, biodiversity and ecosystems; and
- Adaptation and resilience to natural disasters.

Human activities that impact these 'State' indicators, so called 'Pressures,' are presented for the main urban sectors, specifically:

- Transport;
- Buildings, energy and lighting;
- Industry;
- Solid waste;
- Water; and
- Land use.

Response indicators account for measures that seek to improve the environmental performance of the city such as existing actions, policies or regulations aiming to reduce pollution, the consumption of resources or investments into the protection of natural assets. In contrast to State and Pressure indicators, this category is mostly qualitative and builds on the findings of the Political Framework Report**.** Responses can refer to different actors such as:

- International organisations;
- National government;
- Sub-national governments; and
- Private actors.

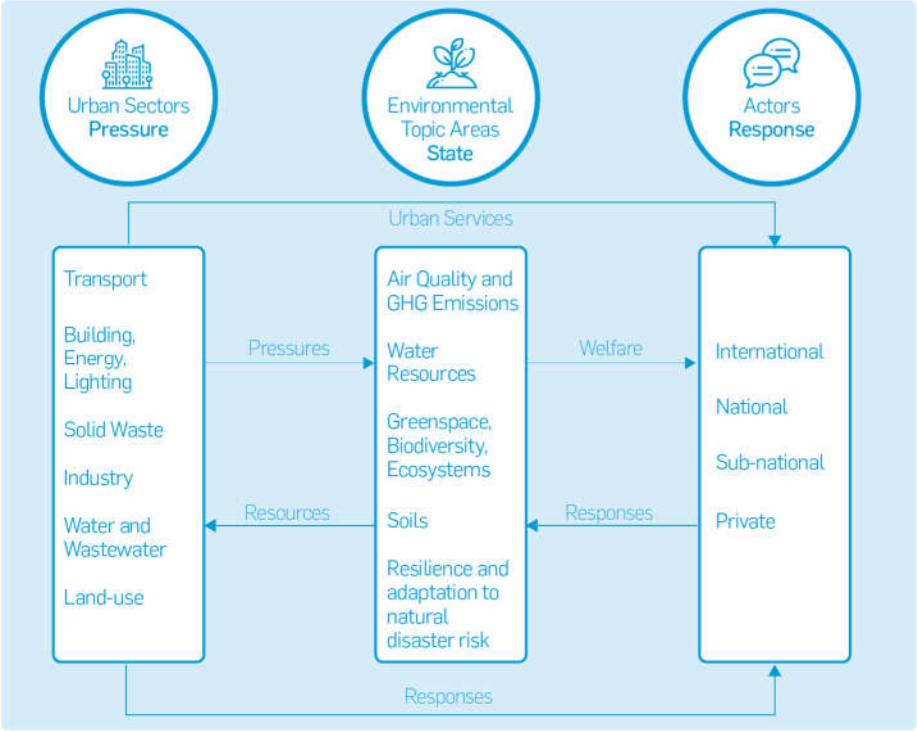


Figure 2-3 - State-Pressure-Response model

Availability and reliability of data as well as the harmonisation of data sets with diverse ownership covering different geographic scales of the urban area, are some of the challenges related to developing the Indicator Database. In Gyumri, there is a lack of environmental baseline data and hence a limited understanding of the city's current environmental performance and the impact of pressures from different urban sectors on the environment. For example, while the air quality problem of high dust levels across the city is strongly felt by residents, there is a lack of air quality monitoring data to understand the root causes of this issue. Therefore, this GCAP sets a focus on improving data collection and analysis as well as monitoring across environmental topic areas and urban sectors, as well presenting implementable environmental actions.

The Indicator Database, in the context of the findings of the political framework analysis, is used as the basis for identifying and prioritising Green City Challenges, which were presented in a **Technical Assessment Report**. The Green City Challenges were identified and prioritised by following a three-step prioritisation process, which is introduced below.

Technical Assessment:

GCAP challenges are identified based on the figures in the Indicator Database. Data collected to populate the GCAP Indicators Database are pre-evaluated using a Red, Yellow, Green (RYG) traffic light system based on standardised benchmarking values provided by the GCAP Methodology. Benchmarking of indicator values according to this traffic light system allows systematic comparison of performance (in terms of environmental outcomes) across the indicator set, referenced to international benchmark values[3]. For the State and Pressure indicators, the most urgent environmental problems faced by Gyumri are marked as "red", areas which do not present a critical priority but require improvement nonetheless are "yellow" and areas demonstrating high compliance with green city parameters are marked as "green". In the case of the State and Pressure indicators, benchmark values vary for each indicator and typically comprise numerical value ranges for each RYG categorisation. For Response indicators the focus is on identifying both the presence or absence of policies and the quality of those policies, using the traffic light categorisations are defined Table 2-2.

[3] The international benchmarks used in the GCAP methodology combine the benchmarks used by leading international organisations, such as WHO, EEA, IADB, Dutch Values, OECD and ICLEI, Odyssee, CIBSE, IEA.

Table 2-2 - Benchmark flags and criteria for Response indicators

Benchmark flag	Criterion
Red	Not existing
Yellow	Existing, but implementation challenges have been observed, and/or existing policies are not sufficient to solve the issue at stake
Green	Existing and well implemented, and there is no significant need to further expand this type of response

The red and yellow State indicators form the basis for identifying environmental topic challenges, while the red and yellow Pressure and Response indicators form the basis of identifying sector challenges. This approach ensures a focus on the most pressing environmental challenges in Gyumri.

Figure 2-4 shows the interlinkages between State-Pressure and Response indicators. A State indicator highlighted in red or yellow, points to an environmental problem in Gyumri. This can be the quality of environmental assets, the availability of resources or a climate change related risk. An environmental problem links to several red or orange Pressure indicators which represent deficiencies within urban sectors responsible for the environmental problem. In this example, the transport and industry sectors are causing air pollution. If there is no response in place (in this case the lack of regulation on vehicles and investment in low emission machinery) or the response fails to solve the identified environmental problem, the GCAP will prioritise these indicators as Green City Challenges.

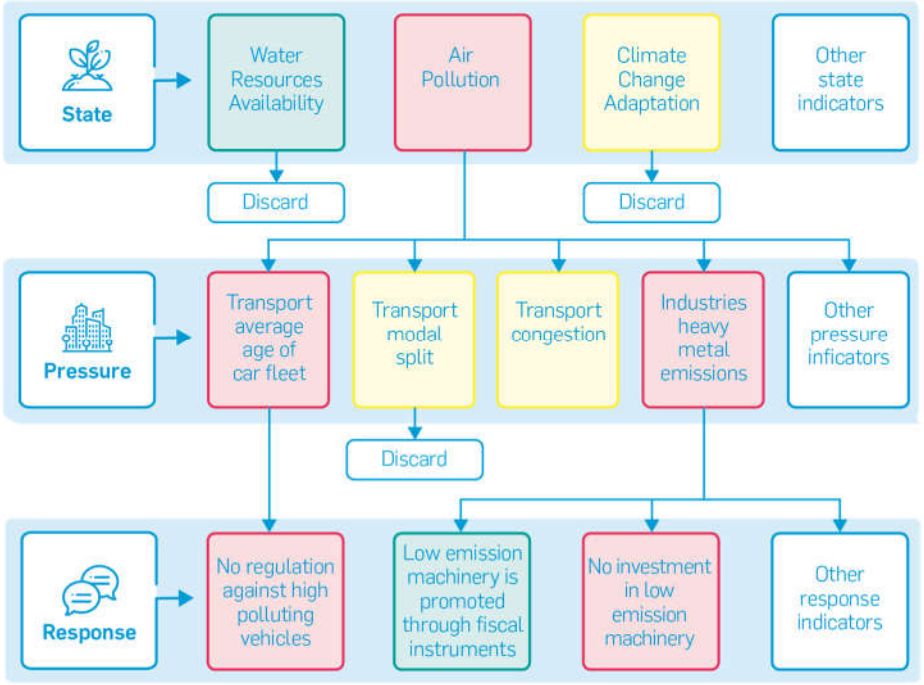


Figure 2-4 - Traffic light methodology for technical prioritisation

Stakeholder-based prioritisation and Political prioritisation

Step two and three of the prioritisation process were combined for Gyumri, in agreement with the City Municipality. The initial list of challenges identified based of the city data using the Indicator Database is advanced and refined by the input of local knowledge and expertise by residents, stakeholders and representative of the Municipality. Several discussions on the prioritisation of challenges were held both on a bilateral basis and through public workshops including representatives of the Municipality and stakeholders.

During a city workshop in December 2018, Municipality staff provided their views on the city's priority challenges.

In two public stakeholder workshops, environmental priorities were presented to external stakeholders, the private sector, Civil Society Organisations (CSOs) and international implementing partners as well as representatives of the Municipality. In the kick-off workshop in September 2018, stakeholders and

representatives from the Municipality discussed key challenges and opportunities. In the workshop on challenges, strategic objectives and actions in June 2019, stakeholders had the chance to rank environmental challenges on a scale from one to five on anonymous feedback forms as well as provide comments and feedback during a question and answer session and a group-based workshop format featuring local and international sector experts, practitioners and academic researchers.

The identified Green City Challenges form the baseline for step two of the Green City process.

2.2.2. Step 2: Green City Action Plan Development

Step 2 involved developing the strategic framework for the GCAP consisting of visions and strategic objectives, which are linked to mid-term and long-term targets and a set of prioritised short-term actions addressing the priority challenges outlined in the Green City Baseline. This GCAP document is the output of this step, which was delivered via a process of technical assessment, stakeholder prioritisation and political prioritisation.

Figure 2-5 summarises the elements of the GCAP's strategic framework. The strategic framework was developed using a systematic, evidence-based and participatory approach, which helped to ensure that the GCAP actions developed were grounded in a holistic view of the city. This will ultimately increase the effectiveness of its implementation and the ability to address each of the identified challenges in due time.

Vision: The GCAP presents an integrated city vision for Gyumri as well as visions for each environmental topic area through to 2035. The visions are based on the environmental topic challenges as well as the corresponding sector challenges and allow for understanding of what should be achieved in terms of the quality of life in Gyumri. The visions facilitate the communication between the city on the one side and the public, academia and the private sector on the other.

Strategic objectives: The GCAP presents one strategic objective for each environmental topic area for the period of 2020-2035. Strategic objectives are high-level and long-term environmental goals that need to be achieved in order to realise the GCAP's visions. They were developed based on the State indicators related to environmental topic challenges.

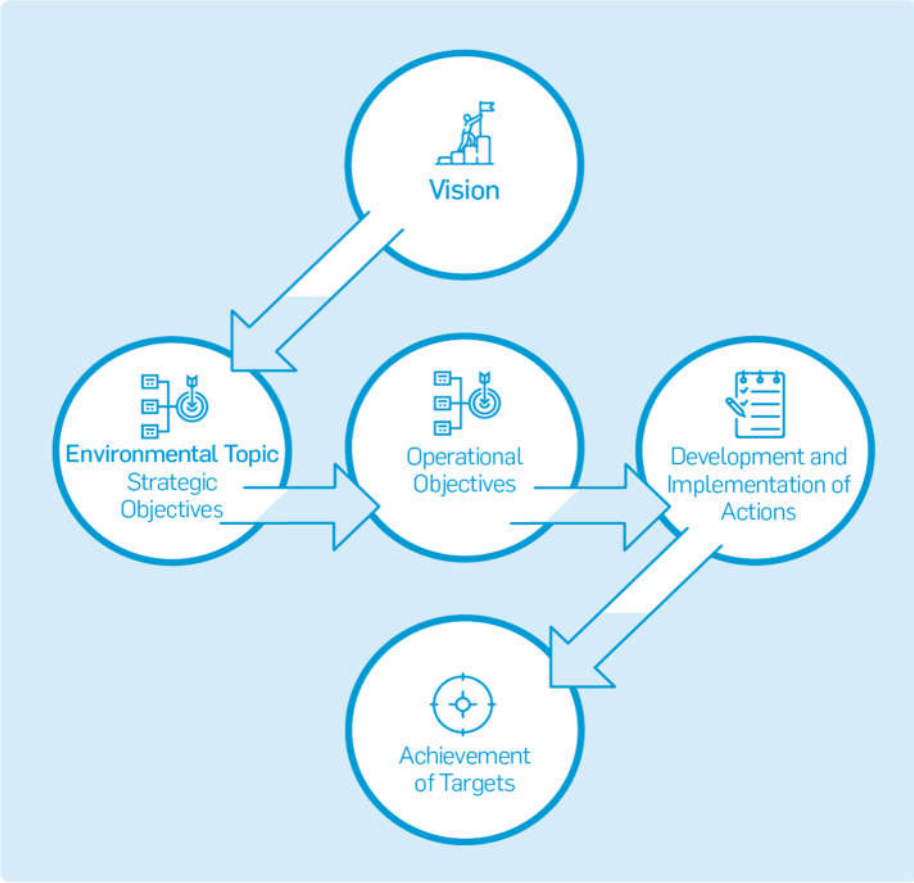


Figure 2-5 - GCAP framework

Operational objectives: Operational objectives point to the sector through which strategic environmental objectives can be addressed. They are based on the Pressure and Response indicators of the Indicator Database.

Targets: The GCAP presents quantified mid-term targets for 2025 and long-term targets for 2035. Each strategic objective has a set of targets linked to it that indicates the operational milestones on the way to achieving the strategic objectives. The targets allow to monitor the process towards achieving the strategic objectives. Targets are developed by shifting the indicator value of the

red and yellow State, Pressure and Response indicators that identified the Green City Challenges towards an improved and achievable value.

Short-term actions: Short-term actions are suggested activities that the GCAP recommends starting to implement between 2020 and 2025. Actions are the vehicle to achieve the strategic objectives for Gyumri's environment. Most actions are situated within urban sectors apart from some cross-cutting actions that address environmental challenges directly. Actions were developed by local and international sector experts and take environmental as well as economic and social impact into account. The actions are prioritised and will partly be included and accounted for in the municipality's five-year development plan and subsequently in the annual development programmes. The action's success is monitored against the targets.

Initially a long list of short-term actions was identified out of which priority actions were prioritised. The three-step action prioritisation process is introduced below and is aimed at choosing actions with the highest environmental, economic and social benefits while also considering budgetary constraints.

Technical Assessment

Each action was scored from 0 to 3 (zero being no impact and three being high impact) according to their contribution to filters reflecting the three key dimensions of sustainability: environment, economy and society.

- Under the environmental filters, the actions are linked to the strategic objectives. The impact of actions on strategic objectives is scored. This allows an understanding of how actions address multiple objectives.
- Economic filters cover the categories of economic return for the investor, economic growth, employment and economic inclusion.
- Social filters cover the categories of access to services, safety, gender equality, green behaviour and awareness, social resilience, citizenship engagement and participation, cultural heritage.

Stakeholder Prioritisation

In the stakeholder workshop in June 2019, the set of actions was ranked and discussed by city stakeholders. The actions were scored from 1 to 5 (1 high priority and 5 low priority).

Political Prioritisation

The results of both the technical and stakeholder assessment were presented to representatives of the City Municipality in August 2019, who scored the action again from 1 to 3 (1 low priority, 3 high priority).

Based on the three steps of prioritisation, 42 actions were chosen as priority actions. A weighted score was calculated for each action in which the technical assessment and stakeholder prioritisations has a weighting of 30% each, while the political prioritisation had a weighting of 40%. The political score weighting is slightly higher because the GCAP implementation is driven by the Municipality.

The complete GCAP is to be presented to the Council of Elders, the City Administration, in December 2019. Once the GCAP has been adopted by the Council of Elders, the City Administration will use it as basis for the elaboration of Gyumri's annual budgets, mid-term and long-term development plans.

2.2.3. Step 3: Green City Implementation

Step 3, Green City Implementation, is set for a period of 12 to 36 months. During this time the GCAP is operationalised. To facilitate smooth implementation of the GCAP in Step 3, the GCAP document contains clear guidance on action targets, monitoring mechanisms and accountable action owners and stakeholders. For the implementation of individual actions further analysis on funding needs and options as well as savings and revenues will be conducted, and funding sources will be identified and pursued. Actions that are implemented will be monitored with respect to the mid-term targets defined in step 2. Further detail on the monitoring framework that will guide this process is provided in Chapter 6.

2.2.4. Step 4: Green City Reporting

Step 4, Green City Reporting, looks at evaluating success of the GCAP process and turns to formulating lessons learned. Based on the GCAP monitoring throughout step 3, the city assesses what has been achieved for the state of the environment in Gyumri and informs the public and relevant stakeholders. Rather than being the final stage of the GCAP process, step four is the beginning of reconsidering State, Pressure and Response indicators, readdressing and potentially refining the GCAP challenges and developing further GCAP actions.

3. Introduction to Gyumri

Gyumri Statistical Data

Area: 4,400 hectares

Average temperature: Summer: 26°C; Winter: -8.5 °C

Natural disaster risk: Earthquakes, mudslides, flooding, draught and hail

Population and demographics[4]:

- Registered: 160,000
- Present (excluding absentees): 114,200, of which women are 59,384; men 54,816

City GDP: 111,636 million AMD (~210 million EUR) per annum

City budget: 3,470 million AMD (~EUR 6 million)

Core economic sectors: Tourism, IT and textiles

Key development plans:

- Gyumri Long-term Strategic Development Plan 2017-21
- Gyumri Sustainable Energy Action Plan 2017-20
- Gyumri Local Economic Development Plan 2019-20
- Shirak Marz Development Plan 2017-25 [5]

Gyumri is the second largest city in Armenia and the administrative centre of the Shirak Marz province. It is located in the north-western region of Armenia, 120km from the Yerevan, as shown in Figure 3-1. Archaeological findings confirm that modern-day Gyumri has been populated since at least the third millennium B.C. and it was initially mentioned as Kumayri in the historic Urartian inscriptions dating back to 8th century B.C. Kumayri grew into a large and prosperous settlement and by the late 19th century it was an important commercial and cultural centre in South Caucasus, strengthened further by the construction of the Alexandrapol-Yerevan railway line which connected it with Tabriz in Persia. After Armenia's 1991 declaration of independence, following the collapse of the Soviet Union and in the aftermath of a powerful earthquake in 1988, the city reverted to its historical name of Gyumri and experienced an economic crisis. This led to significant emigration and it is now a shrinking city. More than half of the population is over 46 years of age with younger generations preferring to either relocate to Yerevan or abroad to Russia or European countries in search of work.[6]

3.1. City context

3.1.1. Geography

Gyumri is located on the left bank of the Akhuryan river within the Shirak Depression. The Gyumri Plain, which is situated about 1,580 meters above sea level, is surrounded by the Jajur and Kamkhut mountains and is bordered by the slopes of the Aragats Mountain in the south east, Shirak mountain chain in the north, Ararat Valley in the south, and Pambak Ridge in the east. It is lined with Cherkes, Jajur, Gyumri and other canyons. While Gyumri is on the same latitude as Napoli and Thessaloniki, it has a continental climate.[7]

A key point to note in terms of geography is Gyumri's vulnerability to natural disasters. Armenia is listed in the top 60 countries exposed to multiple hazards,[8] with earthquakes, floods, draughts, hail, and landslides all major risks that face Gyumri as well as the rest of the country. Armenia is more vulnerable to natural hazards than any other European or Central Asian country, with 80% of population at risk of exposure to catastrophic events.[9] 100% of Armenia is prone to earthquakes, 91% is exposed to the risk of drought, and 31% to floods.[10]

[4] 'The '*registered'* population figure refers to the total number of people who stated that they were either '*permanently (usually) resident and present'* in Gyumri at the time of the last Census, or *'temporarily present,'* people who were living in Gyumri at the time of the Census but intended to reside there for less than one year (and whose permanent residence is elsewhere). The *'present (excluding absentees)'* figure is the number of 'registered' population minus those who referred to themselves as being '*temporarily absent'* at the time of the last Census (residing outside the city for less than one year).

[5] Data sources are: Gyumri Strategic Development Plan, 2016; Local Plan for Environmental Protection Activities in Gyumri, Biosophia NGO; Emergency Risk Management Plan for Shirak Marz, 2018; Gyumri Municipality Website, 2016-2018; Gyumri Local Economic Development Plan, 2018; Gyumri Local Annual Action Plan 2018.

[6] Gyumri Municipality Website, 2016-2018.

[7] Emergency Risk Management Plan for Shirak Marz, 2018.

[8] "Natural Disasters Hotspot – A Global Risk Analysis," the World Bank, 2005.

[9] VFL Armenia National Study; REC Caucasus Armenia National Office, 2013.

[10] Armenia: institutional Arrangements for Disaster Risk Management and Reduction, Global Facility for Disaster Reduction and Recovery (GFDRR), 2009.

Landslide sites cover approximately 122,000 hectares in Armenia, which is over 4% of the country's territory and Gyumri is amongst the 35% of settlements in Armenia that are located in landslide-prone areas.[11]

Seismic risk is the greatest natural disaster threat for Gyumri with several active faults within 150kms of the city. Gyumri has been hit by multiple earthquakes with a magnitude of more than eight on the Richter Scale with the most devastating ones occurring in 1846, 1926, and most recently in 1988. The 1988 earthquake had severe impacts on Armenia's economy and population with more than 25,000 people killed, 19,000 injured and 517,000 homes damaged.[12] It resulted in an estimated economic loss of US 20 billion dollars.[13] Armenia is currently working with several international organisations to assess its natural disaster risk in more depth and to develop associated risk mitigation and emergency preparedness plans.[14]

Figure 3-1 - Gyumri's geographic position within Armenia

[11] National Survey for Seismic Protection and Armenian National Disaster Risk Management Plan were World Bank (WB) funded initiatives. WB utilised GFDRR partnership to conduct numerous studies and help the Armenian government develop emergency management plans; Japan International Cooperation Agency conducted seismic risk assessment and risk management plan in 2010-2012.

[12] JICA study, 2009.

[13] Seismic Risk Assessment in Armenia, Ministry of Emergency Situations of the RoA, 2016.

[14] National Survey for Seismic Protection and Armenian National Disaster Risk Management Plan were World Bank (WB) funded initiatives. WB utilised GFDRR partnership to conduct numerous studies and help the Armenian government develop emergency management plans; Japan International Cooperation Agency conducted seismic risk assessment and risk management plan in 2010-2012.

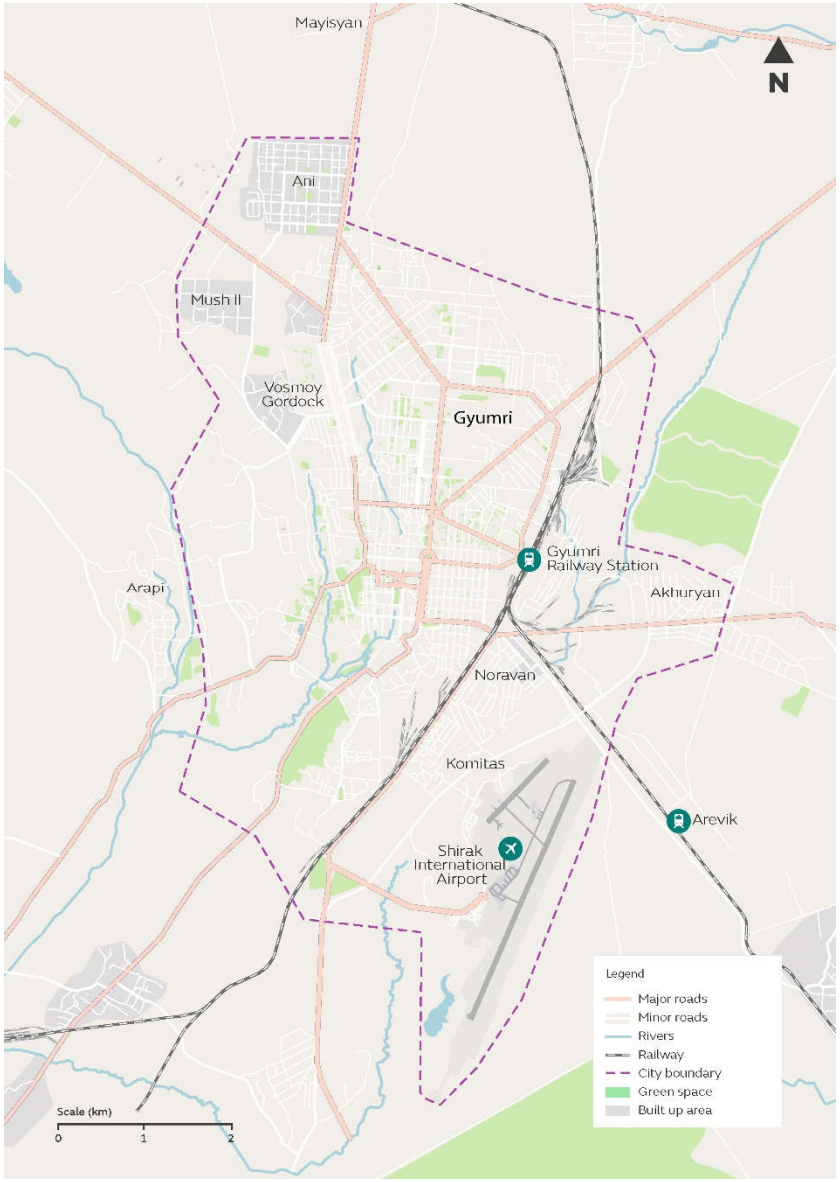
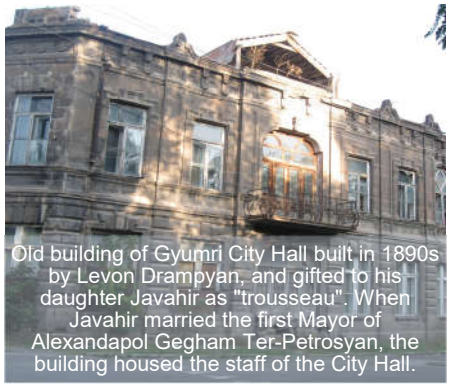
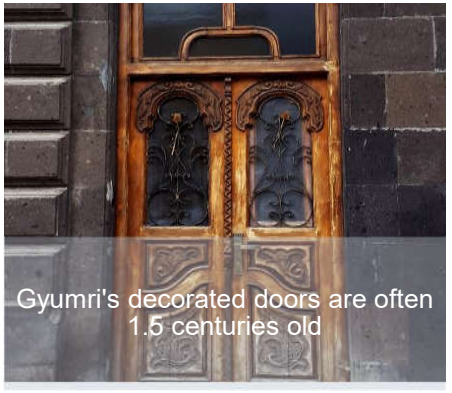


Figure 3-2 - City map of Gyumri

3.1.2. Urban fabric

Gyumri is famous for its rich historical and cultural heritage and unique architectural features (see examples in Figure 3-3) and in April 2019 Gyumri Municipality applied to the United Nations Educational, Scientific and Cultural Organisation (UNESCO) for designation as a UNESCO protected cultural site.





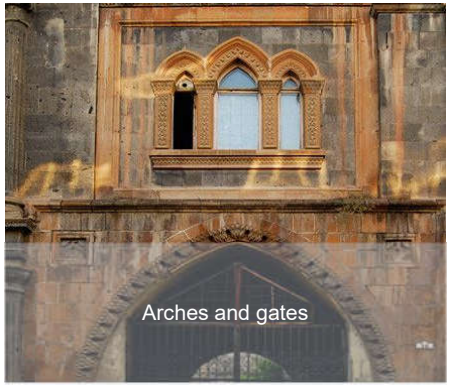


Figure 3-3 - Selected examples of building facades in Gyumri

Gyumri's urban form developed with the construction of military fortresses when the city was under Russian influence in the 19th century. The three fortresses, Alexandrapol, Northern (Red) and Southern (Black), are designated cultural heritage monuments. The residential districts were built gradually, characterised

by the socioeconomic and ethnic characteristics of their inhabitants.[15] The 20th century brought the influence of Soviet architecture to Gyumri and the so called "brutal" architecture made heavy use of concrete and brought about the proliferation of modernist multi-storey buildings.

The central part of the city as well as the adjacent Akhuryan Gorge are part of a conservation area established in 1980 – "Kumayri" Historic-Architectural Reserve-Museum. This area is more than 1,000 hectares in size and includes over 1,200 historical and cultural monuments, as well as more than a thousand buildings dating back to the 18th and 19th centuries. The district is one of the few places in the Republic of Armenia, and the world, with authentic urban Armenian architecture. Almost all the structures of the Kumayri district have survived the two major earthquakes of 1926 and 1988 but they are in urgent need of renovation with maintenance having been restricted owing to issues including the economic challenges faced by the Republic of Armenia since the 1988 earthquake.

A significant proportion of Gyumri's housing stock, over 95% of frame panel buildings and 100% of lift slab buildings (most of them residential apartment buildings), were damaged during 1988 earthquake.[16] In terms of the residential districts, the two-storey buildings of the historical ones such as the "Textile" district (located next to the old Textile factory) and the "Gorku" district (located next to the "Gorka" park) are still relatively well preserved. The main destruction happened to the taller (five, nine, 14, and 24-storey) buildings, which were largely located in more contemporary residential areas (mid/ late 20th century) and were inappropriate for Gyumri's clay-based soils. After the 1988 earthquake a few new districts were built spontaneously in areas outside the ruined building districts, such as the Ani, Moush, Austrian and Sheram districts. These districts have not been adequately integrated into the urban fabric and residents still feel remote and disconnected from city life. In other parts of the city (e.g. Savoyan Street) temporary shelters have resulted in the formation of trailer-districts ("domiks"), which still await Government support owing to a complex set of ownership claims and unresolved disputes over the size of compensation or replacement housing expected from the State. In 2018 and 2019, Gyumri Municipality re-assessed the shelter districts to prepare an inventory of housing needs with the Government of Armenia allocating 3 billion AMD in 2019 to solve the housing issue for those families. Thirty years after the 1988 earthquake, there are still 2,300 families in Gyumri who reside in temporary housing units and 10% of the residential buildings in the city are still at risk of collapsing due to damage sustained in 1988. There is an urgent need to reconstruct, renovate or demolish this infrastructure.

The 1988 earthquake exposed the country's vulnerability to seismic events, lack of emergency preparedness, and the need to develop environmentally conscious and earthquake-resilient urban design and infrastructure. The World Bank and Japan International Cooperation Agency (JICA) conducted a vulnerability assessment of residential buildings and schools in across Armenia, which identified that 90% of schools built during the Soviet era need seismic retrofitting. However, the local design and construction industry has limited capacity and experience to implement effective retrofitting.[17]

3.1.3. Demographics

Gyumri has a population of approximately 159,282, representing over 50% of the population of the Shirak Marz as of January 2018.[18] The city's annual population growth is negative and equals -3.5% (the Shirak Marz Average). Between 2013 and 2018 the population steadily decreased from 121,300 to 114,000, hence Gyumri's identification as a "shrinking city."[19] While the decline coincided with a national population decrease, the continuation of a trend that began in 1988, national rates have improved since 2012 (although the positive growth hasn't surpassed 0.5%) but not in Gyumri.[20]

Gyumri was a thriving industrial, manufacturing and textile hub during Soviet times, but its industrial progress came to a halt with the 1988 earthquake, the collapse of the Soviet Union and the economic crisis of 1992 to 1995. The figures in Table 3-1 provide an indication of the current demographics of Gyumri.

[15] Sargis Matevosyan, "The Folk Architecture of Gyumri of XVIII-XIX Centuries"; Yerevan, "Sovetakan Grogh" Publishing House, 1985, page 22.
[16] Nazaretyan; Suvaryan & Suvaryan (2007) Main Components of Seismic Risk of Gyumri City (Armenia), 05th International Conference on Seismology and Earthquake Engineering.
[17] Armenia: Global Program for Safer Schools, 2015.
[18] Shirak Marz Development Plan 2007-2025.
[19] Shirak Marz Development Plan 2007-2025.
[20] World Bank Country Report, 2017.

Table 3-1 - Selected socio-economic characteristics of Gyumri

Socio-economic characteristic	Value		
Working age population (15 to 75 years of age)	123,640	Male	46.4%
		Female	53.6%
Economically active population	75,420 (61%)	Male	46%
		Female	54%
Registered unemployed population (official figure)[21]	10,494 (8.5%)	Male	30%
		Female	70%
Number of households in the community	31,712[22]		
Households in the official list for the poverty benefit plan	9,909 (31%)[23]		

Most of the social challenges facing Gyumri are common with those faced by the rest of the country with high youth unemployment and emigration, which has changed the urban landscape. Over the course of the last three decades more than 50,000 people have emigrated from Gyumri in search of work and better socio-economic opportunities. Gyumri, however, continues to, and has always, played an important role in the economic and cultural development of Armenia.[24] "The bread and butter of Gyumri is its people" say locals. Gyumri is home to prominent artists, musicians, award-winning athletes, talented craftsmen and builders.

3.1.4. Economy and infrastructure

The GDP of Gyumri is estimated to be 116 billion AMD. According to the Shirak Marz development strategy, the GDP per capita in Shirak Marz is equivalent to 52% of Armenia's average GDP per capita, with the 2017 national GDP per capita calculated to be 1.87 million AMD.

Armenia's GDP growth rate dropped from 41% pre-1988 earthquake to -11% in 1991,[25] and was about 7% 20 years later.[26] The earthquake destroyed power, water and gas supply lines and Armenia lost approximately 40% of its production capacity because many industrial factories were either ruined or destroyed. Despite recent commercial investment in small private enterprises, no major industrial development currently exists. Over 80% of the approximately 2,150 registered private enterprises are individual entrepreneurs, while less than 1% comprise medium and large sized companies. These are manufacturing enterprises including food, textile, electronics, machinery and metal processing, while most private enterprises are mostly in the retail and service sector. Gyumri acts as the financial services centre for the population of the Shirak Marz as branches of 12 banks and six universal credit organisations of Armenia operate in the city.

The Armenian national government does not allocate funds for small business development, but the Gyumri Strategic Development Plan outlines the importance of establishing a free economic zone and favourable financial/ institutional conditions for the creation of small and medium-sized businesses, as well as generating impetus to train and retain educated young people in the city. Several individual initiatives have already been developed to contribute to revitalising the city economy. These include: gradual but continuous development of housing to help phase out temporary housing left after the 1988 earthquake; establishing a Gyumri Technology Centre,[27] and; renovation and expansion of the TUMO Centre for Creative Technologies.

A key growth sector of the economy in Gyumri is tourism, which is developing at a fast pace, testified by the growing number of tourists and tourism companies and facilities that have opened in the last two years. Tourism has been boosted by an increasing number of flights serving the city. In the first six months of 2018, the number of flights and landings increased by 104 (84%) on the same period

[21] Unofficial figures put the unemployment rate as being slightly higher (see, for example, ՀՀ ազգային վիճակագրական ծառայության Շիրակի տարածքային բաժամունք, առ 04.05.2017).
[22] Local Economic Development Plan for Gyumri, 2018.
[23] ՀՀ ՇՄ ԳՀ սոցիալական աջակցության «Գյումրի-1», «Գյումրի-2» տարածքային բաժիններ, առ 10.02.2017թ.
[24] Assets include the city's three higher education institutes, five museums, two galleries, five libraries as well as chess, dance and multiple athletic schools, a school of fine arts, five music schools, and a drama and puppet theatres.
[25] According to a 2013 national in-depth seismic risk assessment and vulnerability mitigation there is a 20% chance, in any given year, of a major disaster occurring in Armenia, each of which could result in losses of 12.7% GDP.
[26] The data was collected after 1991 independence. According to the WB Development Indicators, Armenia lost more than 500,000 people between 1990-2007.
[27] The centre opened in 2014 and is the largest in the region with more than 25 international and local organisations operating their IT businesses from the premises.

in 2017. The historical and cultural centre of Gyumri - the open-air "Kumayri Reserve-Museum" is the focus for tourism development[28] and one of the priorities of the city municipality is to make Gyumri a primary destination for international and domestic tourism in Armenia[29].

Gyumri is a major transport hub that is well connected by the interstate highway, the railway station with Yerevan-Tbilisi-Batumi railroad connecting Armenia and Georgia, and Shirak International Airport. Since 2016, with the arrival of low-cost Russian airlines, the airport has dramatically increased its passenger traffic from 12,000 to over 165,000 passengers in 2018.[30] Most of the passengers are seasonal migrant workers commuting between Armenia and Russia. The railway is of critical economic importance as it is used to transport about two-thirds of Armenia's exports,[31] while the airport is Armenia's second most internationally significant.[32] Armenia depends on the railway as the main over ground option for commercial freight transportation with Europe and Russia as its borders are closed with Turkey and Azerbaijan due to prolonged military conflict.

3.2. City decision-making and governance

3.2.1. Overview

Gyumri is an administrative centre and under direct jurisdiction of the Shirak Marz. The city does not have a legislative function but is governed by national laws, which reside with the National Assembly and the Central Government and are then transposed on Marz level according to long-term development strategies (see section 3.2.2).

Gyumri is run by the Elders' Council, which elects and oversees the activities of the Mayor. The local Government adopts 5-year strategic development plans and approves annual budgets, which are the sole documents governing priorities and actions in the local community. As shown in Figure 3-4, national policies and strategies are implemented at the city level if these are included in the 5-year strategic development plan of the city and if they are further supported by funding either from the annual budget of the city or from external sources.

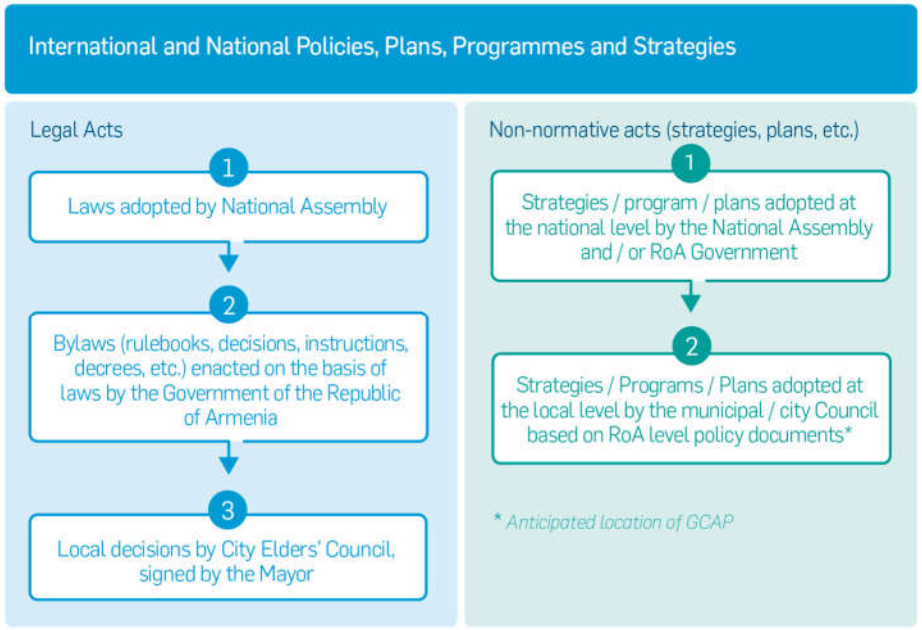


Figure 3-4 - Relationships between policies, plans, strategies, legal acts and bylaws in Armenia and Municipal City Government of Gyumri

Gyumri Municipality aims to provide transparent, accessible and efficient services to its citizens and business representatives. For example, before implementation or final decisions are made regarding large projects, the Municipality modernises public hearings by inviting mass media and informing all stakeholders about the programmes. Key recommendations presented during the hearings are later included in the programme steps.[33] This is reflected in Figure 3-5, which lists the key steps in the Municipal approval process.

When programmes are adopted, Gyumri Administration funds the implementation of programmatic measures from the local city budget (see

[28] Gyumri Local Economic Development Plan (2018).
[29] Local Economic Development Plan, Gyumri, 2018.
[30] Armenian Civil Aviation Department, 2018 Statistics.
[31] Armenia: institutional Arrangements for Disaster Risk Management and Reduction, GFDRR, 2009.
[32] Armenia: institutional Arrangements for Disaster Risk Management and Reduction, GFDRR, 2009.
[33] Local Economic Development Plan, Gyumri, 2018.

section 3.2.2), or, for programmes requiring additional financing, submits applications for State budget subventions or external loan funds.

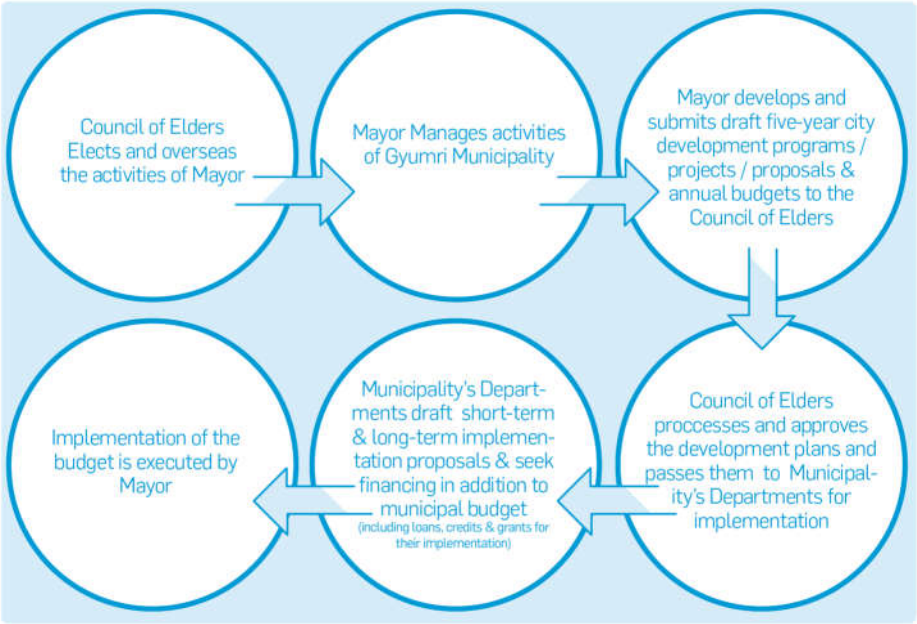


Figure 3-5 - Municipal approval process

3.2.2. Annual budget

Gyumri's annual city budget is 3.274 million AMD (approximately EUR 6 million), of which the community's own revenues from local taxes comprise 37.6%. The remainder is subsidised from the state budget. This budget is supplemented by funding received from international institutions for many city programmes and major reconstruction initiatives.

3.2.3. Existing action plans

This GCAP has been developed as a component of its wider structural framework and in line with existing policies and plans. The key documents are introduced briefly in Table 3-2, but these are not exhaustive, and the wider policy framework comprises other substantive economy-wide and sector specific strategies and plans.

Gyumri Municipality has limited capacity of independently developing sectoral studies, designing and implementing comprehensive investment programs. Most studies and programs to date have been developed and implemented with substantial support from implementing partners.

A criticism of this framework is that there is no long-term vision for the structure of Gyumri's economy, that clear investment priorities have not been set, nor development options assessed. The lack of requisite economic tools and programmes necessary to bring the city to balance, maintain it and help it grow – economically, demographically and move towards a greener economy – is considered a constraint.

Table 3-2 - Existing action plans

Document	Description
Five Year Strategic Development Plan of Gyumri (2017-2021)	Armenian legislation requires national policies to be incorporated into Strategic Development Plans, which facilitates their implementation. Adopted in 2016, key priorities set in the current plan include: protection of the environment; enhanced resilience of the community in case of natural disasters, and; sustaining effective urban development, rehabilitation, development of green spaces, improve waste collection, improving living conditions for citizens. The multi-sector priorities are modernised in 19 specific programmatic initiatives formulated to address some of Gyumri's current economic, social and environmental challenges
Local Economic Development Plan of Gyumri	This Plan was developed with the direct assistance from the Mayors for Economic Growth initiative and focuses on utilising current resources and opportunities, outlining a vision for the community and presenting tangible goals that will translate the vision into reality. It was prepared using a cooperative process that involved local stakeholders, the direct beneficiaries, with the intention that their involvement will extend to the implementation stage. The Plan aims to enable Gyumri to: become one of the primary destinations of inbound and domestic tourism; form a competitive educational and technological cluster; recover its former commercial-industrial capacity; become a transport and logistic hub of regional significance
Sustainable Energy Action Plan (SEAP) of City of Gyumri	Gyumri is a Signatory of the European Covenant of Mayors for Energy and has committed to reduce its GHG emissions by 9,607 tons of CO_2 equivalent by 2020, or approximately 227 tons of CO_2 annually. Adopted in 2017, this plan features means to achieve this target across all sectors, including energy efficient projects and investments that cover both soft measures, like behavioural change and awareness, and capital-intensive measures. It recommends measures to achieve the SEAP target for Gyumri - a 20% reduction of GHG emissions in the jurisdiction of Gyumri City by the year 2020
Gyumri Master Plan 2005	Adopted by the Government of Armenia in 2005, the aim of the Gyumri Master Plan was to guide extensive city redevelopment based on an assessment of opportunities for the city. The plan has not, however, been implemented and contradictory development and initiatives have instead been pursued. Many new residential and industrial buildings, for example, are in areas marked 'green space' on the original master plan. The Master Plan is now outdated but was criticised as being unrealistic from the time of publication
Gyumri Disaster Risk Reduction (DRR) Plan 2018	In this plan, which was approved by the Mayor and coordinated with the Ministry of Emergency Situations (MES) and Shirak Province Administration, the highest risks ranked as a priority for DRR are the poor condition of roads and external lighting, seismic threats and flooding and storm-water overflows and the relatively low awareness of the population to related hazards. The DRR Plan also lists frost, draught, strong winds, forest fires and other climate-related threats as being high seasonal risks
Armenia Development Strategy for 2014-2025	This strategy was formulated under Armenia's Sustainable Development Programme (SDP) and documents the country's socio-economic development priorities and objectives. It also presents the main challenges associated with achieving these and key reforms, including policy measures, required to achieve priority objectives. Environmental protection is covered, but the focus is on achieving economic and social priorities (in a sustainable manner)
Shirak Marz Development Plan 2017 to 2025	This document is the transposition of the national Development Strategy to the regional (Shirak Marz Province) level. It therefore contains regional (Marz-level) development goals and directions, which have been set in the context of current conditions, challenges and opportunities. In addition to localising national goals it also sets out related actions for local entities and institutions

4. Green City Action Plan baseline

The findings presented in this section form the GCAP's baseline and are part of the first step of the GCAP process, the baseline indicators assessment. They have been based on the identification, collection, processing and analysis of a wide range of data and information relating to Gyumri, as well as the results of a stakeholder consultation. As explained in Chapter 2, the baseline consists of three sets of indicators along the Pressure-State-Response axis so that the negative impact of human activities (Pressure indicators) on the state of environmental assets (State indicators) can be identified along with gaps in the policy, legal and regulatory framework (Response indicators).

The assessment presented in this section uses a three-level scale where:

- The most urgent environmental problems faced by Gyumri are marked as "red".
- Areas which do not present a critical priority but require improvement nonetheless are "yellow".
- Areas demonstrating high compliance with green city parameters are marked as "green".

This chapter first sets out key challenges for each environmental topic based on the relevant State indicators and then for each sector based on the Pressure indicators and referencing the Response indicators. It concludes by presenting 'priority action areas' that emerge from the analysis of indicators and identification of key challenges. The priority action areas link the green city baseline to the development of the GCAP actions which are presented in Chapter 5.

4.1. Key challenges

The environmental challenges are presented here under the 'State' indicator topic headings of:

- Air Quality and Mitigation of GHG Emissions;
- Green Space, Biodiversity and Ecosystems;
- Water;
- Resilience and Adaptation to Natural Disaster Risk; and
- Soils.

The Pressure and Response indicators that influence each of these State indicators are then summarised as sector-based challenges, specifically:

- Transport;
- Building, energy and lighting;
- Industry;
- Solid waste;
- Water; and
- Land use.

The stakeholder feedback is presented for each environmental topic and sector. The ranking refers to the stakeholder consultation, including members of the Gyumri Municipality, during the second GCAP workshop on challenges, visions, strategic objectives and actions in Gyumri in June 2019. This was supplemented by a second round of additional consultation held in a focus group organized by the GCAP consultant team, also in June 2019.[34]

The challenges have been further refined after the stakeholder feedback session, so there is a degree of differentiation between the challenges listed in Table 4-3 and the respective tables throughout the chapter.

The stakeholder feedback was captured by the consultant team using feedback forms covering the three topic groups of the workshop which included:

- Group 1: Air quality and mitigation of GHG emissions, transport, solid waste;
- Group 2: Water resource and water, green Spaces, biodiversity and ecosystems, soil and land use, soils; and

[34] The focus group was held by Gyumri GCAP team with participation from "Success Lane" NGO (Ms. Maria Karapetyan), "The Scarlet Flower" social-educational NGO (Ms. Heghine Adamyan), Initiative Group for Creation of New Social CSOs (Ms.Naira Hambardzumyan), Artist Irina Hovakimyan, Teacher-Psychologist Mr. Karen Gevorgyan, Entrepreneur – Mr. Hayk Badalyan.

- Group 3: Energy, building and lighting, industry and adaptation and resilience to natural disasters.

The feedback forms were completed after the presentation of challenges, objectives and actions and the group discussion. All participants ranked the full set of environmental topics and sectors but only the challenges related to their respective groups. Participants were allocated to groups according to their specific background and expertise.

The total sample size of respondents is 30. The number of respondents per group varies as follows:

- Group 1: 10;
- Group 2: 12; and
- Group 3: 8.

Each topic, sector and challenge had the option for a ranking from 1 to 5, with 1 being the highest priority and 5 the lowest priority. The data has been analysed with respect to score, average score, ranking per section and overall ranking.

According to the results of the analysis presented in Tables 4-1 and 4-2, 'Air quality and mitigation of GHG emissions' has been ranked as the highest priority environmental challenge area and 'water' as the highest priority sector.

Even though the sample size is small, the level of expertise of respondents can be considered as high, both in terms of technical expertise and local context related knowledge.

Table 4-1 - Stakeholder feedback on the priority of environmental challenges

Ranking	Green City environment topic area	Average score
1	Air quality and mitigation of GHG emissions	2.23
2	Water resource	2.67
3	Green space and biodiversity and ecosystems	2.70
4	Adaptation and resilience to natural disasters	3.60
5	Soils	3.73

Table 4-2 - Stakeholder feedback on the priority of sectors

Ranking	Green City sectors	Average score
1	Water	2.27
2	Solid waste	2.87
3	Industry	3.25
4	Transport	3.24
5	Building, lighting and energy	3.20
6	Land use	3.30

Table 4-3 provides a summary of the Green City Challenges identified throughout the course of the technical assessment as well as stakeholder feedback process.

Table 4-3 - Summary of the key environmental challenges identified by topic and sector

Environmental topic and sector		Key challenges
Environmental topics	Air quality and mitigation of GHG emissions	High levels of dust pollution Emerging threat from daily concentration of sulphur dioxide High levels of per capita CO_2 emissions and GDP carbon intensity Limited air quality data and monitoring
	Water resource	Levels of ammonium (NH_4) concentration in rivers and lakes – Akhuryan River Inefficient surface water quality monitoring
	Green space, biodiversity and ecosystems	Insufficient size of green areas/low green area/inhabitant ratio Insufficient biodiversity data/lack of monitoring
	Soils	Number of polluted and potentially polluted areas Limited soil data availability and lack of monitoring
	Adaptation and resilience to natural disasters	Estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP High percentage of public infrastructure at risk High percentage of households at risk Low awareness and preparedness to natural disasters
Urban sectors	Transport	High average age (total and by vehicle type), level of maintenance and amount of use of car fleet Fuel standards for light passenger and commercial vehicles (Euro 4) High and increasing modal share of private vehicles Low kilometres of road dedicated exclusively to public transport or non-motorised transport Poor public transport infrastructure and services Inefficient transport sector management
	Buildings, energy and lighting	High levels of electricity and heating consumption in non-residential and residential buildings High levels of electricity used for streetlighting per kilometer of road Lack of public awareness on energy efficiency and renewable energy Lack of green building practice and certification Limited investment in energy efficiency and renewable energy
	Industry	Low industrial material efficiency High levels of waste and pollution

Environmental topic and sector		Key challenges
		Lack of policy/ regulatory tools to promote or mandate industrial resource efficiency and cleaner production Lack of dialogue and information flow between industry and the city
	Solid waste	High percentage of Municipal solid waste (MSW) which is disposed of in open dumps, controlled dumps, or bodies of water or is burnt (percentage of MSW which is disposed of in expired landfill sites) Low percentage of MSW and other waste (including Hazardous Waste (HW)) disposed of and landfilled in EU-compliant sanitary landfills Low percentage of collected MSW composted Low proportion of MSW and industrial waste that is sorted and recycled Limited remaining life of current landfills
	Water	High average age (total and by vehicle type), level of maintenance and amount of use of car fleet Fuel standards for light passenger and commercial vehicles (Euro 4) High and increasing modal share of private vehicles Low kilometres of road dedicated exclusively to public transport or non-motorised transport) Poor public transport infrastructure and services Inefficient transport sector management High water consumption per capita and per unit of city GDP Inadequate WW collection network and wastewater treatment capacity Low percentage of residential, industrial and commercial WW, and WW from energy generation activities, that is treated according to applicable national standards Excessively high levels of NRW in the water supply network Inefficient water usage behaviours and limited data availability and monitoring
	Land use	Lack of integrated land use planning and urban planning Lack of planning guidance, tools and capacity Limited land use data collection process or monitoring Sporadic land use development leading to urban sprawl Insufficient provision of green areas and disconnected network of green Infrastructure Destruction of nursery-gardens due to illegal construction and expansion of constructed areas Low average annual growth rate of built up areas Low percentage of urban development that occurs on existing urban land rather than on greenfield land

4.1.1. Environmental topic challenges

4.1.1.1. Air quality and mitigation of GHG emissions

Air quality data was collated on key air pollutants using publicly available sources published by the Eco-monitoring Centre Republic of Armenia (RoA) and Table 4-4 summarises the results of its review in the context of international benchmarks.

Table 4-4 - Air quality and mitigation of GHG emissions - State indicators

State indicator	Indicator value
Average annual concentration of dust	325.6 µg/m^3 annual average
Average daily concentration of sulphur dioxide (SO_2)	36.7 µg/m^3 mean daily average
Average annual concentration of nitrogen dioxide (NO_2)	18.6 µg/m^3 annual average
Annual CO_2 equivalent emissions per capita	3.36 ton/year/capita
Annual CO_2 emissions per unit of GDP	0.94 ton/m. USD of GDP

As indicated in Table 4-4, the key air quality related green city challenges facing Gyumri are:

- High level of dust pollution;
- Emerging threat from daily concentration of sulphur dioxide; and
- High level of per capita CO_2 emissions and GDP carbon intensity.

A fourth challenge, which is captured in stakeholder feedback on related challenges (see Table 4-5) is 'limited air quality data availability.' The issue of **data quality** can be illustrated in the context of levels of sulphur dioxide (SO_2) where measurements show large fluctuations of concentrations within the range of 9-82 µg/m^3 over the years observed (2009-2017) and do not correlate with other reported emission values. The GCAP indicator mapping has also identified issues regarding availability of air pollutant emissions. Comprehensive monitoring of the air pollutants does not take place and there is a need to improve the overall data collection systems. The current systemic monitoring, reporting and verification of air pollution governed by national institutions needs to be complemented by dedicated municipal monitoring and assessment of air pollution.

Table 4-5 - Stakeholder feedback on air quality and mitigation of GHG emissions challenges

Rank	Average Score	Challenge
1	1.75	High levels of Total Suspended Particles (TSP) (dust)
2	2.50	High electrical consumption from street lighting
3	2.82	Limited air quality data and monitoring
4	3.09	High electrical and heat consumption in buildings
5	3.27	Increasing fossil fuelled private road transport
6	3.91	High GHG emissions per unit of GDP and capita

It is of note that we have deviated from the GCAP methodology thresholds to label the State indicator 'per capita greenhouse gas emissions' as yellow. The standard thresholds would see this being coloured green (Gyumri emits less than the five tons per person benchmark). Therefore, its challenge status has been increased as Armenia's Indicative Nationally Determined Contribution to the United Nations Framework Convention on Climate Change (UNFCCC) under the Paris Agreement states that the Republic of Armenia will strive to achieve ecosystem neutral GHG emissions by 2050 of 2.07 tons/per capita annual. With current emission level for Armenia at nearly 3.4 tons per capita and growing, exceeding the INDC target, we have overridden the GCAP methodology threshold to reflect the true challenge in the national context (meeting the national target).

As indicated in Table 4-5 the key sectors that are putting pressure on the State of Gyumri air quality are transport and buildings, energy and lighting, which are discussed in Section 4.1.2.

4.1.1.2. Water resource

Table 4-6 summarises the results of the baseline State indicator mapping for water resources.

Table 4-6 - Water resource - State indicators

State indicator	State indicator value
Drinking Water Quality	
Drinking water samples complying with national potable water quality standards (%)	100%
Surface Water Quality	
Biochemical Oxygen Demand (BOD_5) in rivers and lakes – Akhuryan River	3.44 mg/l
Ammonium (NH_4) concentration in rivers and lakes – Akhuryan River	1.78 mg/l

As indicated in Table 4-6, the key water resource related green city challenges facing Gyumri are:

- Levels of ammonium (NH_4) concentration in rivers and lakes – Akhuryan River; and
- Inefficient surface water quality monitoring.

The **drinking water quality** indicators reflect the fact that Gyumri benefits from the high-water quality of its groundwater resources. The abundance of very pure, high quality artesian groundwater sources that are used to supply water to majority of Armenian cities, including Gyumri, means that water reaching the city is always of superb quality, particularly as the water supply system is also efficient. The majority (76%) of inhabitants currently have 24-hour access to water supply, and the rest have access to drinking water for 17-23.5 hours. "Veolia Jur" CJSC, the operator for water supply and WW removal system in Gyumri since 2017, is currently working with “Shirak Jrmugh,” the previous water supply and wastewater (WW) removal system operator, to fix water supply problems that arose from earlier stages of the rehabilitation project. They are also engaged in discussion regarding works on the last stage to further improve the quality of the water supply to citizens. Despite these works, this assessment found that a high share of NRW that is, the high share of total water volume which is lost during distribution to consumers and is not billed, was measured to be very high (85-87%). The high NRW values stem from high level of physical water loss from supply system (e.g. from groundwater source to water collection and distribution system) and the existence of potential illegal connections to the supply system and subsequent lack of payment for this utility. The share of NRW in total water volume subsequently influences the price of water for consumers, as well as partially underlines the high-water consumption rates in the city (along with high consumption due to relatively low water prices).

The benchmarking of the **surface water** State indicator reveals poor quality of the surface water, most probably due to anthropogenic activities, suggesting a significant potential for improvement. This is reinforced by stakeholder feedback, which is presented in Table 4-7. Surface water quality is not currently tested or monitored in the three small rivers flowing through Gyumri - the Gyumri-river, Ghor Ghobin and Cherqezi Dzor. Untreated water from these rivers ends up in the Akhuryan River and then in the Akhuryan transboundary reservoir, which is the main water supply for irrigation. The GCAP benchmark based on the European Environmental Agency (EEA) approach is stricter on water quality parameters than the Armenian regulatory framework (N75 Directive). The latter is generally more lenient and uses different threshold values for different water uses. It is recommended that for the Akhuryan River the river quality requirements related to supporting fish life should be used. According to the data provided by Eco-monitoring Centre RoA, while BOD_5 levels are relatively low, ammonium levels in Akhuryan River are significantly higher than safe levels for Cyprinid and Salmonid fish communities’ health and functioning, as well as EEA standards (2.19 mg/l BOD_5 and 0.16 mg/l NH_4). Such excess pollutant levels suggest high anthropogenic pollution, partially resulting from WW discharge from Gyumri. Although surface water is not monitored for biological pollutants and indicators of a possible health risk from direct contact (i.e. occurrence of faecal coliforms), the practice of animal farming in Gyumri, as well as discharge from hospitals suggests high risks of biological pollution in Akhuryan River.

Table 4-7 - Stakeholder feedback on water resource

Rank	Average Score	Challenge
1	1.56	Inadequate wastewater (WW) collection network and wastewater treatment capacity resulting in flood risks, poor aquatic environment and health risks
2	2.78	Excessively high levels of NRW in the water supply network
3	3.22	Inefficient surface water quality monitoring
4	3.33	Inefficient water usage behaviours and limited data availability and monitoring

4.1.1.3. Green space, biodiversity and ecosystems

Green space, biodiversity and ecosystems are considered together as biodiversity is closely related to the prevalence and availability of green space. Gyumri's performance in relation to the related indicators is shown in Table 4-8, which shows that the challenges identified by this technical assessment, are:

- Insufficient size of green areas/low green area/inhabitant ratio; and
- Insufficient biodiversity data/lack of monitoring.

Table 4-8 - Green space, biodiversity and ecosystems - State indicators

State indicator	Value of indicator
Ratio of the open green area per inhabitant	3.91 m^2/inhabitant
Diversity of bird's population growing in number	Shannon Index value can't be calculated because of a lack of data

Green spaces in Gyumri officially cover approximately 552 ha (2017), which is 10% of the city's total surface. The amount of **open green area** decreased as a result of the 1988 earthquake and during the energy crises in the early 1990s when a significant number of trees were cut down and used as fuel to heat houses. This is reflected in Table 4-8, which shows that the ratio of open green area per inhabitant of Gyumri is well below the value of 9m^2 recommended by the World Health Organisation (WHO). The general plan of Gyumri, approved in 2006, envisaged 17 m^2 of open green space per inhabitant but this ratio has not been realised. To achieve such an ambitious target, it will be important to integrate the re-development and renewal of green areas into relevant urban planning projects. In addition, the density of trees on most major avenues in the city is insufficient. Trees within the protection zone of the suburban area buffer zones along roadsides have also been cut down since 1988. Most of the alleys are disrupted or they are left in a single-row formation, which diminishes their significance.

In terms of **biodiversity**, the GCAP methodology uses the value of abundance of bird species (avifauna) to assess Gyumri's biodiversity. As birds are sensitive to structural changes around their habitats, the diversity of their population can be considered a reflection of the pressures caused by the human activity. The biodiversity of Gyumri has, however, been poorly studied and no assessment can be made here about its related status. Monitoring and scientific studies are not carried out periodically and although there is some information available in the form of published research, this is still limited. There is no long-term, regular observation routine for biodiversity and so changes cannot be assessed.

The findings of the technical assessment were supported and further contextualised by stakeholder feedback received, which is summarised in Table 4-9.

Table 4-9 - Stakeholder feedback on green space, biodiversity and ecosystems

Rank	Average Score	Challenge
1	1.70	Insufficient provision of green areas and disconnected network of Green Infrastructure
2	2.20	Destruction of nursery-gardens due to illegal construction and expansion of constructed areas
3	2.89	Sporadic land use development leading to urban sprawl
4	3.44	Dilapidated and poorly maintained public water infrastructure (blue infrastructure)

4.1.1.4. Adaptation and resilience to natural disasters

The current risk of natural disasters is seen as a significant challenge in relation to **potential economic loss**. **Infrastructure and households at risk** are identified as key challenges based on country-wide studies. The Gyumri 2018 DRR Plan prioritises a number of such disaster risks for Gyumri including the poor condition of roads and external lighting, seismic threats, flooding and storm-

water overflow, as well as the low awareness of population. This is reflected in the key State indicators for this environmental topic, which are featured in Table 4-10 and reinforced by the findings of stakeholder consultation, which are featured in Table 4-11.

Table 4-10 - Adaptation and resilience to natural disasters - State indicators

State indicator	Value of indicator
Estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP	12%
Percentage of public infrastructure at risk	15%
Percentage of households at risk	15%
Awareness and preparedness to natural disasters	Citizens are aware of natural disaster risk but do not have resilient attitudes

Table 4-11 - Stakeholder feedback on adaptation and resilience to natural disasters [35]

Rank	Average Score	Challenge
1	1.57	High potential social, economic and infrastructure losses from natural disasters
2	1.71	No inclusion of climate adaptation and disaster resilience in strategies and plans

4.1.1.5. Soils

The quality of soil in Gyumri has been identified as a problem and needs improvement. This is reflected in Table 4-12, which shows that the two primary related challenges at present are overall levels of soil pollution and quality and a lack of monitoring.

Table 4-12 - Soils - State indicators

Criteria of the situation	Value of the situation criteria
Number of polluted and potentially polluted areas	Results of some scientific studies prove existence of such areas in the territories of former industrial enterprises. Citizen and Non-Governmental Organisations (NGO) surveys indicated presence of unauthorised dump-sites
Heavy metals Pb emission intensity of manufacturing industries	No data

The **number of polluted and potentially polluted areas** can be attributed to the history of Gyumri's industrial sector, as well the present situation and the pressures caused by construction and household waste. Intervention is required and the focus should be on conducting a more robust review and study of the quality of soils in the areas adjacent to abandoned lands and sites of unfinished construction. This is linked to another significant challenge, which is the current **scarcity of data on soil quality and the lack of periodic monitoring**. There is presently no soil inventory of the polluted and potentially polluted areas of the city, for example, and no registry of contaminated sites. Obtaining a better understanding of pollution sources should therefore be a key focus along with the introduction of more effective monitoring tools. There are, however, some scientific studies pointing to the level of pollutants which are subject of concern. For example, heavy metal analysis of soil around 22 kindergartens in Gyumri demonstrated mild and average levels of pollution. Areas of high pollution are registered in some residential locations of the city.

The key sectors that pose pressures on the State of water resources include water, solid waste, and buildings, energy and lighting. The key pressures on the quality of soils are featured in Section 4.1.2 and are indicated in Table 4-13, which also shows that stakeholder feedback substantiates the findings of the technical assessment.

[35] The feedback pro-forma displayed the strategic objectives of resilience and adaptation to natural disaster risk. Since the SO is formulated directly following the challenge, we count the feedback as feedback on the challenge.

Table 4-13 - Stakeholder feedback on soils

Rank	Average Score	Challenge
1	2.33	Industrial wastewater is currently untreated
2	2.67	Municipal solid waste and hazardous waste disposal not controlled
3	3.33	Lack of monitoring and understanding of abandoned industrial lands and sites of unfinished construction
4	3.89	Limited soil data availability and lack of monitoring

4.1.1.6. Summary of environmental challenges

The assessment of the relevant data in the Gyumri GCAP Indicators Database has enabled the categorisation of State indicator groups by environmental topic (see Table 4-14). Those that are categorised as red (challenge) or yellow (emerging threat) have been selected for future actions.

Table 4-14 - Averaged benchmark flags for State indicators by type and topic/source

Indicator type and topic/source	Benchmark flag	Selected
Quality of environmental assets		
Air quality	Yellow	Yes
Water resource	Red	Yes
Drinking water	Green	No
Water use	Red	Yes
Soil	Yellow	Yes
Availability of resources		
Green space	Red	Yes
Biodiversity and ecosystems	Grey [no data]	Yes
Climate change risks		
Mitigation of GHG emissions	Red	Yes
Adaptation and resilience to natural disasters	Red	Yes

4.1.2. Sector challenges

4.1.2.1. Transport

Table 4-15 summarises the results of the baseline Pressure indicator mapping for the transport sector. This mapping is the basis for subsequent presentation of challenges.

Table 4-15 - Transport Pressure indicators

Pressure indicator	Pressure indicator value
Average age of car fleet (total and by type)	22 years
Percentage of diesel cars in vehicle fleet	Diesel cars: 5%
Fuel standards for light passenger and commercial vehicles	Euro 4
Share of total passenger car fleet run by electric, hybrid fuel cell, Liquefied Petroleum Gas (LPG) and Compressed Natural Gas (CNG) energy (total and by type)	56%
Transport modal share in commuting (cars, motorcycles, taxi, bus, metro, tram, bicycle, pedestrian)	90%
Transport modal share in total trips	33%
Motorisation rate	0.18
Average number of vehicles (cars and motorbikes) per household	0.54
Kilometres of road dedicated exclusively to public transit per 100,000 population	0
Kilometres of bicycle path per 100,000 population	0
Share of population having access to public transport within 15 min by foot	100%
Frequency of bus service	22
Average travel speed on primary thoroughfares during peak hour	20 km/hour
Travel speed of bus service on major thoroughfares (daily average)	15 km/hour
Interruption of public transport systems in case of disaster	No data
Efficiency of transport emergency systems in case of disaster	No data

Table 4-16 presents an assessment of the relevant policy framework as mapped through the Response indicators.

Table 4-16 - Transport policy framework Response indicators

Response indicator	Response indicator assessment
High-polluting vehicles are regulated / Energy-efficient vehicles are incentivised through fiscal instruments	Emissions standards[36] and a requirement to have a catalytic converter on imported cars exist[37] but are not fully and adequately implemented. While customs increase with age of a car[38], no significant fiscal instruments are offered as incentive to own and operate energy efficient vehicles. Switching to CNG fuelled vehicles is supported through allocation of places for CNG stations in city districts and formulation of safety requirements. Technical data concerning the car fleet is insufficient for identifying further effective and efficient measures
Extension and improvement of public and non-motorised transport is planned and supported through investment in place	Some investments have been made to purchase new buses. No investments have been planned in enabling non-motorised transport, although the development of cycle lanes and parking is proposed in the SEAP
Public and non-motorised transport is promoted through Information and awareness campaigns	There has been limited promotion of public transport in the last decade
Traffic demand is managed (congestion charges, smart technologies)	No such solutions have been implemented
Public transport emergency management (in publicly and/or privately-run networks) is planned and tested	Emergency transport systems can run in case of disaster, but with limited efficiency

These challenges are reinforced by the findings of the stakeholder consultation, the relevant feedback from which highlights the three key transport related green city challenges, which are summarised in Table 4-17.

Table 4-17 - Stakeholder feedback on transport

Rank	Average Score	Challenge
1	1.73	Poor public transport and non-motorised transport infrastructure and systems
2	1.75	Poor transport management, data availability and general awareness
3	2.18	Poorly maintained and older private/public vehicles and use of fossil fuelled vehicles

In terms of the first two of these challenges, **transport infrastructure and systems** and its **management,** Gyumri needs to reconsider its strategy for road based public transport and non-motorised transport modes such as cycling. The city also needs improved walking infrastructure, including pavements and green areas. Improved traffic demand and transport management will in general also need to be improved to support mode shift, thus supporting a reduction in emission of pollutant gases and particulate matter. A key issue to be addressed for future planning is the availability and quality of transport data.

The other key area of concern for this Pressure area is **Gyumri`s vehicle fleet**, which is generally older than 12 years and often poorly maintained. This has a negative impact on the city's environment as, generally, the older the vehicle, the higher the fuel consumption and the emissions. Poorly maintained vehicles further exacerbate the poor fuel efficiency, which in turn further increases the

[36] RA Government Decision N965-N, June 22, 2006; (emission standards).
[37] RA Government Decision N902 of December 31, 2000. See section 2 paragraph "c"; (catalytic converters).
[38] RA Law on Rates of Environmental Protection Payment, December 20, 2006. See Chapter 1, section 4, last 3 rows of table (customs).

emissions. This represents a key challenge, particularly as the use of fossil fuelled private vehicles in the city is increasing.

4.1.2.2. Buildings, energy and lighting

Gyumri's energy supply is relatively reliable due to the full electrification of the country (Gyumri is part of Armenia's single integrated electricity system as there are no municipal energy services specific to Gyumri alone), with access to natural gas also available to the vast majority (95%) of Gyumri's citizens. Due to the overall low-carbon national mix of energy, the sources are also adequately diversified with a significant and growing share of Renewable Energy Sources (RES) in the nationwide energy mix, driven by the policy framework. This is reflected in the related Pressure indicators, which are featured in Table 4-18.

Table 4-18 - Energy supply - Pressure indicators

Pressure indicators	Indicator value
Share of population with an authorized connection to electricity	100%
Annual average number of electrical interruptions per year per customer	5.05
Share of population with access to heating cooling	95%
Proportion of total energy derived from Renewable Energy Sources (RES) as a share of total city energy consumption in TJ	12%
Average share of population undergoing prolonged power outage in case of climatic extremes over the past 5 years	6.7%

The Pressure indicators relating to **efficiency of energy use in buildings,** another dimension of this sector, are featured in Table 4-19. It reveals that electricity consumption is largely high in both residential and public buildings, which can be attributed to the low efficiency of appliances, inefficient lighting and heating devices, and high thermal energy losses due to many buildings in Gyumri being poorly insulated.

Table 4-19 - Energy consumption in buildings - Pressure indicators [39]

Pressure indicators	Indicator value
Electricity consumption in buildings	47.42 kWh/m^2
Electricity consumption in residential building	26.57 kWh/m^2
Electricity consumption in non-residential buildings	7.98 kWh/m^2
Heating cooling consumption[40] in buildings fossil fuels	353.54 kWh/m^2
Heating cooling consumption in residential buildings fossil fuels	374.97 kWh/m^2
Heating cooling consumption in non-residential buildings fossil fuels	57.38 kWh /m^2
Share of city enterprises with ISO50001/EMAS certification or similar	0.00%
Total value of projects with green building certification as a share of the total value of projects granted a building permit per year	0.00%

In Gyumri 79% of municipal energy consumption is for street-lighting,[41] and so the Gyumri GCAP technical assessment measured street lighting energy use by adding three additional Pressure indicators, which are presented in Table 4-20.

[39] In some cases, specific energy consumption is low but this is owing to sacrifices made in terms of comfort and suppressed demand. In these instances, for the purposes of this assessment, the baseline energy consumption was normalised for comfort (corrected) to achieve a realistic assessment of the building energy performance indicator, which otherwise could seem misleadingly low.

[40] The GCAP methodology groups heating and cooling but the use of air-conditioning is not common in Gyumri so the heating/cooling energy use estimates refer solely to the use of thermal energy for heating purposes.

[41] If the lighting of all streets was increased to the required level, electricity consumption would increase further. This high consumption is not the full electricity demand due to incomplete lighting infrastructure, delayed replacement of broken bulbs and failure to deliver the quality of lighting required by standards.

Table 4-20 - Street-lighting energy use - Pressure indicators

Pressure indicators	Indicator value
Share of total streets lit	87%
Electricity used per kilometer of road	35,984 kWh/km
Electricity consumed per light pole	426.6 kWh/year

Table 4-21 summarises the mapping of responses, policies and plans against the State and Pressure analysis.

Table 4-21 - Energy supply, energy use efficiency in buildings and external lighting - Response indicators

Response indicator	Response indicator Assessment
Green building is promoted through standards and fiscal incentives	Non-existent
Energy efficiency building is promoted through standards	New building codes, passportisation, auditing and certification standards adopted recently, enforcement still lags, capacities lack
Public and private investment in energy efficiency in buildings	Promoted by latest amendment to Energy Saving and Renewable Energy Law requiring Energy Efficiency (EE) technologies' application in all new construction and capital reconstruction. Government decree (Decree No 1504 from 25 December 2014 on Mandatory EE Provisions in Public procurement in building (re)construction) and the May 2016 amendment to the ESRE Law on mandatory compliance with EE requirements in state investment projects and residential construction has no provisions for enforcement
Metering and billing for personal energy use is regulated	100% - The electricity and gas (heat) billing is consumption-based on the level of each individual consumer/household, market-based pricing, disconnection possibility. Electric meters have been partially replaced to digital, allowing for application of dual tariff (night and day tariffs vary by 25%)
Coverage and quality of electricity and heat supply is improved through investment	While coverage of electricity is improving, the quality remains an issue. The collapsed district heating was replaced by individual heating solutions, which are elaborate and efficient only to extent of technologies' affordability to individual consumers. However, due to affordability limitations unsustainably harvested firewood remains a significant share among heating fuels
Renewable energy facilities in private buildings are incentivised through fiscal instruments	Net metering legislation adopted incentivising solar panels for autonomous electricity producers with capacity under 150 kW and up to 500kW for legal entities. 4.2 cents/kWh feed-in tariff established for solar PV for under 5 MW electricity producers. Several International Financial Institution (IFI) green credit lines offer grant co-financing for EE & RES investments (10-20% grant for qualifying investment loans) and leasing on below-market terms. More support is necessary to push the market and enhance the private investments in this direction, including public sector taking the lead, private sector receiving more affordable financing

Response indicator	Response indicator Assessment
Renewable energy technologies are developed and supported through public and private investment	Private financing available in the banking sector, but terms remain high for massive uptake
Renewable energy facilities are incentivised through awareness campaigns	Non-existent
The resilience of electricity networks in case of disaster is tested and enhanced through investment	Gyumri emergency service established but electricity network resilience not assessed or enhanced

The latest policy developments at the national level have created a legislative framework that promotes energy efficiency in buildings and the utilisation of renewable energy sources. These include the Government Resolution 1405 of December 2015, which introduced mandatory requirements for the integration of energy efficiency technologies in new construction and capital renovation in state-funded projects, as well as amendments to the Law on Energy Saving and Renewable Energy of May 2016, which made energy efficiency mandatory in all new construction and capital reconstruction. The enforcement mechanisms are still, however, to be put in place.

It is also noteworthy, that the building sector has been subject to new requirements.[42] These legislative provisions also require time, awareness raising, enhanced institutional capacities, procurement procedures, and investment mechanisms to ensure their enforcement. Both public and residential sectors lack the required financial resources and will require different tailor-made solutions to address their building EE potential.

Some of the above issues have been articulated in the Gyumri SEAP (2017). The SEAP only focuses on energy and GHG emission reduction objectives and still needs to identify finance for many of the actions included in the SEAP and is limited in its timeframe targeting primarily the year 2020. This GCAP can therefore build on the SEAP, notably through the development of a Sustainable Energy and Climate Action Plan.

Stakeholder consultation served to validate the findings of the baseline assessment, with the feedback regarding challenges presented in Table 4-22.

Table 4-22 - Stakeholder feedback on building, energy and lighting

Rank	Average Score	Challenge
1	2.13	Lack of public awareness on energy efficiency and renewable energy
2	2.25	High levels of electricity and heat consumption in residential buildings
3	3.13	High levels of electricity used in public infrastructure
4	3.50	Lack of green building practice and certification as many systems and standards exist and the most appropriate should be adopted
5	3.71	Limited investment in renewable energy
6	3.75	High electricity and heat consumption in non-residential buildings

In summary, the key challenges facing this sector are:

- High electricity used for streetlighting per km of road;
- Above average electricity consumed per light pole (for such a low-rise city);
- Lack of energy planning, and Institutional and financial capacity for procurement of building EE services in public sector;
- Low public awareness on the costs and benefits of modern EE solutions;
- Lack of effective financing mechanisms for EE investments in residential buildings;
- Lack of enforcement of national legislation on building EE;
- Lack of municipal funds to EE lighting retrofits;
- Municipality's limited borrowing capacity;
- Lack of holistic conceptual approach to external lighting;
- Lack of funds to increase use of Renewable Energy (RE);
- Lack of effective PPP solutions to leverage RE investments; and
- Limited experience in procurement of RE systems.

Gyumri Municipality has 57 public buildings, all of which have high energy consumption (e.g. kWh/m^2/year) relative to the GCAP methodology thresholds and Armenia's national standard on energy performance in buildings (comparable to class 'F'). This is largely due to inefficient heating or indoor

[42] RoA Construction Norm II-6.02-2006 Seismically Resilient Construction. Design Norms.

lighting technology, age of buildings, poor maintenance, a lack of systemic energy management, and a limited investment capacity. These **building energy inefficiencies** should be addressed, with there being the need initially for detailed energy audits of each building, along with the wider issue of high energy consumption, including for **heating** in specific, which is high in both public and residential buildings. While norms, standards and policy provisions have been adopted by the Government for new buildings, there are no policy responses or plans that relate to existing buildings.

In terms of challenges related to **energy efficiency in external lighting**, which also has a high energy consumption rate and high installed capacity (per km of lit road), lighting energy efficiency retrofits are commonly quite cost-effective and have reasonable payback. However, these are difficult for Municipalities to finance on their own due to lack of available upfront capital investment funds. As for borrowed funds, Gyumri Municipality's limited borrowing capacity creates a major impediment for the attraction of loan resources. Lastly, **challenges with renewable energy** has resulted in the share of renewables being rated as lower than commonly accepted for the relative energy sustainability level of Gyumri. The RE share is also low given the announced national RES targets, which need to be further promoted through awareness and outreach that highlights the related policy tools and private-sector financing instruments available.

The public funds of Gyumri are constrained and are likely to remain limited, and so related investments will need to be repaid from savings. If a scheme is effectively designed, the generated savings could feed into a sustainable and replicable financing scheme, which would allow streamlining of the savings towards more investments through a revolving/ multiplier mechanism. There is currently limited potential for sovereign borrowing by the Republic of Armenia for investments in municipal projects. The non-sovereign borrowing, in turn, is an unexplored path, which should also be considered through Armenia's Renewable Resources and Energy Fund (R2E2) or other instruments, offered by IFIs. The local government legislation makes municipal borrowing cumbersome and is undergoing legal reform before the Municipalities will be open to borrow with less limitations.

While Gyumri's public funds are limited, they will be crucial to attract private investments to create a self-sustained market for commercial financing of energy efficiency. In other EU cities, Energy Performance Contracting (EPCs) have become a very useful business model to create such market. EPCs provide for energy savings without capital requirement from the building owners and at the same time guarantees the energy savings and technical maintenance.

The Municipality will need additional capacity and technical assistance to adequately modernise the procurement of energy auditing services, technical design of EE including construction and surveillance of thermal modernisation projects, followed by respective monitoring, evaluation, certification and labelling of EE.

4.1.2.3. Industry

Gyumri's economy had a strong industrial core and in the 20th century it specialised in textiles, food processing, light industry, and machine building. These industrial capacities were largely destroyed by the 1988 earthquake but in the last thirty years Gyumri's industrial sector has partially recovered by evolving in a different direction. The new focus is on metal processing, food industry, furniture making and IT. This transition to processing and lighter industry has had an impact on the structure of energy use. Many of the industrial enterprises use energy simply for lighting and heating spaces, and no major energy use is currently associated with industrial processes. This is reflected in the industry Pressure indicators, which are featured in Table 4-23.

Table 4-23 - Industry Pressure indicators*

Pressure indicators	Indicator value
Electricity consumption in industries per unit of industrial GDP	0.29 kWh/2010 USD
Heat consumption in industries per unit of industrial GDP	0.01 MJ/2010 USD
Fossil fuel combustion in industrial processes per unit of industrial GDP	No data
Share of industrial energy consumption from renewable energy	12%
Share of industrial waste recycled as a share of total industrial waste produced*	**0%**
Percentage of industrial WW that is treated according to applicable national standards*	**0%**

**Note: The waste and wastewater indicators are also addressed in the respective sections under waste.*

National and local statistics do not track aggregate or sectoral breakdown of local GDP for Gyumri, so it was not possible to calculate the energy intensity of Gyumri's industrial GDP. Instead, national averages are presented. In terms of

waste, there is no organized, regulated recycling of industrial waste or treatment of wastewater. Factory audits indicate that, facing economic challenges, some factories have learned to utilise metal waste by delivering it to metal junkyards for very small compensation. Furniture makers give the sawdust to workers as heating fuel. However, these are rather sporadic practices and lack strategic vision, analysis of all available options and cost-optimisation of choices so have not been captured in Table 4-23.

Table 4-24 presents an assessment of the policy framework as mapped through Response indicators.

Table 4-24 - Industry policy framework Response indicators

Response indicator	Response indicator assessment
Electricity and heat consumption /energy efficient industrial processes: Energy efficient industrial machinery is regulated and incentivised through fiscal instruments (electricity, heat, industrial processes).	There are no fiscal instruments targeted at energy efficient industrial machinery
Electricity and heat consumption/energy efficient industrial processes: Energy efficient industrial technologies (electricity, heat, industrial processes) is supported through private investment.	There are a number of green credit lines that lend at relatively favourable terms (compared to average market rates) for energy efficiency investments in MSMEs and large industries, including the EBRD Green Economy Financing Facility (GEFF) (previously - Energocredit), the IFC SEFF, KfW MSME EE
Industrial waste/material consumption: Material efficiency of new built industrial facilities and waste recycling is regulated and incentivised through fiscal instruments.	No specific mechanisms or regulations developed within national legislation
Industrial wastewater treatment/reuse/recycle is promoted through regulations and fiscal incentives	

The key challenges triggered by these Pressures and Responses are as follows:

- Low industrial material efficiency;
- High levels of waste/pollution;
- Lack of policy/regulatory tools to promote or mandate industrial resource efficiency and cleaner production; and
- Lack of information and dialogue between the city and the industry.

For the first two challenges, **low industrial material efficiency and high levels of waste pollution,** industrial energy use remains low due to the transition from heavy industry to processing and lighter industrial production. Some site audits reveal that material efficiency, however, remains low in many industrial enterprises, including in the context of their treatment of industrial waste and wastewater, addressed in the respective sections above. The local authority does not have ongoing initiatives or legal instruments to regulate industry, besides the national environmental standards. The Gyumri Municipality needs to develop instruments for building partnerships with the industrial companies to promote greener, cleaner, more efficient industrial production.

The third challenge, **lack of policy/regulatory tools to promote or mandate industrial resource efficiency and cleaner production**, relates to the fact that there are no state initiatives directly addressing resource efficiency or pollution in the industrial sector. For the last two decades, the government's approach to the private sector was based on minimal regulation to motivate investment and help spur economic growth. The regulatory framework for heat consumption and fossil fuel combustion in industrial processes does not currently provide sufficient incentivisation either. There are no built-in energy efficiency incentives in energy tariffs. The natural gas tariff even has an adverse incentive with the tariff being lower for larger consumers (over 10,000 m^3 per month) than the regular retail tariff. The 2nd National Energy Efficiency Action Plan adopted by the Government of RoA in February 2017 emphasises the need to raise public awareness in energy efficiency and energy saving.

There is an indication that the direction is changing. There have, for example, recently been multiple legislative initiatives aimed to improve efficiency of operation and processes as well as to promote renewable energy sources in the industrial sector. An example of related initiates include the EC-funded Resource

Efficient and Cleaner Production (RECP), which the UN Industrial Development Organisation (UNIDO) has been working on since 2013 in collaboration with the OECD, United Nations Economic Commission for Europe (UNECE) and United Nations Environment Programme (UNEP) as part of the "Greening Economies in the Eastern Neighbourhood" programme (EaP Green). The RECP covers the whole country and has provided for the training and accreditation of a dozen of RECP experts.

The oversight and regulatory responsibilities relating to industrial facilities in Gyumri lie with the Ministry of Nature Protection (MNP), which has limited direct tools to influence the industrial sector but is also responsible for the fourth challenge, the **lack of information and dialogue between the city and industry.** This is because, according to Armenia's legislation, the local government does not have any delegated authority or jurisdiction over the industrial sector. Consequently, local government plans, strategies and even the institutional structure do not have any elements that can, or have any responsibility for taking, concrete mitigations related to activities in the industry sector.

4.1.2.4. Solid waste

Table 4-25 summarises the results of the baseline Pressure indicator mapping for the solid waste sector. This mapping is the basis for subsequent presentation of challenges.

Table 4-25 - Solid waste Pressure Indicators

Pressure indicator	Pressure indicator value
Total solid waste generation per capita.	301.03 kg/person/year
GDP per domestic material consumption.	No data
Share of the population with regular municipal solid waste collection.	100%
Percentage of Municipal solid waste (MSW) which is disposed of in open dumps, controlled dumps, or bodies of water or is burnt (Percentage of MSW which is disposed of in expired landfill sites).	100%
Percentage of MSW and other waste (including Hazardous Waste (HW)) disposed of and landfilled in EU-compliant sanitary landfills.	0%
Percentage of collected MSW composted.	0%
Proportion of MSW that is sorted and recycled.	<15%
Share of industrial waste recycled as a share of total industrial waste produced.	0%
The remaining life of current landfill(s).	0 years

Table 4-26 - Solid waste policy framework Response indicators

Response indicator	Response indicator assessment
Reduction of material consumption/solid waste generation is promoted through awareness campaigns.	Some activities aimed at reduction of material consumption occurred, but existing measures are insufficient to reduce material consumption and waste generation
Coverage of solid waste collection system is improved through plans and investment.	Improvement measures are provided in the Gyumri development programme for 2017-2021, but while related negotiations have taken place the required sovereign guarantees and state funds have not been made available, and so implementation has been postponed
Littering and non-compliance to sorting systems is disincentivised through fines and penalties.	There are littering fines established and collected in Gyumri. Individual offence is penalised. There is no official municipal solid waste sorting system and sorting incentivising system in Gyumri yet
Composting, recycling, and waste-to-energy facilities are developed through plans and investment.	The Government of Armenia has adopted the development strategy of MSW management system for the years of 2017-2036, but no considerable developments are implemented yet
Solid waste reuse, sorting and recycling is promoted through information and awareness campaigns.	No information or awareness campaigns in place
Overcapacity issues in waste disposal sites are tackled through plans and investment.	Shirak province development strategy for 2017-2025 includes "To construct and equip with the necessary equipment EU-compliant sanitary landfill in the administrative area of the Beniamin community of Akhuryan district of Shirak province". No considerable developments exist to date

In summary, key sector challenges can be summarised as per those identified by stakeholders and listed in Table 4-27.

Table 4-27 - Stakeholder feedback on solid waste

Rank	Average Score	Challenge
1	1.64	Insufficient waste disposal practice
2	2.09	Low material efficiency and limited

To address the first of these two challenges, **insufficient waste disposal practices**, and specifically the urgent need for sanitary landfills for MSW disposal, the Government of Armenia has adopted a MSW collection and disposal strategy. This policy fully covers the existing MSW disposal gap to meet EU regulations, which is also a priority for Gyumri. However, Gyumri Municipality will, in the short term, still need to deal with the consequences of the current waste disposal practice, which will continue until the new sanitary landfill is designed, funded, built and operated. The current waste collection practices cannot be considered EU-compliant landfills, they are merely controlled open dumpsites. The dumping of the vast majority of waste in existing controlled dumpsites has a negative effect on the quality of the environment as it decreases biodiversity (i.e. bird community) in the city and causes contamination of surface water and soil on waste disposal sites and their vicinity. Although the existing policy measures plan for EU-standards-compliant MSW collection and disposal (waste reuse, sorting and recycling, composting, waste-to-energy facilities and similar), other waste management aspects, such as capacities for other waste, including hazardous waste, have not yet been part of long-term planning.

For the second key challenge, issues associated with **low material efficiency,** a challenge is the limited source-separation for the recycling of waste – in Gyumri this indicator is benchmarked "red" (less than earmarked 15% of the total current waste generated, as indicated by the GCAP methodology lower threshold). From the experience of other cities, high material efficiency of a city's economy can bring substantial and tangible benefits for its citizens, as well as to the city's budget. Contributions to improved material recovery can include the introduction of an effective recycling system of MSW commodities and incentivised high material efficiency in the industrial and service sectors. Awareness campaigns concerning solid waste generation prevention, solid waste reuse, separation at source and recycling are also effective measures in this area.

4.1.2.5. Water

This sub-section complements the discussion about water resource quality that was featured in Section 4.1.1.2, with Pressure indicators summarised in Table 4-28. This mapping is the basis for the subsequent presentation of challenges.

Table 4-28 - Water Pressure indicators

Pressure indicators	Indicator value
Water consumption per capita	1324 l/day/capita
Water consumption per unit of city GDP	0.661 l/day/USD
Unit of water consumed in power plants per unit of primary energy generated	N/A
Industrial water consumption as percent of total urban water consumption	N/A
Non-revenue water	86%
Unit of water consumed in power plants per unit of primary energy generated	N/A
Percentage of residential and commercial WW that is treated according to applicable national standards	0%
Percentage of buildings non-industrial equipped to reuse grey water	0%
Percentage of WW from energy generation activities that is treated according to applicable national standards	0%
Percentage of industrial WW that is treated according to applicable national standards	0%
Percentage of dwellings damaged by the most intense flooding in the last 10 years	N/A
Annual number of storm water or sewerage overflows per 100 km of network length	N/A

The key challenges were summarised by the stakeholders, as outlined in Table 4-29.

Table 4-29 - Stakeholder feedback on water

Rank	Average Score	Challenge
1	1.56	Inadequate WW collection network and wastewater treatment capacity resulting in flood risks, poor aquatic environment and health risks
2	2.78	Excessively high levels of NRW in the water supply network
3	3.22	Inefficient surface water quality monitoring
4	3.33	Inefficient water usage behaviours and limited data availability and monitoring

In relation to the first challenge, **inadequate WW collection network,** it is important to note that the state of the wastewater collection system in Gyumri is critical, with an average of 20 million m^3 of wastewater produced in Gyumri daily. The wastewater collection system in Gyumri operates gravitationally and is designated only for wastewater collection and is separate from the drainage system. The main wastewater collection pipeline is located on the right bank of Gyumri River and it collects only 25% of the municipal wastewater. The wastewater system of the left bank has been designed, but not built. Some parts of the sewerage system are connected to underground water removal systems, Qareezes, but the majority of wastewater is dumped into three small rivers, Gyumri-river, Ghor Ghobin and Cherqezi Dzor (canyon). These rivers are currently serving as collectors for the wastewater produced in the city. There is no wastewater treatment before disposal, despite the wastewater containing liquid discharge from hospitals. Approximately 70% of water in the Gyumri-river is wastewater. In recent years, insufficient maintenance and chaotic construction periodically results in clogging or damage of wastewater collection systems. Repair works have been undertaken without taking into consideration technological aspects of the system, such as the diameters of the pipelines, levelling of different sectors and continuity of the connections. Many connections between drainage system and wastewater system exist. This has resulted in poor organisation of the wastewater removal system with inherent management problems, lack of data and generally a poor condition of the entire system. Steaming from haphazard construction following 1988 Earthquake and closing of several parts of the *Qareez* system (which served as a drainage for shallow groundwater) is increased water table in the shallow groundwater reservoirs in the city territory, which in turn pose disaster risks. In addition, as identified by stakeholders, a challenge is posed by the **insufficient treatment of**

wastewater. The Wastewater Treatment Plant (WTP), built in 1984-1985, is not functional and the rehabilitation plans are not considered economically viable (approximately 2 million USD is estimated to be required for full rehabilitation of the WTP). Considering the direct connection between the wastewater treatment efficiency and the quality of surface water, upgrading the existing wastewater collection and treatment system would have a beneficial effect on surface water quality.

The challenges with **non-revenue water** are detailed in Section 4.1.1.3 and those regarding **inefficient water usage** are linked to several issues that require improvement. These are related to treatment and re-use of water, storm water management (infiltration, accumulation, re-use) and water savings in general. To promote efficient use of water, dedicated awareness campaigns and workshops for stakeholders and citizens should be modernised. Development of national standards for water treatment and reuse, and fiscal and economic incentives, could be a larger measure towards efficient water use not only in Gyumri, but also in Armenia as a whole. The related gaps are apparent in Table 4-30, which presents an assessment of the policy framework as mapped through the Response indicators. Table 4-30 also indicates that implementation challenges have been faced in relation to many of the regulations, incentives and policies, as well as wider efforts, that have been developed to improve water use efficiency. The impact of others has been insufficient. The extent and efficiency of water supply systems, and to a lesser extent, wastewater collection systems, for example, are constantly being improved and are serving to improve wastewater collection and management of the system.

The last challenge, **inefficient surface water quality monitoring and limited data availability** is also a key issue. It is a recognised fact that surface water streams in Gyumri are polluted, and untreated residential wastewater and MSW are often visible. The condition of the surface water is not, however, measured or reporting owing to Armenia's relatively limited surface water monitoring network. This means that there is very limited data about water quality and not enough to make any related informed decisions.

Table 4-30 - Water policy framework Response indicators

Response indicator	Response indicator assessment
Metering and billing for water use is regulated	Existing, but implementation challenges have been observed, and/or existing policies are insufficient to solve the issue at stake
Water saving reuse is encouraged through awareness campaigns	Not existing
Coverage and efficiency of water supply networks is improved through plans and investment	Existing, but implementation challenges have been observed, and/or existing policies are insufficient to solve the issue at stake
Buildings access to WW collection and treatment systems is improved through plans and investment	Existing, but implementation challenges have been observed, and/or existing policies are insufficient to solve the issue at stake
WW treatment is promoted through regulations and fiscal incentives	Not existing
WW billing is regulated	Existing
Drinking water pre-treatment is enhanced through plans and investment	Existing
Drainage facilities are developed through plans and investment	Existing, but implementation challenges have been observed, and/or existing policies are insufficient to solve the issue at stake
Business and community resilience are encouraged through awareness campaigns	Not existing

4.1.2.6. Land use

This sub-section complements the discussion about land use that was featured in Section 4.1.1.3, with Pressure and Response indicators relating to green space summarised in Table 4-31. This mapping is the basis for the subsequent presentation of challenges.

Table 4-31 - Green space Pressure and Response indicators

Pressure Indicator	Response indicator
Average annual growth rate of built up areas	No policy, strategy or plan response
Percentage of urban development that occurs on existing urban land rather than on greenfield land	No policy, strategy or plan response

The technical assessment of this sector, which was summarised in Section 4.4.1, highlighted **limited green space** in Gyumri in comparison with international benchmarks. As indicated in Table 4-31 this can be attributed to a lack of regulation regarding building density, a lack of promotion of Transit-Oriented Development and mixed-use development promotion through zoning regulations or incentives. Most of these issues should have been addressed through the 2005 Gyumri City Master Plan, but as indicated previously, there were some discrepancies between reality and the trends featured in the Plan. The Plan has also not been adhered to. Failure to enforce the adopted zoning of the 2005 Master Plan, for example, has resulted in the building of developments over designated green spaces, which includes the existence of industrial enterprises (pre-2005) in public green zones. This, when coupled with the intensive emigration from the city, has resulted in an approximate 30% drop in population size over the past twenty years, which has resulted in inefficient utilisation of built-up areas. The city is spread and dispersed over large areas, with a limited population that occupies the buildings and infrastructure. The GCAP indicators do not adequately reflect such issues.

The related stakeholder feedback, presented in Table 4-32, reinforces the factors that put Pressure from the land use sector is exerted by issues including lack of integrated land use planning and urban planning and sporadic land use development leading to urban sprawl.

Table 4-32 - Stakeholder feedback on land use

Rank	Average Score	Challenge
1	2.00	Lack of complex land use and urban planning
2	2.88	Land use data collection or monitoring limited process
3	2.63	Planning guides, tools and capacity absence
4	2.63	Development of irrational land use, which yields to urban area expansion

The stakeholder feedback relating to green space, biodiversity and ecosystems was presented in Table 4-9 of Section 4.1.1.3. It referred to a number of specific Pressure related challenges, specifically the following challenges, which policy responses are insufficient to address:

- Insufficient provision of green areas and disconnected network of Green Infrastructure;
- Destruction of nursery-gardens due to illegal construction and expansion of constructed areas;
- Sporadic land use development leading to urban sprawl; and
- Dilapidated and poorly maintained public water infrastructure (blue infrastructure).

Additional challenges that were identified after the stakeholder consultation, and so were not ranked, include:

- Absence of disease prevention measures and regular care of biodiversity;
- Average annual growth rate of built up areas; and
- Percentage of urban development that occurs on existing urban land rather than on greenfield land.

A key challenge is the **destruction of nursery-gardens**, as identified by stakeholders. They are an organic part of the city planning yet their destruction results in a deterioration of the quality of the environment, which has a negative impact on the health of the population. Even partial destruction of the green zone of the city contributes to elimination of the protective and ecological functions of the nursery-gardens, which have been nurtured and invested in for generations.

4.2. Emerging action priority areas in Gyumri

Based on the analysis presented above and the identified Green City challenges, a number of action priority areas emerge that the GCAP has to address in order to improve the state of Gyumri's environment comprehensively. Table 4-33 sets out action priority areas for each environmental topic and sector.

Table 4-33 – Priority environmental challenges by topic and sector and action priority areas

Environmental topic / sector		Challenge	Action priority areas
Environmental topic areas	Air quality and mitigation of GHG emissions	High level of dust pollution Emerging threat from daily concentration of sulphur dioxide High level of per capita CO_2 emissions and GDP carbon intensity Limited air quality data and monitoring	**Transport:** Improve the provision for public transport and non motorised transport **Transport:** Enhanced management and control of fossil fuelled vehicles **Buildings, energy and lighting:** Reduce consumption from buildings and street lighting **Land use:** Increase greening of the city **Air quality:** Consider measures to minimise dust pollution **Air quality:** Improve air quality and pollution monitoring
	Water resource	Ammonium (NH_4) concentration in rivers and lakes – Akhuryan River Inefficient surface water quality monitoring	**Water:** Reduce overall levels of non-revenue water **Water**: Improve the quality of the wastewater collection network **Water:** Enhance overall wastewater treatment capacity **Water:** Improve the overall efficiency of surface water quality monitoring **Water:** Promote water usage behaviours by industry, citizens and municipal authorities **Solid waste:** Improve control and management of the disposal of solid and hazardous waste
	Soils	Number of polluted and potentially polluted areas Limited soil data availability and lack of monitoring	**Solid waste**: Improved treatment of industrial wastewater **Solid waste**: Improve control and management of the disposal of solid and hazardous waste **Industry**: Remediation of soils in abandoned industrial lands and sites of unfinished construction **Soil**: Soil quality data collection monitoring
	Green space, biodiversity and ecosystems	Insufficient size of green areas/low green area/inhabitant ratio Insufficient biodiversity data/lack of monitoring	**Land use**: Regulation of illegal construction **Land use**: Urban planning and green infrastructure provision **Land use**: Plan for increased density **Water**: Maintenance and upgrading of public water infrastructure

Environmental topic / sector		Challenge	Action priority areas
			Solid waste: Limited material efficiency and lack of recycling
	Adaptation and resilience to natural disasters	Estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP High percentage of public infrastructure at risk High percentage of households at risk Low awareness and preparedness to natural disasters	High potential social, economic and infrastructure losses from natural disasters No inclusion of climate adaptation and disaster resilience in strategies and plans
Sectors	Transport	High average age (total and by vehicle type), level of maintenance and amount of use of car fleet Inadequate fuel standards for light passenger and commercial vehicles (Euro 4) High and increasing modal share of private vehicles Low kilometres of road dedicated exclusively to public transport or non-motorised transport) Poor public transport infrastructure and services Inefficient transport sector management	Improve the provision for public transport Improve the provision for walking and cycling Better overall management of transport Greater availability and monitoring of transport data Improve awareness and promotion of sustainable transport Enhance regulation of fossil fuelled vehicles
	Buildings, energy and lighting	High levels of electricity and heating consumption in non- and residential buildings High levels of electricity used for streetlighting per kilometre of road Lack of public awareness on energy efficiency and renewable energy Lack of green building practice and certification Limited investment in energy efficiency and renewable energy	Improve awareness of energy efficiency and renewable energy Improve energy and heat efficiency in buildings and public infrastructure Increase green building practice and certification Increase investment in renewable energy
	Industry	Low industrial material efficiency High levels of waste and pollution Lack of policy/ regulatory tools to promote or mandate industrial resource efficiency and cleaner production Lack of dialogue and information flow between industry and the city	Improve industrial material efficiency Untreated industrial wastewater Develop policies and regulations to manage resource efficiency and waste pollution Strengthen co-operation, knowledge transfer and dialogue between city and industry

Environmental topic / sector		Challenge	Action priority areas
	Solid waste	High percentage of Municipal solid waste (MSW) which is disposed of in open dumps, controlled dumps, or bodies of water or is burnt (Percentage of MSW which is disposed of in expired landfill sites) Low percentage of MSW and other waste (including Hazardous Waste (HW)) disposed of and landfilled in EU-compliant sanitary landfills Low percentage of collected MSW composted Low proportion of MSW and industrial waste that is sorted and recycled Limited remaining life of current landfills	Enhance the infrastructure and associated processes to control and manage the disposal of solid waste Enhance the infrastructure and associated processes to control and manage the disposal of hazardous waste Enhance the infrastructure and associated processes to increase the amount of recycled of waste materials Increase domestic awareness of and promote recycling of waste
	Water	High water consumption per capita and per unit of city GDP Inadequate wastewater collection network and wastewater treatment capacity Low percentage of residential, industrial and commercial wastewater, and wastewater from energy generation activities, that is treated according to applicable national standards Excessively high levels of NRW in the water supply network. Inefficient water usage behaviours and limited data availability and monitoring	*Refer to action priority areas for water resources under environmental topics*
	Land use	Lack of integrated land use planning and urban planning Lack of planning guidance, tools and capacity Limited land use data collection process or monitoring Sporadic land use development leading to urban sprawl Insufficient provision of green areas and disconnected network of green Infrastructure Destruction of nursery-gardens due to illegal construction and expansion of constructed areas Average annual growth rate of built up areas Low percentage of urban development that occurs on existing urban land rather than on greenfield land	Improve land use data collection and monitoring Adopt integrated approaches to urban planning Build capacity on integrated urban planning and develop guidelines and tools Plan for increased density to avoid urban sprawl

5. Green City vision, strategic objectives and actions

This chapter summarises Step 2 of the GCAP process, 'Green City Action Plan Development and Adoption.' It features the GCAP's visions, strategic objectives, operational objectives and mid-term targets, which were based on the key challenges and action priority areas outlined in the previous chapter. These are followed by details of the short-term actions and the prioritisation thereof.

5.1. The GCAP framework

Responding to the identified green city challenges, a holistic green city vision has been developed for Gyumri. The city-wide vision statement takes into consideration the identified green city challenges and blends these with the broader aspiration of how the city wants to develop in the future, shaping the green ideals and aspirations. The vision statement also takes into consideration the wider policy agenda identified with the political framework reporting, as well as feedback from city officials and stakeholders at GCAP workshops. This will help to create ownership and backing for the GCAP from across the City Administration.

The city vision sets the broad direction for Gyumri's green transformation. The GCAP framework is a tool that guides the city through this process by breaking it down into five elements. These were presented in Chapter 2 (Figure 2-5). Specifically, visions for each of the environmental topic areas and sectors were identified and translated into environmental strategic objectives, which were based on the challenges identified through State indicators. These are supported by operational objectives which point to the urban sectors that can address each strategic objective. Operational objectives are based on challenges identified through Pressure and Response indicators; and within these sectors short-term actions were developed and prioritised. When implemented, they therefore contribute towards mid-term and long-term targets based on the Indicator Database.

Table 5-1 overleaf presents visions, strategic objectives as well as mid-term and long-term targets in detail.

GCAP vision for Gyumri

"To make Gyumri's environment healthier and more liveable for its citizens by improving air quality, water resource and land use, preserving ecosystems and implementing climate change mitigation and adaptation measures. It is also to enable economic and technological growth, creating jobs and improving livelihoods for the citizens of Gyumri, while ensuring the adoption of green economy, sustainability and resilience principles with the overall goal of making Gyumri's environment safe, clean and green and of innovating to ensure the prosperity and happiness of the entire Gyumri community."

Table 5-1 - Topic-based visions, strategic objectives, operational objectives and targets

<table>
<tr><th>Priority environmental challenge topic</th><th>Vision, strategic objectives, targets</th><th>Operational objectives</th></tr>
<tr><td rowspan="14">1. Air quality and mitigation of GHG emissions</td><td colspan="3"><u>Air quality and GHG emissions resources vision statement:</u>
Gyumri will have clean, healthy air quality throughout the city and will promote the adoption of lower carbon, low-energy solutions across all sectors to lower GHG emissions. The city will have better collection, analysis and management of data to better understand and manage air quality</td><td rowspan="14">• Increase the modal share of walking, cycling and public transport
• Enhance the energy efficiency of the vehicle fleet
• Reduce air pollutant emissions from, and carbon intensity of, energy generation
• Reduce the energy consumption of all buildings and streetlighting
• Promote green procurement and performance contracting practices
• Improve the scope and quality of air quality data collection and procedures for monitoring</td></tr>
<tr><td colspan="3">Strategic objective:
SO_AQGHG: Reduced volume of dust and other air pollutant emissions (local and global)</td></tr>
<tr><td>Indicator</td><td>MT Target</td><td>LT Target</td></tr>
<tr><td>Average annual concentration of dust</td><td>0.15 µg/m^3</td><td>10 µg/m^3-PM2.5
20 µg/m^3-PM10</td></tr>
<tr><td>Annual CO_2 emissions per unit of GDP</td><td>20% reduction on 2014 levels</td><td>30% reduction on 2014 levels</td></tr>
<tr><td>Annual CO_2 equivalent emissions per capita</td><td>3.0 t/yr/capita</td><td>2.5 t/yr/capita</td></tr>
<tr><td>Electricity consumption in industries per unit of industrial GDP</td><td>5% reduction on 2015 levels</td><td>10% reduction on 2015 levels</td></tr>
<tr><td>Private vehicle modal share in commuting</td><td>80%</td><td>50%</td></tr>
<tr><td>Non-motorised transport modal share in total trips</td><td>2%</td><td>5%</td></tr>
<tr><td>Share of public transport fleet run by electric, hybrid fuel cell, Liquefied Petroleum Gas (LPG) and Compressed Natural Gas (CNG) energy</td><td>60%</td><td>70%</td></tr>
<tr><td>Share of municipal vehicles operating on electricity</td><td>20%</td><td>50%</td></tr>
<tr><td>Energy consumption in buildings</td><td>23 kWh</td><td>21 kWh</td></tr>
<tr><td>Energy consumption from street lighting</td><td>25,000 kWh/km</td><td>20,000 kWh/km</td></tr>
<tr><td>Share of air pollutant sources identified and monitored</td><td>30%</td><td>100%</td></tr>
<tr><td>Modes of transport subject to annual data collection</td><td>100%</td><td>100%</td></tr>
</table>

<table>
<tr><th>Priority environmental challenge topic</th><th colspan="3">Vision, strategic objectives, targets</th><th>Operational objectives</th></tr>
<tr><td rowspan="12">2. Water resource</td><td colspan="3"><u>Water resource vision statement:</u>

Gyumri will have a clean water supply and an efficient wastewater and stormwater collection system that are accessible to everyone and that comply with EU standards. The water usage behaviours of domestic and non-domestic users will also be improved</td><td rowspan="12">• Develop and promote initiatives to manage water consumption
• Enhance the water supply system and reduce overall wastage of NRW
• Increase WW (including sewerage), stormwater, shallow groundwater and MSW control, collection and treatment capacity
• Improve the protection of freshwater sources
• Improve data availability, quality and monitoring relating to waste, surface and shallow groundwater, and surface water</td></tr>
<tr><td colspan="3">Strategic objective:
SO_WR: Enhanced water supply, quality (including surface water) and efficiency of use, and reduced overall wastage of NRW</td></tr>
<tr><td>Indicator</td><td>MT Target</td><td>LT Target</td></tr>
<tr><td>Ammonium (NH_4) concentration in rivers and lakes</td><td>0.4-1.2 mg/l</td><td><0.4 mg/l</td></tr>
<tr><td>Industrial water consumption as percentage of total urban water consumption</td><td>25%</td><td>17%</td></tr>
<tr><td>Coverage and efficiency of water supply networks is improved through plans and investment</td><td>75%</td><td>100%</td></tr>
<tr><td>Annual number of storm water or sewerage overflows per 100 km of network length</td><td>50% decrease on 2017 levels</td><td>20% decrease on 2017 levels</td></tr>
<tr><td>Percentage of residential and commercial WW that is treated according to applicable national standards</td><td>30%</td><td>60%</td></tr>
<tr><td>Non-revenue water</td><td>25-35%</td><td><25%</td></tr>
<tr><td>Water consumption per unit of city GDP</td><td>0.4 m^3/year</td><td><0.2 m^3/year</td></tr>
<tr><td>Water saving reuse is encouraged through awareness campaigns</td><td>Developed communication strategy and awareness campaign</td><td>Implemented communication strategy and awareness campaign</td></tr>
<tr><td>Water assets, including information about their condition and performance, featured in a GIS database by 2021</td><td>50%</td><td>100%</td></tr>
<tr><td>Water consumption per capita for domestic users</td><td>120 litres per head per day</td><td>115 liters per head per day</td></tr>
</table>

<table>
<tr><th>Priority environmental challenge topic</th><th colspan="3">Vision, strategic objectives, targets</th><th>Operational objectives</th></tr>
<tr><td rowspan="6">3. Green space, biodiversity and ecosystems</td><td colspan="3"><u>Green space, biodiversity and ecosystems vision statement:</u>
Gyumri will be the green capital of Armenia, with connected green space delivered in line with international best practice, which will support enhancement of biodiversity and ecosystems. Green infrastructure will be used for amenity as well as function</td><td rowspan="5">• Improve the scope and quality of biodiversity related data collection and procedures for monitoring
• Enhance the extent, quality and diversity of green spaces and other green infrastructure
• Apply a sequential approach (brownfield, infill, greenfield) to urban development to avoid sporadic development</td></tr>
<tr><td colspan="3">Strategic objective:
SO_GSBIO: Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city</td></tr>
<tr><td>Indicator</td><td>MT Target</td><td>LT Target</td></tr>
<tr><td>Ratio of open green area per inhabitant</td><td>6 m^2/inhabitant</td><td>10.5 m^2/inhabitant</td></tr>
<tr><td>Diversity of bird’s population growing in number</td><td>Annual increase</td><td>Annual increase</td></tr>
<tr><td>Municipal staff in the planning department with up-to-date training in related policy and planning</td><td>100%</td><td>100%</td></tr>
<tr><td>Share of land use and environment data collected and made accessible on a GIS platform</td><td colspan="2">50%</td><td></td></tr>
<tr><td rowspan="6">4. Soils</td><td colspan="3"><u>Soils vision statement:</u>
The soil quality in Gyumri will be remediated, maintained and enhanced to support human and natural life</td><td rowspan="5">• Improve the control (including by recycling) and treatment of solid and hazardous waste and WW
• Remediate abandoned industrial lands and construction sites
• Increase data collection, measurement and monitoring of soil quality</td></tr>
<tr><td colspan="3">Strategic objective:
SO_SL: Protected, enhanced and rehabilitated soil quality across the city</td></tr>
<tr><td>Indicator</td><td>MT Target</td><td>LT Target</td></tr>
<tr><td>Percentage of MSW and other waste (including Hazardous Waste (HW)) disposed of and landfilled in EU-compliant sanitary landfills</td><td>95%</td><td>100%</td></tr>
<tr><td>Proportion of MSW that is sorted and recycled</td><td>25%</td><td>100%</td></tr>
<tr><td>Share of industrial waste recycled as a share of total industrial waste produced</td><td>25%</td><td>50%</td></tr>
<tr><td>Share of waste producers covered by the fee-based volume-based waste disposal service</td><td>80%</td><td>100%</td></tr>
</table>

<table>
<tr><th>Priority environmental challenge topic</th><th colspan="3">Vision, strategic objectives, targets</th><th>Operational objectives</th></tr>
<tr><td rowspan="2"></td><td>Number of polluted and potentially polluted areas</td><td>40% reduction on 2017 levels</td><td>80% reduction on 2017 levels</td><td></td></tr>
<tr><td>Share of contaminated sites that are inventoried, mapped and assessed</td><td colspan="2">50%</td><td></td></tr>
<tr><td rowspan="8">5. Adaptation and resilience to natural disasters</td><td colspan="3"><u>Resilience and adaptation to climate change vision statement:</u>
Gyumri will increase resilience to weather extremes and other natural disasters (such as earthquakes) and in so doing secure sustainable development gains</td><td rowspan="8">• Increase the resilience of water infrastructures to disasters
• Promote sequential development of green infrastructures for enhanced resilience to extreme weather events
• Assessment of climate risks, planning of disaster risk reduction actions</td></tr>
<tr><td colspan="3">Strategic objective:
SO_AR: Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td></tr>
<tr><td>Indicator</td><td>MT Target</td><td>LT Target</td></tr>
<tr><td>Percentage of public infrastructure at risk</td><td>12%</td><td>10%</td></tr>
<tr><td>Percentage of households at risk</td><td>12%</td><td>10%</td></tr>
<tr><td>Estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP</td><td>1%</td><td>0.5%</td></tr>
<tr><td>Average share of population undergoing prolonged power outage in case of climatic extremes over the past 5 years</td><td>5%</td><td>3%</td></tr>
<tr><td>Funding provided for Disaster Disk Reduction and resilience enhancement in GCAP lifetime</td><td>Sufficient for implementation for local DRR plans</td><td>Sufficient for implementation for local DRR plans</td></tr>
</table>

5.2. Green City Actions

This section presents a suite of **64 Green City Actions (GCAs).** The actions have been prioritised using a the three-step prioritisation process outlined in Chapter 2, including a technical assessment of environmental, economic and social benefits, a stakeholder prioritisation as well as a political validation.

A total of 46 actions are identified as 'priority actions' with a further 18 'additional actions' presented in Appendix A.

The GCAs are the primary vehicle for Gyumri's green city transformation. While responding directly to strategic objectives, they also contribute to the achievement of mid and long-term targets. The GCAs were developed specifically for Gyumri based on interactive consultation with local stakeholders and Gyumri Municipality. While strategic objectives are set at the level of environmental topic, the actions are set on the level of sectors covering:

- Transport;
- Buildings, energy and lighting;
- Solid waste;
- Water;
- Industry;
- Land use; and
- Cross-cutting.

Cross-cutting actions form the only exception as they are not organised under one of the urban sectors but address environmental challenges directly. The development of a municipal air quality monitoring system is an example for such a cross-cutting action.

Actions are also categorised under seven different classifications, which are presented opposite.

Table 5-2 - Action classifications

	Monitoring, data collection and studies: the collection of new data, the monitoring of information and implementation, coupled with the undertaking of focussed studies.
	Awareness, demonstration and capacity building: public awareness initiatives which includes public information campaigns, community projects and engagement with local businesses to deliver local improvements to the environment. Capacity building initiatives relate to actions which enable the Municipality and other formal actors to improve access to information, to build skills and knowledge and to improve decision making and management processes.
	Standards, guidelines and regulations: prerequisite standards, guidelines and regulations, which will be implemented by Gyumri Municipality, Shirak Marz Administration or the Armenian National Government (including ministries, agencies or other statutory bodies).
	Strategies, plans and programmes: strategies, plans and programmes which will provide front end feasibility and planning, to assess in further detail the viability of subsequent/follow on actions and will act as a lead into major capital investment.
	Public Procurement: internal procedures, procurement rules, technical specifications and tendering protocol revisions to enable procurement of environmentally friendly, energy efficient, sustainable and "green" goods and services with minimal lifecycle cost.
	Capital investment in new city assets, infrastructure and technologies: actions which involve direct investment in new infrastructure, assets (for example, rolling stock) and technologies (for example, web applications).
	Capital investments in existing city assets, infrastructure and technologies: actions which involve direct investment in existing infrastructure, assets (for example, rolling stock) and technologies (for example, web applications). This includes upgrading of infrastructure as applicable.

The structure of each sub-section in this chapter is detailed below.

Firstly, short-term actions are presented in tabular format, in relation to the GCAP framework, outlined in Chapter 5, identifying their link to strategic objectives and mid-term targets and thus indicating which environmental challenges they address. Priority actions are clearly highlighted and appear first in each table, followed by the additional actions.

Secondly, a programme is presented for each sector indicating the action programme sequencing, as well as linkages between actions. The sector programmes focus on the first GCAP phase from 2020 to 2025. It is worth noting that a six-year period is presented for the first (short-term) period, as it likely that 2020 will be used a transition year for the city to fully absorb the plan into its five-year development plan.

Thirdly, action proformas for each priority and additional action are presented, with the former in the main body of the document and the latter in Appendix A. Each action proforma contains the following information:

- Action reference;
- Action title;
- Action description;
- Action alignment with strategic objectives;
- Action benefits;
- Action CAPEX;
- Action OPEX;
- Action funding options;
- Action implementation start and end dates;
- Action owner;
- Implementing partner(s); and
- Action stakeholders.


“Gyumri will have a transport sector that promotes the increased use of public transport and non-motorised modes, has resilient infrastructure, and that adopts new technology and efficiently uses transport data.”

5.2.1. Transport

For the transport sector in Gyumri, 14 actions have been developed through the GCAP process, in conjunction with the city municipality and stakeholders. Eight out of the 14 actions are included within the prioritised list of actions, with the remaining six included as additional actions.

All transport actions put forward for Gyumri aim to improve air quality and mitigate GHG emissions. Additionally, some actions, particularly those relating to the provision of new infrastructure, will contribute to making Gyumri more resilient and support its adaptive capacity to climate change.

The priority transport actions focus on **implementing a new, modern and operationally efficient public transport service**, built on the foundations of new bus stop infrastructure, an upgraded public transport vehicle fleet and a revised operator model. A key focus for public transport will be the implementation of a cleaner public transport vehicle fleet, contributing to improvements in localised air pollution and a mode shift away from private vehicle trips. Modernisation of the public vehicle fleet will also open up opportunities for private sector investment. It should be noted that the EBRD is in the process of implementing the programme, "Modernization of Gyumri Inter-Community Passenger Traffic and Service Rolling Stock program", as part of a loan and grants framework to upgrade the public transport network in Gyumri. In particular, it seeks to import and operate medium-sized buses, introduce a single ticket system, install new bus stops and thereby ensure a well-managed public transport system.

Improvements to **cycle infrastructure** are also a key focus of the plan, with new cycle lanes and cycle parking needed and desired throughout the city. As demonstrated in GCAP workshops, there is a desire to promote cycling throughout the city, which will also contribute to an increase in non-motorised mode share. **Improved pedestrian wayfinding infrastructure** is also to be implemented, specifically through the introduction of a city-wide pedestrian wayfinding signage network. This will encourage a more holistic approach to the planning of new cultural and tourist developments, in conjunction with areas of the city that are better suited to walking.

In addition to the implementation of physical infrastructure, it also important that Gyumri consolidates its sustainable transport policies and actions into a consolidated **Sustainable Urban Mobility Plan or SUMP**. The SUMP will be drafted in conjunction with a **programme of improved data collection** (a major challenge across all sectors in Gyumri), along with the creation of a new, multi-modal transport model, which is an industry recognised tool that can be used to test the impact and benefits of large-scale transport interventions, including policy and/or new infrastructure.

Table 5-3 - Transport actions

Action reference	Action title	Strategic objectives	Alignment with mid-term targets for 2025
Priority actions			
A_TR_01	New public transport network operator model and integrated tariffs and ticketing	SO_AQGHG SO_AR	Reduction of average annual concentration of dust to 0.15 µg/m^3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Increase in the hare of public transport fleet run by electric, hybrid fuel cell, Liquefied Petroleum Gas (LPG) and Compressed Natural Gas (CNG) energy to 60% Reduction of private vehicle modal share in commenting to 80%
A_TR_02	Upgrading bus stop infrastructure including with Real Time Passenger Information (RTPI)	SO_AQGHG SO_AR	Reduction of average annual concentration of dust to 0.15 µg/m^3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Increase in the hare of public transport fleet run by electric, hybrid fuel cell, Liquefied Petroleum Gas (LPG) and Compressed Natural Gas (CNG) energy to 60% Reduction of private vehicle modal share in commenting to 80% Reduction of public infrastructure at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1%
A_TR_04	New cycle lanes and cycle parking infrastructure	SO_AQGHG SO_AR	Reduction of average annual concentration of dust to 0.15 µg/m^3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Increase non-motorised transport modal share in total trips 2% Reduction of public infrastructure at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1%
A_TR_05	City-wide pedestrian wayfinding signage network	SO_AQGHG SO_AR	Reduction of average annual concentration of dust to 0.15 µg/m^3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Increase non-motorised transport modal share in total trips 2% Reduction of public infrastructure at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1%
A_TR_06	Promotional campaigns for walking and cycling	SO_AQGHG	Reduction of average annual concentration of dust to 0.15 µg/m^3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Increase non-motorised transport modal share in total trips 2%

Action reference	Action title	Strategic objectives	Alignment with mid-term targets for 2025
A_TR_09	Sustainable Urban Mobility Plan (SUMP) for Gyumri	SO_AQGHG SO_AR	Reduction of average annual concentration of dust to 0.15 µg/m^3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of private vehicle modal share in commenting to 80% Increase in the hare of public transport fleet run by electric, hybrid fuel cell, Liquefied Petroleum Gas (LPG) and Compressed Natural Gas (CNG) energy to 60% Increase of non-motorised transport modal share in total trips to 2% Increase of share of municipal vehicles operating on electricity to 20% Increase modes of transport subject to annual data collection to 100% Reduction of public infrastructure at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1% Increase funding provided for DRR and resilience enhancement in GCAP lifetime to a sufficient level for the implementation of local DRR plans
A_TR_12	City-wide data collection programme and transport model	SO_AQGHG SO_AR	Reduce average annual concentration of dust to 0.15 µg/m^3 Reduce annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Increase modes of transport subject to annual data collection to 100%
A_TR_14	Renewal of public bus fleet with low emission vehicles	SO_AQGHG	Reduce average annual concentration of dust to 0.15 µg/m^3 Reduce annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of private vehicle modal share in commenting to 80% Increase in the hare of public transport fleet run by electric, hybrid fuel cell, Liquefied Petroleum Gas (LPG) and Compressed Natural Gas (CNG) energy to 60%
Additional actions			
A_TR_03	New public transport hubs	SO_AQGHG SO_AR	Reduction of average annual concentration of dust to 0.15 µg/m^3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of private vehicle modal share in commenting to 80% Increase in the hare of public transport fleet run by electric, hybrid fuel cell, Liquefied Petroleum Gas (LPG) and Compressed Natural Gas (CNG) energy to 60% Reduction of public infrastructure at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1%

Action reference	Action title	Strategic objectives	Alignment with mid-term targets for 2025
A_TR_07	Pedestrianised city-centre streets	SO_AQGHG: SO_AR	Reduction of average annual concentration of dust to 0.15 µg/m^3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Increase non-motorised transport modal share in total trips 2% Reduction of public infrastructure at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1%
A_TR_08	Low Emission Zone (LEZ) for the centre of Gyumri	SO_AQGHG SO_AR	Reduction of average annual concentration of dust to 0.15 µg/m^3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Increase in the hare of public transport fleet run by electric, hybrid fuel cell, Liquefied Petroleum Gas (LPG) and Compressed Natural Gas (CNG) energy to 60% Reduction of private vehicle modal share in commenting to 80% Increase non-motorised transport modal share in total trips 3%
A_TR_10	City-wide car sharing scheme	SO_AQGHG SO_AR	Reduction of average annual concentration of dust to 0.15 µg/m^3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Increase modes of transport subject to annual data collection to 100%
A_TR_11	City-wide transport mobility application	SO_AQGHG	Reduce average annual concentration of dust to 0.15 µg/m^3 Reduce annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of private vehicle modal share in commenting to 80% Increase of non-motorised transport modal share in total trips to 2%
A_TR_13	Partial electrification of Municipality vehicle fleet	SO_AQGHG SO_AR	Reduce average annual concentration of dust to 0.15 µg/m^3 Reduce annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Share of municipal vehicles operating on electricity

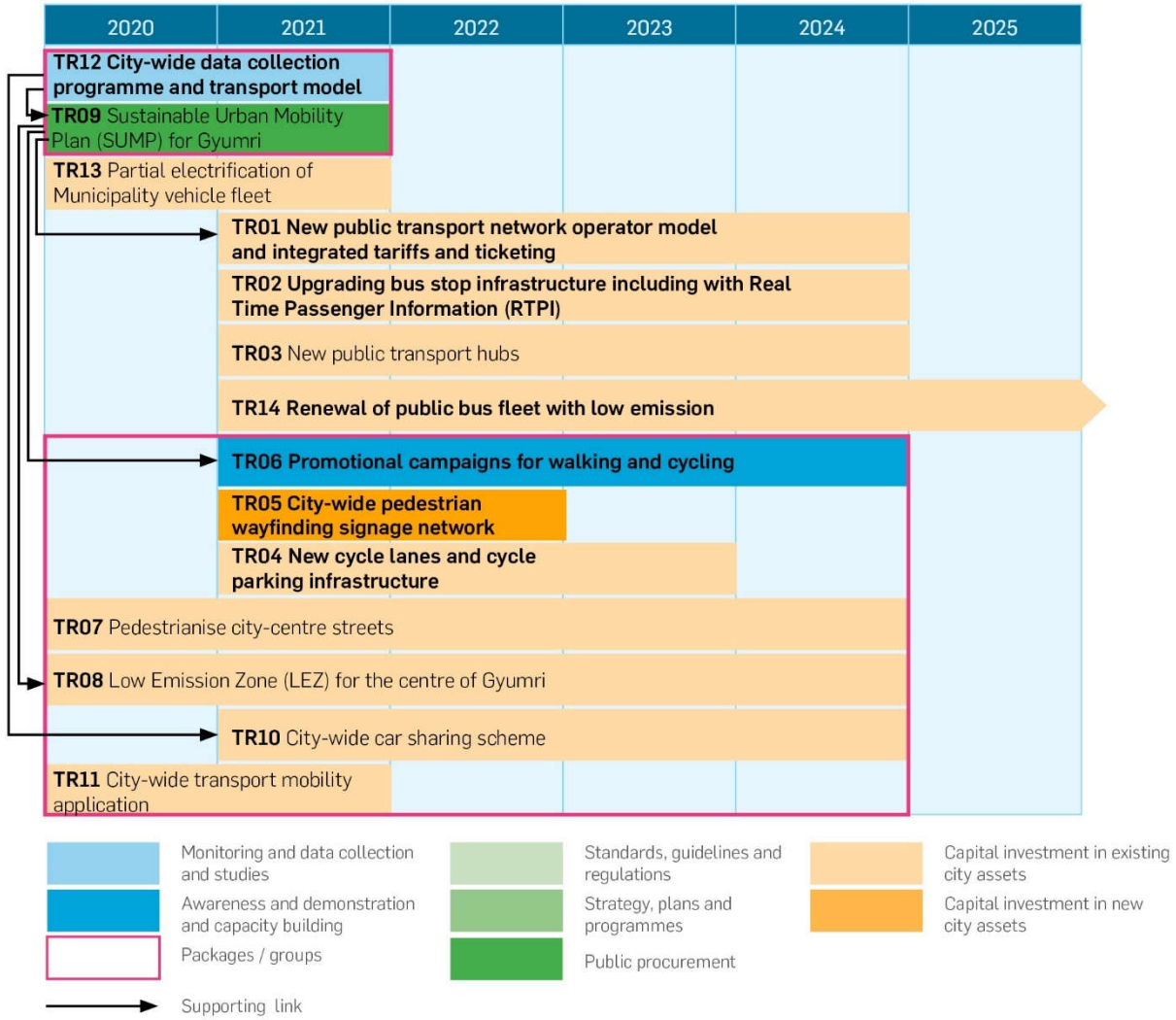


Figure 5-1 - Transport actions programme

Reference number
A TR 01

Title: New public transport network operator model and integrated tariffs and ticketing

Classification: Capital investment in new city assets

Description:

New bus operator model:

There is a high degree of inefficiency and poor service quality in bus service provision in Gyumri, including poor quality vehicles and an inefficient fare structure. A new bus operator model is required, with options for bus service contract types including gross cost or net cost. With gross cost contracts, the tendering authority pays an operator to provide services, retaining the passenger revenue and often specifying the routes and the types of vehicles. With net cost contracts, the operator takes on both the income risk and the cost risk but retains all passenger revenue. The action to update the city bus operator model would, as a minimum, cover the following:

- New commercial and contractual arrangements;
- Establishment of clear and measurable operating Key Performance Indicators (KPIs) and Service Level Agreements (SLAs);
- Refinement and rationalisation of bus routes;
- Development of updated, distance-based fare structure;
- Implementation of procurement standards related to vehicle quality; and
- Implementation of procurement standards related to vehicle emissions.

Integrated tariffs and ticketing:

Integrated tariffs and ticketing allow a passenger to transfer between different transport modes or buses operated by different service providers with a single ticket, which is valid for a complete journey. This promotes a seamless journey for users and can increase the attractiveness of public transport by simplifying switching between transport modes and by improving the efficiency of services. Integrated ticketing can be very efficient to introduce owing to the availability of electronic ticketing technologies such as smart card or magnetic stripe cards. The single electronic ticket is widely used in many cities globally. A good communication backbone is needed for the implementation of such a system. Also, the transaction will have to adhere to Armenia's national 'electronic money' regulation. The integrated ticketing system in Gyumri would primarily cover bus services but should be developed with consideration of other modes including rail.

<table>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters</td><td>Key benefits
• Social: improved access to services, enhanced social inclusion and green behaviours and awareness
• Economic: economic inclusion, economic returns for investor
• Environmental: enhanced air quality and reduced GHG emissions</td></tr>
<tr><td>CAPEX (EUR)
2,500,000
CAPEX (AMD)
1,325,000,000</td><td>Annual OPEX (EUR)
220,000
Annual OPEX (AMD)
116,600,000</td><td>Funding options
• National government
• IFI and donors
• Private sector</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - 2024</td></tr>
<tr><td>Action owner: Transport Department, Gyumri Municipality</td><td>Implementing partner(s): Public transport operators</td><td>Key stakeholders: Regional administration of Shirak, IFIs, national government</td></tr>
</table>

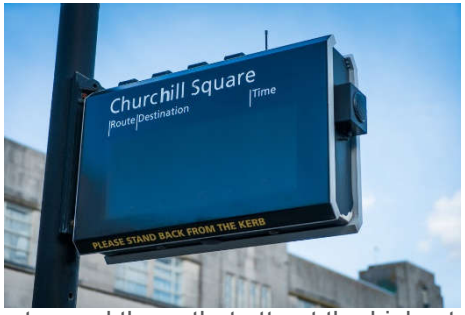
Reference Number
A_TR_02

Title: Upgrading bus stop infrastructure including with Real Time Passenger Information (RTPI)

Classification: Capital investment in existing city assets

Description

Upgrading of bus stop infrastructure:



The bus network and the quality of the supporting bus stop infrastructure makes a critical contribution to overall public transport infrastructure quality in the city, and its improvement can contribute towards increasing public transport patronage and promoting better overall accessibility to vital city amenities. Well-planned, designed and maintained bus stops promote inclusive bus services and in doing so reduce social isolation increasing the number of citizens who can use these services.

Any new bus stop infrastructure should be planned and designed in accordance with international good practice. The planning and design of bus stops will need to be based on a framework of street/ road types, where different layouts of bus stops are implemented depending on the classification of road. In the specific context of Gyumri, the current bus stop infrastructure needs upgrading. The stops that would be upgraded under this action would be located on the busiest routes and those that attract the highest levels of demand. It is proposed that 500 bus stops are upgraded in Gyumri.

Provision of Real Time Passenger Information:

Real Time Passenger Information is an automated system for supplying users of public transport with information about the nature and state of a public transport service, using real time information, derived from automatic vehicle location systems, which changes continuously because of actual events and is typically used during the course of a journey. In the specific context of Gyumri, it is proposed that a phased roll-out of RTPI systems takes place with the first implemented at the main bus station and then at bus stops on the most heavily utilised bus routes. The system should be installed at the same time as general renewal and upgrades of the bus stop infrastructure takes place.

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)		• Social: improved access to services, enhanced social inclusion and green behaviours and awareness • Economic: economic inclusion • Environmental: enhanced air quality and reduced GHG emissions
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters		
CAPEX (EUR) 4,000,000 **CAPEX (AMD)** 2,120,000,000	**Annual OPEX (EUR)** 200,000 **Annual OPEX (AMD)** 106,000,000	**Funding options** • National government • IFI and donors • Private sector
Implementation start and end date: 2020 - 2024		
Action owner: Transport Department, Gyumri Municipality	**Implementing partner(s):** Public transport operators	**Key stakeholders:** Regional administration of Shirak, IFIs, national government

Reference Number
A_TR_04

Title: New cycle lanes and cycle parking infrastructure

Classification: Capital investment in new city assets

Description

Implement cycle lanes:

In order for Gyumri to increase the modal share of cycling cycle lanes need to be introduced on the busiest streets. The design of the cycle lanes should consider factors including user experience, the existing mix of traffic, safety, visibility and integration with key land uses. There is currently no cycle lane provision within Gyumri and this proposal is to introduce approximately 60km of cycle lanes to promote cycling across the city. The routes would need to interface with critical sites such as the city centre bus station, train station, city centre attractions and workplace locations.

City-wide cycle parking network:

In line with international good practice, cycle parking facilities should be planned, designed and installed in Gyumri based on the following key principles:

- Visible and accessible – easy to find, well signed and within 20m to 30m of the destination;
- Safe and secure – secure frames and supported by Closed Circuit Television (CCTV);
- Easy to manage, maintain and monitor – able to support all types of bicycle and with robust and durable finishes;
- Consistently available – careful planning of numbers to ensure adequate supply is available;
- Connected – linked to the strategic network of routes and other services/modes (e.g. located at rail and bus stations);
- Covered – particularly important for long stay cycle parking; and
- Attractive – high quality fixtures and fit into the surrounding environment.

Cycle parking needs to be located adjacent to the main cycle route network and at strategic points throughout the city – preferably close to areas where there are significant concentrations of tourists, commuters and/ or students. It is proposed that 40 cycle parking spaces are provided per 1km of cycle route, which equates to approximately 2,400 cycle spaces in the city.

<table>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)</td><td rowspan="3">Key benefits
• Social: enhanced social inclusion and green behaviours and awareness, reduced health risks
• Economic: economic inclusion
• Environmental: enhanced air quality and reduced GHG emissions</td></tr>
<tr><td colspan="2">SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)</td></tr>
<tr><td colspan="2">SO_AR Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td></tr>
<tr><td>CAPEX (EUR)
Cycle Lanes: 3,000,000
Cycle parking: 240,000
CAPEX (AMD)
Cycle Lanes 1,590,000,000
Cycle parking: 127,200,000</td><td>Annual OPEX (EUR)
Cycle Lanes: 148,000
Cycle parking: 12,000
Annual OPEX (AMD)
Cycle Lanes: 78,520,000
Cycle parking: 6,280,000</td><td>Funding options
• Municipality budget
• IFI and donors
• Private sector</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - 2024</td></tr>
<tr><td>Action owner: Transport Department, Gyumri Municipality</td><td>Implementing partner(s): Private sector</td><td>Key stakeholders: Regional administration of Shirak, NGOs, IFIs</td></tr>
</table>

<table>
<tr><td colspan="3">Reference Number
A_TR_05</td></tr>
<tr><td colspan="3">Title: City-wide pedestrian wayfinding signage network</td></tr>
<tr><td colspan="3">Classification: Capital investment in new city assets</td></tr>
<tr><td colspan="3">Description
Gyumri is a relatively flat city which makes it suitable for walking. The introduction of a city-wide pedestrian wayfinding network would help to encourage and promote walking, provide enhanced connectivity between city locations in terms of accessibility and visibility, and would provide a consistent approach to walking and wayfinding information. The wayfinding network could also be integrated with other pedestrian focussed infrastructure improvements such as improved pedestrian crossings with lower curbing for mobility impaired access, wider footpaths and provision of all-weather pedestrian access/surface improvements. The wayfinding network would consist of clear and consistent signage and floor markings as applicable, including strategically positioned on-street navigation posts, which would feature different levels of information. The signage would feature components including ‘heads-up mapping’ (where the signage orientation corresponds with the direction that the user is facing, as opposed to following the traditional true-north orientation), walking times, walking directions, building locations, finder mapping, integrated transport nodes and street names. In the specific context of Gyumri, to ensure that any potential wayfinding signage is appropriate and user friendly, it is recommended that initially a small area of the city would be selected for piloting, where the network signage can be tested and feedback from users collated to enhance the product. This pilot would be conducted in an appropriate location within the city centre, which should have high levels of pedestrian footfall and key points of interest. Once piloted, there would be a wider rollout of the network markings and signage, which would ideally emerge from a wider city level pedestrian and wayfinding strategy. It is envisaged that the signage network could be supported by up to 50 maps and signs.</td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)
SO_AR Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td><td>Key benefits
• Social: enhanced social inclusion and green behaviours and awareness, reduced health risks
• Economic: economic growth
• Environmental: enhanced air quality and reduced GHG emissions</td></tr>
<tr><td>CAPEX (EUR)
250,000
CAPEX (AMD)
132,500,000</td><td>Annual OPEX (EUR)
15,000
Annual OPEX (AMD)
7,950,000</td><td>Funding options
• National government
• IFI and donors
• Private sector</td></tr>
<tr><td colspan="3">Implementation start and end date: 2021 - 2023</td></tr>
<tr><td>Action owner: Transport Department, Gyumri Municipality</td><td>Implementing partner(s): Private sector</td><td>Key stakeholders: Regional administration of Shirak, local businesses, NGOs, IFIs, national government</td></tr>
</table>

Reference Number: A_TR_06

Title: Promotional campaigns for walking and cycling

Classification: Awareness, demonstration and capacity building

Description

City level cycling promotional campaign:

This action will identify, design and deliver the most appropriate forms of promotional campaigns for Gyumri with the objective of increasing cycling across the city. The actions that could be undertaken to encourage more cycling in the city include:

- City/government/workplace incentive schemes to buy bicycles;
- Promoting cycling through various media outlets such as distributing leaflets, TV and radio advertisement and on-street billboards;
- Run promotional campaign in workplaces to encourage cycle to work option;
- City-wide cycling month;
- Road safety awareness advice for cyclist;
- Cycling pocket guides; and
- Establishment of cycling groups.

The promotional campaign should be integrated with other demand management initiatives and phased to coincide with wider overarching improvements proposed to Gyumri's cycling infrastructure (such as A TR 04).

City level walking promotional campaign:

There is a relatively high level of walking in Gyumri, which is driven by Gyumri's relatively flat topography and general walkability. In conjunction with other non-motorised transport development initiatives, the objective will be to promote initiatives to actively promote walking in Gyumri. The campaign could include:

- Citywide walking month;
- Walk to school days/weeks;
- Car-free days on certain streets in the city;
- Restricted car access (routes/streets/zones/timings);
- Pedestrian safety awareness advice; and
- Walking pocket guides.

<table>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)</td><td>Key benefits
• Social: enhanced social inclusion and green behaviours and awareness, reduced health risks
• Economic: economic inclusion
• Environmental: enhanced air quality and reduced GHG emissions</td></tr>
<tr><td>CAPEX (EUR)
300,000
CAPEX (AMD)
159,000,000</td><td>Annual OPEX (EUR)
10,000
Annual OPEX (AMD)
5,300,000</td><td>Funding options
• Municipality budget
• IFI and donors</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - 2021</td></tr>
<tr><td>Action owner: Transport Department, Gyumri Municipality</td><td>Implementing partner(s): Private sector</td><td>Key stakeholders: Regional administration of Shirak, local businesses, Universities, NGOs, public and private transport operators, IFIs</td></tr>
</table>

Reference Number
A_TR_09

Title: Sustainable Urban Mobility Plan (SUMP) for Gyumri

Classification: Strategies, plans and programmes

Description

A SUMP is a plan, dedicated to transport, that contains integrated, sustainable transport solutions, across all modes of transport, relevant to a specific functional urban area, in this case the city of Gyumri and its hinterland. SUMPs are developed using a participatory process and in cooperation with all levels of government and relevant authorities, representatives of all modes of transport, citizens and other city stakeholders. This SUMP would be linked to this GCAP and also the update of the wider city master plan (A LU 01), the anticipated increase of the traffic flow related to set up of logistical centre(s) and Customs Hub, and other plans and strategies that promote carbon reductions in the city. The main aim of a SUMP is to improve the accessibility of urban areas and provide high-quality and sustainable mobility and transport to, through and within the urban a rea. It contains a long-term vision and clear implementation plan, an assessment of current and future performance of the urban transport system, an integrated set of technical, infrastructure, policy-based and soft measures to improve performance and cost-effectiveness, and a monitoring process that can be used as the basis for a review of implementation.

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)		• Social: enhanced access to services, safety and social resilience • Economic: economic growth and inclusion • Environmental: enhanced air quality and reduced GHG emissions and increased resilience to climate change
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters		
CAPEX (EUR) 1,000,000 **CAPEX (AMD)** 530,000,000	**Annual OPEX (EUR)** 0 **Annual OPEX (AMD)** 0	**Funding options** • Municipality budget • IFI and donors
Implementation start and end date: 2020 - 2021		
Action owner: Transport Department, Gyumri Municipality	**Implementing partner(s):** IFIs	**Key stakeholders:** Regional administration of Shirak, local businesses, NGOs, public and private sector transport operators, general public

Reference Number: A_TR_12

Title: City-wide data collection programme and transport model

Classification: Monitoring and data collection and studies

Description

City wide permanent traffic data collection system:

The action is to implement a permanent data collection system, linked to a central data repository, that collects data from the following devices/ using the following methods:

- Inductive loops buried under the road to record traffic flows (50 junctions);
- Automatic Number Plate Recognition (ANPR) cameras to monitor vehicular movements (50 cameras);
- CCTV camera mounted on specific section of the road network, to monitor behaviour (50 cameras);
- Annual collection and surveying of public transport and taxi ridership (every year);
- Origin and destination surveys (every year);
- Travel to work surveys (every year); and
- Utilisation of Global Positioning System (GPS) mobile phone data.

Civil works will be needed to install the above collection equipment – notably the inductive loops and the ANPR cameras. The location of the equipment should be on the key corridors that cater not only for intra-urban traffic movements but also the inter-urban and through city movements.

City level transport and traffic model:

A robust city-wide transport model will help the Municipality to forecast, simulate, assess and evaluate traffic and transport proposals, which will have a wide range of applications in wider city planning and evidence-based decision-making. There are a number of industry standard modelling platforms available that can be used as the basis for developing a multi-modal model. Availability of traffic data is key to the successful development of any of these model types. The first component of this action, the establishment of a permanent city-wide data collection system, will therefore be required to ensure the availability of the required information for the development and maintenance of the model. The city boundary should form the core model area and the rest of the city should be segmented into a number of internal zones by taking the locations of trip generators into account such as residential, commercial and industrial areas. The visitor and transit traffic through the city should be captured by incorporating wider external city zones.

<table>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)</td><td rowspan="3">Key benefits
• Social: enhanced access to services, safety and social resilience
• Economic: economic growth and inclusion
• Environmental: enhanced air quality and reduced GHG emissions</td></tr>
<tr><td colspan="2">SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)</td></tr>
<tr><td colspan="2">SO_AR Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td></tr>
<tr><td>CAPEX (EUR)
2,150,000
CAPEX (AMD)
1,139,500,000</td><td>Annual OPEX (EUR)
322,500
Annual OPEX (AMD)
170,925,000</td><td>Funding options
• Municipality budget
• IFI and donors
• Private sector</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - 2022</td></tr>
<tr><td>Action owner: Transport Department, Gyumri Municipality</td><td>Implementing partner(s): IFIs</td><td>Key stakeholders: Regional administration of Shirak, private sector, universities, NGOs, public and private sector transport operators</td></tr>
</table>

Reference Number
A_TR_14

Title: Renewal of public bus fleet with low emission vehicles

Classification: Capital investment in new city assets

Description

The action is to deliver electric buses as part of any replenishment or upgrade of the existing bus fleet. This would be a contractual requirement of any new bus operator model within the city. Operators would be asked to replace their existing bus fleet with electric vehicles. Based on a high-level assessment of route demand, we have estimated that a mixture of 20 12m buses and 50 15-20 seat minibuses are required to service current operations.

To incentivise this change to electric vehicles, there may need to be public subsidisation of significant elements of the cost of purchasing the new vehicles.

The Municipality will need to take certain prior measures before the action is adopted. It should:

- Carry out a positive campaign to inform the public about the benefits of this policy to the operators;
- Ensure buy-in from the stakeholders; and
- Carry out a study to develop an appropriate standards for technology and develop a plan for implementation, monitoring, and evaluation.

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)		• Social: enhanced social inclusion and green behaviours and awareness, reduced health risks • Economic: economic inclusion • Environmental: enhanced air quality and reduced GHG emissions
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters		
CAPEX (EUR) 14,000,000 **CAPEX (AMD)** 7,420,000,000	**Annual OPEX (EUR)** 1,400,000 **Annual OPEX (AMD)** 742,000,000	**Funding options** • National government • IFI and donors • Private sector
Implementation start and end date: 2021 - 2024		
Action owner: Transport Department, Gyumri Municipality	**Implementing partner(s):** IFIs	**Key stakeholders:** Public transport operators, private sector

"Gyumri will minimise its energy and carbon footprint, manage its energy demand and reduce energy bills for streetlighting and public and residential buildings by encouraging the application of energy efficient and renewable energy technologies, planning and managing municipal energy use, promoting low-carbon public procurement, and raising the awareness and engagement of all players in clean, smart and innovative energy solutions."

5.2.2. Buildings, energy and lighting

For the buildings, energy and lighting sector in Gyumri, ten actions have been developed through the GCAP process, in conjunction with the city municipality and stakeholders. All of the 10 of the actions are included within the prioritised list of actions.

Presently, Gyumri is part of the integrated national energy supply system and as such the potential for urban scale interventions by Gyumri Municipality within the city is limited. As such, a long-term shift towards a greener energy sector must be vertically integrated across national and local scales of governance and with private and public sector cooperation. The GCAP therefore focuses on a range of actions that will promote greener practices in the energy sector locally. A number of the actions contained within the GCAP are aligned with the Gyumri SEAP of 2017, but the GCAP broadens their scope and extends their timeframe.

A key focus of the plan is to **improve energy efficiency in residential buildings**. This will be achieved through selected interventions, which include campaigns to support improved energy awareness, the introduction of low energy LED lighting and a programme to improve the thermal efficiency of selected residential buildings and apartment blocks in the city.

Improved energy management, contracting and infrastructure for public (municipal) buildings and infrastructure is also a focus. This will involve the monitoring, planning and management of municipal energy to inform improved decision making, which will be driven through the use of innovative energy efficiency solutions. Key municipal infrastructure has also been identified for modernisation, primarily focussed on large public buildings. In addition, there will be a continued programme of upgrades to municipal streetlighting.

There is also a need to drive i**mproved energy efficiency in the procurement of goods and services**. As such, there is an action which puts forward the development of a conceptual framework for integrating Energy Performance Contracting (EPC) into municipal procurement and procurement of goods and services.

Table 5-4 - Building, energy and lighting actions

Action reference	Action title	Strategic objectives	Alignment with mid-term targets for 2025
A_BEL_01	Residential energy efficiency awareness raising and outreach	SO_AQGHG SO_AR	Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of electricity consumption in industries per unit of industrial GDP by 5 % on 2015 levels
A_BEL_02	Low-income LED transformational programme and campaign	SO_AQGHG SO_AR	Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of electricity consumption in residential buildings to 23 kWh
A_BEL_03	Residential building thermal modernisation PPP programme	SO_AQGHG SO_GSBIO SO_AR	Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of Heating energy consumption in residential buildings to 104kWh/m2 Reduction of households at risk to 12%
A_BEL_04	Municipal energy information system and management	SO_AQGHG	Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Increase of share of air pollutant sources identified and monitored to 30% Reduction of energy consumption from street lighting to 25,000 kWh/km
A_BEL_05	Energy Performance Contracting (EPC) and Energy Service Company (ESCO) contracts	SO_AQGHG SO_AR	Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of Heating energy consumption in public buildings to 96kWh/m2 Reduction of energy consumption from street lighting to 25,000 kWh/km
A_BEL_06	Public building thermal modernisation programme	SO_AQGHG SO_AR	Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of Heating energy consumption in public buildings to 96kWh/m2 Reduction of public infrastructure at risk to 12% Reduction in the estimated economic damage from natural disasters (floods, droughts, earthquakes) as a share of GDP to 1%
A_BEL_07	Development of framework for enhancing energy efficiency in public procurement	SO_AQGHG SO_AR	Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of Heating energy consumption in public buildings to 96kWh/m2

Action reference	Action title	Strategic objectives	Alignment with mid-term targets for 2025
A_BEL_08	Promoting green building	SO_AQGHG SO_SL SO_AR	Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of Heating energy consumption in residential buildings to 104 Wh/m2 Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1%
A_BEL_09	Energy efficient Municipal streetlighting upgrades	SO_AQGHG SO_SL SO_AR	Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of energy consumption from street lighting to 25,000 kWh/km Reduction of public infrastructure at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1%
A_BEL_10	Deployment of medium and large-scale Renewable Energy Systems (RES)	SO_AQGHG	Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita

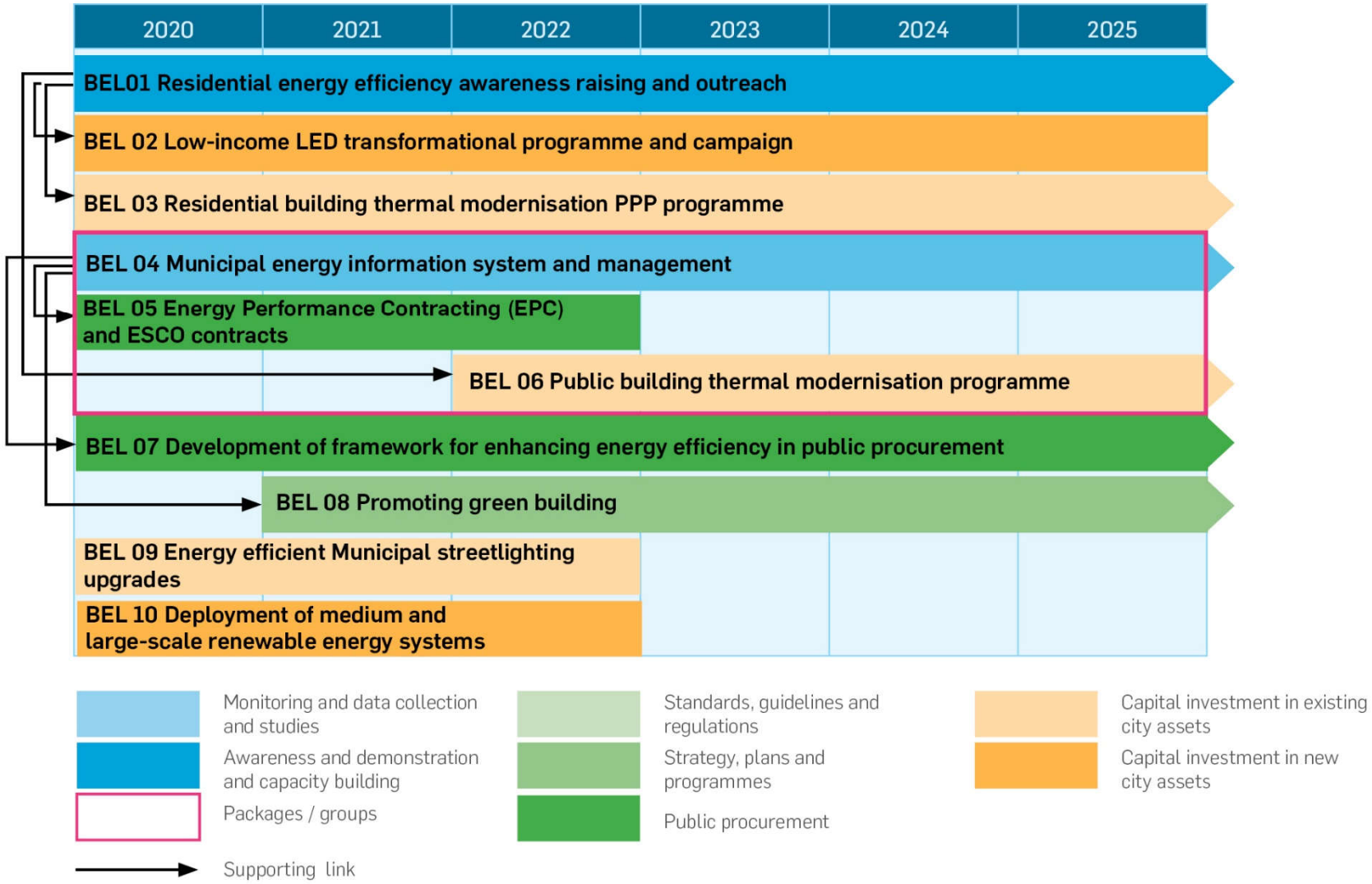


Figure 5-2 - Building, energy and lighting programme

Reference Number
A_BEL_01

Title: Residential energy efficiency awareness raising and outreach

Classification: Awareness, demonstration and capacity building

Description

Gyumri City will develop a comprehensive thermal modernisation programme with integrated financing solutions for residential energy efficiency programmes in multi-apartment buildings, which might include loans, grants or contributions from residents. It will include the promotion and leveraging of securities for financing energy efficiency through commercial loan mechanisms for increasing energy efficiency in residential buildings. It will include the establishment of partnerships with universities and technology development foundations, banks and IFIs (Cleantech Centre, TUMO, universities), hold events and initiatives, leverage investments and develop public private partnerships and alliances for joint promotion of energy efficiency and sustainability agenda. It will also include the conducting of awareness and outreach events, dedicated resources for outreach measures, and seek donors and supporters for joint information measures, which might include Earth Hour, Sustainable Energy Week and other similar initiatives (the number of events that can be held will depend on the availability of partner resources to leverage). It will help to solicit financing for low-cost/no-cost energy saving measures, such as behavioural routines, motion sensors, mode automation and remote sensing to encourage efficient behaviours.

Two of the most frequently used delivery mechanisms for such awareness raising efforts applied in Armenia are (i) calls for small grants to local CSOs/universities for design and implementation of such campaigns; or (ii) cooperation with ongoing programs of implementing partners to scale-up their already planned outreach measures to achieve broader coverage, higher frequency of events with the support of municipal staff, resources and space.

<table>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)</td><td>Key benefits</td></tr>
<tr><td colspan="2">SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)</td><td rowspan="4">• Social: enhanced green behaviours and awareness and social resilience
• Economic: better energy security
• Environmental: enhanced air quality and reduced GHG emissions</td></tr>
<tr><td colspan="2">SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW</td></tr>
<tr><td colspan="2">SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city</td></tr>
<tr><td colspan="2">SO_AR Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td></tr>
<tr><td>CAPEX (EUR)
25,000
CAPEX (AMD)
13,250,000</td><td>Annual OPEX (EUR)
5,000
Annual OPEX (AMD)
2,650,000</td><td>Funding options
• Municipality budget
• IFI and donors
• Private sector</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - Ongoing</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): Donors, IFIs</td><td>Key stakeholders: NGOs, universities, clean-tech centres, innovation hubs, private sector</td></tr>
</table>

Reference Number
A_BEL_02

Title: Low-income LED transformational programme and campaign

Classification: Capital investment in new city assets

Description

The city will develop low-income energy efficiency programmes to help vulnerable households mitigate high electricity bills. This will include working with donors, NGOs and local utilities, and crowdfunding solutions will be sought to start a low-income lightbulb replacement campaign giving five LED lightbulbs to each low-income family in Gyumri (the official recipients of the State Poverty Benefit plan).

The City will need to develop a concept note and endorse it soliciting partnerships with donors, IFIs, vendors of LED lightbulbs, community outreach groups, sign memoranda of understanding (MOUs) to start securing resources and competitively procuring LED lightbulbs that have the highest performance certified in lab tests. This phase may take 6-8 months. Concurrently, the joint efforts will develop a website and a social media campaign for publicizing the campaign and starting the crowdfunding to "Help every Gyumri family in need save on electricity bills". The City will work with CSOs and community outreach groups to mobilize volunteers to visit families at risk, and deliver the lightbulbs, sign necessary documentation. The scale and duration of the program will depend on the effectiveness of the fundraising effort, the trust towards and the publicity of the campaign. The program will heavily rely on "A_BEL_01" to launch and outreach campaign.

Environmental performance (alignment with GCAP objectives)	**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)	• Social: social resilience, inclusion, citizenship engagement and participation • Economic: economic returns for investor and economic growth • Environmental: enhanced air quality and reduced GHG emissions
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW	
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city	
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters	

CAPEX (EUR)	**Annual OPEX (EUR)**	**Funding options**
260,000 **CAPEX (AMD)** 137,800,000	5,000 **Annual OPEX (AMD)** 2,650,000	• Municipality budget • IFI and donors • Private sector

Implementation start and end date: 2020 - 2025

Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** IFIs	**Key stakeholders:** Donors, utility companies, banks/leasing companies, private sector

Reference Number
A_BEL_03

Title: Residential building thermal modernisation PPP programme

Classification: Capital investment in existing city assets

Description

The action involves the implementation of energy efficiency retrofitting measures committed to in Gyumri's SEAP. These include the following:

- Thermal modernisation of 189 multi apartment monolithic reinforced concrete residential buildings (indicatively on: E. Charents street; A. Avetisyan, street; T. Chartarapet street; "Ani" 5th, 9th, 7th and 13th districts; Khorenatsi street; Mush-2 district; Sevak street; A. Khachatryan street; Minas Avetisyan street), and;
- Energy efficient modernisation of indoor lighting (replacement of incandescent lamps with LED) in residential buildings.

This action has already been adopted by Gyumri under the SEAP on the assumption that the city budget will provide the required funds for the residential building retrofits, as is common for housing and communal improvements. Co-financing from donors, such as the United Nations Development Programme (UNDP)/Green Climate Fund (GCF), EU grants through the Neighbourhood Investment Platform (NIP), Eastern European Energy Efficiency and Environmental Partnership (E5) will also be pursued in combination with available EE loan funds will also be pursued in combination with available EE loan funds. The above should be implemented by drawing on best practices from the other building EE implementation programs using energy performance contracting and sub-sovereign borrowing.

Establishment of such a program will go through a phased process, indicatively:

Year 1: (i) development of partnerships with donors and IFIs, signing memoranda of understanding (MOUs) to secure a high share of grants and low-cost loans, (ii) developing a functional organizational and financial model for channelling investments into the residential buildings with combined grant-lending financing from multiple sources;

Year 2: (iii) launching a call for applications from interested buildings, securing consent from 2/3 majority of residents for joint investment in building common spaces; (iv) developing procurement documents and competitively procuring services for implementing structural integrity and energy audits in selected buildings; preparation of technical designs for thermo-modernisation;

Year 3: (v) based on the proposed technical designs, competitively procure construction services for implementation of the retrofits (potentially through energy performance contracting);

Years 4-5: (vi) conduct monitoring, reporting and verification of energy savings; (vii) secure repayment of loaned funds and reinvestment through a revolving fund; (viii) continue accepting applications from more buildings on rolling basis; (ix) ensure long-term sustainability of the program with gradual.

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)		• Social: enhanced safety, affordability of utilities, reduced fuel poverty • Economic: economic growth • Environmental: enhanced air quality and reduced GHG emissions
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city		
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters		
CAPEX (EUR) 15,000,000 **CAPEX (AMD)** 7,950,000,000	**Annual OPEX (EUR)** 150,000 **Annual OPEX (AMD)** 79,500,000	**Funding options** • Municipality budget • IFI and donors • Private sector

Reference Number **A_BEL_03**		
Title: Residential building thermal modernisation PPP programme		
Classification: Capital investment in existing city assets		
		• **R2E2**
Implementation start and end date: 2020 - 2030		
Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** Multilateral organisations	**Key stakeholders:** Ministry of Territorial Administration and Infrastructures, State Committee on Urban Development, R2E2, donors/ IFIs, private sector

Reference Number
A_BEL_04

Title: Municipal energy information system and management

Classification: Monitoring and data collection and studies

Description

The city will introduce an effective energy information management system, with benchmarking and the prioritisation of public building electricity and thermal modernisation retrofits. Gyumri will start monitoring, planning and managing energy to enable informed decision-making, including to support the identification and implementation of appropriate innovative energy efficiency solutions. This action involves the development of the energy information management system as well as the delivery of associated capacity building activities and the establishment of routine data entry and management practices. This will include the following:

- Deploying smart metering and smart billing systems;
- Establishment of energy monitoring information system (online);
- Development of instruction manuals and training materials;
- Designation of key focal points for the identification and entry of energy consumption data into the municipal energy information system;
- Hands-on training of staff;
- Routine monitoring of energy use, benchmarking, analysis and reporting to Community Leader and Covenant of Mayors; and
- Where possible, introduction of smart metering, smart billing and other energy performance monitoring solutions.

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)		• Social: green behaviour and awareness • Economic: economic returns for investor and economic growth • Environmental: enhanced air quality and reduced GHG emissions
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city		
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters		
CAPEX (EUR) 15,000 **CAPEX (AMD)** 7,950,000	**Annual OPEX (EUR)** 5,000 **Annual OPEX (AMD)** 2,650,000	**Funding options** • Municipality budget • IFI and donors • Private sector
Implementation start and end date: 2022 - 2027		
Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** Private sector	**Key stakeholders:** Ministry of Territorial Administration and Infrastructures, Energy Saving Foundation (ESF), R2E2, IFI/ donors

Reference Number
A_BEL_05

Title: Energy Performance Contracting (EPC) and Energy Service Company (ESCO) contracts

Classification: Public procurement

Description

In order to identify the potential for energy performance contracting, Gyumri will assess energy saving opportunities in Gyumri's Municipal economy (e.g. public buildings and streetlighting) as well as expected financial returns. It appears that the potential for EPC and ESCO contracts is high, and if this is proved to be the case then a conceptual and contractual framework will be developed to seek private sector participation through energy performance contracting for:

- Public building energy efficiency retrofitting (e.g. through R2E2); and
- External lighting through vendors credits from the suppliers of energy efficient lighting equipment (LEDs and luminaries).

Note: The Municipality will not directly finance such investments, but rather allow for bank financing with the application of factoring.

<table>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)</td><td rowspan="5">Key benefits
• Social: green behaviour and awareness
• Economic: economic returns for investor and economic growth
• Environmental: enhanced air quality and reduced GHG emissions</td></tr>
<tr><td colspan="2">SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)</td></tr>
<tr><td colspan="2">SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW</td></tr>
<tr><td colspan="2">SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city</td></tr>
<tr><td colspan="2">SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters</td></tr>
<tr><td>CAPEX (EUR)
10,000
CAPEX (AMD)
5,300,000</td><td>Annual OPEX (EUR)
5,000
Annual OPEX (AMD)
2,650,000</td><td>Funding options
• Municipality budget
• IFI and donors
• Private sector</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - 2022</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): Private sector</td><td>Key stakeholders: Ministry of Territorial Administration and Infrastructures, ESF, R2E2, donors/ IFIs</td></tr>
</table>

Reference Number
A_BEL_06

Title: Public building thermal modernisation programme

Classification: Capital investment in existing city assets

Description

In order to meet political commitments of the Gyumri SEAP and the Covenant of Mayors Signatory Status, Transition to Covenant of Mayors for CLIMATE and ENERGY, Gyumri will need to implement, monitor and report on SEAP measures. This will require the implementation of measures including thermal insulation and thermal modernisation of numerous Community Non-Commercial Organisations (CNCOs), the installation of solar water heaters in schools and preschool educational organisations, and the installation of PV modules on municipal buildings and infrastructures. It will also require energy efficient modernisation of indoor lighting (replacement of incandescent lamps with LED) in preschool educational organizations, sport schools, musical schools, museums, art schools and city hall.

This action will involve the development of a programme in which the benefits of implementing these measures will be quantified, energy audits will be conducted, the financing structure for the implementation of the measures will be identified, and a detailed implementation plan is presented. The capital investments will come from a third-party, specifically the R2E2 financing facility, which is now available at commercial banks.

Based on the current energy performance of public, municipal buildings, Gyumri Municipality will seek external technical support to screen and rank the buildings based on the largest potential for energy saving. Energy audits will be conducted. Implementation can be based on energy performance contracting for competitively procuring thermo-modernisation services from professional construction companies who will design and implement the EE measures. The compensations for these services can be partially linked to documented savings. The financial savings from reduced energy bills will be used to repay investments and generate more funds for similar investments.

Environmental performance (alignment with GCAP objectives)	**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)	• Social: enhanced safety • Economic: economic returns for investor and economic growth • Environmental: enhanced air quality and reduced GHG emissions
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW	
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city	
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city	
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters	

CAPEX (EUR)	**Annual OPEX (EUR)**	**Funding options**
850,000 **CAPEX (AMD)** 450,500,000	50,000 **Annual OPEX (AMD)** 26,500,000	• Municipality budget • IFI and donors • Private sector

Implementation start and end date: 2022 - 2027

Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** Private sector	**Key stakeholders:** Ministry of Territorial Administration and Infrastructures, ESF, R2E2, donors/IFIs, NGOs

Reference Number **A_BEL_07**		
Title: Development of framework for enhancing energy efficiency in public procurement		
Classification: Public procurement		
Description This action will support Gyumri to develop and introduce green procurement practices, energy performance contracting and life-cycle cost-based planning of municipal investments. It will also support the integration of energy efficiency, low-carbon and green indicators in goods and services procurement specifications in buildings, streetlighting, public/ municipal transportation. The action includes the development of a conceptual framework for integrating EPC into municipal procurement and procurement of goods and services as part of regular public procurement to specify minimal energy and carbon intensity across product or operation lifespan. It will also include an element of related capacity building. Note: This is a national action that needs to be adopted locally. The new legal package on public procurement, which is currently pending adoption by the Government, also includes guidelines for the application of energy efficiency in public procurement.		
Environmental performance (alignment with GCAP objectives)		**Key benefits** • Social: green behaviour and awareness • Economic: economic returns for investor • Environmental: enhanced air quality and reduced GHG emissions
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)		
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW		
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city		
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city		
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters		
CAPEX (EUR) 50,000 **CAPEX (AMD)** 26,500,000	**Annual OPEX (EUR)** 5,000 **Annual OPEX (AMD)** 2,650,000	**Funding options** • Municipality budget • IFI and donors • Private sector
Implementation start and end date: 2020 - Ongoing		
Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** Private sector	**Key stakeholders:** Ministry of Territorial Administration and Infrastructures, ESF, R2E2, donors/IFIs

Reference Number
A_BEL_08

Title: Promoting green building

Classification: Strategies, plans and programmes

Description

This action is a study to determine the requirements, practicalities and benefits of applying the principles of near-zero energy and green architecture in all new construction and reconstruction initiatives. It would promote the development of a showcase green building that could demonstrate and promote the approach. The building would use locally manufactured, easy-to-erect construction materials with a good energy performance. Many such systems have been developed, which presents the opportunity to partner with organisations that were involved. The city should:

- Seek municipal instruments to incentivise for such investments (e.g. expedited construction review and permitting and via local property tax rates); and develop a local regulation for promoting green construction;
- Seek partnerships with donors and benefactors to solicit financial participation;
- Introduce EE and RES requirements in construction permitting;
- Introduce mandatory enforcement of building EE standards in new construction and capital reconstruction, integration of green building technologies; and
- Ensure Municipal construction supervision and commissioning to ensure energy efficiency technologies are adequately integrated.

Environmental performance (alignment with GCAP objectives)	**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)	• Social: enhanced safety and green behaviours and awareness • Economic: employment generation and economic returns for investors • Environmental: enhanced air quality and reduced GHG emissions and increased resilience to climate change
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW	
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city	
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city	
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters	

CAPEX (EUR)	**Annual OPEX (EUR)**	**Funding options**
120,000 **CAPEX (AMD)** 63,600,000	5,000 **Annual OPEX (AMD)** 2,650,000	• IFI and donors • Private sector

Implementation start and end date:
2021 - Ongoing

Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** Donors/ IFIs	**Key stakeholders:** Ministry of Territorial Administration and Infrastructures, R2E2, private sector

Reference Number
A_BEL_09

Title: Energy efficient Municipal streetlighting upgrades

Classification: Capital investment in existing city assets

Description

This action will involve the delivery of comprehensive remapping and modelling, as well as infrastructure upgrades, for Gyumri's external streetlighting infrastructure. It is not a new activity but would extend the ongoing action already being conducted by the EBRD. The following activities would be conducted:

- The design and scoping of lighting EE retrofit needs, including lighting norm requirements, technical specifications for safety, aesthetics;
- Assessment of investment needs, expected energy and financial savings;
- Integration of smart technologies in the street lighting network (such as dimming, remote control, motion sensors and integration with traffic lighting systems);
- Design and development of an associated financing scheme (such as an integrated financing pool for implement street-lighting LED retrofits in Gyumri);
- Pursuit of external financing in addition to municipal budget resources (including grants, loans, Public Private Partnership (PPP)/energy performance contracting schemes); and
- Development of a logistical framework and assessment for enhancing the efficient lighting revolving fund with energy saving proceeds accumulating from all lighting retrofits to first serve for repayment of any borrowed funds, and further to generate sufficient resources to scale up the energy efficiency retrofits to other sectors of the municipal economy.

As a result of the action, there will be an increase in the energy efficiency of street-lighting in Gyumri as well as an increase in the number of lit objects. This should allow Gyumri to maintain or reduce energy consumption of the overall service while enhancing the quality of lighting and comfort to the citizens.

Environmental performance (alignment with GCAP objectives)	**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)	• Social: enhanced safety and green behaviours and awareness • Economic: economic returns for investors and economic growth • Environmental: enhanced air quality and reduced GHG emissions
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW	
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city	
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city	
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters	

CAPEX (EUR)	**Annual OPEX (EUR)**	**Funding options**
6,000,000 **CAPEX (AMD)** 3,180,000,000	150,000 **Annual OPEX (AMD)** 79,500,000	• Municipality budget • IFI and donors

Implementation start and end date: 2020 - 2022

Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** IFIs/ donors	**Key stakeholders:** Ministry of Territorial Administration and Infrastructures

Reference Number
A_BEL_10

Title: Deployment of medium-and large-scale Renewable Energy Systems (RES)

Classification: Monitoring and data collection and studies

Description

This action will seek to increase the deployment of medium- and large-scale RES in Gyumri by assessing available resource, exploring associated PPP opportunities, and examining the business case for the deployment of larger scale renewable energy systems within and around the city. This action will assess the utilisation potential of all forms of RES, but those to be deployed are likely to include medium-scale and large-scale wind power, solar farms, geothermal, hydro power, heat pumps and biomass. A 47.5MW plant can supply around 66,400 Megawatt hours (MWh), which is equivalent to 20% of Gyumri's electricity needs per year. The city will finance the resource assessment and market studies, support the soft costs related to RES investments, offer community land at favourable terms, potentially partially co-finance to a minor share. The bulk of investments shall be sought from private investors.

Environmental performance (alignment with GCAP objectives)	**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)	• Social: enhanced safety and green behaviours and awareness • Economic: economic returns for investors and economic growth • Environmental: enhanced air quality and reduced GHG emissions and increased resilience to climate change
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW	
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city	
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city	
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters	

CAPEX (EUR)	**Annual OPEX (EUR)**	**Funding options**
300,000 **CAPEX (AMD)** 159,000,000	25,000 **Annual OPEX (AMD)** 13,250,000	• Municipality budget • National government • IFI and donors • Private sector

Implementation start and end date: 2020 - 2022

Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** Private sector	**Key stakeholders:** Ministry of Territorial Administration and Infrastructures, R2E2, donors/ IFIs

“Gyumri will revive its industrial sector to spur economic growth and create jobs with a focus on clean production (water, air, land), resource efficiency, innovative and knowledge-intensive areas of production, attraction of investors in light industry, IT and innovation and services, and the application of best available technologies. Gyumri Municipality will build a platform for promoting, featuring and showcasing local green businesses.”

5.2.3. Industry

For the industry sector in Gyumri, five actions have been developed through the GCAP process, in conjunction with the city municipality and stakeholders. One of the five of the actions is included within the prioritised list of actions.

The GCAP industry actions are focused on two key areas.

The first aims to shift the remaining industrial sector in Gyumri (primarily focused on light industry) towards greener business models, which is intended to support and promote a revival in the sector. The shift would largely be achieved via closer cooperation between businesses supported by strategic political leadership from the Municipality in the form of a 'Green Business' concept and an industrial/ Small and Medium Sized Enterprises (SME) energy management system.

The second is intended to the address the issue of contaminated land related to former heavy industrial sites in the city. Presently, there is an acknowledgement that several sites within the city are contaminated, but the exact location and scale of the contamination is not known. Therefore, the initial action for the industry sector is to undertake a detailed mapping and screening of the city, identifying the different sites, so a full remediation exercise can be implemented.

Table 5-5 - Industry actions

Action reference	Action title	Strategic objectives	Alignment with mid-term targets for 2025
Priority actions			
A_IN_04	Screening and de-risking of contaminated industrial sites	SO_SL	Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Increase of share of contaminated sites that are inventoried, mapped and assessed to 50%
Additional actions			
A_IN_01	Gyumri 'Green Business' concept	SO_AQGHG SO_WR SO_SL SO_GSBIO SO_AR	Reduction of average annual concentration of dust to 0.15 µg/ m3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Reduction of electricity consumption in industries per unit of industrial GDP by 5 % on 2015 levels Increase of share of industrial waste recycled as a share of total industrial waste produced to 25% Reduction of industrial water consumption as percentage of total urban water consumption by 25%
A_IN_02	Green Business Coordination platform 'Gyumri Green Economy Club'	SO_AQGHG SO_WR SO_SL SO_GSBIO SO_AR	Reduction of average annual concentration of dust to 0.15 µg/ m3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Reduction of electricity consumption in industries per unit of industrial GDP by 5 % on 2015 levels Increase of share of industrial waste recycled as a share of total industrial waste produced to 25% Reduction of industrial water consumption as percentage of total urban water consumption by 25%
A_IN_03	Provision of energy management system support to industry/ SMEs	SO_AQGHG SO_WR SO_SL SO_AR SO_GSBIO SO_WR SO_AR	Reduction of average annual concentration of dust to 0.15 µg/ m3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Reduction of electricity consumption in industries per unit of industrial GDP by 5 % on 2015 levels Increase of share of industrial waste recycled as a share of total industrial waste produced to 25% Reduction of industrial water consumption as percentage of total urban water consumption by 25%
A_IN_05	Remediation of former industrial sites for urban regeneration	SO_SL SO_GSBIO SO_WR SO_AR	Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Reduction of number of polluted and potentially polluted areas by 40% on 217 levels

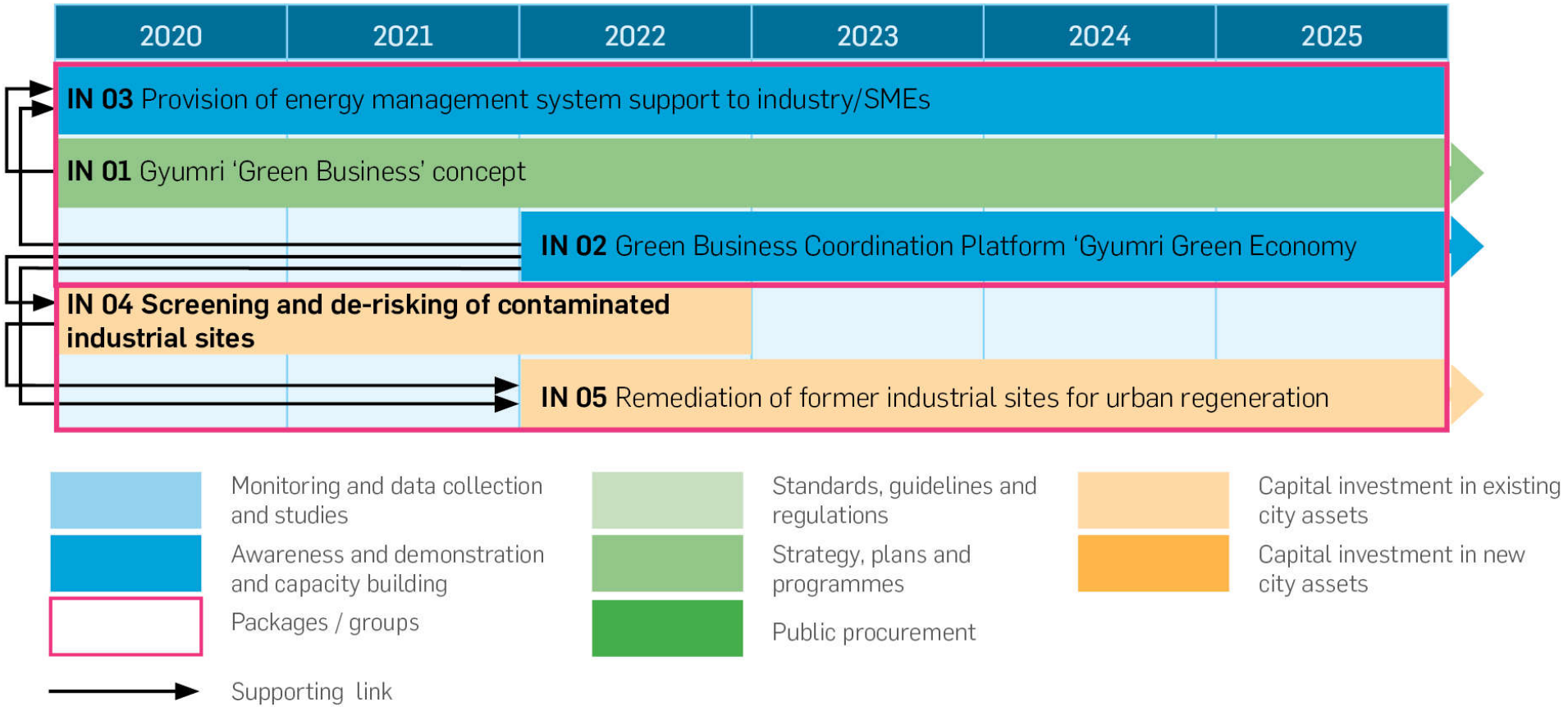


Figure 5-3 - Industry actions programme

Reference Number
A_IN_04

Title: Screening and de-risking of contaminated industrial sites

Classification: Monitoring, data collection and studies

Description

The screening element of this action will involve the development of an inventory and database of local contaminated industrial sites, which will support their further remediation and "greening." This will also involve a screening process, mapping of contaminated industrial sites and their ranking in terms of severity of contamination. The second part of the action, 'de-risking,' will result in the development of a remediation plan for clearing former industrial land of hazardous materials to ensure that polluting agents are removed from the sites. This plan will propose the use of the most modern de-risking technologies to neutralise contamination threats, will identify alternative uses for the sites, and will dictate that related work be conducted to international environmental standards.

Note: This action refers to abandoned industrial sites, previous production facilities and other contaminated sites (including spontaneous, unauthorized industrial / construction waste dumps) and their management. This does not refer to existing industrial resource efficiency or landfills.

Environmental performance (alignment with GCAP objectives)	**Key benefits**
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city	Social: improved safety Economic: economic growth Environmental: enhanced soil quality.
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city	
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters	

CAPEX (EUR)	**Annual OPEX (EUR)**	**Funding options**
250,000 **CAPEX (AMD)** 132,500,000	20,000 **Annual OPEX (AMD)** 10,600,000	• Municipality budget • National government • IFI and donors • Private sector

Implementation start and end date: 2020 - 2022

Action owner: Department of Trade and Service Coordination, Gyumri Municipality	**Implementing partner(s):** National government	**Key stakeholders:** Private sector, IFIs/ donors

"Gyumri will be served by a modern integrated waste-management system that employs international standards and that directs Gyumri towards a circular economy where all recyclable waste is sorted, collected and recycled."

5.2.4. Solid waste

For the solid waste sector in Gyumri, six actions have been developed through the GCAP process, in conjunction with the city municipality and stakeholders. Five out of the six actions are included within the prioritised list of actions, with the remaining action included as an additional action.

Waste management in Gyumri is currently characterised by insufficient waste disposal practices, including a prevalence of illegal open-dumpsites, as well as low material efficiency which leads to economic losses and negative environmental impacts.

The actions prioritised for the solid waste sector will focus on the **removal of illegal open dumps**, which would also include the remediation of contaminated waste areas.

There will also be a focus on **integrating the waste disposal and treatment systems** and directing Gyumri towards a more circular economy, which will help to reduce the production of waste by following the principle of recycling and re-use, a practice which does not exist within the city at present. A successful recycling system, in the context of Gyumri, will require a thorough review of the existing systems in place and in response to that the **provision of appropriate infrastructure**. As such, actions have been generated which involve a review of the current waste collection and fee systems, which would be supported through a separate waste collection system for recyclables. Major capital investment is also proposed, through the construction of new municipal solid waste disposal and treatment infrastructure, options for which may include the development of a Material Recovery Facility (MRF), Waste-to-Energy thermal treatment plant (WtE) and organic waste treatment facilities.

The implementation of waste treatment and disposal infrastructure also requires specific knowledge and expertise within the Municipality to allow for an efficient steering and effective leadership throughout the project implementation process. There also needs to be a focus on enhancing the knowledge and understanding of recycling amongst the population, including why and how to separate waste, which will be critical for the implementation of an efficient and effective recycling system. Therefore, in addition to new infrastructure, there will need to be **behavioural change** within Gyumri's population, businesses and industry, as well as capacity building within the Municipality. Awareness campaigns and capacity building on waste disposal, treatment and recycling will therefore be a key action to support change within the sector.

Table 5-6 - Solid waste actions

Action reference	Action title	Strategic objectives	Alignment with mid-term targets for 2025
Priority actions			
A_SW_02	Removal of illegal open dumps and remediation of contaminated areas, including proper operation of current landfill	SO_AQGHG SO_SL SO_WR	Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Reduction of number of polluted and potentially polluted areas by 40% on 217 levels Increase in the percentage of MSW and other waste (including Hazardous Waste (HW)) disposed of and landfilled in EU-compliant sanitary landfills to 95%
A_SW_03	Review of current waste collection and waste fee systems and implementation of a separate collection system for recyclables	SO_AQGHG SO_SL SO_WR	Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Increase in the proportion of MSW that is sorted and recycled to 25% Increase of share of waste producers covered by the fee-based volume-based waste disposal service to 80%
A_SW_04	Construction of new MSW disposal and treatment infrastructure	SO_AQGHG SO_SL SO_WR	Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Increase in the percentage of MSW and other waste (including Hazardous Waste (HW)) disposed of and landfilled in EU-compliant sanitary landfills to 95% Reduction of number of polluted and potentially polluted areas by 40% on 2017 levels
A_SW_05	Assessment of MSW morphology and Market study for recyclable materials and establishment of waste quality protocols	SO_AQGHG SO_SL SO_WR	Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Increase in the proportion of MSW that is sorted and recycled to 25% Increase of share of industrial waste recycled as a share of total industrial waste produced to 25%
A_SW_06	Conduct regular waste management awareness (5Rs)campaigns	SO_AQGHG	Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Increase in the proportion of MSW that is sorted and recycled to 25% Increase of share of industrial waste recycled as a share of total industrial waste produced to 25%

Action reference	Action title	Strategic objectives	Alignment with mid-term targets for 2025
Priority actions			
Additional actions			
A_SW_01	Feasibility study on waste treatment and disposal options, development of Integrated Waste Management Plan for Gyumri and publicly available Solid Waste Database	SO_AQGHG SO_SL SO_WR	Reduction of annual CO2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Increase in the percentage of MSW and other waste (including Hazardous Waste (HW)) disposed of and landfilled in EU-compliant sanitary landfills to 95% Increase in the proportion of MSW that is sorted and recycled to 25% Increase of share of industrial waste recycled as a share of total industrial waste produced to 25% Reduction of number of polluted and potentially polluted areas by 40% on 2017 levels, including new landfill operation, acting landfill compliance with the norms (fencing, weighting, regular pressing and landfilling).

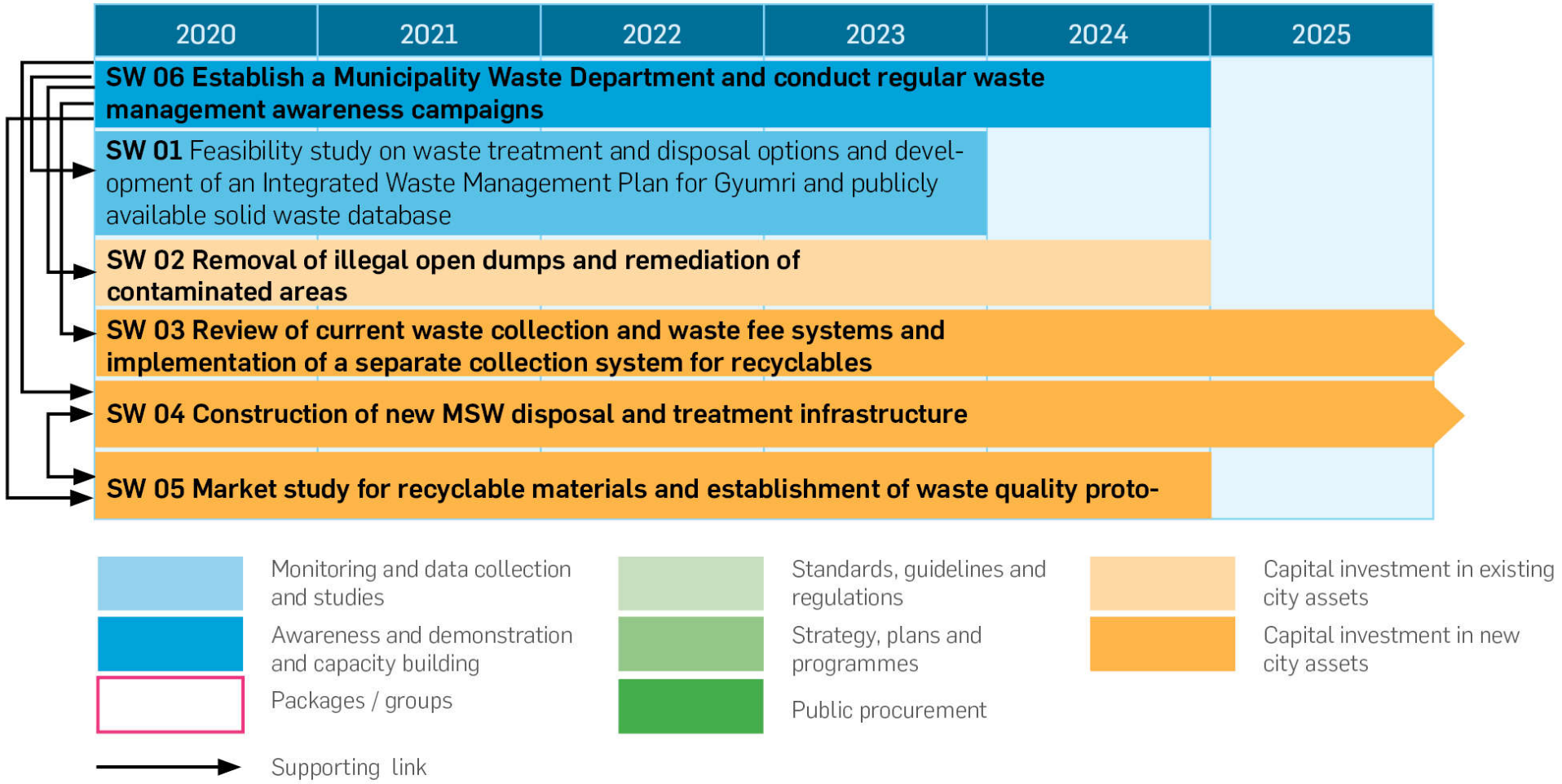


Figure 5-4 - Solid waste programme

Reference Number
A_SW_02

Title: Removal of illegal open dumps and remediation of contaminated areas

Classification: Capital investment in existing city assets

Description

Open dumping is the most common form of waste disposal in Gyumri and illegal dumps are a consequence of a lack of adequate formal waste collection infrastructure and frequency. This action would only cover the implementation of a first phase of the removal of illegal dumps and remediation of contaminated areas. However, it is recommended for this action to be ongoing, should new dumping events take place after the implementation phase, which would require the identification of additional sources of funding. This action entails the following tasks:

- Their geo-localisation;
- Creation of a GIS database identifying illegal and open dumps;
- Characterisation of the wastes in each dump;
- The removal and landfill disposal of waste;
- The sites to be sanitised and recovered;
- Monitoring of identified areas to avoid similar illegal dumping events in future.

The sites to be remediated will be prioritised based on a raking system that will take into consideration:

- Surfaces of area to be remediated;
- Tonnages of waste to be compliantly disposed of;
- Hazardous waste content; and
- Vicinity to residential areas.

<table>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)</td><td rowspan="4">Key benefits
• Social: green behaviour and awareness, improved safety
• Economic: economic inclusion
• Environmental: enhanced water resources and soil quality</td></tr>
<tr><td colspan="2">SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)</td></tr>
<tr><td colspan="2">SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW</td></tr>
<tr><td colspan="2">SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city</td></tr>
<tr><td>CAPEX (EUR)
1,000,000
CAPEX (AMD)
530,000,000</td><td>Annual OPEX (EUR)
50,000
Annual OPEX (AMD)
26,500,000</td><td>Funding options
• Municipality budget
• National government
• IFI and donors</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - 2024</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): Private sector</td><td>Key stakeholders: Regional administration of Shirak, IFIs/ donors, national government</td></tr>
<tr><td colspan="3">Reference Number</td></tr>
</table>

A_SW_03

Title: Review of current waste collection and waste fee systems and implementation of a separate collection system for recyclables

Classification: Capital investment in new city assets

Description

Review of current waste collection and waste fee systems:

Gyumri Municipality has adopted an Integrated Waste Management Plan but a review of the current waste collection system is required with a focus on the existing waste collection fleet and equipment. The quantity and state of collection vehicles and waste bins and containers should be assessed to determine whether improvements are required to ensure collection of both streams (i.e. recyclable and residual waste and, potentially, organic waste). A review of the current waste fee system on waste collection and the establishment of a waste littering fee will also be required as part of this action.

Implementation of a separate collection system for recyclables:

Various systems can be implemented for the separate collection of recyclable waste, with different outcomes. These include the introduction of additional waste bins for the storage of recyclable waste or the use of special coloured sacks to be disposed of in the residual waste bins. The implementation of the most appropriate system depends on the type of plant the waste will be treated in. However, the source segregation of waste into more streams should be preferred as it is linked to higher recycling rates; single stream recyclable collection is only recommended if the implementation of a two-stream collection system results unfeasible. In some municipalities recycling centres (named Green Islands) have been established with a disappointing outcome: due to an unclear labelling they have quickly been used as mixed MSW containers and lessons from such experience should be learned and reflected in this action.

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)		• Social: green behaviour and awareness, citizenship engagement and participation • Economic: economic returns for investors, employment generation • Environmental: enhanced water resources and soil quality
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW		
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city		
CAPEX (EUR) 1,000,000 **CAPEX (AMD)** 530,000,000	**Annual OPEX (EUR)** 100,000 **Annual OPEX (AMD)** 530,000,000	**Funding options** • Municipality budget • National government • IFI and donors
Implementation start and end date: 2020 - 2022		
Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** IFIs	**Key stakeholders:** Regional administration of Shirak, private sector, NGOs, national government

<table>
<tr><td colspan="3">Reference Number
A_SW_04</td></tr>
<tr><td colspan="3">Title: Construction of new MSW disposal and treatment infrastructure</td></tr>
<tr><td colspan="3">Classification: Capital investment in new city assets</td></tr>
<tr><td colspan="3">Description
The construction of an engineered landfill (including a double liner, improving and re-operating its landfill gas collection and recovery system, and a leachate collection and treatment system) is a priority for Gyumri in the short- to medium-term. Potential options include the development of a Material Recovery Facility (MRF), thermal treatment plants (e.g. WtE) and organic waste treatment facilities (e.g. Anaerobic Digestion (AD)). This action addresses the concern of air pollution and disturbing smells due to open waste disposal in Gyumri. The integrated sorting and recycling system will be put in place bringing revenues back to the MSW management system (> 10% of MSW management costs per annum). Ideally, the construction of new treatment infrastructure should be based on the outcome of the waste treatment and disposal feasibility study, a proposed additional action (A SW 01), and the collection of waste data.

In order to monitor the implementation of the action, the following milestones have been considered:
• 2022: finalised construction of engineered landfill;
• 2025: ongoing construction of MSW treatment infrastructure (e.g. MRF);
• 2027: finalised construction of MSW treatment infrastructure.</td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city</td><td>Key benefits
• Social: improved safety
• Economic: economic returns for investors, employment generation and economic growth
• Environmental: enhanced water resources, soil quality and air quality, and reduced GHG emissions</td></tr>
<tr><td>CAPEX (EUR)
50,000,000
CAPEX (AMD)
26,500,000,000</td><td>Annual OPEX (EUR)
5,000,000
Annual OPEX (AMD)
2,650,000,000</td><td>Funding options
• National government
• IFI and donors
• Private sector</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - 2027</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): IFIs</td><td>Key stakeholders: Regional administration of Shirak, private sector, national government</td></tr>
</table>

<table>
<tr><td colspan="3">Reference Number
A_SW_05</td></tr>
<tr><td colspan="3">Title: Assessment of MSW morphology and market study recyclable materials and establishment of waste quality protocols</td></tr>
<tr><td colspan="3">Classification: Monitoring, data collection and studies</td></tr>
<tr><td colspan="3">Description
It is important to assess the composition of the municipal solid waste and further establish a local market for recyclable materials to stimulate market and sector growth. A study to prioritise the key target materials should therefore be undertaken to establish initial 'focus' materials for this market. This study will be conducted in this action, which will also develop waste quality protocols, using a collaborative process and based on extensive stakeholder engagement, to ensure that recyclable materials will be used within the industry as new resources. This action is linked to the development of recycling infrastructure, as proposed in A SW 04, but the costs for its construction are not included in the CAPEX estimate.</td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city</td><td>Key benefits
• Social: green behaviour and awareness, citizenship engagement and participation and social resilience
• Economic: economic returns for investors, employment generation
• Environmental: enhanced water resources, soil quality and air quality and reduced GHG emissions</td></tr>
<tr><td>CAPEX (EUR)
1,000,000
CAPEX (AMD)
530,000,000</td><td>Annual OPEX (EUR)
300,000
Annual OPEX (AMD)
159,000,000</td><td>Funding options
• Municipality budget
• IFI and donors</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - 2024</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): Private sector</td><td>Key stakeholders: Regional administration of Shirak, IFIs</td></tr>
</table>

Reference Number
A_SW_06

Title: Establish a Municipality Waste Department and conduct regular waste management awareness campaigns

Classification: Awareness, demonstration and capacity building

Description

Establish a Municipality Waste Department:

Gyumri Municipality will require the establishment of a Waste Department responsible for waste collection, treatment and disposal in Gyumri and for delivering an awareness strategy able to inform the population about the impact of incorrect waste management on the environment and what citizens can do to minimise it. Some of the tasks to be undertaken by the Waste Department will include waste tariffs setting, planning of waste collection and waste facilities management. The Department's employees will require extensive capacity building, and additional personnel will possibly also need to be hired. It is proposed that a Green City Awareness Centre (GCAC), as described below, support the municipality with related expertise.

Conduct regular waste management awareness campaigns:

A GCAC will be created and will support Gyumri's Waste Department, established under this action, to devise and conduct dedicated campaigns to educate citizens of Gyumri about the impact of waste management on the environment. In these campaigns, special attention will be paid to source segregation of recyclables and waste minimisation measures. The promotion of solid waste reduction, reuse, sorting and recycling through awareness campaigns represents two 'Responses' indicators in the GCAP Indicator Database. The municipality together with the GCAC will develop and deliver such campaigns, with the GCAC's role including to engage volunteers, NGOs, students and the media.

The campaigns will focus on the renown principle of 5Rs:

1. Reduce
2. Reuse
3. Recycle
4. Recover
5. Residue management

<table>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)</td><td rowspan="4">Key benefits
• Social: green behaviour and awareness, citizenship engagement and participation and social resilience
• Economic: employment generation
• Environmental: enhanced water resources, soil quality and air quality and reduced GHG emissions</td></tr>
<tr><td colspan="2">SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)</td></tr>
<tr><td colspan="2">SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW</td></tr>
<tr><td colspan="2">SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city</td></tr>
<tr><td>CAPEX (EUR)
220,000
CAPEX (AMD)
116,600,000</td><td>Annual OPEX (EUR)
50,000
Annual OPEX (AMD)
26,500,000</td><td>Funding options
• Municipality budget
• IFI and donors</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - 2024</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): IFIs</td><td>Key stakeholders: Regional administration of Shirak, private sector, general public</td></tr>
</table>

"Gyumri will have a clean water supply and an efficient wastewater and stormwater collection system that are accessible to everyone and that comply with EU standards. The water usage behaviours of domestic and non-domestic users will also be improved."

5.2.5. Water

For the water sector in Gyumri, 12 actions have been developed through the GCAP process, in conjunction with the city municipality and stakeholders. Ten out of the 12 actions are included within the prioritised list of actions, with the remaining two included as additional actions.

The water actions put forward for Gyumri aim to extend safe and reliable water supply to most of the city; and to extend the wastewater collection system and to connect more of it to a refurbished and extended wastewater treatment plant, which will lead to enhanced river water quality and ecosystems. The development of the networks of underground water supply, wastewater collection and drainage systems will be coordinated with plans to develop the green urban spaces of the city by including sustainable urban drainage and nature-based solutions for green urban infrastructure.

The improved urban water, wastewater and drainage infrastructure will lead to improved living conditions for residents, support economic growth, reduce health issues arising from poor sanitation and increase resilience to flooding and to climate change. Climate change may increase extreme rainfall events and increase frequency of high temperatures which may be partially offset by increased greenery for shade and transpiration in the city.

Building water and wastewater infrastructure is very expensive and can be disruptive to other objectives such as transport and urban planning due to the need to dig up roads and spaces in the city. For these reasons the actions need to be carefully planned to ensure that the most effective interventions are prioritised. The planning must be based on a proper understanding of the locations and condition of the current belowground and above ground assets. Therefore, the first tasks will be the development of GIS and asset management systems backed up with surveys and installation of monitoring to understand the performance of the water and wastewater networks. District meters in the water supply network will allow understanding of performance at local scales in comparison to customer records. Leakage surveys can help to find burst pipes and target repairs. For the wastewater system flow surveys can help in understanding the performance of the system and flow and load surveys will inform the design of the wastewater treatment processes. Computer modelling systems should be used to interpret this information and allow the engineers to plan and design optimal solutions. The GIS and asset management systems may also link to customer management systems to ensure that all information is connected, and that billing and revenue collection is fair and comprehensive from domestic and commercial customers.

There are complex challenges in how large investments in water infrastructure are best financed and contracted. These are reliable revenue generating assets and in the appropriate regulatory environment it is possible to use combinations of public and private capital to fund investments and incentivise efficient operation of the water services through concession agreements. For this reason, an action to assess the possible legal and financial options for the water service in Gyumri is included.

For the water and wastewater systems the city should: develop action plans for improvement of asset condition to meet targets for performance in each district; put action plans in the context of the concession agreements and legal frameworks, and; prepare tenders for the repair of existing assets or construction of new assets to deliver the phased programme of the action plans. The action plans should consider the interventions in the 5-year GCAP plan and also in the context of a 20-year assessment and vision for water resources management and climate change adaption for the city.

The action plans with be executed through contracts for the repairs and extensions of assets in accordance with phased plans. The performance of the contractors and of the assets themselves will be monitored on an ongoing basis and the results used to revise and adapt the plans for subsequent phases to meet initial or revised targets. For urban green infrastructure components this may require greater coordination with other urban development options and may come under different institutional responsibilities than the water and wastewater assets.

Table 5-7 - Water actions

Action Ref	Action Title	Strategic Objectives	Alignment with mid-term targets for 2025
Priority actions			
A_WR_01	Prepare an inventory and GIS of Gyumri's water supply network infrastructure and assets	SO_WR	Reduction of non-revenue water to 25-35% Increase in water assets, including information about their condition and performance, featured in a GIS database by 2021 to 100%
A_WR_02	Enhanced water supply and demand data and analysis	SO_WR	Reduction of non-revenue water to 25-35% Increase in water assets, including information about their condition and performance, featured in a GIS database by 2021 to 100% Water consumption per unit of city GDP Reduction of water consumption per capita for domestic users to 120 liters per head per day
A_WR_03	Leak Reduction Action Plan (LRAP) development	SO_WR SO_AR	Reduction of non-revenue water to 25-35% Increase in water assets, including information about their condition and performance, featured in a GIS database by 2021 to 100% Coverage and efficiency of water supply networks is improved through plans and investment by 75% Reduction of public infrastructure at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1% Reduction of households at risk to 12% Increase funding provided for DRR and resilience enhancement in GCAP lifetime to a sufficient level for the implementation of local DRR plans
A_WR_04	Legal and financial mechanisms for enforcement of LRAP	SO_WR SO_AR	Reduction of non-revenue water to 25-35% Increase in water assets, including information about their condition and performance, featured in a GIS database by 2021 to 50% Coverage and efficiency of water supply networks is improved through plans and investment by 75% Reduction of public infrastructure at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1% Reduction of households at risk to 12% Increase funding provided for DRR and resilience enhancement in GCAP lifetime to a sufficient level for the implementation of local DRR plans

Action Ref	Action Title	Strategic Objectives	Alignment with mid-term targets for 2025
A_WR_05	Repair and rehabilitation of supply system parts with highest leakages	SO_WR SO_AR	Reduction of non-revenue water to 25-35% Increase in water assets, including information about their condition and performance, featured in a GIS database by 2021 to 50% Coverage and efficiency of water supply networks is improved through plans and investment by 75% Reduction of public infrastructure at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1% Reduction of households at risk to 12%
A_WR_06	Prepare an inventory and GIS for WW infrastructure	SO_WR SO_SL SO_AR	Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Reduction of number of polluted and potentially polluted areas by 40% on 2017 levels Increase in water assets, including information about their condition and performance, featured in a GIS database by 2021 to 50%
A_WR_07	Preparation of a Wastewater Action Plan and tender documentation for recommended infrastructure upgrades	SO_WR SO_SL SO_AR	Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Decrease of annual number of storm water or sewerage overflows per 100 km of network length by 50% on 2017 levels Increase in the percentage of residential and commercial WW that is treated according to applicable national standards to 30% Reduction of public infrastructure at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1% Reduction of households at risk to 12% Increase funding provided for DRR and resilience enhancement in GCAP lifetime to a sufficient level for the implementation of local DRR plans
A_WR_08	Rehabilitation and extension of drainage systems	SO_WR SO_SL SO_AR	Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Decrease of annual number of storm water or sewerage overflows per 100 km of network length by 50% on 2017 levels Reduction of number of polluted and potentially polluted areas by 40% on 2017 levels Reduction of public infrastructure at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1%
A_WR_09	Rehabilitation and extension of the WW treatment system	SO_WR SO_SL SO_AR	Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Increase in the percentage of residential and commercial WW that is treated according to applicable national standards to 30% Reduction of number of polluted and potentially polluted areas by 40% on 2017 levels Reduction of public infrastructure at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1%
A_WR_10		SO_WR	

Action Ref	Action Title	Strategic Objectives	Alignment with mid-term targets for 2025
	Upgrading public water infrastructure in green spaces	SO_GSBIO SO_AR	Decrease of annual number of storm water or sewerage overflows per 100 km of network length by 50% on 2017 levels Reduction of public infrastructure at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1%
Additional actions			
A_WR_11	Establish a Smart City Action Pilot area	SO_WR SO_GSBIO SO_AR	Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Reduction of public infrastructure at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1% Reduction of households at risk to 12% Increase funding provided for DRR and resilience enhancement in GCAP lifetime to a sufficient level for the implementation of local DRR plans
A_WR_12	Develop an Action Plan for Rivers	SO_WR SO_GSBIO SO_AR	Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Reduction of public infrastructure at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1% Reduction of households at risk to 12% Increase funding provided for DRR and resilience enhancement in GCAP lifetime to a sufficient level for the implementation of local DRR plans
A_WR_13	Water usage behaviour targets for residents	SO_WR SO_AR	Development of a communication and awareness campaign for water saving reuse Reduction in water consumption per unit of city GDP to 00.4 m3/year Reduction of water consumption per capita for domestic users to 120 liters per head per day

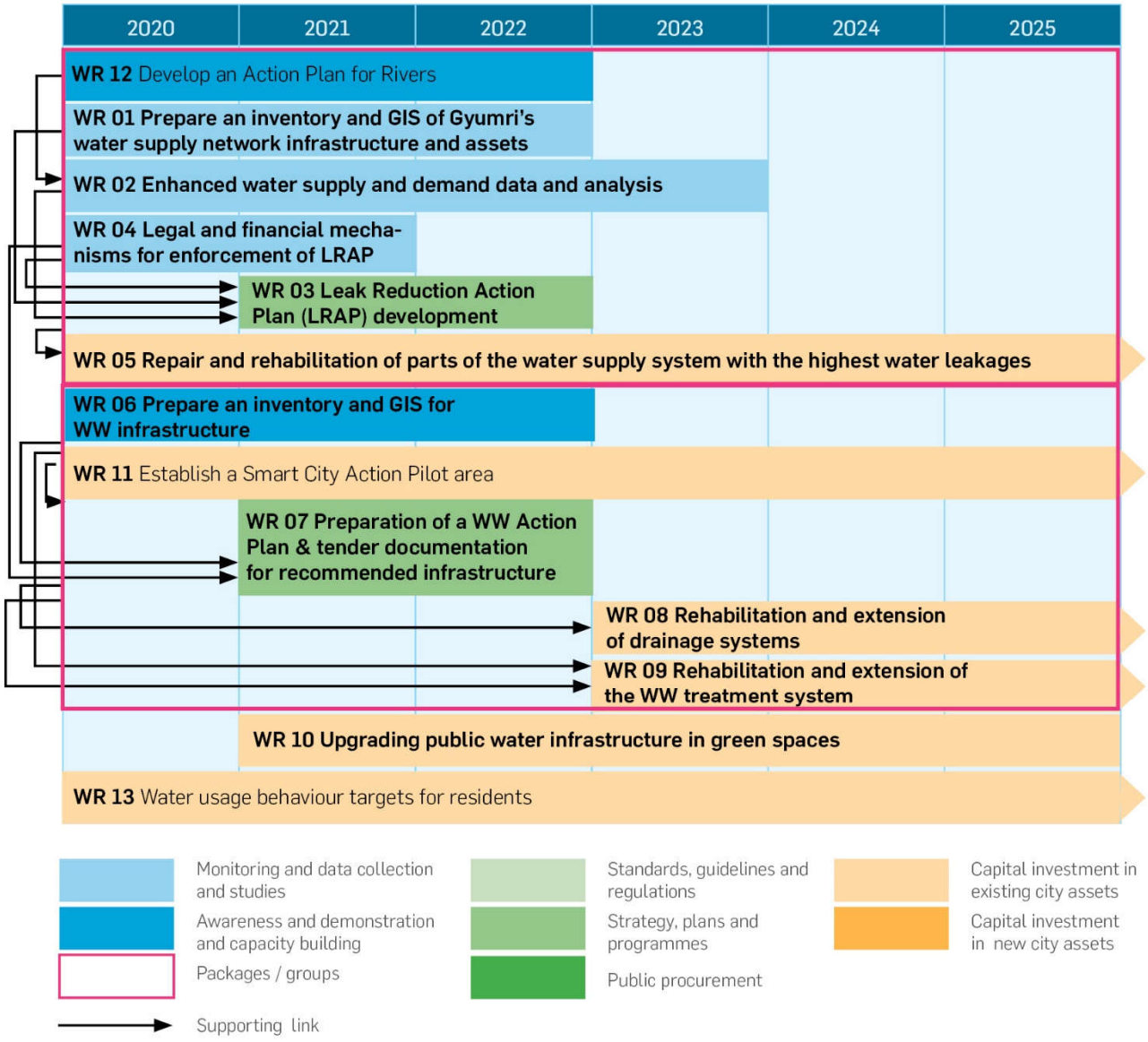


Figure 5-5 - Water actions programme

Reference Number
A_WR_01

Title: Prepare an inventory and GIS of Gyumri's water supply network infrastructure and assets

Classification: Monitoring and data collection and studies

Description

This action will involve the development of a central inventory (database) on featuring data on water infrastructure in GIS form. This will be based on a collation of existing information and the identification of data gaps on asset condition and performance. Asset surveys will then be undertaken where necessary, based on the findings of the gap study, to identify and assess the condition and performance of each component of the system. The inventory will be complemented by customer management systems and asset management systems, which will also be established under this action. The scope of water supply infrastructure and assets to be incorporated in the database is: water resources (from wells and intakes); conveyance to treatment and disinfection systems; condition of water treatment systems; the distribution network; pump stations, and; service reservoirs to the connection to commercial or residential customers. This action addresses the request to identifying where NRW occurs and who is legally and financially responsible for the losses (workshop 002).

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW		• Social: enhanced social resilience • Economic: employment generation • Environmental: improved water resources
CAPEX (EUR) 150,000 **CAPEX (AMD)** 79,500,000	**Annual OPEX (EUR)** 20,000 **Annual OPEX (AMD)** 10,600,000	**Funding options** • Municipality budget • IFI and donors
Implementation start and end date: 2020 - 2022		
Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** Veolia Jur CJCS	**Key stakeholders:** Private sector, IFIs/ donors

Reference Number **A_WR_02**		
Title: Enhanced water supply and demand data and analysis		
Classification: Monitoring and data collection and studies		
Description This action will improve water metering by installing district meters at strategic points in the network and using data from these meters to estimate levels of leakage and other NRW use from illegal connections. Based on the GIS developed in A WR 01 and the metering data collected, water supply network modelling tools will be used to understand the flow of water through the system and the supply demand balance overall and by district. This will be used to identify areas of highest water loss or poor asset conditions. Targeted surveys of leakage will also be undertaken using sonic surveys and other techniques to locate leakage points, as will surveys of water quality. This action will extend to providing customer management tailored to supply demand projections based on extending coverage. This action addresses the request for identifying where NRW occurs and who is legally and financially responsible for the losses (workshop 002).		
Environmental performance (alignment with GCAP objectives) SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW		**Key benefits** • Social: green behaviour and awareness • Economic: economic returns for investor • Environmental: improved water resources
CAPEX (EUR) 400,000 **CAPEX (AMD)** 212,000,000	**Annual OPEX (EUR)** 60,000 **Annual OPEX (AMD)** 31,800,000	**Funding options** • National government • IFI and donors
Implementation start and end date: 2020 - 2023		
Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** Veolia Jur CJCS	**Key stakeholders:** Gyumri Municipality, national government, private sector, IFIs/ donors

Reference Number
A_WR_03

Title: Leak Reduction Action Plan (LRAP) development

Classification: Strategies, plans and programmes

Description

A LRAP that covers a 20-year period will be developed in this action. It will feature a phased five- year programme that is based on costed strategies for each district regarding:

- The reduction of NRW;
- Improved resilience;
- Enhanced reliability of supply and water quality based on extending the system to new customers;
- Asset repairs and replacement, and;
- Pressure management.

The LRAP will include planning for long-term asset management with appropriate inventories and proactive asset replacement planning. The development of digital asset management systems will be considered based on the Internet of Things (IoT) smart monitoring of asset conditions. It is proposed that while the LRAP is in preparation there should be an increase in targeted repair of the most serious leaks.

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters		• Social: green behaviour and awareness • Economic: economic returns for investor • Environmental: improved water resources and resilience to climate change
CAPEX (EUR) 100,000 **CAPEX (AMD)** 53,000,000	**Annual OPEX (EUR)** 20,000 **Annual OPEX (AMD)** 10,600,000	**Funding options** • National government • IFI and donors
Implementation start and end date: 2021 - 2022		
Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** Veolia Jur CJCS	**Key stakeholders:** Gyumri Municipality, national government, IFIs/ donors, private sector

<table>
<tr><td colspan="3">Reference Number
A_WR_04</td></tr>
<tr><td colspan="3">Title: Legal and financial mechanisms for enforcement of LRAP</td></tr>
<tr><td colspan="3">Classification: Standards, guidelines and regulations</td></tr>
<tr><td colspan="3">Description
Legal and financial mechanisms for enforcement of the LRAP proposed in A WR 03 will be developed based on a programme of enforcement of the concession agreement between the Ministry of Energy Infrastructure and Natural Resources and Gyumri’s water utility. Existing legal and financial mechanisms for enforcement of LRAP will be analysed and new mechanisms will be suggested. This action addresses the request for identifying where NRW occurs and who is legally and financially responsible for the losses (workshop 002).</td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW
SO_AR Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td><td>Key benefits
• Social: improved social resilience
• Economic: economic returns for investor
• Environmental: improved water resources</td></tr>
<tr><td>CAPEX (EUR)
50,000
CAPEX (AMD)
26,500,000</td><td>Annual OPEX (EUR)
0
Annual OPEX (AMD)
0</td><td>Funding options
• National government
• IFI and donors</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - 2022</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): Veolia Jur CJCS</td><td>Key stakeholders: Gyumri Municipality, national government, IFIs/ donors, private sector</td></tr>
</table>

Reference Number
A_WR_05

Title: Repair and rehabilitation of parts of the water supply system with the highest water leakages

Classification: Capital investment in existing city assets

Description

Step1: Feasibility study and preparation of procurement:

A feasibility study for water supply system rehabilitation will be conducted and then used, along with the LRAP developed in A WR 03, to prepare procurement processes and tender documents for water supply rehabilitation and extension contractors, as well as for supporting survey services. The work will be implemented in accordance with the concession agreements in a phased programme.

Step 2: Procurement of repair and rehabilitation of parts of the water supply system:

The contracts for the repair and rehabilitation of parts of the water supply system with the highest water leakages will be let through competitive tenders for delivering the approach developed in the LRAP. Asset management systems will need to be installed, parts of the water supply system with the highest water leakages will need to be identified, and repair works will be started. Work on addressing the worst leaks and losses could start in 2020 at minimal cost. After two years when full surveys, DMA and modelling have been completed then LRAP can be implemented and works let in accordance with the full tendering processes.

Step3: Monitoring the performance of the contractors delivering the LRAP:

Based on feedback from monitoring against leakage reduction targets, it will be necessary to update and extend the LRAP programme and incorporate the asset investment plan for the city. Factors such as water quality, reliability of supply and non-revenue water levels will need to be considered and targets will need to be revised to ensure that they are appropriate to the new situation. The quality of the work done by contractors will be continuously monitored.

<table>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW
SO_AR Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td><td>Key benefits
• Social: improved social resilience
• Economic: economic returns for investor
• Environmental: improved water resources and resilience to climate change</td></tr>
<tr><td>CAPEX (EUR)
Step 1: 50,000; Step 2: 49,900,000; Step 3: 50,000
CAPEX (AMD)
Step 1: 26,500,000; Step 2: 26,447,000,000; Step 3: 26,500,000</td><td>Annual OPEX (EUR)
Step 2: 1,000,000
Annual OPEX (AMD)
Step 2: 530,000,000</td><td>Funding options
• National government
• IFI and donors
• Private sector</td></tr>
<tr><td colspan="3">Implementation start and end date: Step 1: 2020 – 2022; Step 2: 2022 – 2025; Step 3: 2022 - 2026</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): Veolia Jur CJCS</td><td>Key stakeholders: Gyumri Municipality, national government, IFIs/ donors, private sector</td></tr>
</table>

<table>
<tr><td colspan="3">Reference Number
A_WR_06</td></tr>
<tr><td colspan="3">Title: Prepare an inventory and GIS for WW infrastructure</td></tr>
<tr><td colspan="3">Classification: Monitoring and data collection and studies</td></tr>
<tr><td colspan="3">Description
This action will involve the preparation of GIS by collating existing information and conducting asset surveys where necessary. Data gaps on asset condition and performance will be identified based on the findings, and some surveys will be undertaken to fill additional gaps by identifying and assessing the condition and performance of each component of the system. A central inventory database of Gyumri City WW infrastructure will be developed based on the findings and will be established as the basis of asset management systems.

The inventory will cover WW and stormwater sewers, groundwater reservoirs, overflows to rivers, pumping stations, WW Treatment Plants (WWTP), sludge treatment and outfalls to the river. It will also be linked to water supply customer and billing management systems. If necessary, short term flow surveys of the sewer system and groundwater reservoirs will be conducted, along with flows and loads surveys at the WW Treatment Works (WWTW) inlets to determine the design parameters for necessary process upgrades.

It is understood that some of the infrastructure such as WWTP or sludge handling may be disused or may never have been constructed in Gyumri, and this will be identified by the study.</td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city
SO_AR Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td><td>Key benefits
• Social: improved social resilience
• Economic: employment generation
• Environmental: improved water resources</td></tr>
<tr><td>CAPEX (EUR)
200,000
CAPEX (AMD)
106,000,000</td><td>Annual OPEX (EUR)
10,000
Annual OPEX (AMD)
5,300,000</td><td>Funding options
• National government
• IFI and donors</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - 2022</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): Veolia Jur CJCS</td><td>Key stakeholders: Gyumri Municipality, national government, IFIs/ donors, private sector</td></tr>
</table>

Reference Number
A_WR_07

Title: Preparation of a Wastewater Action Plan and tender documentation for recommended infrastructure upgrades

Classification: Strategies, plans and programmes

Description

Wastewater Action Plan:

Gyumri's sewerage network has been substantially damaged by the earthquake, deteriorated with age, and may be undersized in places with overflows and other structures in a poor condition. New extensions will therefore be required to connect the system to more of the population and industry. Gyumri's wastewater treatment plant will also require extensive repair and improvement, possible increases in capacity and additional processes to meet water quality targets.

This action will involve the development of a costed Action Plan for the rehabilitation and extension of the WW and stormwater network to effectively meet targets for the: collection and conveyance of WW to the WWTP; separation of foul sewage from the stormwater system; prevention of discharges to the river, and; reduction of urban flooding risk from the sewers. Digital tools such as drainage modelling, based on the GIS system, may be used in the planning, design and testing of solutions featured in the Action Plan. The opportunities to incorporate SUDS (A WR 10) should also be considered in this Action Plan for the rehabilitation and extension of the WWTP to meet identified and agreed treatment and discharge standards. Sludge treatment facilities for the dewatering and stabilisation of sewage sludge produced in the treatment works prior to further use should also be incorporated.

Tender documents for recommended infrastructure upgrades:

The second part of this action will involve the preparation of tender documentation for upgrading the sewer system and WWTP.

<table>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)</td><td rowspan="4">Key benefits
• Social: enhanced safety
• Economic: employment generation
• Environmental: improved water resources</td></tr>
<tr><td colspan="2">SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW</td></tr>
<tr><td colspan="2">SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city</td></tr>
<tr><td colspan="2">SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters</td></tr>
<tr><td>CAPEX (EUR)
300,000
CAPEX (AMD)
159,000,000</td><td>Annual OPEX (EUR)
10,000
Annual OPEX (AMD)
5,300,000</td><td>Funding options
• National government
• IFI and donors</td></tr>
<tr><td colspan="3">Implementation start and end date: 2021 - 2022</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): Veolia Jur CJCS</td><td>Key stakeholders: Gyumri Municipality, private sector, national government, IFIs/ donors</td></tr>
</table>

<table>
<tr><td colspan="3">Reference Number
A_WR_08</td></tr>
<tr><td colspan="3">Title: Rehabilitation and extension of drainage systems</td></tr>
<tr><td colspan="3">Classification: Capital investment in existing city assets</td></tr>
<tr><td colspan="3">Description
Step 1: Feasibility study and preparation of procurement: The WW contracts will use similar contractual approaches as WR05 Step 1
Step 2: Undertake rehabilitation and extension of the drainage systems:
Contracts let through competitive tenders will deliver the approach developed in the WW Action Plan (A WR 07) for upgrades to the sewer, stormwater and shallow groundwater drainage systems. These should reflect a consideration of the possibilities for sustainable urban drainage features identified in A WR 10.
Step 3: Monitoring the performance of the contractors and updating the Wastewater Action Plan:
Based on feedback from monitoring against targets based on standards established by the Municipality, there should be an update and extension of the Action Plan, including to incorporate the asset investment plan for the city. This should consider factors including customer connections, sewer flood prevention, and customer service targets. Assume that work on the sewer rehabilitation contracts increases to a peak after 3 years at which point there is the review and update of the WW action plan and work scales down over the final 2 years.</td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city
SO_AR Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td><td>Key benefits
• Social: enhanced social resilience
• Economic: economic growth and employment generation
• Environmental: improved water resources and resilience to climate change</td></tr>
<tr><td>CAPEX (EUR)
13,000,000
CAPEX (AMD)
6,890,000,000</td><td>Annual OPEX (EUR)
260,000
Annual OPEX (AMD)
137,800,000</td><td>Funding options
• National government
• IFI and donors
• Private sector</td></tr>
<tr><td colspan="3">Implementation start and end date: 2021 - 2025</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): Veolia Jur CJCS</td><td>Key stakeholders: Gyumri Municipality, private sector, national government, IFIs/ donors</td></tr>
</table>

Reference Number
A_WR_09

Title: Rehabilitation and extension of the WW treatment system

Classification: Capital investment in existing city assets

Description

Step 1: Feasibility study and preparation of procurement: The WW contracts will use similar contractual approaches as WR05 Step 1

Step 2: Undertake rehabilitation and extension of the WW treatment system and provision of sludge treatment:

Contracts let through competitive tenders will be used to deliver the approach developed in the WW Action Plan (A WR 07) for the work that needs to be conducted to upgrade and possibly extend the existing treatment works. The nature of work that needs to be undertaken will be identified in this action, but it is expected that significant work will be required, including possibly to increase treatment capacity and upgrade levels of treatment to meet nutrient removal standards. Adherence to new standards will also require the addition of new processes to support the production of cleaner effluent. Sludge, the solid residual matter that is extracted from the wastewater treatment process, is difficult to handle and requires treatment before it can be usefully spread on land to improve soils or be reused in other ways – this requires specific infrastructure provision.

Step3: Monitoring of the performance of the contractors and update of the Wastewater Action Plan

Based on feedback from monitoring against targets the Action Plan will be updated and extended and will incorporate the asset investment plan for the city. With multiple components the WW treatment rehabilitation / extension will have multiple components such as tertiary nutrient removal stages, sludge treatment and extension of capacity to be scheduled over the 5 year programme to lead to steadily improving levels of service. This review will include the assessment of timing for expansion of the works in addition to rehabilitation.

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW		• Social: enhanced safety and access to services • Economic: economic returns for investors • Environmental: improved water resources and resilience to climate change
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city		
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters		
CAPEX (EUR) 14,000,000 **CAPEX (AMD)** 7,420,000,000	**Annual OPEX (EUR)** 700,000 **Annual OPEX (AMD)** 371,000,000	**Funding options** • National government • IFI and donors • Private sector
Implementation start and end date: 2021 - 2025		
Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** Veolia Jur CJCS	**Key stakeholders:** Gyumri Municipality, private sector, national government, IFIs and donors

Reference Number
A_WR_10

Title: Upgrading public water infrastructure in green spaces

Classification: Capital investment in existing city assets

Description

Where possible, stormwater and effluents should be re-used for urban irrigation in preference to the use of the fresh water supply. This may be done by the integration of water storage features in the urban landscape, such as surface water storage, underground tanks or by utilising aquifer recharge if appropriate geological conditions exist. This action will involve the assessment of Sustainable Urban Drainage (SUDS) options for Gyumri and their introduction. These can help to meet the requirements for flood risk reduction and potentially reduce the investment cost of underground sewers. Nature based drainage solutions will also enhance the green landscape of the city and provide secondary benefits in terms of air quality, scenery, microclimate, rainwater re-use and water quality improvement. Normal storm water drainage and SUDS solutions have significant interaction with highway drainage requirements and the regulations and financing related to roads should be considered in proposed works.

This work would have to proceed in Phases, starting with the assessment of options, building on the GIS systems produced for the Wastewater Action plan identifying sites suitable for SuDs / Green Infrastructure solutions and the multiple benefits these may bring and the construction costs leasing to consultations on the appropriate cost benefits and which projects to progress (2020-2021). Some pilot projects may be constructed (2022-2023) then based on experience and feedback a larger tranche of projects could be contracted and constructed (2023-2026). Monitoring will be put in place for each scheme to assess performance, operational cost and stakeholder feedback. The total cost of this component is very dependent on the option selection process and could be much less than budgeted.

<table>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)</td><td rowspan="4">Key benefits
• Social: green behaviours and awareness
• Economic: employment generation
• Environmental: enhanced green spaces and biodiversity</td></tr>
<tr><td colspan="2">SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW</td></tr>
<tr><td colspan="2">SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city</td></tr>
<tr><td colspan="2">SO_AR Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td></tr>
<tr><td>CAPEX (EUR)
2,000,000
CAPEX (AMD)
1,060,000,000</td><td>Annual OPEX (EUR)
60,000
Annual OPEX (AMD)
31,800,000</td><td>Funding options
• Municipality budget
• National government
• IFI and donors</td></tr>
<tr><td colspan="3">Implementation start and end date:
2021 - 2025</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): Veolia Jur CJCS</td><td>Key stakeholders: Gyumri Municipality, private sector, national government, IFI/ donors</td></tr>
</table>

"Land use development in Gyumri will adopt a fully integrated and holistic approach to ensure there is a balance between urban development, regeneration and the protection and enhancement of green spaces."

5.2.6. Land use

For the land use sector in Gyumri, seven actions have been developed through the GCAP process, in conjunction with the city municipality and stakeholders. All seven actions for land use are included within the prioritised list of actions.

A key issue in Gyumri is the lack of a holistic, adopted and implemented planning framework and master plan. The last city mater plan was developed in 2005, but there has been little or no adherence to the plan since its development. As such, the city has developed sporadically, with a lack of integrated land use planning, leading to poor connectivity between transport and land use and a lack of green space. One of the key land use and planning actions of the GCAP is therefore to develop and implement an updated planning framework, which will include the generation of a revised master plan and associated zoning regulations. This will be supported by the development of a comprehensive GIS database and information model, which will be produced in conjunction with the updating of the master plan. In Gyumri, there is also a lack of wider urban planning guidance, specifically related to the re-development of brownfield sites, which will be addressed in the plan.

Implementing a new master plan, zoning regulations and planning guidance will only be successful with the relevant supporting actions. Specifically, within Gyumri, there is a significant issue with enforcement and regular monitoring of new developments and as such the GCAP contains an action to review the process and recommend changes and updates as necessary, which will be aligned with full utilisation and adoption of the new planning documentation. There is also a need to upskill and capacity build amongst city policy makers, planners and regulators to ensure that there is a complete understanding of the planning guidance, which will help to empower a greater quality of monitoring and enforcement.

Finally, it is important to for Gyumri to continue to protect, enhance and where possible expect is green and open spaces. As such, actions are proposed to improve the overall management of existing parks and green spaces, as well identify and implement new green spaces within the city.

Table 5-8 - Land use actions

Action reference	Action title	Strategic objectives	Alignment with mid-term targets for 2025
A_LU_01	Develop a Sustainable Urban Planning Framework for the city of Gyumri and develop an updated master plan and zoning regulations	SO_AQGHG SO_WR SO_SL SO_GSBIO	Reduction of average annual concentration of dust to 0.15 µg/ m3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Increase of ratio of open green area per inhabitant to 6 m2/inhabitant Reduction of number of polluted and potentially polluted areas by 40% on 2017 levels Reduction of public infrastructure at risk to 12% Reduction of households at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1% Increase funding provided for DRR and resilience enhancement in GCAP lifetime to a sufficient level for the implementation of local DRR plans
A_LU_02	Develop a GIS based land use database and City Information Model (CIM) for Gyumri	SO_AQGHG SO_WR SO_SL SO_GSBIO SO_AR	Reduction of average annual concentration of dust to 0.15 µg/ m3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Increase of ratio of open green area per inhabitant to 6 m2/inhabitant Reduction of number of polluted and potentially polluted areas by 40% on 2017 levels Increase of the share of land use and environment data collected and made accessible on a GIS platform Reduction of public infrastructure at risk to 12% Reduction of households at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1% Increase funding provided for DRR and resilience enhancement in GCAP lifetime to a sufficient level for the implementation of local DRR plans
A_LU_03	Create targeted urban planning guidance and tools	SO_AQGHG SO_WR SO_SL SO_AR SO_GSBIO	Reduction of average annual concentration of dust to 0.15 µg/ m3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Increase of ratio of open green area per inhabitant to 6 m2/inhabitant Reduction of number of polluted and potentially polluted areas by 40% on 2017 levels Reduction of public infrastructure at risk to 12% Reduction of households at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1%
A_LU_04		SO_AQGHG	Reduction of average annual concentration of dust to 0.15 µg/ m3

	Enforce planning policy and building regulations	SO_WR SO_SL SO_GSBIO SO_AR	Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Increase of ratio of open green area per inhabitant to 6 m2/inhabitant Reduction of number of polluted and potentially polluted areas by 40% on 2017 levels Reduction of public infrastructure at risk to 12% Reduction of households at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1%
A_LU_05	Urban planning and sustainable development public-sector capacity building	SO_AQGHG SO_WR SO_SL SO_GSBIO SO_AR	Reduction of average annual concentration of dust to 0.15 µg/ m3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Increase of ratio of open green area per inhabitant to 6 m2/inhabitant Reduction of number of polluted and potentially polluted areas by 40% Reduction of public infrastructure at risk to 12% Reduction of households at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1% Increase funding provided for DRR and resilience enhancement in GCAP lifetime to a sufficient level for the implementation of local DRR plans] Increase in municipal staff in the planning department with up-to-date training in related policy and planning to 100%
A_LU_06	Management strategy for public parks and green spaces	SO_AQGHG SO_WR SO_SL SO_GSBIO SO_AR	Reduction of average annual concentration of dust to 0.15 µg/ m3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita Reduction of ammonium (NH4) concentration in rivers and lakes to 0.4-1.2 mg/l Increase of ratio of open green area per inhabitant to 6 m2/inhabitant Reduction of number of polluted and potentially polluted areas by 40% on 2017 levels Increase in the diversity of bird's population Increase of the share of land use and environment data collected and made accessible on a GIS platform Reduction of public infrastructure at risk to 12% Reduction of households at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1% Increase funding provided for DRR and resilience enhancement in GCAP lifetime to a sufficient level for the implementation of local DRR plans
A_LU_07	Provision of green infrastructure, parks and open space	SO_AQGHG SO_WR SO_SL SO_GSBIO SO_AR	Increase of ratio of open green area per inhabitant to 6 m^2/inhabitant Increase in the diversity of bird's population

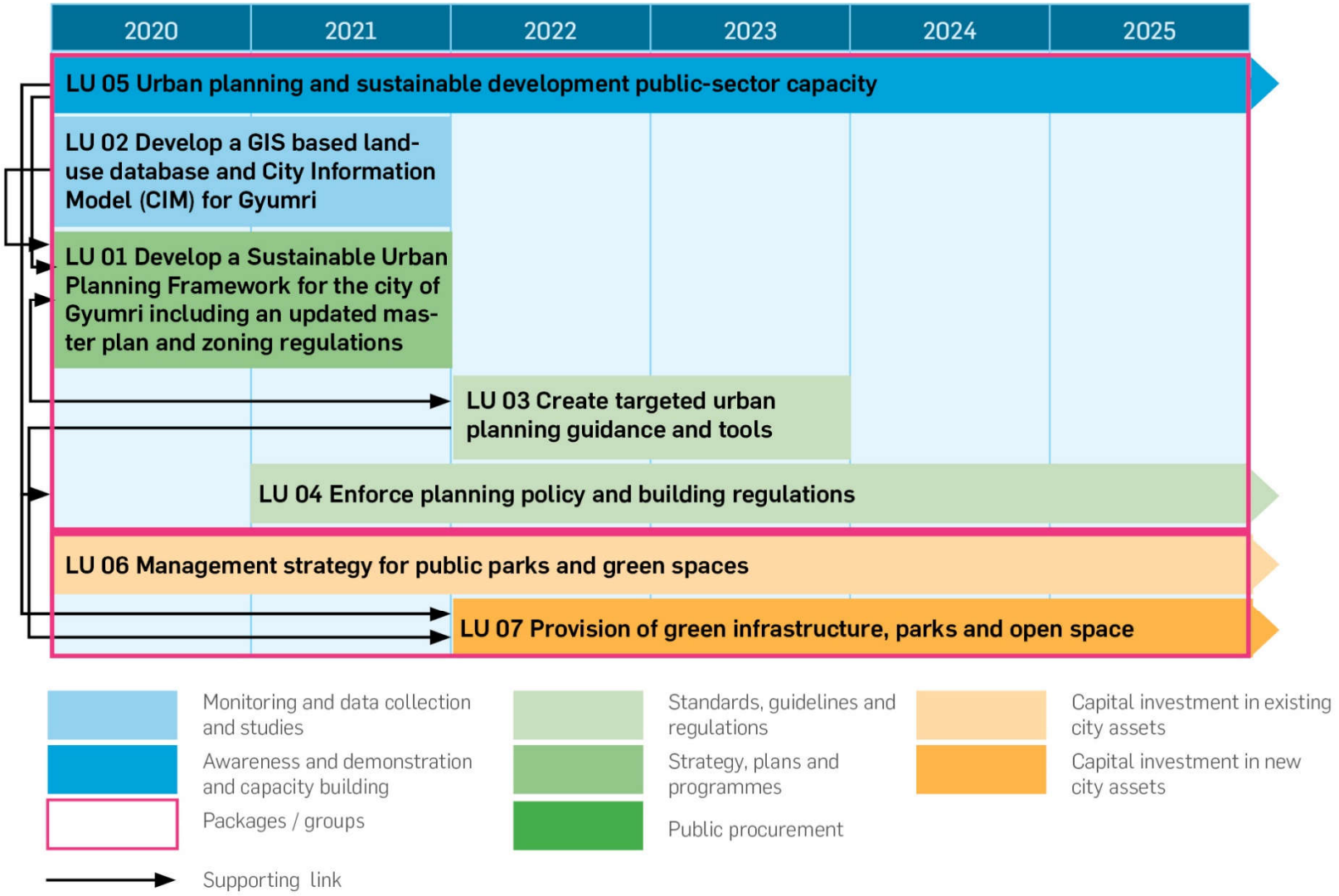


Figure 5-6 - Land use actions programme

Reference Number
A_LU_01

Title: Develop a Sustainable Urban Planning Framework for the city of Gyumri including an updated master plan and zoning regulations

Classification: Strategies, plans and programmes

Description

Step 1: Development of an overarching planning framework for the city to address existing policy gaps, such as the absence of an up-to-date urban plan of Gyumri and in relation to sustainable solid waste and wastewater management, transport, land use and urban planning, and climate change.

Step 2: Generation of an integrated and holistic master plan for the city, which is a key component of the sustainable urban planning framework. The master plan will cover all land uses and be developed via extensive consultation and coordination with city stakeholders. It will recommend focussed interventions, which could include Innovation Districts, establishing a series of interconnected, mid-to high density, pedestrian priority (car free) districts, such as Kumayri Historical Centre and Gyumri Technology Centre. The master plan, which will incorporate detailed zoning regulations for the city, will need to be reviewed every five years and updated every 10 years. In order to support the master plan development process, Gyumri Municipality will establish a physical and digital platform to host regular consultations with all stakeholders.

Environmental performance (alignment with GCAP objectives)	**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)	• Social: cultural heritage, green behaviour and awareness • Economic: economic growth and inclusion • Environmental: enhanced water resources, soils, green spaces and biodiversity and air quality and reduced GHG emissions
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW	
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city	
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city	

CAPEX (EUR)	**Annual OPEX (EUR)**	**Funding options**
Step 1: 300,000 Step 2: 500,000 **Total CAPEX (AMD)** 424,000,000	Step 1: 5,000 Step 2: 5,000 **Annual OPEX (AMD)** Step 1: 2,650,000 Step 2: 2,650,000	• Municipality budget • National government • IFI and donors

Implementation start and end date:
2020 - 2021

Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** IFIs/ donors	**Key stakeholders:** Statutory Bodies (e.g. Shirak Marz District Administration, Land Cadastre, Ministry of Territorial Administration and Infrastructure, Ministry of Environment, State Committee on Urban Development, and Ministry of Economic Development and Investments), community groups, industry associations, CSOs, universities, NGOs, private sector, cultural/ heritage organisations, and other professional bodies

<table>
<tr><td colspan="3">Reference Number
A_LU_02</td></tr>
<tr><td colspan="3">Title: Develop a GIS based land use database and City Information Model (CIM) for Gyumri</td></tr>
<tr><td colspan="3">Classification: Monitoring and data collection and studies</td></tr>
<tr><td colspan="3">Description
There is a lack of an integrated database on land use and the environment. A GIS based land use and environmental database of Gyumri should therefore be developed as a useful tool for urban planning, research, analysis and monitoring. The Municipality should digitise city data, which will allow data to be processed, analysed and displayed quickly for various urban planning purposes. A GIS based land use database should comprise a number of layers with different spatial information content. The system should consist of land use types, green infrastructure, transport, hydrology, contaminated land, utilities, public facilities, protected ecological sites and brownfield sites. The GIS system will facilitate high quality monitoring of basic climate elements and help define the climate trends. The digitisation process and development of the GIS system could be a common activity of the city administration departments in cooperation with universities, statutory bodies, utility companies and NGOs. The GIS system after development could later be made available online for public accessibility. The GIS could also form the backbone of a City Information Model (CIM), which will also be developed in this action based on the data featured in the database.</td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city
SO_AR Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td><td>Key benefits
Social: citizenship engagement and participation
Economic: economic growth, employment generation and inclusion
Environmental: enhanced water resources, soils, green spaces and biodiversity and air quality and reduced GHG emissions</td></tr>
<tr><td>CAPEX (EUR)
1,000,000
CAPEX (AMD)
530,000,000</td><td>Annual OPEX (EUR)
10,000
Annual OPEX (AMD)
5,300,000</td><td>Funding options
Municipality budget
IFI and donors</td></tr>
<tr><td colspan="3">Implementation start and end date:
2021 - 2023</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): Urban Constructions and Architecture, Gyumri Municipality, IFIs/ donors</td><td>Key stakeholders: Statutory Bodies, NGOs professional bodies</td></tr>
</table>

Reference Number
A_LU_03

Title: Create targeted urban planning guidance and tools

Classification: Standards, guidelines and regulations

Description

There is a lack of detailed urban planning policy and land use plans in the city. Supplementary planning guidance is useful for providing a further steer regarding specific policies set out within the Sustainable Urban Planning Framework, including topics such as urban design requirements and appropriate housing density, development management guidance, green infrastructure and heritage conservation. These can be used to identify maintenance, deficiencies, enhancements, new provisions, densities and standards. They can play an important supporting role in planning decisions by providing more information on how to apply specific urban planning policies in Gyumri. Once adopted by the Municipality the supporting documents can be considered in decisions or to support development proposals.

It is proposed that the creation of urban planning and guidance and tools focuses in particular on guidance to encourage brownfield and mixed-use development, and Transit Oriented Development (TOD), which would facilitate sustainable development in Gyumri and reduce urban sprawl. TOD optimises and maximises land use with strong public transport links, and promotes a mix of residential, commercial, retail and leisure opportunities. TOD should therefore become an integral part of Gyumri's urban development with environmentally friendly modes of transport between the city centre and recreational zones sought to enhance the sustainable integration of the central business district to the train station. Opportunities for the infilling of urban areas to meet appropriate density targets, including targets regarding the reactivation of brownfield sites, should also be pursued and the Municipality should restrict and resist urban sprawl and development that does not promote this urban planning policy. Other associated measures, such as the promotion of car free spaces and reduction of car parks that can be released for other developments, or new public spaces, while promoting sustainable transport modes should also be the subject of urban planning guidance and tools.

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)		• Social: cultural heritage, green behaviour and awareness • Economic: economic growth and inclusion • Environmental: enhanced green spaces and biodiversity, resilience to climate change, and air quality and reduced GHG emissions
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW		
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city		
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city		
CAPEX (EUR) 400,000 **CAPEX (AMD)** 212,000,000	**Annual OPEX (EUR)** 15,000 **Annual OPEX (AMD)** 7,950,000	**Funding options** • Municipality budget • IFI and donors
Implementation start and end date: 2022 - 2023		
Action owner: Urban Constructions and Architecture, Gyumri Municipality	**Implementing partner(s):** IFIs/ donors	**Key stakeholders:** Statutory Bodies, private sector, Universities, NGOs, professional bodies

<table>
<tr><td colspan="3">Reference Number
A_LU_04</td></tr>
<tr><td colspan="3">Title: Enforce planning policy and building regulations</td></tr>
<tr><td colspan="3">Classification: Standards, guidelines and regulations</td></tr>
<tr><td colspan="3">Description
There is a lack of enforcement, and inconsistent monitoring, of development in accordance with urban planning policies. Urban planning enforcement deals with breaches of land use planning, including where building work requiring planning permission is undertaken without such permission or does not comply with urban planning laws or plans. Establishing a regulated process of monitoring development, the focus of this action, will help the Municipality to identify where inappropriate development is taking place and enable efficient enforcement to be undertaken.</td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city
SO_AR Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td><td>Key benefits
• Social: cultural heritage, green behaviour and awareness
• Economic: employment generation
• Environmental: enhanced green spaces, biodiversity, soils, and air quality and reduced GHG emissions</td></tr>
<tr><td>CAPEX (EUR)
200,000
CAPEX (AMD)
106,000,000</td><td>Annual OPEX (EUR)
20,000
Annual OPEX (AMD)
10,600,000</td><td>Funding options
• Municipality budget
• National government
• IFI and donors</td></tr>
<tr><td colspan="3">Implementation start and end date:
2021 – 2030</td></tr>
<tr><td>Action owner: Urban Constructions and Architecture, Gyumri Municipality</td><td>Implementing partner(s): Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Key stakeholders: Statutory Bodies, NGOs, private sector, professional bodies, IFIs/ donors</td></tr>
</table>

Reference Number
A_LU_05

Title: Urban planning and sustainable development public-sector capacity building

Classification: Awareness, demonstration and capacity building

Description

To support capacity building, planning training courses and workshops will help to increase capabilities for urban planning and sustainable development in Gyumri. Gyumri Municipality will establish a digital platform communicate regular consultations with all stakeholders, community groups, industry associations, CSOs, academia, cultural and heritage groups to create, foster and maintain a comprehensive dialogue on the desired future of Gyumri. This would be a permanent forum. Further details of the capacity building include:

- Establishment of the digital platform to support communication and marketing
- Minimum four consultation capacity building sessions per annum – target of 30 plus delegates
- Utilisation of international experts at specific sessions – minimum two per annum

Environmental performance (alignment with GCAP objectives)	**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)	• Social: cultural heritage, green behaviour and awareness • Economic: employment generation • Environmental: enhanced green spaces, biodiversity, soils, resilience to climate change and air quality and reduced GHG emissions
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW	
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city	
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city	
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters	

CAPEX (EUR)	**Annual OPEX (EUR)**	**Funding options**
100,000 **CAPEX (AMD)** 53,000,000	20,000 **Annual OPEX (AMD)** 10,600,000	• IFIs and donors

Implementation start and end date:
2020 - Ongoing

Action owner: Urban Constructions and Architecture, Gyumri Municipality	**Implementing partner(s):** Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Key stakeholders:** Statutory Bodies, Universities, NGOs professional bodies, private sector

Reference Number
A_LU_06

Title: Management strategy for public parks and green spaces

Classification: Monitoring, data collection and studies

Description

Harmonisation is required between dynamic urbanisation and environmental protection in Gyumri. The city's green areas, both urban and rural, are under threat due to shortcomings in the implementation of the previous city master plan, where the need for preserving and enhancing green space was lost. Although there are some established green recreational areas in Gyumri, there is a general lack of urban green space for recreational purposes within the wider urban area and where these green spaces exist they are not always well maintained or managed and opportunities for their enhancement are not exploited. This action will identify opportunities for the Municipality to protect its green spaces by improving their maintenance, management and enhancement. This should include the implementation of related best practices such as the Green Flag Award (a benchmark national standard used in the UK) or other internationally recognised best practice as an incentive to encourage well managed and accessible parks and green spaces. This type of option will be identified in this action, which also includes a significant amount of green space management, monitoring and inspection.

Environmental performance (alignment with GCAP objectives)	**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)	• Social: citizenship engagement and participation and cultural heritage • Economic: employment generation • Environmental: enhanced green spaces, biodiversity and soils
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW	
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city	
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city	
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters	

CAPEX (EUR)	**Annual OPEX (EUR)**	**Funding options**
50,000 **CAPEX (AMD)** 26,500,000	40,000 **Annual OPEX (AMD)** 21,200,000	• Municipality budget • National government • Private sector

Implementation start and end date:
2020 – 2029

Action owner: Urban Constructions and Architecture, Gyumri Municipality	**Implementing partner(s):** Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Key stakeholders:** Statutory Bodies, NGOs professional bodies, national government, private sector

<table>
<tr><td colspan="3">Reference Number
A_LU_07</td></tr>
<tr><td colspan="3">Title: Provision of green infrastructure, parks and open space</td></tr>
<tr><td colspan="3">Classification: Capital investment in new city assets</td></tr>
<tr><td colspan="3">Description
Provision of green infrastructure:
A change in approach to the urban planning of green infrastructure has had a negative impact on green spaces, and this has been exacerbated by the existence of temporary dwellings associated with earthquakes and the sporadic nature of urban development. This action proposes to identify and confirm where there are specific green space deficiencies in the city and to establish strategic green infrastructure where there is the identified potential to introduce well-planned parks and open space with connections to appropriate land use developments and transport infrastructure. New green spaces and corridors for the city will be identified and created and ideally linked by tree lines to help to restore, enhance and preserve the landscape identity of the city. This should be done in line with best practices for parks and green spaces and the urban planning standards to be developed in this action. The proposal is for the acquisition of 40 hectares of land new green space and improvements.</td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city
SO_AR Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td><td>Key benefits
Social: enhanced green behaviours and awareness and social resilience
Economic: Economic returns for investor and economic growth
Environmental: Enhanced green spaces and biodiversity</td></tr>
<tr><td>CAPEX (EUR)
3,000,000
CAPEX (AMD)

1,590,000,000</td><td>Annual OPEX (EUR)
30,000Annual OPEX (AMD)
15,900,000</td><td>Funding options
Municipality budget
National government
Private sector</td></tr>
<tr><td colspan="3">Implementation start and end date:
2022 - 2025</td></tr>
<tr><td>Action owner: Urban Constructions and Architecture, Gyumri Municipality</td><td>Implementing partner(s): Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Key stakeholders: Statutory Bodies, NGOs, national government, professional bodies, private sector</td></tr>
</table>

"Gyumri will enhance the completeness and quality of its collection of environmental data and invest in actions which will protect the city from the impact of climate change and natural disasters"

5.2.7. Cross-cutting actions

Cross-cutting actions do not sit under any of the urban sectors but address environmental challenges directly. Nine cross-cutting actions have been developed through the GCAP process, in conjunction with the city municipality and stakeholders. Five cross-cutting actions are included within the prioritised list of actions.

A key issue in Gyumri is the lack of localised, good quality data on air quality. Some data is available within the city, but its completeness and reliability is questionable. The GCAP puts forward actions that specially address the need for a dedicated municipal level air quality monitoring system, as well as the establishment of a corrective system to address immediate air quality issues in the city. The priority GCAP actions address the former, with a municipal air quality monitoring system a key recommended action of the plan.

Other actions put forward as cross-cutting measures include addressing issues of soil quality through the enforcement of international regulations and undertaking baseline studies to obtain a clearer understanding of the levels and type of biodiversity in the city, although both were not included within the priority list.

A key component of the plan is also to consider the adaptation and resilience of the city, specifically linked to climate change. As such, the plan includes actions which specially address the environmental challenges in this area. This includes conducting a climate risk assessment of infrastructure in the water, transport, solid waste and buildings, energy and lighting sectors and the development of a plan for climate proofing Gyumri's infrastructure. This diagnostic and action plan will enable the city to earmark focused investment for measures that increase the resilience of the city to changing climatic conditions.

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Table 5-9 - Cross-cutting actions

Action reference	Action title	Strategic objectives	Alignment with mid-term targets for 2025
Priority actions			
A_AQGHG_01	Develop a municipal air quality monitoring system	SO_AQGHG	Increase of share of air pollutant sources identified and monitored to 30%
A_AR_01	Conduct a Climate Risk Assessment of infrastructure in the water, transport, solid waste and building, energy and lighting sectors	SO_AR	Reduction of public infrastructure at risk to 12% Reduction of households at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1% Increase funding provided for DRR and resilience enhancement in GCAP lifetime to a sufficient level for the implementation of local DRR plans
A_AR_02	Prepare an Action Plan for enhancing the climate resilience of Gyumri's infrastructure	SO_AR	Reduction of public infrastructure at risk to 12% Reduction of households at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1 Increase funding provided for DRR and resilience enhancement in GCAP lifetime to a sufficient level for the implementation of local DRR plans
A_AR_03	Develop an Emergency Preparedness Action Plan	SO_AR	Reduction of public infrastructure at risk to 12% Reduction of households at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1 Increase funding provided for DRR and resilience enhancement in GCAP lifetime to a sufficient level for the implementation of local DRR plans
A_AR_04	Investment in climate change adaptation and resilience measures	SO_AR	Reduction of public infrastructure at risk to 12% Reduction of households at risk to 12% Reduction in the estimated economic damage from natural disasters floods droughts earthquakes as a share of GDP to 1 Increase funding provided for DRR and resilience enhancement in GCAP lifetime to a sufficient level for the implementation of local DRR plans

Action reference	Action title	Strategic objectives	Alignment with mid-term targets for 2025
Additional actions			
A_AQGHG_02	Establish a corrective system for air quality	SO_AQGHG	Reduction of average annual concentration of dust to 0.15 µg/ m3 Reduction of annual CO_2 emissions per unit of GDP by 20% on the 2014 level Reduction of annual CO_2 equivalent emissions per capita to 3.0 t/yr/capita
A_SL_01	Adopt and enforce international soil quality regulations	SO_SL	Reduction of number of polluted and potentially polluted areas by 40% on 2017 levels
A_SL_02	Assess soil quality and air quality and integrate findings into urban development decision-making	SO_SL	Reduction of number of polluted and potentially polluted areas by 40% on 2017 levels
A_GSBIO_01	Establish a baseline of biodiversity in the city	SO_GSBIO	Increase in the diversity of bird's population

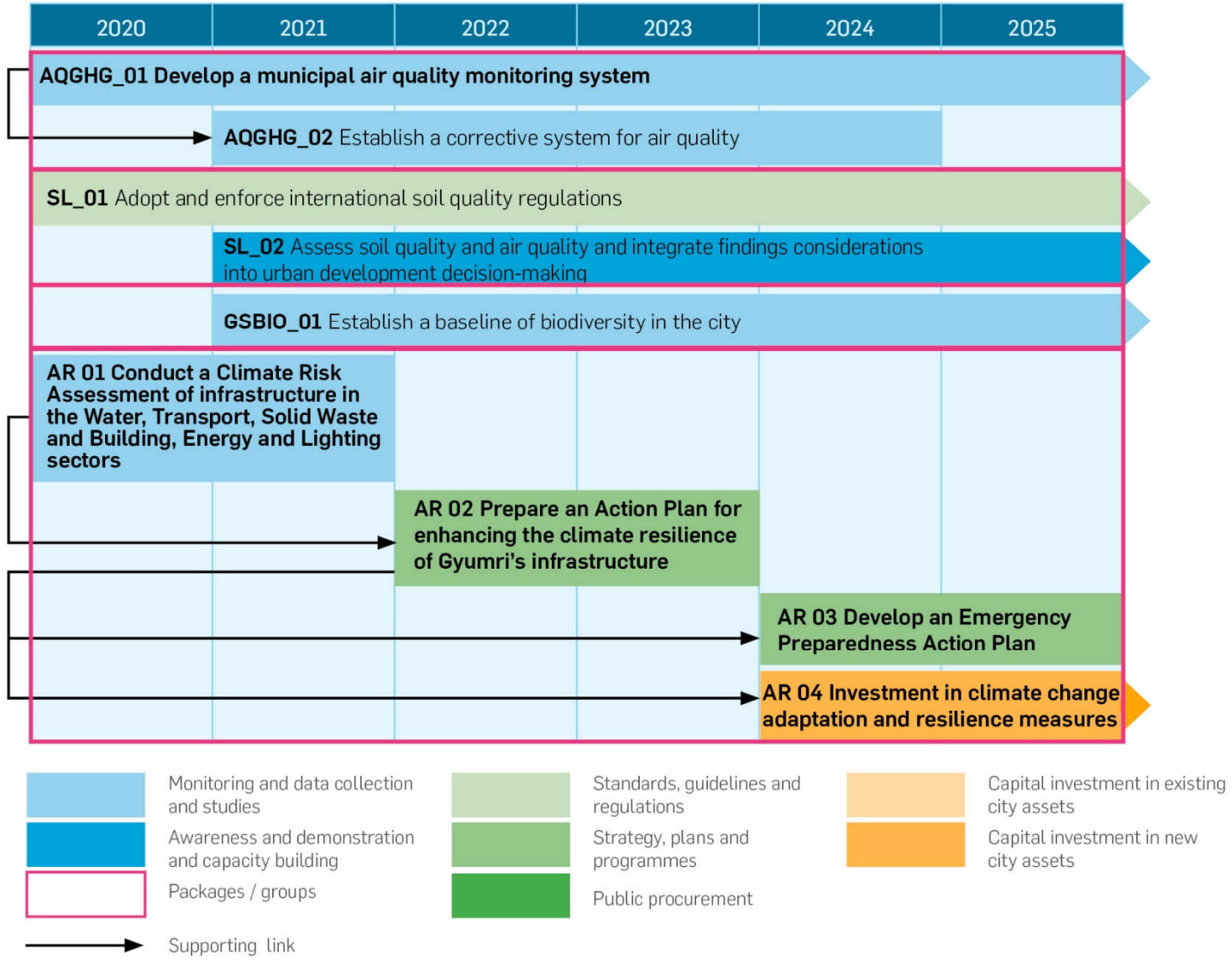


Figure 5-7 - Cross-cutting actions programme

Reference Number
A_AQGHG_01

Title: Develop a municipal air quality monitoring system

Classification: Monitoring and data collection and studies

Description

This action will involve the development and implementation of an integrated monitoring system of air pollution in Gyumri based on local needs for air quality reporting. It will involve the delivery of the following activities:

(1) The city should establish an integrated system of air quality monitoring and air pollution modelling, including on-line interactive map of air pollution and also of traffic monitoring and modelling. The system should be based on professional analysis of the city air quality data needs, related to the city development trends and functional zones.

(2) The city will procure its own stationary/mobile monitoring system of air pollution gathering short-term period data (e.g. 10- or 20-minute values, which can be compared with EU/ WHO as well as national standards), within the limits of budgetary possibilities and available external funding.

(3) The city will hire technical personnel and provide them with necessary training to make them capable of operating the system. The external experts will develop the scope of equipment, the monitoring methodology based on city needs and need to cross-reference with the national monitoring system, the public information sharing, reporting and data visualization on a web-based platform.

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)		• Social: green behaviours and awareness, citizen participation and engagement • Economic: economic inclusion, employment generation • Environmental: enhanced air quality and reduced GHG emissions
CAPEX (EUR) 200,000 **CAPEX (AMD)** 106,000,000	**Annual OPEX (EUR)** 20,000 **Annual OPEX (AMD)** 106,000,000	**Funding options** • Municipality budget • National government • IFI and donors
Implementation start and end date: 2021 - 2023		
Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** National government	**Key stakeholders:** Hydrometeorological Service, Ministry of Nature Protection, Ministry of Health, IFIs/ donors

Reference Number
A_AR_01

Title: Conduct a Climate Risk Assessment of infrastructure in the water, transport, solid waste and building, energy and lighting sectors

Classification: Strategies, plans and programmes

Description

Armenia has worked with several international organisations, including the World Bank and JICA, to assess its natural disaster risk. Outputs include the Gyumri Disaster Risk Reduction (DRR) Plan of 2018, which lists seasonal climate related threats, such as frost, draught, strong winds and forest fires, and ranks associated risks, such as the poor condition of roads and external lighting. There does, however, appear to remain a lack of in-depth and targeted understanding about the risk of infrastructure in Gyumri's water, transport, solid waste and building, energy and lighting sectors. In this context, to inform the adoption of appropriate next steps, this action will have four key outputs:

- A vulnerability assessment detailing existing resilience of these three sectors to a range of climate risks;
- Identification of a set of thresholds that define likely 'trigger' points for action;
- An assessment of future vulnerability using climate change projections, and;
- A list of potential actions that could enhance resilience and build adaptive capacity.

Gyumri's main vulnerabilities are in the water, transport, building, energy and lighting, and solid waste sectors, which will be the focus of this Climate Risk Assessment that will set out the risks and opportunities that Gyumri faces in relation to climate change. A targeted desk-based review of available data and evidence of the impact of climatic events on Gyumri's infrastructure and services will first need to be conducted, and then a set of thresholds that can be used to identify critical points beyond which damage or changes to levels of service will occur should be identified. Quantitative data associated with the identified climate risks will then need to be reviewed to enable a link to be made between different climate risks (e.g. flooding, earthquakes, draughts and hail) and economic impacts. Local stakeholders will need to be involved in this process, including to support the development of a better understanding of vulnerabilities to climate risks. This data, along with evidence of potential risks, will feed into a vulnerability assessment, which will then be reviewed in the context of the current condition of infrastructure, which will in turn further affect vulnerability. Lastly, the findings will inform the development of a list of potential actions that could enhance Gyumri's resilience and build its adaptive capacity.

<table>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)</td><td rowspan="4">Key benefits
• Social: enhanced social resilience and safety
• Economic: economic growth
• Environmental: enhanced climate change adaptation capacity and natural disaster preparedness</td></tr>
<tr><td colspan="2">SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW</td></tr>
<tr><td colspan="2">SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city</td></tr>
<tr><td colspan="2">SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters</td></tr>
<tr><td>CAPEX (EUR)
500,000
CAPEX (AMD)
265,000,000</td><td>Annual OPEX (EUR)
0
Annual OPEX (AMD)
0</td><td>Funding options
• Municipality budget
• National government
• IFIs and donors</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - 2021</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): IFIs/ donors</td><td>Key stakeholders: Ministry of Territorial Administration and Infrastructures, Ministry of Emergency Situations, Shirak Marz Administration, Donors/IFIs</td></tr>
</table>

Reference Number
A_AR_02

Title: Prepare an Action Plan for enhancing the climate resilience of Gyumri's infrastructure

Classification: Strategies, plans and programmes

Description

This Action Plan will draw on the findings of the Climate Risk Assessment conducted in A_AR_01 by appraising and refining the list of potential actions that could be implemented to enhance Gyumri's resilience and adaptive capacity. This will be done in cooperation with the GCAP, SEAP and SECAP processes and could include land use planning, flood and erosion control, designing and renovating buildings, structural resilience upgrades, infrastructure resilience (e.g. back-up power supply, gas safety, water supply safety and contamination control) and managing natural resources (agricultural resilience, renewable energy use).

The scope of the Action Plan will be agreed with key stakeholders and consider factors such as: impacts in terms of reduced sensitivity and exposure to climate change risks or increased adaptive capacity; capacity to address key vulnerabilities identified; costs; benefits (including in terms of avoided costs of reconstruction, avoided disruptions, lower risks for users and contributions towards wider environmental, social and economic objectives, and; implementation timescales.

The Action Plan will present the prioritised adaptation measures as well as information on their costs, benefits, barriers to implementation, risks and Implementing partner(s). The plan will also include examples of best practice from other areas/countries to show that the proposed actions can be delivered and initial recommendations on the next steps for implementation, for example with regard to potential funding sources and mechanisms. This will cover the integration of implementation provisions and DRR measures into municipal budgets. It will also include indicators of preparedness (to track adaptation actions and associated risks, opportunities and impacts) and wider recommendations for monitoring and evaluating the impacts of the Adaptation Action Plan.

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters		• Social: enhanced social resilience and safety • Economic: economic growth • Environmental: enhanced climate change adaptation capacity and natural disaster preparedness
CAPEX (EUR) 500,000 **CAPEX (AMD)** 265,000,000	**Annual OPEX (EUR)** 0 **Annual OPEX (AMD)** 0	**Funding options** • Municipality budget • National government • IFIs and donors
Implementation start and end date: 2021 - 2022		
Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** IFIs/ donors	**Key stakeholders:** Ministry of Territorial Administration and Infrastructures, Ministry of Emergency Situations, Shirak Marz Administration

Reference Number **A_AR_03**		
Title: Develop an Emergency Preparedness Action Plan		
Classification: Strategies, plans and programmes		
Description Armenia has been working with several international organisations to develop natural disaster risk mitigations and emergency preparedness plans, including via the Global Facility for Disaster Reduction and Recovery (GFDRR). These include the Gyumri Disaster Risk Reduction (DRR) Plan of 2018. There does not, however, appear to be an Emergency Preparedness Action Plan in place for Gyumri. This Action will develop this plan, which will include disaster risk reduction and management plans and protocols, including provisions for practice evacuations, in close cooperation with city institutions (including public organisations, educational and pre-school institutions, public / utility services, community groups and NGOs). The process of developing the plan will also be designed to raise awareness of climate change related risks amongst citizens of Gyumri.		
Environmental performance (alignment with GCAP objectives) SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters		**Key benefits** • Social: enhanced social resilience and safety and citizenship engagement and participation • Economic: economic growth • Environmental: enhanced climate change adaptation capacity and natural disaster preparedness
CAPEX (EUR) 500,000 **CAPEX (AMD)** 265,000,000	**Annual OPEX (EUR)** 0 **Annual OPEX (AMD)** 0	**Funding options** • Municipality budget • National government • IFIs and donors
Implementation start and end date: 2023 - 2024		
Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** IFIs/ donors	**Key stakeholders:** Ministry of Territorial Administration and Infrastructures, Ministry of Emergency Situations, Shirak Marz Administration

Reference Number
A_AR_04

Title: Investment in climate change adaptation and resilience measures

Classification: Capital investment in new city assets

Description
This action would contribute towards the implementation of measures identified in A_AR_01 and prioritised and refined in A_AR_02 for their potential to enhance Gyumri's resilience and adaptive capacity and associated investment requirement s in the water, transport, solid waste and buildings, energy and lighting sectors. The specific investments have not, therefore, yet been identified but they would be in addition to the mainstreaming of adaptation and resilience elements into other GCAP measures.

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters		• Social: enhanced social resilience and safety • Economic: economic returns for investor, economic growth and employment generation • Environmental: enhanced climate change adaptation capacity and natural disaster preparedness
CAPEX (EUR) 15,000,000 **CAPEX (AMD)** 7,950,000,000	**Annual OPEX (EUR)** 0 **Annual OPEX (AMD)** 0	**Funding options** • Municipality budget • National government • IFIs and donors • Private sector
Implementation start and end date: 2024 - Ongoing		
Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** IFIs/ donors	**Key stakeholders:** Ministry of Territorial Administration and Infrastructures, Ministry of Emergency Situations, Shirak Marz Administration, private sector

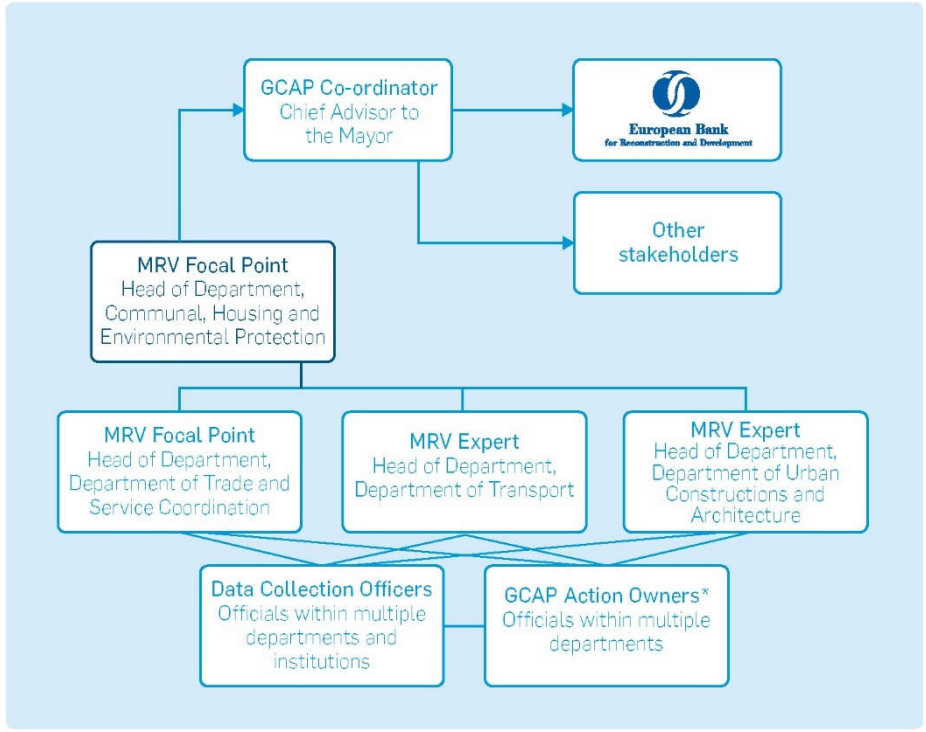
6. Monitoring

The implementation of the GCAP needs to be reviewed, its impact evaluated, and the likelihood of achieving its visions and objectives, as well as opportunities for improvement, understood. This will be done by monitoring GCAP actions with respect to their progress and contribution towards achieving mid-term and long-term targets. The results of the monitoring will then need to be reported and communicated with the relevant stakeholders. The findings will enable GCAP challenges, objectives, actions and targets to be periodically revisited and potentially refined. This chapter provides an overview of the monitoring process that will guide this process and of associated governance arrangements. It also summarises the stakeholders who are either accountable, responsible or have and will continue to be consulted in relation to the Monitoring, Reporting and Verification (MRV) process.

6.1. Monitoring, Reporting and Verification and process

A designated official (an MRV Focal Point) within Gyumri Municipality (potentially the Department of Communal, Housing and Environmental Protection) will be responsible for ensuring the timely MRV of the implementation of the GCAP actions, their contribution towards achieving mid-term and long-term targets, and the likelihood of GCAP visions and objectives being met. They will adopt a co-ordination role, executed with the appropriate senior-level support from the wider Municipality, as summarised in Figure 6-1. It is proposed that this role be assigned to an individual in accordance with best practice, but as per all elements of this proposed approach, this will need to be discussed when the monitoring process is fully established with the city. Resource requirements, for example, might dictate that it is more appropriate for the role to be shared between several individuals within a department. The role will involve the delivery of the following activities:

1. Liaise with the GCAP Co-ordinator, the Chief Advisor to the Mayor, to confirm the data collection requirements (including its frequency and quality) for assessing the implementation and impact of GCAP actions, as well as associated timescales and budget, and ultimately of the GCAP as a whole. This should include a review of the targets and constituent indicators that each GCAP action will contribute towards achieving, as well as the objectives that each target addresses, which are presented in Chapter 5. This step will also be used to support the identification of synergies with other city, and wider domestic, processes and protocols as well as of the specific stakeholders responsible for each (see also Section 6.2);
2. Identify and assign an official ('MRV Expert') within each of the departments responsible for the implementation of a GCAP action(s) (see Table 6-1) to MRV the action(s) – it is likely that this would be a head of department. It is anticipated that this will in most instances, if not all, be the same official who is responsible for the implementation of the relevant GCAP action ('GCAP Action Owner') from the relevant department within Gyumri Municipality. The selected officials will be responsible for the monitoring, data verification and reporting on a) the implementation progress of each action, b) on the budget, scope and implementation programme of each action, and c) the impact of each action in relation to the relevant targets;
3. Identify and designate an official ('Data Collection Officer') with responsibility for the collection and review of data to inform each GCAP indicator;
4. Establish formal communication channels between the MRV Experts and the relevant Data Collection Officers;
5. Communicate regularly with officials designated MRV responsibilities to ensure that they are suitably informed, trained and otherwise supported to conduct their role effectively, efficiently and in a transparent and consistent manner. This will include the development and dissemination of proformas and associated guidance to facilitate the MRV of appropriate and consistent data that meets the requirements of the GCAP methodology. This communication should also be conducted to ensure that the tasks of the MRV Experts and Data Collection Officers are being executed to the specified quality, time and budget, as set by the GCAP Co-ordinator;
6. Set and enforce deadlines for regular reports relating to each GCAP action and indicator;
7. Assimilate inputs from MRV Experts to report on each GCAP action, as well as on the progress and impact of the GCAP as a whole, and cascade the findings to the GCAP Co-ordinator, the Chief Advisor to the Mayor. The Chief Advisor to the Mayor will in turn share findings with other stakeholders (see Section 6.2), notably internal and external actors who are responsible for making decisions based on the findings.



* If different from the designated MRV Focal Point and MRV Experts.

Figure 6-1 - An overview of key actors in the MRV process and the governance arrangements for managing its implementation

The stakeholders who are either responsible or accountable for elements of the GCAP MRV process or have or will be consulted as part of the process, are listed in Section 6.2.

Table 6-1 - Departments responsible for MRV by GCAP sector

GCAP sector	Department responsible for MRV
Buildings, energy and lighting	Communal, Housing and Environmental Protection
Industry	Department of Trade and Service Coordination
Land use	Urban Constructions and Architecture
Solid waste	Communal, Housing and Environmental Protection
Transport	Transport
Water	Communal, Housing and Environmental Protection

The MRV Experts, as appointed by the MRV Co-ordinator to take responsibility for the MRV of actions in specific GCAP sectors, will be required to:

1. Acquire an in-depth understanding of the targets and indicators relevant to their GCAP action(s) and about how the data to inform each is derived and validated. This will require consultation with the Data Co-ordinator and relevant Data Collection Officers;
2. Communicate regularly with the official responsible for the implementation of each GCAP action ('GCAP Action Owner'), and if different then also the official responsible for reviewing and if necessary, revising the budget, scope and planning of each action;
3. Familiarise themselves with the required method and frequency of data collection for each data item. In terms of the monitoring of the implementation of GCAP actions, data collection will in all instances be continuous throughout the implementation period, but there will be more variation in the frequency of the data collection for each indicator. Examples are provided in Table 6-2 in the context of a specific GCAP action;
4. Liaise with Data Collection Officers to ensure that any factors that might compromise the quality or availability of data to meet deadlines set by the MRV Focal Point are identified in time to identify an alternative approach;
5. Adopt responsibility for the validation of all data in relation to each GCAP action, reviewing data received to ensure that it is complete, consistent and otherwise robust;

6. Analyse and assimilate the inputs of Data Collection Officers and GCAP Action Owners to report on the progress and impact of each GCAP action, and report on the findings; and
7. Cascade the results of the MRV to the MRV Focal Point.

Table 6-2 - Indicative monitoring scheme for GCAP action A_TR_15

Indicator	Data collection frequency	Data collection method	Responsible department
Average annual concentration of dust	Continuous	Stationary (active sampling) automated observation stations that monitor dust (and other pollutants) on a daily basis using data from both existing stations and the stationary/ mobile monitoring system that will be procured in A-AQGHG_01	The existing observation stations are managed by the State Environmental Monitoring and Information Centre (SEMIC), a State Non-Commercial Organisation (SNCO) that reports to the Ministry of Environment and liaises with Gyumri's Department of Communal, Housing and Environmental Protection
Annual CO_2 emissions per unit of GDP	Annual	The National Statistical Service publishes GDP data. CO_2 emissions are calculated (using IPCC guidelines) by analysing activity data from a range of sources including reports of utility companies, other private enterprises and government departments[43]	The National Statistical Service (re GDP data) and the Institute of Geological Sciences, which currently co-ordinates the compilation of CO_2 emission data. The Climate Change Centre of the Department of Communal, Housing and Environmental Protection also has access.
Annual CO_2 equivalent emissions per capita	Annual	The National Statistical Service publishes population data. CO_2 emissions are calculated (using IPCC guidelines) by analysing activity data from a range of sources including reports of utility companies, other private enterprises and government departments[44]	The National Statistical Service (re population data), the Institute of Geological Sciences, which currently co-ordinates the compilation of CO_2 emission data, or the Ministry of Environment, which oversees the compilation of annual CO_2 emission data in Armenia's GHG Inventory
Public transport modal share in commuting (cars,	Annual	Survey[45]	Department of Transport, Gyumri Municipality

[43] The main sources of activity data are the Public Services Regulatory Commission of the Republic of Armenia, the Settlement Centre CJSC under the Ministry of Energy Infrastructures and National Resources of the Republic of Armenia, Gazprom Armenia CJSC and the National Statistical Service (NSS). This is supplemented by data from Ministries including the Ministry of Agricultural of the Republic of Armenia and Ministry of Economic Development and Investments of the Republic of Armenia.

[44] See previous footnote.

[45] These will be collected under A_TR_12, which will establish a city-wide data collection programme that will see annual origin and destination surveys conducted as well as surveys of public transport and taxi ridership and travel to work surveys.

Indicator	Data collection frequency	Data collection method	Responsible department
motorcycles, taxi, bus, metro, tram, bicycle, pedestrian)			

The suite of indicators (State, Pressure and Response) that have been used to identify, assess and prioritise environmental challenges facing Gyumri, and to inform the development of actions to address them and the mid- and long-term targets against which they will be assessed, has already been introduced in this GCAP. As referenced previously, the data collected has been presented alongside global benchmark values in an Indicator Database, an EBRD spreadsheet-based tool, which sets out a baseline against which the impact of GCAP actions can be assessed. The data collected in the monitoring process will largely be consistent with the indicators that form this baseline, and so the database will continue to be used in the MRV process. Figure 6-2 features a screenshot of the database. The MRV requirements will not necessitate the update of all indicators - those that map against the GCAP actions and targets are listed in Chapter 5, and these are likely to be refined (and perhaps reduced in number) as understanding about the optimal set of indicators develops in the course of the MRV process. It is, however, proposed that funding be secured to ensure the update of the full Indicator Database, which can be used to inform the periodic revisiting of GCAP challenges, objectives, actions and targets and its ultimate refresh.

In order to enhance the utility of the Indicator Database in this MRV process it will be extended, in addition to the update of indicator years and values. The extension and refinement, subject to the availability of associated funding, will be to:

- Fill gaps in data reporting (for example regarding the annual change in abundance of bird species);
- Address constraints and limitations associated with the available data for Gyumri, as outlined in the GCAP Technical Assessment Report; and
- Add sheets featuring each GCAP action alongside the indicators used to assess their impact.

ID	P/S/R	Type / Sector	Topic / Source	Indicator	Unit	Classification	Green Benchmark	Yellow Benchmark	Red Benchmark	National Standard	Data availability (0/1)	2015	2016	2017	2018	2019	2020	Latest year with available data	Indicator value (latest available)	Indicator flag	Sparkline	Trend	Implications	Policy relevance	Responsible Authority	Related indicators	Source of data (provide link if possible)	Notes
1.2	State	Quality_of_ Environmental _Assets	Air	Average_daily_ concentration_ of_SO2	µg/m3	Optional	20	20 – 50	50	50	1	80	69	37				2017	36.70	YELLOW		Fluctuating			Ministry of Nature Protection		Ministry of Nature Protection	
1.3	State	Quality_of_ Environmental _Assets	Air	Average_daily_ concentration_ of_NOx	µg/m3	Optional	40	40 – 80	80	40	1	13	15	19				2017	18.60	GREEN					Ministry of Nature Protection		Ministry of Nature Protection	
1.1.1	State	Quality_of_ Environmental _Assets	Air	Average_annual_ concentration_ of_TSP	µg/m3	Additional	30	30 – 70	70	150	1	280.1	174.8	325.6				2016	325.6	RED							Ministry of Nature Protection	

Figure 6-2 - A screenshot of the existing Indicator Database for Gyumri

The EBRD has set reporting requirements that apply to all GCAPs. These require the submission of a targeted report regarding the status of implementation of actions included in GCAPs, and a second report regarding the status or likelihood of achieving visions and objectives set in GCAPs. The template in Figure 6-3 ('Progress Monitoring Plan' (PMP)) has been, and will continue to be, used to communicate the results of monitoring the implementation status of GCAP actions. As indicated in Figure 6-3, it has been populated with GCAP visions, targets and actions, as well as with the contact details of implementing bodies of GCAP actions. The MRV Focal Point will update this report within a year of the GCAP being adopted by the Council of Elders, and at least annually thereafter, to state whether each GCAP action has been subject to 'No Action,' or is 'In Preparation,' 'Implementation Underway,' or 'Completed.' An explanatory note will need to be provided for each, and for GCAP actions that are either being implemented or have been completed this will need to outline any social, economic and environmental benefits that have been realised. The report will also need to state the likelihood of objectives being achieved for each GCAP action, again with an explanation provided in relation to each. The PMPs will each be submitted to the EBRD and shared with wider stakeholders.

City	Country	Sector	Code	Vision	Target	Actions	Investment / Policy	Implementing Body	Source of Funding	Potential Support	Status Implementation	Note	Date	Entered by	Verifiable target	Status meeting targets	CAPEX (€)	OPEX (over 5 years) (€)	Devt & Advisor costs	Funding need

Figure 6-3 - The Progress Monitoring Plan (PMP) reporting template

In relation to the second reporting requirement, the status or likelihood of achieving visions and objectives set in GCAPs, a similar template, the 'Impact Monitoring Plan' (IMP) (see Figure 6-4) has been populated and will be updated after three years and five years to report on the environmental improvements realised by the GCAP. This template been populated by drawing on the relevant indicator data in the Indicator Database and will be used to communicate whether the GCAP indicators are 'red,' 'amber' or 'green.' The source of related data and contact details for experts in relation to each will be featured in the report to enable the EBRD and other selected stakeholders to follow-up as appropriate.

Indicator Code (from Indicator Database)	**Topic/ Sector**	**Pressure-State-Response**	**Trend** [N/A, negative or positive]	**Colour code** [red, amber, green]	**Figure** (in Indicator Database)	**Data Source**	**Related Actions (Major Impact)**	**Related Actions (Medium Impact)**	**Related Actions (Minor Impact)**	**Data Source_ Contact / Note**
1	Air	State			667 µg/m3 annual average over 2011-2015					
1.1	Air	State								
1.1.1	Air	State								
2.1	Water	State								
10	Transport	Pressure								
10.1	Transport	Pressure								
…	…	…	…	…	…	…	…	…	…	…

Figure (3 years after GCAP finalisation)	**Colour code**	**Figure (5 years after GCAP finalisation)**	**Colour code**
667 µg/m3 annual average over 2011- 2015	Red	667 µg/m3 annual average over 2011- 2015	Green

Figure 6-4 - The Impact Monitoring Plan (IMP) reporting template

Any additional reporting requirements will be set by the GCAP Owner, which is likely to be the Chief Advisor to the Mayor, in Step 3 of the GCAP process ('Green City Implementation'), but in line with the templates featured in Figures 6-3 and 6-4 the reports should be short and focused and present data regarding GCAP action implementation progress and impact to demonstrate what has gone well and where there is scope for improvement. In terms of timing, reporting on GCAP actions that are relatively short in duration is likely to take place once the action has been completed, and the actions with a longer duration are likely to be subject to reporting at the end of each year of implementation.

6.2. Stakeholder engagement

The stakeholder engagement conducted in the course of this project was described in Chapter 2, and a list of the stakeholders who have been involved is provided in Appendix B. A wide-range of stakeholders were consulted, and selected via a stakeholder mapping exercise, to ensure that both key stakeholder groups and individuals within those stakeholder groups were identified and engaged (in relation to States, Pressures and Responses) from the beginning of the GCAP development process. This enabled the incorporation of a broad and in-depth understanding of local knowledge and interests in the process - stakeholder-based prioritisation was a key component of the identification and analysis of challenges and actions and feedback validated and contextualised the findings of the technical assessment. It also resulted in the development of support for, and ownership of, the GCAP, which it is anticipated will ultimately facilitate implementation. The role of stakeholders will remain crucial in the MRV process. Gyumri Municipality will own the MRV process, and as indicated in Section 6.1 many internal and external stakeholders will have a role to play.

The engagement model for each GCAP action, and in each GCAP sector, will vary, but Table 6-3 provides an overview of the key local stakeholders who are either accountable, responsible or have and will continue to be consulted in relation to the MRV process. The role of those who have been consulted includes supporting the identification of additional sources of data and of funding to facilitate the update and extension of the Indicator Database, including using innovative financing mechanisms.

Table 6-3 - Local stakeholders in the MRV process

Definitions:

Accountable – Answerable for the correct, thorough and comprehensive MRV of the action. The accountable stakeholder must approve and implicitly or explicitly sign off on the activities of any responsible stakeholder(s). Accountable and Responsible (see below) roles are often shared, although may be different individuals or departments within the same organisation (one approving the work of the other).

Responsible – Doing or leading the work to MRV. This may be unconstrained or constrained by conditions, rules and regulations defined by another higher (often Accountable) stakeholder.

Consulted – Opinion or contributions are sought on the MRV through two-way communication.

Sector	Gyumri Municipality Department				Shiraz Marz Province[46]	National Ministries		Veolia Jur Shirak CJSC[47]	Gazprom[48] (Shirak Marz branch)	Armenian Electric Networks CJSC (ArmElNet), Northern branch	Specialised committees[49]	NGOs and other community groups[50]	Local academia[51]
	Communal, Housing and Environmental Protection	Urban Constructions and Architecture	Department of Trade and Service Coordination	Transport		Ministry of Environment	Ministry of Territorial Administration and Infrastructures						
Buildings, energy and lighting	Accountable and Responsible	Responsible	-	-	-	Consulted[52]	Consulted[53]	-	Consulted	Consulted	Consulted[54]	Consulted	Consulted
Industry	Responsible	-	Accountable and Responsible	-	-	-	-	-	-	-	Consulted	Consulted	Consulted
Land use	Accountable and Responsible	Responsible	-	-	-	-	-	-	-	-	Consulted	Consulted	Consulted
Solid waste	Accountable and Responsible	-	-	-	-	-	-	Consulted	-	-	-	-	-
Transport	Responsible	-	-	Accountable and Responsible	Consulted	-	Consulted[55].	-	-	-	-	-	-
Water	Accountable and Responsible	-	Responsible	-	-	-	-	-	-	-	-	-	-

[46] Including the Administration's Department of Transport.
[47] Water and sewerage company serving Gyumri.
[48] Gas and electricity company serving Gyumri.
[49] Including the State Committee of Urban Development, National Statistical Service of the Republic of Armenia, Cadastre Committee of the Republic of Armenia and the Armenia Renewable Resources and Energy Efficiency Fund (R2E2).
[50] Including A.D. Sakarov, Aravot Charitable, Biosophia, Compass, Contact Plus, Energy Saving Foundation (ESF), Gyumri Youth Initiatives Centre, Meghvik, National Value Club, Regional Environmental Centre (REC), Stability and Progress, Third Nature, and Vanand.
[51] Including the National Academy of Sciences of the Republic of Armenia and the Gyumri Technology Centre.
[52] Climate Change Centre.
[53] Energy Department.
[54] The Technical Policy Department.
[55] Department on Road Maintenance and the Transportation Policy Department.

7. GCAP costs and funding options

This chapter of the GCAP presents estimated CAPEX and OPEX costs, as well as high level commentary on possible funding sources for priority actions that require investment. These are primarily for upgrading, rehabilitation or renovations of existing city assets or the development of new city assets. City assets can be developments in the built environment of Gyumri as well new technological interventions. The actions also involve awareness and outreach, capacity building of key stakeholders in issues related to proper planning, management and conservation of the city environmental assets. Similarly, the actions which may require financing include the development of strategies, policies and plans, which, in turn, will help eliminate barriers and create favourable environment for more investments to flow in GCAP measures. Often such capacity building, awareness and policy, legislative or regulatory measures are prerequisites that support individual or groups of capital investment measures.

Action classifications

Individual actions that require investment have been classified by type as follows:

- Monitoring and data collection and studies
- Awareness, demonstration and capacity building
- Standards, guidelines and regulations
- Strategies, plans and programmes
- Public Procurement
- Capital investment in new city assets, infrastructure or technology
- Capital investment in existing city assets, infrastructure or technology

The Municipality budget

As outlined in Chapter 3 of this document, the Gyumri annual municipal budget is nearly EUR 6m (AMD 3,200,000,000), of which approximately two thirds is subsidised from the state budget of the Republic of Armenia. For the numerous needs of the city and the new priorities that have been put forward by the present plan based on the Green City challenges. Most of the city budget is spent on ongoing operations of the municipal services, such as kindergartens, cultural and athletic centres, routine maintenance of municipal building stock and infrastructure. If the City has any major capital repairs of existing assets, the city needs to seek leveraging of additional State subventions, donor grants or loans. The city also needs to consider options relating to private sector investment. The funding options are set out within the following section.

Funding options

The investments and their funding opportunities are built based in the needs and priorities of the city, however, their implementation should not and will not be the sole responsibility of Gyumri Municipality. The GCAP measures will be best implemented if linked to ongoing actions, state and local initiatives, leveraging donor, IFI resource as well as private sector funding. The softer actions, in turn, aim to create the understanding and the motivation for creating a behavioural impact on local citizens, utility operators, business owners and larger investors in development, industry and infrastructure.

A number of the proposed actions are outside the Gyumri Municipality jurisdiction within the current scope of local government roles and responsibilities according to the Armenian legislation. Nonetheless, as the technical challenges, stakeholder preferences and political priorities have ranked them as a priority, these actions will need attention and funding to help the city mitigate its environmental challenges. These actions will require that the city works closely with the national authorities, lobbies regulatory changes, coordinate with government institutions and utilities for joint actions by escalating the key findings of the GCAP technical assessment to the attention of the responsible external institutions. Such measures are proposed in all sectors: transport, energy, waste and water, green spaces and land use.

A number of proposed actions require direct capital investment. Where possible, the city will finance these from the Municipality budget. However, considering the limitations of the municipal funds, the GCAP recommends that the Municipality seeks external financing that can leverage alternative funds. This includes:

- State budget subventions;
- Donor IFI funds; and
- Private sector funding.

State budget subventions

The Republic of Armenia operates a vehicle of horizontal cooperation between the State and the local authorities by matching (parities set for each type of project) the local financing by the city in capital-intensive economic and social projects. Since January 2018, the communities providing over AMD 1bn (over EUR 2m) in own contribution are considered for co-financing from the State budget subventions through the Ministry of Territorial Administration and Infrastructures of nearly AMD 350m (over EUR 650,000). The acceptable types of projects include roads, water and wastewater infrastructure, irrigation networks, streetlighting, renewable energy, gasification of settlements, public building construction and maintenance, residential building construction, maintenance of public parks, landfill rehabilitation or closure, as well as procurement of equipment and machinery.[56] In March 2019 four projects proposed by Gyumri Municipality were selected for financing, including over EUR 0.5m (over AMD 260m) for the Gyumri Urban Roads Project.

Donor-IFI funds

IFI Loans

Loans from international financial institutions are a common source or municipal infrastructure investments. The RA legislation for local state bodies sets up restrictions for Municipalities in terms of loan involvement and service. The local authorities are allowed to borrow if the following conditions are met:

- Written permission from the state designated institutions, which in this case are the Ministry of Finance (MoF) and the Ministry of Territorial Administration and Development (MTAD);
- The cumulative debt service and repayment amount does not exceed 20% of community's "fund budget". Fund budget is made of a city's "other revenues", which do not include the primary budget made of own and state funds, necessary to perform the key, vital functions of the city;
- The community does not have more than one debt obligation, and any previous loan is repaid before borrowing a new one. This ensures that the Municipality does not have more than one loan at any given time; and
- While not provided in the legislation – de facto, the MoF also strongly discourages using Treasury accounts of the communities for repaying loans. One exception has been made for the loans provided for municipal EE under the R2E2/ACBA Bank arrangement.

The above provisions are a significant limitation and have been voiced by Municipalities and IFIs. Consequently, legal reform had been initiated under the previous Government which was aimed at redefining the old provisions and algorithms related to municipal borrowing capacity. It is unclear how this process will proceed under the new administration. As of Autumn 2019, the draft legal package is on hold. The discussed new regulations are expected to be more enabling for municipal borrowing by eliminating the linkage of the borrowing capacity to the size of the "extra-budgetary fund budget"; and instead base the credit-worthiness and borrowing capacity assessment on the revenue generation streams, which is more common in the commercial lending field. With regard to the provision of municipal guarantees for third party borrowing, the Armenian legislation views guarantees as debt as well, hence guarantees are regulated under the same provisions as borrowing.[57] Given the currently signed and committed loans have already "filled" the limited fiscal space, thus creating a situation with the state debt in which there is no opportunity to even consider a new loan. All discussions with the Ministry of Finance have concluded that Armenia is currently undergoing debt consolidation and new borrowing is not possible at this stage. Each individual loan has undergone thorough prioritisation and assessment of commitments before signing. Currently, the only possibility to borrow for the cities is to reduce or cancel another loan in implementation stage. However, Gyumri has a special status. The Law of the RoA on "Gyumri City Rehabilitation" (2002) states that Gyumri shall receive priority in provision of state support for state investment programs, city rehabilitation projects, for all projects aimed at infrastructure, economic development and social support, under equal circumstances with other communities.[58]

Grants

Fully grant-funded or blended grant co-financing for investments that do not generate savings (e.g. planning, studies, data collection and monitoring,

[56] Source: Ministry of Territorial Administration (MTAD) and Infrastructures available at http://www.mtad.am/hy/mtad31/

[57] Note: According to the Article 63 of the Agreement "On the Eurasian Economic Union (EEU)", the public sector debt should not exceed 50% of the GDP. Under the definitions of the EEU, unlike the IMF definitions, the public sector includes the central government, local state bodies and municipalities. Thus, the loans involved by municipalities are incorporated into the public debt. Nonetheless, in practice the Ministry of Finance has been quite liberal in interpretation of this clause and have not directly enforced this provision, as long as the municipalities involve loans without placing burden on the RA state budget.

[58] Source: Law on Gyumri City Rehabilitation, available at http://www.parliament.am/legislation.php?sel=show&ID=1299&lang=arm.

technical assistance, social projects, resilience and inclusivity upgrades, aesthetic renovations) are necessary to help prepare good quality projects, eliminate barriers for cost-effective projects to follow. Such grants are available in Armenia from United Nations agencies (UNDP, UNIDO, UNICEF), European Union (Neighbourhood Investment Platform (NIP), Eastern European Energy Efficiency and Environment Partnership (E5P), bilateral funds from EU Delegation in Armenia), other bilateral and multilateral donors. There are a diverse range of grants available from these donors, including funding dedicated to addressing environmental challenges such as climate change.

Note, that according to the current legislation on community finance, the borrowing of cities is limited. The city's loan obligation, specifically the annual repayment and service instalment, should not exceed 20% of "fund budget revenues" of the annual budget.59 The 2018 municipal budget had nearly EUR 320,000 in fund budget, of which the 20% is nearly EUR 64,000. With this amount of borrowing capacity for a project with loan tenor of 5-7 years Gyumri Municipality cannot borrow more than EUR 0.3-0.5 million. As the current overall cost of GCAP implementation substantially exceeds the borrowing capacity of the city, the lending resources should be substantially blended with other external grant and private sector financing.

Private sector funding

The Municipality should seek opportunities for private sector participation in different sectors through encouraging businesses to upgrade their properties or new development projects to standards required by GCAP, engaging with private sector service vendors or transportation service upgrades, inviting energy service companies for energy performance contracting to share performance risks and leverage private sector finance in thermal modernisation of buildings. If adequate methodological and political guidance can be put in place to allow for such private sector participation arrangements to be recorded off balance sheet, this will eliminate one of the major barriers for third party financing allowing governments to invest in infrastructure projects while complying with the debt and deficit thresholds;

Summary of GCAP costs

The priority GCAP actions have been costed using, as applicable, benchmarking data based on good practice and knowledge from past projects, as well utilising the professional judgement of sectoral experts. All costs have been locally adjusted to account, as an example, for the cost of local materials and labour.

It should be noted that the CAPEX cost the estimates are exclusive of delivery risk, optimism bias and climate change adaptation.

For the OPEX cost estimates, the following general principles apply:

- Capital investments, new and upgrading – in general, the annual OPEX is estimated as a percentage of the CAPEX, to cover operations and maintenance. This estimate would also cover the cost of associated labour.
- Policies, strategies, programmes, plans, monitoring, capacity – in general, the annual OPEX is based on an FTE labour cost of EUR 10,000 per day.

Table 7-2 overleaf presents a summary of the following information:

- The total CAPEX cost of all prioritised actions by sector, in Euro's (EUR) and Armenian Dram (AMD);
- The mid-term cost of all prioritised actions by sector, in Euro's (EUR) and Armenian Dram (AMD); and
- The annual OPEX cost of all prioritised actions by sector, in Euro's (EUR) and Armenian Dram (AMD).

Table 7-3 overleaf provides a summary of all priority investments identified under this GCAP. The additional investments, including costs, are presented in Appendix A. According to the local planning rules, Gyumri Municipality will include actions from the below list in its long-term strategic development plans, mid-term development programs, and annual budgets based on availability of internal and external funding.

Costs associated with climate change adaptation

Gyumri is highly exposed to physical climate risks, many of which are likely to become more frequent and intense owing to climate change. It is vital for Gyumri to adapt to these changes and become more resilient to their impacts. The GCAP contains four dedicated climate change adaptation actions but climate change adaptation will need to be mainstreamed in all GCAP measures and the associated cost assigned to each measure takes account of this. It is difficult to determine the additional costs to proposed investments, but we have identified the overall (not climate change adaptation specific) level of investment need for the city in key sectors (see Table 7-2) and if the proposed interventions are planned and designed with climate change considerations in mind then there will not necessarily be any additional cost. The required investment in new capital

[59] Source: Law of RoA on Budgeting available at http://www.irtek.am/views/act.aspx?aid=150079.

infrastructure assets need not be higher, for example, if they are planned, designed, built and operated to account for the climate change that may occur over the life of the asset. There is, however, a cost associated with retrofitting, which is more expensive than making assets climate resilient at the outset.

Adaptation measures appropriate for Gyumri will be developed and prioritised in GCAP Action A_AR_02, which will also generate information about the associated costs and provide guidance about mainstreaming climate change adaptation considerations into the wider portfolio of GCAP investment projects proposed. The main costs are likely to be incurred in the transport and buildings, energy and lighting sectors, which, along with the water sector (featured in Table 7-1) appear to be the most vulnerable of the sectors in Gyumri to climate change impacts. The level of investment need is not yet apparent, but indicative costs are featured in Table 7-1.

Table 7-1 - Selected indicative climate change adaptation costs for Gyumri

Nature of investment	CAPEX investment requirement (EUR) per annum[60]	Explanatory Notes
Resilient water	800,000	Gyumri Municipality does not have authority over water supply and sanitation, Veolia water company must address this as part of nationwide infrastructure programmes
Investment in resilience to extreme weather	1,700,000	These costs only include measures that are exclusively to enhance adaptation, such as strengthening river banks
Investment in resilient infrastructure	6,500,000	Climate change adaptation investment will be highest for infrastructure, and related investments should also take the opportunity enhance resilience to other natural disasters (such as earthquakes)

[60] The CAPEX costs in this table are pro-rata estimates developed using estimated national adaptation investment need (World Bank (2010) Economics of Adaptation to Climate Change) and the proportion of Gyumri's estimated population (2016) relative to the estimated national population (2017).

Table 7-2 - Priority GCAP actions: Costs by sector (EUR and AMD)

Sector	Total CAPEX (EUR)	Total CAPEX (AMD)	Mid-term CAPEX (EUR)	Mid-term CAPEX (AMD)	Annual OPEX (EUR)	Annual OPEX (AMD)	No. of actions
Transport	27,440,000	14,543,200,000	20,440,000	10,833,200,000	2,327,500	1,233,575,000	8
Buildings, energy and lighting	22,630,000	11,993,900,000	15,270,000	8,093,100,000	405,000	214,650,000	10
Industry	250,000	132,500,000	250,000	132,500,000	20,000	10,600,000	1
Solid waste	53,220,000	28,206,600,000	38,220,000	20,256,600,000	5,500,000	2,915,000,000	5
Water	80,200,000	42,506,000,000	75,200,000	39,856,000,000	2,140,000	1,134,200,000	10
Land use	5,550,000	2,941,500,000	5,550,000	2,941,500,000	145,000	76,850,000	7
Cross-cutting	16,700,000	8,851,000,000	16,700,000	8,851,000,000	20,000	10,600,000	5
Totals	**205,990,000**	**109,174,700,000**	**171,630,000**	**90,963,900,000**	**10,557,500**	**5,595,475,000**	**46**

Table 7-3 - Priority GCAP actions: Costs (EUR and AMD) and funding options

Action reference and title	Action classification	Implementation timescales	Total CAPEX estimate		Mid-term CAPEX estimate		Annual OPEX estimate		Notes on CAPEX cost estimate	Revenue generation or Savings	Potential funding source				Potential funding options
			EUR	AMD	EUR	AMD	EUR	AMD			Municipality budget	National government	IFI and donor	Private sector	
A_TR_01 New public transport network operator model and integrated tariffs and ticketing	Capital investment in new city assets	2020 to 2024	2,500,000	1,325,000,000	2,500,000	1,325,000,000	220,000	116,600,000	The CAPEX estimate is inclusive of all professional fees to support the establishment of the new bus operator model and associated infrastructure for integrated ticketing	Yes		✓	✓	✓	Limited financing through city resources. Options for national government and IFI funding to be considered. Significant funding to be leveraged from the private sector, with a specific focus on fare box
A_TR_02 Upgrading bus stop infrastructure including with Real Time Passenger Information (RTPI)	Capital investment in existing city assets	2020 to 2024	4,000,000	2,120,000,000	4,000,000	2,120,000,000	200,000	106,000,000	The CAPEX estimate is based on a unit cost rate of implementing 500 new bus stops and RTPI displays at 50 bus stops	No		✓	✓	✓	Limited financing through city resources. Options for national government and IFI funding to be considered. Significant funding to be leveraged from the private sector, with a specific focus on advertising
A_TR_04 New cycle lanes and cycle parking infrastructure	Capital investment in new city assets	2020 to 2024	3,240,000	1,717,200,000	3,240,000	1,717,200,000	160,000	84,800,000	The CAPEX is calculated on a per metre of cycle lane, which is non-segregated. 60km of lanes are proposed. The CAPEX for cycle parking is based on a per unit cost per stand	Yes	✓		✓	✓	To be funded by the city resources and potential IFIs or donors. There is an opportunity to attract private sector investment through the advertising and marketing linked to the infrastructure
A_TR_05 City-wide pedestrian wayfinding signage network	Capital investment in new city assets	2021 to 2023	250,000	132,500,000	250,000	132,500,000	15,000	7,950,000	The CAPEX estimate is based on a unit cost rate of implementing 50 new signs	Yes		✓	✓	✓	Options for national government and IFI funding to be considered. Some funding to be leveraged from the private sector, with a specific focus on advertising
A_TR_06 Promotional campaigns for walking and cycling	Awareness, demonstration and capacity building	2020 to 2021	300,000	159,000	300,000	159,000,000	10,000	5,300,000	The CAPEX estimate is for the initial promotional campaign, engagement with stakeholders and establishment of all supporting materials	No	✓		✓		With limited own resources, the city can seek co-financing by from environmental donor organizations through small research grants, hackathons or climathons
A_TR_09 Sustainable Urban Mobility Plan (SUMP) for Gyumri	Strategy, plans and programmes	2020 to 2021	1,000,000	530,000,000	1,000,000	530,000,000	0	0	The CAPEX estimate is based on benchmarked costs of developing past SUMPs	No	✓		✓		The cost of strategies should be covered from the city budget and options for co-financing from donor institutions should be explored
A_TR_12 City-wide data collection programme and transport model	Monitoring and data collection and studies	2020 to 2022	2,150,000	1,139,500,000	2,150,000	1,139,500,000	322,500	170,925,000	The CAPEX estimate is based on experience of developing city-wide traffic data collection systems and city level traffic models. The exact cost of the action will be dependent on detail which is developed in the model. The data collection programme would include the installation of induction loops at 50 junctions, with an additional 50 CCTV cameras and 50 ANPR cameras.	No	✓		✓	✓	Financed by city resources, with potential funding leveraged from state subventions, or IFI loans
A_TR_14 Renewal of public bus fleet with low emission vehicles	Capital investment in new city assets	2021 to 2029	14,000,000	7,420,000,000	7,000,000	3,710,000,000	1,400,000	742,000,000	The CAPEX estimate is based on a EUR 450,000 per large bus unit cost and EUR 100,000 for minibuses. A total of 70 vehicles to be purchased.	Yes		✓	✓	✓	Funding for new buses may be part subsidised by the national government or through green grants or II loans, but there is an opportunity to explore private sector financing through a new bus operator/concession model

Action reference and title	Action classification	Implementation timescales	Total CAPEX estimate		Mid-term CAPEX estimate		Annual OPEX estimate		Notes on CAPEX cost estimate	Revenue generation or Savings	Potential funding source				Potential funding options
			EUR	AMD	EUR	AMD	EUR	AMD			Municipality budget	National government	IFI and donor	Private sector	
A_BEL_01 Residential energy efficiency awareness raising and outreach	Awareness, demonstration and capacity building	2020 to ongoing	25,000	13,250,000	25,000	13,250,000	5,000	2,650,000	Base CAPEX estimates align with those contained in the SEAP as approved by the City Council. The CAPEX estimate is based on the past experience from energy audits of public buildings and average remuneration of an energy auditor and existing public buildings in Gyumri. CAPEX cost of awareness and outreach measures is not included, to be leveraged from partners	No	✓		✓	✓	With limited co-financing from the city, the campaigns can be support by donors and private vendors of energy efficiency equipment and services
A_BEL_02 Low-income LED transformational programme and campaign	Capital investment in new city assets	2020 to 2025	260,000	137,800,000	260,000	137,800,000	5,000	2,650,000	Base CAPEX estimates align with those contained in the SEAP as approved by the City Council. The cost is based on the average market prices of LED light bulbs estimated for low-income families at the rate of 5 bulbs per family	Yes	✓		✓	✓	These programs are rarely supported by the state, but with limited financing from the city, donors and private crowdfunding campaigns can help finance this initiative, similar to the "ledify" initiative (Bright Boarder campaign)
A_BEL_03 Residential building thermal modernisation PPP programme	Capital investment in existing city assets	2020 to 2030	15,000,000	7,950,000,000	8,000,000	4,240,000,000	150,000	79,500,000	Base CAPEX estimates align with those contained in the SEAP as approved by the City Council. This action was adopted by Gyumri city council under the 2018 SEAP. The city budget allocations are sufficient for basic, low-cost residential building retrofits. The CAPEX is estimated for more comprehensive and ambitious EE retrofits ranging from EUR 10-12K/building, to more comprehensive measures at EUR 80-125K/building, based on experience from past projects (HFHH, UNDP)	Yes	✓		✓	✓	The municipal budget funds assigned from building renovation and maintenance can be combined with donor grants, IFI and commercial bank loans for thermal modernisation. Habitat for Humanity has municipally co-financed lending scheme for condominiums. Currently, donors and IFIs are working to design additional multi-apartment building (MAB) investment instruments (UNDP/GCP, AFD, EBRD/GEFF). In the near future, such loans, with municipal co-financing can also become available to Gyumri MABs. Armenia Renewable Resources and Energy Efficiency Fund (R2E2) promotes energy efficiency and renewable energy sectors development.
A_BEL_04 Municipal energy information system and management	Monitoring and data collection and studies	2022 to 2027	15,000	7,950,000	15,000	7,950,000	5,000	2,650,000	Base CAPEX estimates align with those contained in the SEAP as approved by the City Council. CAPEX methodology: Smart metering costs roughly 260-300 EUR per public building[61]	Yes	✓		✓	✓	Energy information and management can help generation 1-3% energy saving at no investment cost. Grant co-financing can be sought from the EU Covenant of Mayors, UNDP and other similar donor sources

[61] For comparable benchmark examples see http://www.interreg-danube.eu/media/download/19896.

Action reference and title	Action classification	Implementation timescales	Total CAPEX estimate		Mid-term CAPEX estimate		Annual OPEX estimate		Notes on CAPEX cost estimate	Revenue generation or Savings	Potential funding source				Potential funding options
			EUR	AMD	EUR	AMD	EUR	AMD			Municipality budget	National government	IFI and donor	Private sector	
A_BEL_05 Energy Performance Contracting (EPC) and Energy Service Company (ESCO) contracts	Public procurement	2020 to 2022	10,000	5,300,000	10,000	5,300,000	5,000	2,650,000	Base CAPEX estimates align with those contained in the SEAP as approved by the City Council. Note, this CAPEX estimate is related exclusively to the administration, due diligence, MRV costs. When such buildings are identified and projects procured, the investments will come from third party (bank) on factoring basis paid directly to the ESCO contractor, similar to ongoing model operated with R2E2. OPEX includes partial labour cost of a municipal staff for oversight	Yes	✓		✓	✓	An existing, replicable scheme offers energy performance contracting loans from Armenian private banks (ACBA bank, Converse Bank), IFIs, which, combined with own resources can be used to financing public building energy efficiency renovations and repaid from savings
A_BEL_06 Public building thermal modernisation programme	Capital investment in existing city assets	2022 to 2027	850,000	450,500,000	750,000	397,500,000	50,000	26,500,000	Base CAPEX estimates align with those contained in the SEAP as approved by the City Council, as municipal funds allocation, supplemented by potential external financing under R2E2 EPC scheme (average cost of EE retrofits = EUR 25/m2 for positive NPV investments) with m2	Yes	✓		✓	✓	An existing, replicable scheme offers energy performance contracting loans from Armenian private banks (ACBA bank, Converse Bank), IFIs, which, combined with own resources can be used to financing public building energy efficiency renovations and repaid from savings
A_BEL_07 Development of framework for enhancing energy efficiency in public procurement	Public procurement	2020 to ongoing	50,000	26,500,000	10,000	5,300,000	5,000	2,650,000	CAPEX includes development of local procurement procedures with external support for development of technical specifications	Yes	✓		✓	✓	An existing, replicable scheme offers energy performance contracting loans from Armenian private banks (ACBA bank, Converse Bank), IFIs, which, combined with own resources can be used to financing public building energy efficiency renovations and repaid from savings
A_BEL_08 Promoting green building	Strategy, plans and programmes	2021 to ongoing	120,000	63,600,000	50,000	26,500,000	5,000	2,650,000	CAPEX includes potential support for commissioning of the green building, while the main cost will be covered by private sector	Yes			✓	✓	Construction of green buildings should be funded by private sector, which can seek co-financing from environmental donors for monetarization of environmental benefits
A_BEL_09 Energy efficient Municipal streetlighting upgrades	Capital investment in new city assets	2020 to 2022	6,000,000	3,180,000,000	6,000,000	3,180,000,000	150,000	79,500,000	Base CAPEX estimates align with those contained in the SEAP as approved by the City Council. Estimated costs based on a feasibility study and tendering estimates of EBRD for creating of new, underground electric wiring, lighting polls and LED luminaries under EBRD Gyumri Urban Roads project	Yes	✓		✓		Such initiative is already underway within the EBRD-funded Gyumri Urban Roads project, further reinvestment of savings can be used to expand the investments to underserved secondary streets and courtyards
A_BEL_10 Deployment of medium and large-scale Renewable Energy Systems (RES)	Capital investment in new city assets	2020 to 2022	300,000	159,000,000	150,000	79,500,000	25,000	13,250,000	Base CAPEX for mid-term target estimates aligns with those contained in the SEAP as approved by the City Council. Indicative investment costs of solar PV at EUR 800/kW for solar systems to be installed in 11-12 kindergartens. Long-term target assumes continued efforts in all remaining kindergartens	Yes	✓	✓	✓	✓	With due promotional campaigns, the city budget can seek co-financing from State Subventions for deployment of RES in Gyumri. Funding is available from donors, IFI loans, and the practice will be replicated by the private sector, led by public example

Action reference and title	Action classification	Implementation timescales	Total CAPEX estimate		Mid-term CAPEX estimate		Annual OPEX estimate		Notes on CAPEX cost estimate	Revenue generation or Savings	Potential funding source				Potential funding options
			EUR	AMD	EUR	AMD	EUR	AMD			Municipality budget	National government	IFI and donor	Private sector	
A_IN_04 Screening and de-risking of contaminated industrial sites	Monitoring, data collection and studies	2020 to 2022	250,000	132,500,000	250,000	132,500,000	20,000	10,600,000	CAPEX estimate generated based on potential cost of external services to conduct surveys of historically known industrial sites, mapping, cataloguing, land sample collections, lab testing, database management and updating	Yes	✓	✓	✓	✓	The city will seek to leverage donor support to leverage municipal and state funds for screening of soils and co-financing from private sector partners for de-risking. Where possible De-risking to be done through PPP, at no cost to the city e.g. favourable transfer of ownership, business development
A_SW_02 Removal of illegal open dumps and remediation of contaminated areas	Capital investment in existing city assets	2020 to 2024	1,000,000	530,000,000	1,000,000	530,000,000	50,000	26,500,000	The CAPEX estimate is based on an approximation of the number of sites to be remediated, waste to be alternatively disposed or treated and level of contamination of areas to be remediated	No	✓	✓	✓		Municipal budget and State subventions to be used, potentially bundling with IFI loan resources
A_SW_03 Review of current waste collection and waste fee systems and implementation of a separate collection system for recyclables	Capital investment in new city assets	2020 to 2022	1,000,000	530,000,000	1,000,000	530,000,000	100,000	53,000,000	The CAPEX estimate covers personnel costs for management, oversight, reporting and regular revisions of the waste collection system	No	✓	✓	✓		Municipal budget and State subventions to be used, potentially bundling with IFI loan resources
A_SW_04 Construction of new MSW disposal and treatment infrastructure	Capital investment in new city assets	2020 to 2027	50,000,000	26,500,000	35,000,000	18,550,000,000	5,000,000	2,650,000,000	The CAPEX estimate is based on the following assumptions: • Development of landfill with ~70 tonnes per day capacity and 10-year lifetime • Development of AD facility • Development of Mechanical Biological Treatment (MBT) facility • Development of WtE facility	Yes		✓	✓	✓	State subventions to be considered, supported by IFI loan resource. There is significant opportunity for private sector investment through PPP or Build, Operate Transfer (BOT)
A_SW_05 Market study for recyclable materials and establishment of waste quality protocols	Monitoring, data collection and studies	2020 to 2024	1,000,000	530,000,000	1,000,000	530,000,000	300,000	159,000,000	The CAPEX estimate is inclusive of all professional fees to deliver the study, including the development of waste quality protocols and stakeholder engagement	Yes	✓		✓		Study can be part funded by city budget with extensive support from IFIs or donors
A_SW_06 Establish a Municipality Waste Department and conduct regular waste management awareness campaigns	Awareness, demonstration and capacity building	2020 to 2024	220,000	116,600,000	220,000	116,600,000	50,000	26,500,000	The CAPEX estimated to cover the establishment of a Waste Department within Gyumri Municipality and Green City Awareness Centre, and the development and delivery of waste awareness campaigns	No	✓		✓		Study can be part funded by city budget with extensive support from IFIs or donors
A_WR_01 Prepare an inventory and GIS of Gyumri's water supply network infrastructure and assets	Monitoring and data collection and studies	2020 to 2022	150,000	79,500,000	150,000	79,500,000	20,000	10,600,000	The CAPEX estimate includes labour for development, combination of international and local plus some additional computing hardware. Includes GIS work, site surveys and condition assessments. May combine with wastewater systems where possible	No	✓		✓		The mapping cost should be seed-funded by the municipal budget (as part of urban planning costs), however, funds should be leveraged with potential donor grant funding

Action reference and title	Action classification	Implementation timescales	Total CAPEX estimate		Mid-term CAPEX estimate		Annual OPEX estimate		Notes on CAPEX cost estimate	Revenue generation or Savings	Potential funding source				Potential funding options
			EUR	AMD	EUR	AMD	EUR	AMD			Municipality budget	National government	IFI and donor	Private sector	
A_WR_02 Enhanced water supply and demand data and analysis	Monitoring and data collection and studies	2020 to 2023	400,000	212,000,000	400,000	212,000,000	60,000	31,800,000	The CAPEX estimate includes the installation of 4 to 10 district meters in system with telemetry. Includes modelling and international support to the local team. Leakage surveys to be undertaken by specialist contractors	Yes		✓	✓		The water utility is operated under a single, national license, funded from the State Water Committee and the Utility's revenues. Therefore, funding likely to come from national government or IFIs/donors
A_WR_03 Leak Reduction Action Plan (LRAP) development	Strategy, plans and programmes	2021 to 2022	100,000	53,000,000	100,000	53,000,000	20,000	10,600,000	The CAPEX estimate is to procure experts with local support to prepare LRAP using the GIS and modelling tools developed in WR_01&02. Includes costed plans for procurement of works	No		✓	✓		The water utility is operated under a single, national license, funded from the State Water Committee and the Utility's revenues. Therefore, funding likely to come from national government or IFIs/donors
A_WR_04 Legal and financial mechanisms for enforcement of LRAP	Standards, guidelines and regulations	2020 to 2022	50,000	26,500,000	50,000	26,500,000	0	0	The CAPEX estimate is for the provision of expert advice, stakeholder meetings and capacity building	Yes		✓	✓		The water utility is operated under a single, national license, funded from the State Water Committee and the Utility's revenues. Therefore, funding likely to come from national government or IFIs/donors
A_WR_05 Repair and rehabilitation of parts of the water supply system with the highest water leakages	Capital investment in existing city assets	Step 1: 2020 to 2022 Step 2: 2022 to 2025 Step 3: 2022 to 2026	50,000,000	26,500,000,000	45,000,000	23,850,000,000	1,000,000	530,000,000	The CAPEX cost is split into three steps which are: Step 1: Expert advice and studies to prepare documentation. Step 2: CAPEX: Phased programme of works EUR 10m to EUR 50m million repair costs (60% of network). Step 3: CAPEX cost is to appoint experts to undertake monitoring and prepare reports for duration of contracts only, so no ongoing OPEX	Yes		✓	✓	✓	The water utility is operated under a single, national license, funded from the State Water Committee and the Utility implements investments are based on the national authorities' instructions, borrowed sovereign loans and nationally adopted investment plans. However, there is significant opportunity for private sector investment through PPP or BOT but this would need to be considered in conjunction with the concession structure under which the existing water service is provided
A_WR_06 Prepare an inventory and GIS for WW infrastructure	Monitoring and data collection and studies	2020 to 2022	200,000	106,000,000	200,000	106,000,000	10,000	5,300,000	The CAPEX estimate includes labour for development, combination of international and local plus some additional computing hardware. Includes GIS work, site surveys and condition assessments. May combine with water supply systems where possible	No		✓	✓		The water utility is operated under a single, national license, funded from the State Water Committee and the Utility's revenues. Therefore, funding likely to come from national government or IFIs/donors
A_WR_07 Preparation of a Wastewater Action Plan and tender documentation for recommended infrastructure upgrades	Strategy, plans and programmes	2021 to 2022	300,000	159,000,000	300,000	159,000,000	10,000	5,300,000	The CAPEX estimate is to procure experts with local support to prepare WWAP using the GIS and Modelling tools developed in WR_08. Costed plans for procurement of works. Sewerage studies and planning, sewerage modelling, wastewater treatment design and sludge treatment specification all required. Also includes costs for procurement document preparation	No		✓	✓		The water utility is operated under a single, national license, funded from the State Water Committee and the Utility's revenues. Therefore, funding likely to come from national government or IFIs/donors

Action reference and title	Action classification	Implementation timescales	Total CAPEX estimate		Mid-term CAPEX estimate		Annual OPEX estimate		Notes on CAPEX cost estimate	Revenue generation or Savings	Potential funding source				Potential funding options
			EUR	AMD	EUR	AMD	EUR	AMD			Municipality budget	National government	IFI and donor	Private sector	
A_WR_08 Rehabilitation and extension of drainage systems	Capital investment in existing city assets	2021 to 2025	13,000,000	6,890,000,000	13,000,000	6,890,000,000	260,000	137,800,000	The CAPEX: estimate Based on "Compliance Costs of the Urban Wastewater Treatment Directive", European Commission Directorate General (DG) Environment, Sept 2010, COWI. For Collection system. Assume additional sewerage requirement is roughly estimated at 28750 pe (being 25% of population of 115,000) at EUR 874 per pe, assume 20% materials 80% local contracts and Armenia prices 50% of Euro norm for Civils contracts. Consumer Price Index (CPI) 2008 to 2018 Denmark factor 1.15. Gives cost of EUR 13 million	Yes		✓	✓	✓	The water utility is operated under a single, national license, funded from the State Water Committee and the Utility implements investments are based on the national authorities' instructions, borrowed sovereign loans and nationally adopted investment plans. However, there is significant opportunity for private sector investment through PPP or BOT but this would need to be considered in conjunction with the concession structure under which the existing water service is provided
A_WR_09 Rehabilitation and extension of the WW treatment system	Capital investment in existing city assets	2021 to 2025	14,000,000	7,420,000,000	14,000,000	7,420,000,000	700,000	371,000,000	The CAPEX: estimate Based on "Compliance Costs of the Urban Wastewater Treatment Directive", European Commission DG Environment, Sept 2010, COWI. Assume 115,000 pe, Advanced Secondary treatment, nitrification and P removal, estimated cost EUR 138 per pe at 2008 DK price. Of cost 35% materials at Eurowide prices, 65% local civils at 50% of Eurowide cost (EUROSTAT). CPI 2008 to 2018 Denmark factor 1.15. Total cost of WWTW = EUR 12 million. Add €2 million for sludge treatment dewatering and stabilisation. Total EUR 14 million	Yes		✓	✓	✓	The water utility is operated under a single, national license, funded from the State Water Committee and the Utility implements investments based on the national authorities instructions, borrowed sovereign loans and nationally adopted investment plans. There is significant opportunity for private sector investment through PPP or BOT
A_WR_10 Upgrading public water infrastructure in green spaces	Capital investment in existing city assets	2021 to 2025	2,000,000	1,060,000,000	2,000,000	1,060,000,000	60,000	31,800,000	CAPEX estimate is based on a phased programme of works	Yes	✓	✓	✓		The city budget resources can be supplemented by State budget subventions, environmental grants can be sought to support improved greening of the city
A_LU_01 Develop a Sustainable Urban Planning Framework for the city of Gyumri including an updated master plan and zoning regulations	Strategy, plans and programmes	2020 to 2021	800,000	424,000,000	800,000	424,000,000	10,000	5,300,000	The CAPEX estimate covers two steps including the development of a multi-sector planning policy framework and the master plan including zoning plans. The bulk of the cost would be for professional fees and the collation of data	No	✓	✓	✓		The city budget resources can be supplemented by State budget subventions and environmental or donor grants as applicable
A_LU_02 Develop a GIS based land use database and City Information Model (CIM) for Gyumri	Monitoring and data collection and studies	2021 to 2023	1,000,000	530,000,000	1,000,000	530,000,000	10,000	5,300,000	The CAPEX estimate covers the development of a GIS land use and environmental database and web-based GIS platform. Most of the work is associated with professional fees	No	✓		✓		The city budget resources should be supplemented by donor grants

Action reference and title	Action classification	Implementation timescales	Total CAPEX estimate		Mid-term CAPEX estimate		Annual OPEX estimate		Notes on CAPEX cost estimate	Revenue generation or Savings	Potential funding source				Potential funding options
			EUR	AMD	EUR	AMD	EUR	AMD			Municipality budget	National government	IFI and donor	Private sector	
A_LU_03 Create targeted urban planning guidance and tools	Standards, guidelines and regulations	2022 to 2023	400,000	212,000,000	400,000	212,000,000	15,000	7,950,000	The CAPEX estimate is based on the development of two planning guideline documents and a feasibility study and/or/ pilot project. Most of the work is associated with professional fees	No	✓		✓		The city budget resources should be supplemented by donor grants
A_LU_04 Enforce planning policy and building regulations	Standards, guidelines and regulations	2021 to 2030	200,000	106,000,000	200,000	106,000,000	20,000	10,600,000	CAPE estimate includes the purchase of satellite imagery, software and hardware and associated professional fees	Yes	✓	✓	✓		The city budget resources can be supplemented by State subsidies for enhanced environmental monitoring, as well as potential donor grants
A_LU_05 Urban planning and sustainable development public-sector capacity building	Awareness, demonstration and capacity building	2020 to ongoing	100,000	53,000,000	100,000	53,000,000	20,000	10,600,000	CAPEX: Cost of establishing a digital platform to share capacity building materials and professional fees	No			✓		A typical grant-funded initiative which can be supported by technical assistance grants of donor organisations
A_LU_06 Management strategy for public parks and green spaces	Monitoring, data collection and studies	2020 to 2029	50,000	26,500,000	50,000	26,500,000	40,000	21,200,000	The CAPEX estimate is focussed on a one-time cost for the use of professional services to set up appropriate processes	No	✓	✓		✓	The city budget resources can be supplemented by State budget subventions. There is also an opportunity to contract out regular maintenance contracts to private sector companies
A_LU_07 Provision of green infrastructure, parks and open space	Capital investment in new city assets	2020 to 2025	3,000,000	1,590,000,000	3,000,000	1,590,000,000	30,000	15,900,000	CAPEX estimate is based on a provision of approximately 40 ha of new public parks and green infrastructure, 7.5EUR per m2.	No	✓	✓		✓	The city budget resources can be supplemented by State budget subventions. Private sector investment should be explored in relation to naming, advertising and commercial rights
A_AQGHG_01 Develop a municipal air quality monitoring system	Monitoring and data collection and studies	2021 to 2023	200,000	106,000,000	200,000	106,000,000	20,000	10,600,000	The CAPEX estimate covers costs for establishment of the system, methodology, measurement, monitoring and data reporting equipment and software support	No	✓	✓	✓	✓	The city budget resources can be supplemented by State subsidies for enhanced environmental monitoring, as well as potential donor grants
A_AR_01 Conduct a Climate Risk Assessment of infrastructure in the water, transport, solid waste and building, energy and lighting sectors	Strategy, plans and programmes	2020 to 2021	500,000	265,000,000	50,000	265,000,000	0	0	CAPEX estimated based on experience of procuring and delivering similar Climate Risk Assessments, with funds to be spent on Consultancy Services	No	✓	✓	✓		The Municipality and national Government usually rely on donor technical assistance for funding similar technical studies, although some public funds can be made available either for co-financing or an in-kind contribution
A_AR_02 Prepare an Action Plan for enhancing the climate resilience of Gyumri's infrastructure	Strategy, plans and programmes	2021 to 2022	500,000	265,000,000	500,000	265,000,000	0	0	CAPEX estimated based on experience of procuring and delivering similar Action Plans, with funds to be spent on Consultancy Services	No	✓	✓	✓		The Municipality and national Government usually rely on donor technical assistance for funding similar technical studies, although some public funds can be made available either for co-financing or an in-kind contribution
A_AR_03 Develop an Emergency Preparedness Action Plan	Strategy, plans and programmes	2023 to 2024	500,000	265,000,000	500,000	265,000,000	0	0	CAPEX estimated based on experience of procuring and delivering similar Emergency Preparedness Action Plans, with funds to be spent on Consultancy Services	No	✓	✓	✓		The Municipality and national Government usually rely on donor technical assistance for funding similar technical studies, although some public funds can be made available either for co-financing or an in-kind contribution

Action reference and title	Action classification	Implementation timescales	Total CAPEX estimate		Mid-term CAPEX estimate		Annual OPEX estimate		Notes on CAPEX cost estimate	Revenue generation or Savings	Potential funding source				Potential funding options
			EUR	AMD	EUR	AMD	EUR	AMD			Municipality budget	National government	IFI and donor	Private sector	
A_AR_04 Investment in climate change adaptation and resilience measures	Capital investment in new city assets	2024 to ongoing	15,000,000	7,950,000,000	15,000,000	7,950,000,000	0	0	Pro-rata estimate developed using estimated national adaptation investment need (World Bank (2010) Economics of Adaptation to Climate Change) and the proportion of Gyumri's estimated population (2016) relative to the estimated national population (2017)	Yes	✓	✓	✓	✓	Climate funds available from international donor organizations shall be pursued for associated funding, for example in the form of grants, concessional or market rate debt, equity or a mix, with Municipal and state co-financing
Total			**205,990,000**	**109,174,700,000**	**171,630,000**	**90,963,900,000**	**10,557,500**	**5,595,475,000**							

8. Next steps

8.1. The GCAP and its status

This GCAP is a strategic planning document that will be used by the City of Gyumri to communicate its green city ambitions and as a roadmap for realising those ambitions. It outlines high-level aspirations and presents corresponding actions and investment priorities for the city in the short-term, medium-term and long-term.

The environmental, economic and social improvements that Gyumri can experience by implementing the GCAP are reflected in the objectives and targets that will be used to measure the GCAP's progress, but to realise the transformation potential of the Plan the momentum generated during its development will need to be maintained.

The GCAP is expected to be adopted by the Council of Elders and the City Administration will now use it as the basis for elaborating Gyumri's annual budgets and mid-term and long-term development plans. This will be crucial for building political support. A concerted effort will be made to help to ensure that this first stage of the Green City Implementation period, Step 3 of the GCAP process, begins in early 2020 as planned. This will mark the start of the 60 to 72-month implementation period, over which a series of GCAP actions will be delivered using a holistic and carefully structured approach that is fully aligned with, and embedded in, its wider framework.

8.2. GCAP implementation planning

The Municipality will need to decide which of the GCAP actions to implement. This will require further analysis of each proposal, including with regards to the funding needs and their potential to generate revenue, as well as the pursuit of the funding sources proposed in this Plan. Feasibility studies, which are objective assessments of the practicality of proposed interventions, will need to be conducted as part of this process.

In the course of GCAP development we have come across numerous examples of how the implementation and operationalisation of well-conceived measures has been compromised, and in some instances abandoned, owing to factors including insufficient political support, supporting actions, institutional framework, capacity, affordability, stakeholder engagement and data. We have sought to reflect related lessons learnt in the GCAP development process. Targeted capacity building activities have been conducted, for example, and packages of actions and supporting links between measures have been identified, as have action costs and potential funding sources. Stakeholder engagement activities, which have involved key decision-makers, have also been designed and conducted to build political support for the GCAP's targets and actions. The risks associated with operationalising the Plan must, however, be identified and rigorously reviewed at the beginning of Step 3 and mitigation measures for each designed and adopted. The effectiveness of these mitigation measures will be apparent in Step 4, Green City Reporting, where the implementation progress of GCAP actions and their impact will be analysed.

8.3. GCAP reporting

The Green City Reporting will identify what has been achieved and how, along with successes and opportunities for improvement in each period. The process that will be used to guide this process will be discussed and refined at the outset, but an indicative approach formulated during GCAP development, outlined in Chapter 6, will be used as a starting point. Green City Reporting is the fourth and final Step of the GCAP process, but the GCAP methodology is cyclical and GCAP challenges, objectives, actions and targets will need to be periodically revisited to identify changes in State, Pressure and Response indicators that could require a revised approach to be adopted and the GCAP to be updated. The effectiveness of this process will depend on continued political support and clear and consistent ownership by a committed individual within the City Administration.

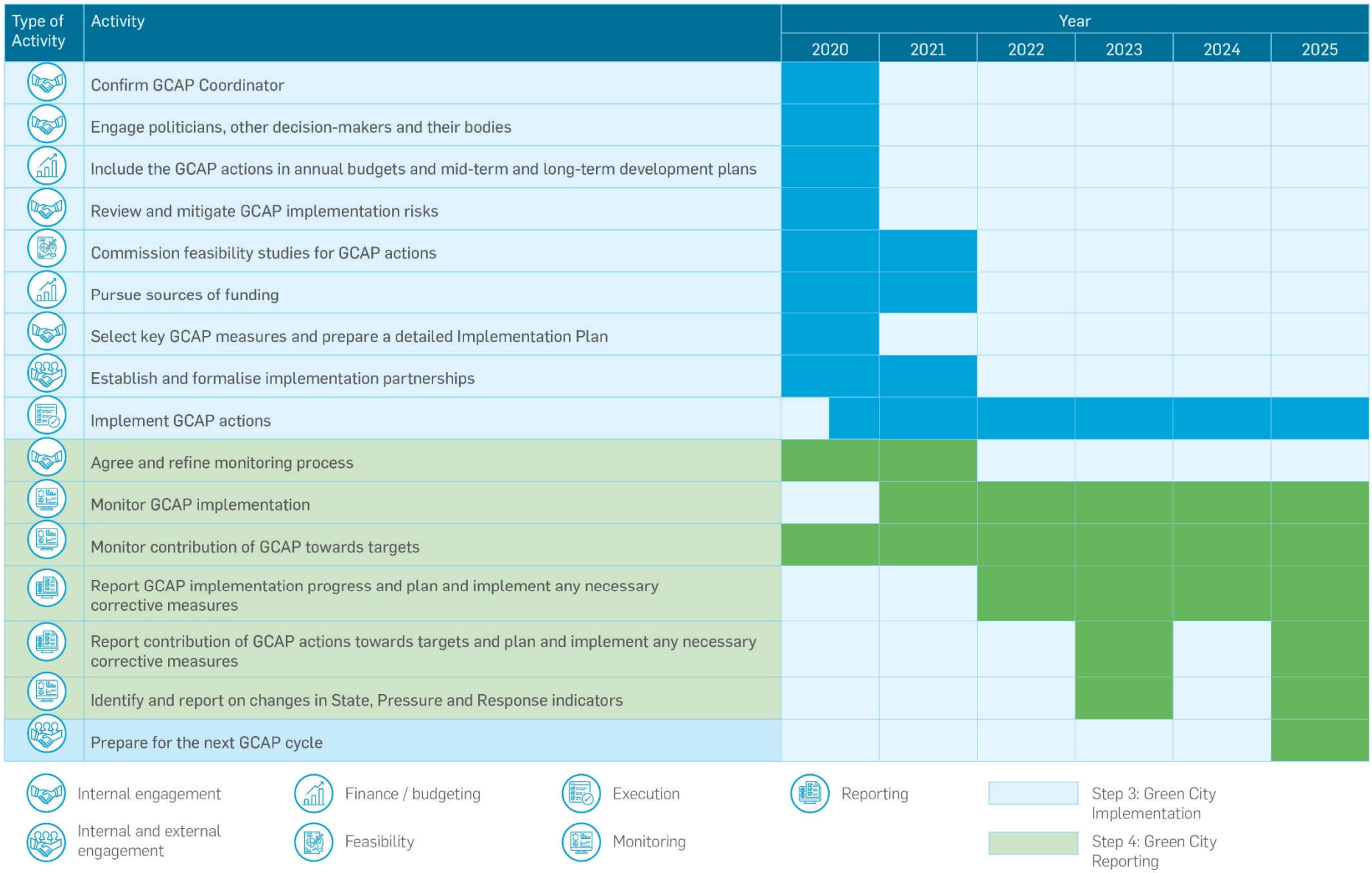


Figure 8-1 - Programme of activities for GCAP Step 3 (Green City Implementation) and 4 (Green City Reporting)

Appendices

Appendix A. Additional actions

The actions presented in this appendix are additional to those presented in detail in Chapter 5. The actions, although not identified through the technical, stakeholder and political prioritisation process as highest priority, are still presented as part of this GCAP document as they were generated by the GCAP team to respond to identified environmental challenges identified in the city and as such can but brought back into the prioritised list as deemed necessary by the city.

A total of 18 additional actions are presented in this appendix and they cover the following:

- Transport – 6 actions;
- Industry – 4 actions;
- Solid waste – 1 action;
- Water – 3 actions;
- Air quality – 1 action;
- Soils - 2 actions; and
- Green space, biodiversity and ecosystems – 1 action.

A.1.1. Transport actions

Additional transport actions include the provision of new transport hubs, cycle infrastructure, promotional campaigns for walking and cycling, pedestrianisation of city streets, consideration of low emission zones, citywide mobility applications and renewal of the public transport fleet with lower emission vehicles.

A.1.2. Industry actions

Additional industry actions include the development of green business concepts and green economy clubs, Industrial/SME energy management systems and surveying, screening and remediation of industrial waste sites.

A.1.3. Solid waste actions

The additional solid waste action is the feasibility study on waste treatment and disposal options, development of the Integrated Waste Management Plan for Gyumri and the generation of a publicly available Solid Waste Database.

A.1.4. Water resource actions

Additional water actions focus on the establishment of a smart city pilot area (specific to water resource) and the development of a River Action Plan.

A.1.5. Air quality actions

Additional air quality actions focus on the development of a municipal air quality monitoring system and mechanisms for corrective air quality interventions.

A.1.6. Soil actions

Additional actions related to soil quality include adaptation and enforcement of international regulations on soil quality and the integration of soil quality issues into urban development decisions making, including raising overall awareness.

A.1.7. Green space, biodiversity and ecosystems actions

The action for green space and biodiversity is to conduct a study to establish a baseline of the biodiversity in the city, as there is presently limited information on biodiversity in Gyumri.

The costs of additional GCAP actions and associated funding options are listed in Table A-1. This table is followed by a detailed proforma for each additional action.

Table A-1 – Additional GCAP actions: CAPEX and OPEX costs (EUR and AMD) and funding options

Ref no.	Action title	Classification	Implementation timescales	Total CAPEX estimate		Mid-term CAPEX estimate (EUR)		Annual OPEX estimate (EUR)		Notes on cost estimates	Revenue generating	Potential funding source				Potential funding options
				EUR	AMD	EUR	AMD	EUR	AMD			Municipality budget	National Government	IFI & donors	Private sector	
A_TR_03	New public transport hubs	Capital investment in new city assets	2020 to 2024	5,000,000	2,650,000	5,000,000	2,650,000	350,000	185,500,000	The CAPEX estimate is based on approximate costings of the development of comparable transport hubs	Yes		✓	✓	✓	Funding opportunities through state subventions and, IFI loans, green grants for potential sustainable solutions and PPP/BOT for private sector participation
A_TR_07	Pedestrianised city-centre streets	Capital investment in new city assets	2020 to 2024	1,000,000	530,000,000	1,000,000	530,000,000	50,000	26,500,000	The CAPEX estimate would cover the development of up to 5 streets each with costs covering new furniture, paving, lighting and access control	No	✓	✓	✓		The action could be part financed through city resources, with potential funding leveraged from state subventions, IFI loans, as part of the transport investments, green grants for potential sustainable solutions
A_TR_08	Low Emission Zone (LEZ) for the centre of Gyumri	Standards, guidelines and regulations	2020 to 2024	5,000,000	2,650,000,000	5,000,000	2,650,000,000	1,000,000	530,000,000	CAPEX Based on expert judgement of investment cost needed for low emission zone infrastructure	Yes		✓	✓	✓	Funding opportunities through state subventions IFI loans, green grants for potential sustainable solutions
A_TR_10	City-wide car sharing scheme	Capital investment in new city assets	2021 to 2023	500,000	265,000,000	500,000	265,000,000	50,000	26,500,000	The CAPEX estimated would cover the costs to develop the scheme through a lump sum consultancy fee. The CAPEX would also include public engagement and consultation and the investment in supporting web/app-based technology	Yes	✓	✓		✓	The city could explore part financing the action with the support of state subsidy. There is an opportunity to explore private sector investment in car sharing schemes, which has been adopted in other cities
A_TR_11	City-wide transport mobility application	Capital investment in new city assets	2022 to 2026	3,000,000	1,590,000,000	0	0	600,000	318,000,000	Annual OPEX calculated as 20% of CAPEX to cover overall operational and monitoring costs	Yes	✓	✓		✓	The city could explore part financing the action with the support of state subsidy. There is an opportunity to explore private sector investment in the development of a web-based application, opening up revenue generating opportunity through marketing and advertising
A_TR_13	Partial electrification of Municipality vehicle fleet	Capital investment in new city assets	2020 to 2021	100,000	53,000,000	100,000	53,000,000	10,000	5,300,000	The CAPEX estimate is based on a per unit vehicle cost for two vehicles	No	✓		✓		The cost of purchasing electric vehicles in the city fleet should be covered from the city budget and options for co-financing from donor institutions should be explored

Ref no.	Action title	Classification	Implementation timescales	Total CAPEX estimate		Mid-term CAPEX estimate (EUR)		Annual OPEX estimate (EUR)		Notes on cost estimates	Revenue generating	Potential funding source				Potential funding options
				EUR	AMD	EUR	AMD	EUR	AMD			Municipality budget	National Government	IFI & donors	Private sector	
A_IN_01	Gyumri 'Green Business' concept	Strategy, plans and programmes	2020 to ongoing	90,000	47,700,000	90,000	47,700,000	5,000	2,650,000	CAPEX: municipal staff or engaged external experts' cost for coordinating with donors/IFIs/NGOs to develop the concept for a 3-year core programme	No			✓	✓	Funding to be sought from donors/IFIs interested in clean production agenda for support for development of the strategy, as well as potential co-financing from industrial partners
A_IN_02	Green Business Coordination Platform 'Gyumri Green Economy Club'	Awareness, demonstration and capacity building	2020 to ongoing	120,000	63,600,000	120,000	63,600,000	5,000	2,650,000	CAPEX estimated the cost of in-house or external advisors' personnel costs for development of the programme and regulatory provisions, fundraising, legal costs for development of voluntary agreements, green certification schemes, costs related to the establishment of an information hub	Yes			✓	✓	Funding to be sought from donors/IFIs interested in clean production agenda for support for development of the strategy, as well as potential co-financing from industrial partners
A_IN_03	Provision of energy management system support to industry/ SMEs	Awareness, demonstration and capacity building	2020 to 2025	250,000	132,500,000	250,000	132,500,000	25,000	13,250,000	CAPEX estimated the cost of external services' cost for industrial energy management programme development, exemplary energy audits in 10 enterprises per year and illustrative investments to leverage private (equity/loan) and donor financing	Yes			✓	✓	Funding to be sought from donors/IFIs interested in clean production agenda for support for development of the strategy, as well as potential co-financing from industrial partners
A_IN_05	Remediation of former industrial sites for urban regeneration	Strategies, plans and programmes	2022 to 2025	1,000,000	530,000,000	1,000,000	530,000,000	25,000	13,250,000	CAPEX estimated only for sites, which will remain under municipal ownership and management will require remediation with application of special means and green space development. Cost of CAPEX for PPP cases will be estimated on case-by-case basis	Yes	✓	✓	✓	✓	Municipal budget and State subventions to be used, potentially bundling with IFI loans. Should private sector be interested in grayfield development, PPP can be a possible financing mechanism
A_SW_01	Feasibility study on waste treatment and disposal options and development of an Integrated Waste Management Plan for Gyumri and publicly available Solid Waste Database	Monitoring and data collection and studies	2020 to 2023	1,000,000	530,000,000	1,000,000	530,000,000	50,000	26,500,000	CAPEX estimate generated based on past project experience for delivering comparable feasibility studies and plans	Yes	✓	✓	✓		Municipal budget and State subventions to be used, potentially bundling with IFI loans
A_WR_11	Establish a Smart City Action Pilot area	Monitoring, data collection and studies	2020 to 2022	20,000	10,600,000	20,000	10,600,000	0	0	The CAPEX estimate covers Costs for study and identification of water parts of SMART cities pilot	No	✓	✓	✓		The city budget resources can be supplemented by State budget subventions, or funding from IFIs and donors

Ref no.	Action title	Classification	Implementation timescales	Total CAPEX estimate		Mid-term CAPEX estimate (EUR)		Annual OPEX estimate (EUR)		Notes on cost estimates	Revenue generating	Potential funding source				Potential funding options
				EUR	AMD	EUR	AMD	EUR	AMD			Municipality budget	National Government	IFI & donors	Private sector	
A_WR_12	Develop an Action Plan for Rivers	Strategy, plans and programmes	Step 1: 2020 to 2022 Step 2: 2020 to 2026 Step 3: 2020 to 2022	Step 1: 50,000 Step 2: 50,000 Step 3: 50,000	Step 1: 26,500,000 Step 2: 26,500,000 Step 3: 26,500,000	150,000	79,500,000	15,000	7,950,000	The CAPEX estimate is generated base on three steps. Step 1: To undertake stakeholder engagement and prepare studies. Step 2: Costs to undertake studies to set up appropriate monitoring. Costs of actual monitoring not included, unknown how much will be needed in the future. Step: 3 Costs to undertake a small study to agree action plan, some international specialists plus local support staff	Yes	✓	✓	✓		The city budget resources can be supplemented by State budget subventions, environmental grants can be sought to support monetizing the environmental benefits
A_WR_13	Water usage behaviour targets for residents	Awareness, demonstration and capacity building	2020 to 2026	100,000	53,000,000	100,000	53,000,000	5,000	2,650,000	The CAPEX estimate is to undertake a small study and stakeholder engagement activities	Yes	✓	✓	✓		The city budget resources can be supplemented by State budget subventions, environmental grants can be sought to support monetizing the environmental benefits
A_AQGHG_02	Establish a corrective system for air quality	Monitoring and data collection and studies	2020 to 2024	200,000	106,000,000	200,000	106,000,000	20,000	10,600,000	The CAPEX estimate is to establish the programme of corrective action	Yes	✓	✓	✓		The city budget resources can be supplemented by State subsidies for enhanced environmental monitoring, as well as potential donor grants for environmental mitigation
A_SL_01	Adopt and enforce international soil quality regulations	Standards, guidelines and regulations	2020 to ongoing	150,000	79,500,000	150,000	79,500,000	20,000	10,600,000	The CAPEX estimate is to provide outsourced services for development and approval of the methodology, mapping, regular testing, reporting into an open data platform	No	✓	✓	✓		The city budget resources can be supplemented by State subsidies for enhanced environmental monitoring, as well as potential donor grants for environmental mitigation
A_SL_02	Assess soil quality and integrate findings into urban development decision-making	Monitoring, data collection and studies	2021 to ongoing	150,000	79,500,000	150,000	79,500,000	20,000	10,600,000	CAPEX: The development of the platform can be outsourced to academic/CSO partners, but regular maintenance of the dialogue to be done by municipal administration	Yes	✓	✓	✓		The city budget resources can be supplemented by State subsidies for enhanced environmental monitoring, as well as potential donor grants for environmental mitigation
A_GSBIO_01	Establish a baseline of biodiversity in the city	Monitoring and data collection and studies	2021 to ongoing	300,000	159,000,000	300,000	159,000,000	15,000	7,950,000	The CAPEX estimate is to competitively procure the services of academic / research institutions for biodiversity assessment, zoning, and mapping, and regular updating into open city database	Yes	✓	✓	✓		The city budget resources can be supplemented by State subsidies for enhanced environmental monitoring, as well as potential donor grants for environmental mitigation

<table>
<tr><td colspan="3">Reference Number
A_TR_03</td></tr>
<tr><td colspan="3">Title: New public transport hubs</td></tr>
<tr><td colspan="3">Classification: Capital investment in new city assets</td></tr>
<tr><td colspan="3">Description
The action would include the development of two new public transport hubs within the city. One would be larger than the other and would form part of an upgraded railway station and the second smaller facility would either be centrally located within the city or in main bus station. Each facility would include appropriate capacity for vehicles, passengers and operations and would include appropriate seating, retail/commercial units and interfaces for other modes including walking and cycling. Technology would form an integral part of its design and operation. The transport hubs would present the opportunity for TOD if planned with other land use developments, including development corridors.
  </td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)</td><td rowspan="3">Key benefits
• Social: improved safety, enhanced social inclusion and green behaviours and awareness
• Economic: employment generation
• Environmental: enhanced air quality and reduced GHG emissions</td></tr>
<tr><td colspan="2">SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)</td></tr>
<tr><td colspan="2">SO_AR Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td></tr>
<tr><td>CAPEX (EUR)
5,000,000
CAPEX (AMD)
2,650,000,000</td><td>Annual OPEX (EUR)
350,000
Annual OPEX (AMD)
185,500,000</td><td>Funding options
• National government
• IFI and donors
• Private sector</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - 2024</td></tr>
<tr><td>Action owner: Transport Department, Gyumri Municipality</td><td>Implementing partner(s): Public transport operators</td><td>Key stakeholders: Regional administration of Shirak, national government, IFI/ donors, private sector</td></tr>
</table>

<table>
<tr><td colspan="3">Reference Number
A_TR_07</td></tr>
<tr><td colspan="3">Title: Pedestrianised city-centre streets</td></tr>
<tr><td colspan="3">Classification: Capital investment in new city assets</td></tr>
<tr><td colspan="3">Description
Pedestrianised streets are areas of a city or town reserved for pedestrian-only use and in which most or all vehicular traffic is prohibited. The aim of this type of scheme is to provide better accessibility and mobility for pedestrians, to enhance the quality and volume of business/commercial activity in the area and/or to improve the attractiveness of the local environment, including in terms of air pollution, noise and safety. This action would introduce pedestrianised streets in Gyumri’s city centre but there will first need to be a review of the impact of traffic displacement on surrounding areas, as well as on business/commercial activities, notably in terms of drive-by trade and delivery logistics. It is proposed that a new city centre pedestrian area is implemented in and around routes including Aragats Street, Rizhkov Street and Abovan Street, although the exact size and coverage of the pedestrianised areas would need to be subject to more detailed feasibility and local consultation. The scheme could be integrated with other actions including new urban planning and regeneration schemes, an LEZ (A TR 08) and improved walking and cycling routes (A TR 04), as well as plans to improve facilities and the streetscape for tourists (A TR 05).</td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)
SO_AR Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td><td>Key benefits
• Social: enhanced social inclusion and green behaviours and awareness, reduced health risks
• Economic: economic inclusion
• Environmental: enhanced air quality and reduced GHG emissions</td></tr>
<tr><td>CAPEX (EUR)
1,000,000
CAPEX (AMD)
530,000,000</td><td>Annual OPEX (EUR)
50,000
Annual OPEX (AMD)
26,500,000</td><td>Funding options
• Municipality budget
• National government
• IFI and donors</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - 2024</td></tr>
<tr><td>Action owner: Transport Department, Gyumri Municipality</td><td>Implementing partner(s): IFI/ donors</td><td>Key stakeholders: Regional administration of Shirak, local businesses, NGOs, public and private transport operators, national government, other private sector</td></tr>
</table>

Reference Number
A_TR_08

Title: Low Emission Zone (LEZ) for the centre of Gyumri

Classification: Standards, guidelines and regulations

Description

A Low Emission Zone is an area where a fee is charged to the owners of motor vehicles that fail to meet a specified standard within a specific zone of the city, generally within the city centre where there is the highest concentration of vehicular flow and the highest footfall from business users and tourists. The zones can be restricted to specific times of the day. This action would introduce an LEZ where the charging zone would be monitored and enforced through the use of technology. The charging by type of vehicle will be tailored towards meeting specific standards i.e. vehicles that do not meet Euro 6 standards or highly polluting diesel vehicles would be charged a fee, for example. The area to be subject to the LEZ would need to be thoroughly investigated, but it is likely to include the areas surrounding Vandanants Square and/or Independence Square.

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants) SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters		• Social: green behaviours and awareness • Economic: economic inclusion, economic returns for investor • Environmental: enhanced air quality and reduced GHG emissions
CAPEX (EUR) 5,000,000 **CAPEX (AMD)** 2,650,000,000	**Annual OPEX (EUR)** 1,000,000 **Annual OPEX (AMD)** 530,000,000	**Funding options** • National government • IFI and donors • Private sector
Implementation start and end date: 2020 - 2024		
Action owner: Transport Department, Gyumri Municipality	**Implementing partner(s):** Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Key stakeholders:** Regional administration of Shirak, local businesses, NGOs, public and private transport operators, national government, other private sector, IFI/ donors

<table>
<tr><td colspan="3">Reference Number
A_TR_10</td></tr>
<tr><td colspan="3">Title: City-wide car sharing scheme</td></tr>
<tr><td colspan="3">Classification: Capital investment in new city assets</td></tr>
<tr><td colspan="3">Description
A citywide car sharing scheme is a way of increasing car occupancy by reducing low occupancy car trips and of reducing vehicle ownership by offering vehicle rentals. The scheme incentivises car drivers share their journey with someone else with the same or nearby/ en-route destinations. This action will introduce and promote such a scheme, which will be flexible to allow the rental of vehicles for a short period of time. Large scheme operators, such as Zip Car, offer rental platforms through online applications and allow for non-fixed locations and pre-booking. The promotion of the scheme chosen by Gyumri would include promotion through various media outlets such as distributing leaflets, TV and radio advertisement and on-street billboards, promotional campaigns in business offices to encourage sharing rides to and from the office with colleagues, incentive programs in the workplace for employee car-sharing and complementary schemes, such as the potential to introduce car clubs where members can gain access to a car on a short-term rental basis and charge by the hour or by a day. This particular action can be incorporated in any new form of city-based mobility application (A TR 11).</td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)
SO_AR Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td><td>Key benefits
• Social: enhanced social inclusion and green behaviours and awareness, reduced health risks
• Economic: economic inclusion
• Environmental: enhanced air quality and reduced GHG emissions</td></tr>
<tr><td>CAPEX (EUR)
500,000
CAPEX (AMD)
265,000,000</td><td>Annual OPEX (EUR)
50,000
Annual OPEX (AMD)
26,500,000</td><td>Funding options
• Municipality budget
• National government
• Private sector</td></tr>
<tr><td colspan="3">Implementation start and end date: 2021 - 2023</td></tr>
<tr><td>Action owner: Transport Department, Gyumri Municipality</td><td>Implementing partner(s): Private sector</td><td>Key stakeholders: Regional administration of Shirak, NGOs, national government, other private sector</td></tr>
</table>

<table>
<tr><td colspan="3">Reference Number
A_TR_11</td></tr>
<tr><td colspan="3">Title: City-wide transport mobility application</td></tr>
<tr><td colspan="3">Classification: Capital investment in new city assets</td></tr>
<tr><td colspan="3">Description
A citywide transport mobility application (or journey planner) provides information on the best routes to travel between stations, bus stops, places of interest, addresses or postcodes. The application can set the time you want to travel and whether you want to take the fastest route or the one with fewest changes or least walking. The application that would be developed in this action would link to other key sources of information including interactive maps, real-time and audio/visual information, signage and wayfinding. The app would provide information regarding the end-to-end journey including available modes and costs. The action would need to be delivered in phases, with the first stage including information gathering and market research, the second relating to piloting and the third roll out.</td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)</td><td>Key benefits
• Social: enhanced access to services, green behaviours and awareness
• Economic: economic inclusion
• Environmental: enhanced air quality and reduced GHG emissions</td></tr>
<tr><td>CAPEX (EUR)
3,000,000
CAPEX (AMD)
1,590,000,000</td><td>Annual OPEX (EUR)
600,000
Annual OPEX (AMD)
318,000,000</td><td>Funding options
• Municipality budget
• National government
• Private sector</td></tr>
<tr><td colspan="3">Implementation start and end date: 2022 - 2026</td></tr>
<tr><td>Action owner: Transport Department, Gyumri Municipality</td><td>Implementing partner(s): Private sector</td><td>Key stakeholders: Regional administration of Shirak, local businesses, universities, NGOs, public and private transport operators, national government</td></tr>
</table>

<table>
<tr><td colspan="3">Reference Number
A_TR_13</td></tr>
<tr><td colspan="3">Title: Partial electrification of Municipality vehicle fleet</td></tr>
<tr><td colspan="3">Classification: Capital investment in new city assets</td></tr>
<tr><td colspan="3">Description
There is a drive and desire within Gyumri to promote a shift from traditional gasoline powered vehicles to alternative, cleaner fuel sources. A significant proportion of the city vehicles already run on CNG but no consolidated city level strategy exists that sets out a roadmap or action plan for low emission roll out/adoption. To drive forward and promote active take up of low emission vehicles by the general public and city commuters, it is proposed that the Municipality and other city stakeholders, notably public authorities, replace a proportion of their existing gasoline-based vehicle fleets with low emission, preferably electric, vehicles and prepare a related action plan for future improvements. Depending on the total size of the city vehicle fleet, it is proposed that up to two Municipality vehicles be replaced with electric vehicles in this action.</td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)
SO_AR Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td><td>Key benefits
• Social: green behaviours and awareness, reduced health risks
• Economic: economic returns for investors
• Environmental: enhanced air quality and reduced GHG emissions</td></tr>
<tr><td>CAPEX (EUR)
100,000
CAPEX (AMD)
53,000,000</td><td>Annual OPEX (EUR)
10,000
Annual OPEX (AMD)
5,300,000</td><td>Funding options
• Municipality budget
• IFI and donors</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - 2021</td></tr>
<tr><td>Action owner: Transport Department, Gyumri Municipality</td><td>Implementing partner(s): Private sector</td><td>Key stakeholders: Gyumri Electricity Company, private transport operators, IFI/ donors</td></tr>
</table>

Reference Number
A_IN_01

Title: Gyumri 'Green Business' concept

Classification: Strategies, plans and programmes

Description

This is an action to develop a local concept for stimulating resource efficiency and clean production by creating a favourable investment climate for low-carbon, low-pollution and low-waste production practices, including with the application of state-of-the-art innovative technologies. The nature of the concept would be explored in the first part of this action, but it could include, for example, diverse actions such as the introduction of a waste collection tariff system to encourage minimisation of industrial waste. It could also include the development of waste utilisation platforms/apps, which would provide support and advise to industries, SMEs and other commercial entities regarding the reuse, reduction and recycling of all forms of waste, production of by-products, product modification and waste-to-energy applications. The action would be delivered by the Municipality in close cooperation with donors and NGOs, with a key benefit of the action being the generation of related dialogue and sharing of best practices.

Environmental performance (alignment with GCAP objectives)	**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)	• Social: green behaviours and awareness • Economic: economic growth, employment generation • Environmental: enhanced air quality and reduced GHG emissions
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW	
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city	
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city	
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters	

CAPEX (EUR)	**Annual OPEX (EUR)**	**Funding options**
90,000 **CAPEX (AMD)** 47,700,000	5,000 **Annual OPEX (AMD)** 2,650,000	• IFI and donors • Private sector

Implementation start and end date: 2020 - Ongoing

Action owner: Department of Trade and Service Coordination, Gyumri Municipality	**Implementing partner(s):** Private sector	**Key stakeholders:** Ministry of Territorial Administration and Infrastructures, Ministry of Economic Development, R2E2, donors/IFIs

Reference Number
A_IN_02

Title: Green Business Coordination Platform 'Gyumri Green Economy Club'"

Classification: Awareness, demonstration and capacity building

Description

Gyumri will create an open platform for communicating with industry and design an associated local green business agenda with aims including to support the formation of partnerships to facilitate the introduction and promotion of industrial energy management and resource efficiency practices. The exact nature and scope of the platform will be reviewed in this action, but it is anticipated that it will include:

- Establishing a programme of voluntary actions and agreements for reduced resource use and pollution control;
- Drawing on resources of local and national university academia, the clean technology centre, sister city networks, and other institutions;
- Organising an annual expo oriented towards energy and material efficiency and GHG emission reduction in the industrial sector;
- Implementing and introducing a voluntary rating system for green production/Eco friendly industry;
- Introducing an annual Green Business of the Year Award by the City of Gyumri;
- Promoting local economic activity, job creation and opportunities to minimise the environmental footprint of local production via the platform;
- Creating incentives for industries to engage with voluntary green certification programmes, for example to qualify for Municipal competitive procurements;
- Integration of green business support into public procurement procedures for local vendors; and
- Setting up an Information Hub that monitors environmental pollution and pressures from all sectors, provides regular monitoring updates and highlights emerging risks.

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)		• Social: green behaviours and awareness • Economic: economic growth, employment generation, economic returns for investors • Environmental: enhanced air quality and reduced GHG emissions
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW		
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city		
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city		
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters		
CAPEX (EUR) 120,000 **CAPEX (AMD)** 63,600,000	**Annual OPEX (EUR)** 5,000 **Annual OPEX (AMD)** 2,650,000	**Funding options** • IFI and donors • Private sector
Implementation start and end date: 2020 - Ongoing		
Action owner: Department of Trade and Service Coordination, Gyumri Municipality	**Implementing partner(s):** Private sector	**Key stakeholders:** Universities, TUMO Centre, Gyumri Cleantech Centre, Regional Environmental Centre (REC), IFIs/ donors

Reference Number
A_IN_03

Title: Provision of energy management system support to industry/SMEs

Classification: Awareness, demonstration and capacity building

Description

Gyumri city administration will identify partners and develop toolkits to feature on a cooperation platform for industry-community joint efforts in industrial energy management. This action will involve working with donors to establish support services for Gyumri businesses to engage in energy audits and develop energy management systems. It will also seek to identify appropriate incentive mechanisms that can be adopted to support and incentivise businesses to adopt energy-smart behaviour. It will also encourage companies to establish voluntary agreements regarding energy audits, which are one way of motivating companies (e.g. via small grants) to increase energy efficiency by conducting energy audits and implementing recommended energy efficiency measures.

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)		• Social: green behaviours and awareness • Economic: economic growth, economic returns for investors • Environmental: enhanced air quality and reduced GHG emissions
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW		
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city		
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters		
CAPEX (EUR) 250,000 **CAPEX (AMD)** 132,500,000	**Annual OPEX (EUR)** 25,000 **Annual OPEX (AMD)** 13,250,000	**Funding options** • IFI and donors • Private sector
Implementation start and end date: 2020 - 2025		
Action owner: Department of Trade and Service Coordination, Gyumri Municipality	**Implementing partner(s):** Private sector	**Key stakeholders:** Donors/IFIs, UN agencies

Reference Number
A_IN_05

Title: Remediation of former industrial sites for urban regeneration

Classification: Strategies, plans and programmes

Description

This action will involve the following:

- Conducting a comprehensive analysis of Gyumri's development paths and master planning, including with regards to the cleaning and de-risking of former industrial sites, and considering these plans in the context of knowledge of active and abandoned/ idle industrial sites;
- Designating industrial zones that need to/ can be ameliorated or repurposed for other uses, such as greenfield construction to meet urban development needs;
- Developing alternative incentive schemes for utilisation of previously contaminated sites through, for example, expedited construction permitting procedures, low-cost/no-cost provision for potential businesses/ development use, and/or alternative use for renewable energy facilities.

The required remediation would then be conducted by private entities.

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city		• Social: enhanced safety • Economic: economic growth, employment generation • Environmental: improved soils, green spaces and biodiversity
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city		
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters		
CAPEX (EUR) 1,000,000 **CAPEX (AMD)** 530,000,000	**Annual OPEX (EUR)** 25,000 **Annual OPEX (AMD)** 13,250,000	**Funding options** • Municipality budget • National government • IFI and donors • Private sector
Implementation start and end date: 2022 - 2025		
Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** Private sector	**Key stakeholders:** Ministry of Territorial Administration and Infrastructures, Ministry of Economic Development, R2E2, donors/IFIs

Reference Number
A_SW_01

Title: Feasibility study on waste treatment and disposal options and development of an Integrated Waste Management Plan for Gyumri and publicly available Solid Waste Database

Classification: Monitoring and data collection and studies

Description

The lack of information about waste arisings and composition is a major obstacle to the legal disposal of generated waste and to estimating the required treatment capacity for various waste types. A waste characterisation study should therefore be conducted on representative samples on an annual basis to identify waste fractions that could be recycled or recovered. Based on the gathered information, a feasibility study should be conducted to evaluate the best options for the collection, treatment and disposal of waste generated in Gyumri. Options to be investigated should focus on the recovery of recycling materials, treatment of organic waste and disposal in engineered landfills. The chosen options and detailed information regarding their implementation will then be described in an Integrated Waste Management Plan (IWMP) for Gyumri, which will also be developed in this action. The IWMP will include an action plan aimed at reducing waste generation and improve the recycling rate. The outcome of the waste characterisation study and the information on Gyumri's waste arisings will be made available via the creation of an online Solid Waste Database. The update of the database should be considered as an ongoing action.

Environmental performance (alignment with GCAP objectives)	**Key benefits**
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)	• Social: improved access to services • Economic: economic inclusion • Environmental: enhanced soil quality, water resources and air quality and reduced GHG emissions
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW	
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city	

CAPEX (EUR)	**Annual OPEX (EUR)**	**Funding options**
1,000,000 **CAPEX (AMD)** 530,000,000	50,000 **Annual OPEX (AMD)** 26,500,000	• Municipality budget • National government • IFI and donors

Implementation start and end date: 2020 - 2023

Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** IFIs/ donors	**Key stakeholders:** Regional administration of Shirak, NGOs, national government

<table>
<tr><td colspan="3">Reference Number
A_WR_11</td></tr>
<tr><td colspan="3">Title: Establish a Smart City Action Pilot area</td></tr>
<tr><td colspan="3">Classification: Monitoring, data collection and studies</td></tr>
<tr><td colspan="3">Description
It is proposed that an area is assigned where a network of sensors can be tested to monitor water demand of green infrastructure. This action will involve the establishment of such a pilot area and will also review the potential to develop wider SMART digital asset management systems based on the Internet of Things (IoT) concept, whereby interrelated devices can be used to conduct the smart monitoring of asset conditions. The action will also explore how these could interact with other city-wide SMART systems.</td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city
SO_AR Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td><td>Key benefits
• Social: green behaviours and awareness
• Economic: economic growth and employment generation
• Environmental: enhanced water resources, green spaces and biodiversity</td></tr>
<tr><td>CAPEX (EUR)
20,000
CAPEX (AMD)
10,600,000</td><td>Annual OPEX (EUR)
0
Annual OPEX (AMD)
0</td><td>Funding options
• Municipality budget
• National government
• IFI and donors</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - 2022</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): Veolia Jur CJCS</td><td>Key stakeholders: Gyumri Municipality, national government, private sector, IFI/ donors</td></tr>
</table>

Reference Number
A_WR_12

Title: Develop an Action Plan for Rivers

Classification: Strategies, plans and programmes

Description

Define river water flow and quality targets: Based on national best practice, this action will first involve agreeing relevant regulations and monitoring points in rivers flowing through Gyumri as well as appropriate objectives and targets for environmental flows, chemical water quality and biological/ecological aquatic environmental quality. This will take into account limitations, such as the fact that flow monitoring may only be possible at distant locations where appropriate infrastructure is available in the river, and that localised estimates of flow may need to be made at the same locations where water quality is monitored.

Monitor flow and water quality in the river and review progress against targets: Actions to establish monitoring regimes and the associated recording, sharing and processing of data will be agreed and implemented. This will result in surveys and measurements being taken at appropriate intervals (e.g. daily for flow, monthly for chemical quality and every three to five for biological and ecological quality). Water flow and quality monitoring systems will be set in the rivers flowing though Gyumri.

Develop an Action Plan for meeting River targets: The final part of the action will involve the preparation of five-year and 20-year programmes that will be based on an assessment of the effect of actions on meeting river quality targets in terms of flow, chemical, biological, ecological and morphological quality. This assessment can be conducted using a number of different approaches, but it is likely that it would involve some basic water quality modelling using a simplified system such as SAGIS, SimBasinQ or QUAL2K. The gaps in surface water monitoring will be identified based on the findings and an Action Plan prepared.

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW		• Social: green behaviours and awareness • Economic: economic growth • Environmental: enhanced water resources, green spaces and biodiversity
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city		
SO_AR Enhanced resilience of Gyumri's social, economic physical infrastructure and environmental assets to natural disasters		
CAPEX (EUR) Step 1: 50,000 Step 2: 50,000 Step 3: 50,000 **CAPEX (AMD)** Step 1: 26,500,000 Step 2: 26,500,000 Step 3: 26,500,000	**Annual OPEX (EUR)** 15,000 **Annual OPEX (AMD)** 7,950,000	**Funding options** • Municipality budget • National government • IFI and donors
Implementation start and end date: Step 1: 2020 – 2022 Step 2: 2020 – 2026 Step 3: 2020 - 2022		
Action owner: Eco-monitoring centre, RoA	**Implementing partner(s):** Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Key stakeholders:** Shirak Marz administration, Akhuryan river basin, private sector, national government, IFI/ donors

<table>
<tr><td colspan="3">Reference Number
A_WR_13</td></tr>
<tr><td colspan="3">Title: Water usage behaviour targets for residents</td></tr>
<tr><td colspan="3">Classification: Awareness, demonstration and capacity Building</td></tr>
<tr><td colspan="3">Description
Define water usage targets by residents, industry and municipal authorities:

Agree on practical targets for the city for per capita water usage, industrial water usage for different production processes and best practice in the use of water by the municipal authorities for street cleaning, urban irrigation and other purposes. Review the WW discharge practices of industrial and commercial users and the requirements for connection to sewers and for providing treatment prior to discharge. Standards for water usage by residents, industry and municipal authorities will be established and confirmed.</td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_WR Enhanced water supply, quality (incl. surface water) and efficiency of use, and reduced overall wastage of NRW
SO_AR Enhanced resilience of Gyumri’s social, economic physical infrastructure and environmental assets to natural disasters</td><td>Key benefits
• Social: green behaviours and awareness, social resilience, citizen engagement and participation
• Economic: economic returns for investors
• Environmental: enhanced water resources</td></tr>
<tr><td>CAPEX (EUR)
100,000
CAPEX (AMD)
53,000,000</td><td>Annual OPEX (EUR)
5,000
Annual OPEX (AMD)
2,650,000</td><td>Funding options
• Municipality budget
• National government
• IFI and donors</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - 2026</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): Veolia Jur CJCS</td><td>Key stakeholders: Shirak Marz administration, Akhuryan river basin, private sector, IFI/ donors, national government</td></tr>
</table>

<table>
<tr><td colspan="3">Reference Number
A_AQGHG_02</td></tr>
<tr><td colspan="3">Title: Establish a corrective system for air quality</td></tr>
<tr><td colspan="3">Classification: Monitoring and data collection and studies</td></tr>
<tr><td colspan="3">Description
Corrective measures are a key-stone of short-term pollution regulation and long-term air quality improvement. In this action, it is therefore proposed that Gyumri:
 

(1) Receive and evaluate real-time information on incidents where air pollution exceeds norms using data from the integrated monitoring system to be established in A_AQGHG_01, and also review and evaluate associated measures to be taken (or that have already been taken) to reduce this pollution;
(2) On the basis of the data obtained, take action or cooperate with local stakeholders and national authorities as required to identify and implement opportunities to reduce the level of pollution;
(3) Introduce a mechanism to initiate corrective actions in the event of adverse meteorological conditions, when human health is threatened (based on national norms relative to EU/ WHO standards); and
(4) Seek synergies with the industrial voluntary agreements scheme (as proposed in A IN 03) to pursue partnerships with the polluting industries to reduce pollution.</td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_AQGHG Reduced volume of dust and other air pollutant emissions (local and global pollutants)</td><td>Key benefits
• Social: green behaviours and awareness, reduced health risks
• Economic: employment generation
• Environmental: enhanced air quality and reduced GHG emissions</td></tr>
<tr><td>CAPEX (EUR)
200,000
CAPEX (AMD)
106,000,000</td><td>Annual OPEX (EUR)
20,000
Annual OPEX (AMD)
10,600,000</td><td>Funding options
• Municipality budget
• National government
• IFI and donors</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - 2024</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): National government</td><td>Key stakeholders: Hydrometeorological Service, Ministry of Nature Protection, Ministry of Health, IFI/ donors</td></tr>
</table>

<table>
<tr><td colspan="3">Reference Number
A_SL_01</td></tr>
<tr><td colspan="3">Title: Adopt and enforce international soil quality regulations</td></tr>
<tr><td colspan="3">Classification: Standards, guidelines and regulations</td></tr>
<tr><td colspan="3">Description
This action is to apply and disseminate international best-practice soil quality standards to all relevant local stakeholders to ensure that they are aware of and clearly understand these standards. This will enable them to be adopted and enforced at the city level. The standards and requirements for their adoption and enforcement will be explored in this action, which will include activities including:
- Assessment of the city's soil quality testing and monitoring needs in terms of coverage density, frequency, accuracy and similar;
- Develop a plan and methodology for city soil quality monitoring, reporting and data dissemination;
- Organise a regular routine of testing, measurement and reporting of soil quality throughout Gyumri targeting chemical, physical and biological characterisation, impacts; and
- Adequately mapping and reporting on the current quality of soils and contaminated sites and developing amelioration measures.</td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city</td><td>Key benefits
• Social: enhanced safety
• Economic: economic inclusion
• Environmental: improved soil quality</td></tr>
<tr><td>CAPEX (EUR)
150,000
CAPEX (AMD)
79,500,000</td><td>Annual OPEX (EUR)
20,000
Annual OPEX (AMD)
10,600,000</td><td>Funding options
• Municipality budget
• National government
• IFI and donors</td></tr>
<tr><td colspan="3">Implementation start and end date: 2020 - ongoing</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): National government</td><td>Key stakeholders: Ministry of Emergency Situations, Ministry of Territorial Administration and Development, IFI/ donors</td></tr>
</table>

Reference Number
A_SL_02

Title: Assess soil quality and air quality and integrate findings into urban development decision-making

Classification: Monitoring, data collection and studies

Description

The additional data generated by other actions, such as the mapping of contaminated sites (A IN 04) and enhanced air quality monitoring system (A_AQGHG_01) will be used to inform an assessment of soil and air quality, the findings of which will be used to generate dialogue on the city level. This will include a discussion of hot spots and remediation measures with all stakeholders, the impacts of various pollution threats to environmental assets in individual districts, and associated mitigation action requirements. Capacity building will also be conducted as part of this action, which will include related awareness building workshops, with a focus on integrating soil and air quality information into urban planning decision-making processes.

Environmental performance (alignment with GCAP objectives)		**Key benefits**
SO_SL Protected, maintained, diversified and enhanced natural assets, including green and blue infrastructure, across the city		• Social: enhanced safety and social resilience • Economic: economic growth • Environmental: improved soil quality
CAPEX (EUR) 150,000 **CAPEX (AMD)** 79,500,000	**Annual OPEX (EUR)** 20,000 **Annual OPEX (AMD)** 10,600,000	**Funding options** • Municipality budget • National government • IFI and donors
Implementation start and end date: 2021 - ongoing		
Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality	**Implementing partner(s):** National government	**Key stakeholders:** Ministry of Environment, Eco-Monitoring Centre, National Academy of Sciences (Econosphere Centre), IFI/ donors

<table>
<tr><td colspan="3">Reference Number
A_GSBIO_01</td></tr>
<tr><td colspan="3">Title: Establish a baseline of biodiversity in the city</td></tr>
<tr><td colspan="3">Classification: Monitoring and data collection and studies</td></tr>
<tr><td colspan="3">Description
This action will involve identifying and establishing biodiversity monitoring sites across the city in order to increase the availability of related data to inform an enhanced understanding of habitats in Gyumri, which is currently poor. The focus, in line with the indicators in the Indicator Database, is on monitoring bird species in Gyumri.</td></tr>
<tr><td colspan="2">Environmental performance (alignment with GCAP objectives)
SO_GSBIO Protected, enhanced and rehabilitated soil quality across the city</td><td>Key benefits
• Social: citizen engagement and participation
• Economic: employment generation
• Environmental: enhanced green spaces and biodiversity</td></tr>
<tr><td>CAPEX (EUR)
300,000
CAPEX (AMD)
159,000,000</td><td>Annual OPEX (EUR)
15,000
Annual OPEX (AMD)
7,950,000</td><td>Funding options
• Municipality budget
• National government
• IFI and donors</td></tr>
<tr><td colspan="3">Implementation start and end date: 2021 - 2030</td></tr>
<tr><td>Action owner: Communal, Housing and Environmental Protection Department, Gyumri Municipality</td><td>Implementing partner(s): National government</td><td>Key stakeholders: Ministry of Environment, National Academy of Sciences Scientific Centre for Zoology and Hydro-ecology, Armenian Agrarian Academy Regional Environmental Centre, World Wildlife Fund (WWF), American University of Armenia (AUA), Birdwatchers Association, IFIs/ donors</td></tr>
</table>

Appendix B. GCAP stakeholders

Organisation name	Name of representative
Third Nature NGO	Rafayel Mkhitaryan
Biosophia NGO	Karen Gevorgyan
A.D. Sakharov NGO	Seyran Martirosyan
A.D. Sakharov NGO	Armen Petrosyan
A.D. Sakharov NGO	Vardan Golchenko
Meghvik NGO	Vehanush Hovhannisyan
Compass NGO	Marine Avetisyan Program Manager
Contact Plus NGO	Hasmik Petrosyan
Araks centre	Hayk Zakaryan, President of NGO
“Kumayri Historical-Cultural Reserve-Museum” SNCO	Inga Avagyan, Director
National Value Club NGO	Vardan Srtashyan, President
National Value Club NGO	Mher Khachatryan
National Value Club NGO	Anahit Hovhannisyan
National Value Club NGO	Dianna Smbatyan
National Value Club NGO	Mamikon Stepanyan

Organisation name	Name of representative
Up'Gyumri	Thomas Tromille, Architect
Up'Gyumri	Hyugo Dugvillon, Architect
Up'Gyumri	Inga Avagyan, Interpreter
Deem Communications» Marketing and PR Company	Raffi Niziblian, Founding Director
Deem Communications» Marketing and PR Company	Karine Aroyan
Gyumri Youth Initiatives Centre NGO	Karen Terterya
Green Technologies Centre	Vachik Sahakyan, Director
Stability/Kayunutyun NGO	Levon Mazmanyan
Stability and Progress NGO	Shushanik Unusyan
Aravot Charitable NGO	Arusyan Grigoryan
Vanand NGO	Hamlet Ghazaryan, President
KAZA Foundation	Lusine Avagyan, Project Coordinator
Armenian Caritas	Armen Martirosyan, Project Manager
Craftsmanship Vocational College #4	Levon Igityan, Head of Career Centre
Craftsmanship Vocational College #4	Lyudvig Hakobyan, Student
Craftsmanship Vocational College #4	Emma Ter-Hovhannisyan, Student

Organisation name	Name of representative
Craftsmanship Vocational College #4	Ashot Trdatyan, Student
Craftsmanship Vocational College #4	Narine Hovakimyan, Student
Shirak State University	Angin Grigoryan, Lecturer
Shirak State University	K.Petrosyan, Associate Professor
Shirak State University	Diana Smbatyan, Student
RA Statistics Committee	Asya Podpomogova, Statistician
RoA Ministry of Emergency Situations	Suren Grigoryan, Shirak Marz Rescue Department
Armenian Electric Networks “Ghars Branch”, Gyumri	Karen Grigoryan, Engineer
Veolia Djur» CJSC, Shirak Branch	Saribek Pepanyan, Senior engineer
Akhuryan Community Seniors Council	Artashes Gevorgyan
Shirak Marz, Marmashen Community	Hovik Melkonyan, Advisor to the Head of Community
Shirak Marz Administration	Seda Tumasyan, Environment. Division, leading specialist
Gyumri Municipality	Rouben Sanoyan, First Deputy Mayor
Gyumri Municipality	Ararat Balabekyan, Chief Advisor to Mayor
Gyumri Municipality	Aram Sarpinyan, Transport Dpt. specialist
Gyumri Municipality	Artush Avagyan, Communal division chief specialist