Draft Initial Environmental Examination

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Armenia: ENA Investment Program Phase 2

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Abbreviations and Acronyms

Accountability Mechanism	AM
Affected Person	AP
Air sensitive receptors	ASR
Annual investment plans	AIP
Asbestos-containing materials	ACM
Asian Development Bank	ADB
Avian Power Line Interaction Committee	APLIC
Central and West Asia Department	CWRD
Closed Joint Stock Company	CJSC
Core Labour standards	CLS
Corrective Action Plan	CAP
Country Partnership Strategy	CPS
Critically Endangered	CR
Electromagnetic Fields	EMF
Electric Networks of Armenia	ENA
Endangered Species	EN
Environmental and Social Action Plan	ESAP
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Environmental and Social Management System	ESMS
Environmental Impact Assessment	EIA
Environmental Impact Expertise Center	EIEC
Environmental Management Plan	EMP
Environmental Monitoring Plan	EMoP
Environmental, Health, and Safety	EHS
Environmental, Health, and Safety Guidelines	EHS Guidelines
European Bank for Reconstruction and Development	EBRD
European Investment Bank	EIB
European Union	EU
Executing Agency	EA
Extended Annual Review Report	XARR
Gas Insulated Equipment	GIE
Global Environment Facility	GEF
Global Warming Potential	GWP
Government of Armenia	GoA
Greenhouse Gas	GHG
Grievance Redress Mechanism	GRM
Gross Domestic Product	GDP
Hazardous Substances Databank	HSDB
Hazardous Waste Storage Facility	HWSF

Hertz	Hz
Hydrofluorocarbons	HFCs
Impact Assessment	IA
Important Bird Area	IBA
Important Plant Area	IPA
Indigenous Peoples	IPs
Initial Environmental Examination	IEE
Integrated Biodiversity Assessment Tool	IBAT
Integrated Management System	IMS
Integrated Management System Department	IMSD
International Commission on Non-Ionizing Radiation Protection	ICNIRP
International Finance Corporation	IFC
International Financial Institution	IFI
International Labor Organization	ILO
International Organization for Standardization	ISO
International Union for Conservation of Nature	IUCN
Land Acquisition and Resettlement	LAR
Land Acquisition and Resettlement Plan	LARP
Least Concern	LC
Maximum Permissible Concentration	MPC
Ministry of Environment	MoE
Ministry of Healthcare	MoH
National Implementation Plan	NIP
Near Threatened	NT
Non-Governmental Organization	NGO
Non-Technical Summary	NTS
Occupation Health and Safety	OHS
Operational Manual	OM
Perfluorocarbons	PFCs
Persistent Organic Pollutants	POPs
Personal Protective Equipment	PPE
Physical Cultural Heritage	PCH
Polychlorinated Biphenyls	PCBs
Project Affected Person	PAP
Public Relations	PR
Rapid Environmental and Social Assessment	RESA
Republic of Armenia	RA
Resettlement Action Plan	RAP
Respiratory Protective Equipment	RPE
Safeguard Policy Statement	SPS
Solid Waste Management	SWM

Specially Protected Nature Areas	SPNAs
Stakeholder Engagement Plan	SEP
Standard Operating Procedures	SOPs
State Non-Commercial Organizations	SNCOs
Sulphur Hexafluoride	SF_6
Technical safety and firefighting Department	TSFD
Threshold Limit Values	TLV
Tons CO2 Equivalent	tCO_2e[1]
UN Framework Convention on Climate Change	UNFCCC
United Nations Environment Program	UNEP
United Nations Industrial Development Organization	UNIDO
United States Dollar	USD
US Fish and Wildlife Service	FWS
Volts Per Meter	V/m
Vulnerable	VU
World Bank Group	WBG
World Health Organization	WHO
World Wildlife Foundation	WWF

Currency Equivalents

1 US$ = 517.10 Armenian Dram (AMD) - as of 22nd June 2021
($ refers in this report to US-Dollars)

Weights and Measures

mm	Millimeter
As	Arsenic
Cadmium	Cd
Chrome	Cr6+
Cl	Chlorine
cm	Centimeter
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
dB	Decibel(s)
dBA	A-Weighted Decibel(s)
dBPEAK	Peak sound pressure level (PEAK) – The largest absolute value of the instantaneous maximum overpressure or under pressure observed during each pulse
Fe	Iron
ha	Hectare
Hz	Hertz
km	Kilometer
km/h	Kilometers Per Hour
Km^2	Square Kilometer
kV	Kilovolt
l	Liter
Ldn	Day night average noise level
Leaq	Equivalent Continuous Level
m	Meter
m^2	Square Meter
m^3	Cubic Meter
m^3/d	Cubic Meter Per Day
m^3/h	Cubic Meters Per Hour
m^3/s	Cubic Meters Per Second
m^3/s	Cubic Meter Per Second
MAC	Maximum Allowable Concentrations
mg	Milligram
mg/kg	Milligram Per Kilogram
mg/l	Milligram Per Liter
mg/m3	Milligram Per Cubic Meter
MPC	Maximum Permissible Concentrations

N	Nitrogen
NH^3	Ammonia
NO_2	Nitrogen Dioxide
NO_3	Nitrate
NO_x	Nitrogen Oxides
Pb	Lead
pH	Potential of Hydrogen
PM	Particulate Matter
PM10 and PM2.5	Particulate Matter of 2.5 micron or 10 micron size
POPs	Persistent Organic Pollutants
ppb	Parts Per Billion
PPM	Parts Per Million
RMS	Root Mean Square
SEL	Sound exposure level is a measure of the total sound energy that a fish would be exposed to for each individual pile strike which can help to determine the potential for injury to fishes.
SELCUMULATIVE	Cumulative SEL is determined by adding up the sound energy associated with all pile strikes that occur over a given day
SiF_4	Silicon tetrafluoride
So_2	Sulfur dioxide
SO_2F_2	Sulfuryl fluoride
SPL	Sound pressure level an expression of the sound pressure using the decibel (dB) scale and the standard reference pressures of 1 micro-Pascal (µPa) for water and biological tissues.
SF_4	Sulfur tetrafluoride
t	Ton
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
TTS	Temporary threshold shift
Zinc	Zn2+
µg	Microgram
$\mu g/m^3$	Micrograms per cubic meter
µPa	Micro pascal — unit of measure for pressure equal to 1 x 10-6 Pascals

1 Executive Summary

1.1 Introduction

1. Armenia is bordered to the north and east by Georgia and Azerbaijan and to the southeast and west by Iran and Turkey, respectively. Armenia is a mountainous, landlocked country in the geopolitical Transcaucasia region, characterized by the Southern Caucasus mountains.

2. Armenia is divided into 906 administrative territorial units: 10 regions (marzes) – Aragatsotn, Ararat, Armavir, Gegharkunik, Kotayk, Lori, Shirak, Syunik, Tavush, Vayots Dzor – and 502 communities consolidated into 52 community areas. The city of Yerevan is the capital of the country has a special administrative status. Regions are governed by marzpets (governors) appointed by the Government of Armenia (GoA). Yerevan is governed by a mayor appointed by the Council of Elders.[1]

3. Following the collapse of the Soviet Union, generation, transmission, and distribution infrastructure deteriorated from the effects of poor and irregular construction and maintenance work. In 2011, transmission assets were estimated to be on average more than 45 years old[2], and distribution assets in the two largest cities of Yerevan and Gyumri are almost fully depreciated.

4. Since the start of the 21st century, Armenia's energy sector has undergone a series of reforms that have significantly improved its performance. The reforms involved the unbundling of a vertically integrated electricity subsector and the privatization of power and gas distribution networks and of most generating companies.[3] Despite these positive reforms, Armenia's energy sector faces challenges, including the need to maintain energy supply reliability. Regular investments in various segments of the power network, including distribution, are vitally important, otherwise the gap between energy supply and demand will continue to increase.

5. The GoA has given high priority to measures that address current challenges facing the energy sector, including the issues of increasing energy efficiency, reducing losses, and ensuring reliability and high quality of power supply.

1.2 Project Background

6. Electric Networks of Armenia (ENA) is undertaking a five-year investment program with financing from the European Bank of Reconstruction and Development (EBRD) and the Asian Development Bank (ADB) to improve distribution service quality; reduce electricity losses and operational expenses; improve technical maintenance and safety conditions; modernize the metering system; rehabilitate, reinforce, and augment the distribution network; connect new customers; and introduce international standards of management and an automated control system.

[1] According to the RA law "On local self-government in the city of Yerevan", the Council of Elders is elected by the procedure determined by the RA election code and is comprised of 65 members. The Council is elected for a 5-year term.
[2] World Bank. "Charged Decisions: Difficult Choices in Armenia's Energy Sector." October 2011.
[3] ADB. 2014. Country Partnership Strategy: Armenia, 2014–2018. Manila.

7. Financing is being sought to support a second phase (herein referred to as Phase 2 of the Project) of the Distribution Network Rehabilitation, Efficiency Improvement, and Augmentation Project. The Project will be financed by a combination of internal funding and secured loans from the ADB, EBRD, and Leading Asia's Private Infrastructure Fund (LEAP). ENA will be contributing its own resources to cover 20% of the investment under the Project.

1.3 Description of the Project

8. The Project under Phase 2 will continue the same investment program completed under Phase 1. Note that this is a rolling three-year Project and that although the total amount of investment and the general types of works under Phase 2 are known, the exact locations of the first year's activities are largely unknown. Annual investment plans (AIP) will be prepared at the start of each year of the Project by ENA and these plans will specify the locations where activities will be undertaken during that specific year. At the time of writing this IEE, the AIP for year one was still not finalized. In some cases, the works being implemented under Phase 1 will roll into Phase 2 when additional financing is introduced.

9. Information available on the investment program for Phase 2 is included in the table below.

Table 1. Investment Program, 2021-2022

Item	Amount (AMD million)	Amount ($ million)	Share Total (%)
Substation modernization and reinforcement	23,726	45.56	30%
Network expansion and improvement	31,884	61.22	41%
Automatic metering systems	20,628	39.61	26%
Other investments	2,057	3.95	3%
Total	78,295	150.34	100%

Source: Financial model of Electric Networks of Armenia.

1.4 Alternatives

10. No-Project Alternative. Without the Project, Armenia's electricity network would continue to deteriorate resulting in further electricity losses, unsafe conditions at existing facilities, and degraded quality of electricity for end users. The steadily declining state of the electricity network would severely hamper economic development throughout the country and widen the gap between the worst served and the average customer. The utility would also forego the opportunity of increasing its consumer base as well as revenue associated with the system expansion.

11. Phase 2 of this Project will help ENA improve private sector electricity distribution by improving the quality of the distribution network and services; rehabilitating, reinforcing, and augmenting the distribution network; and introducing international standards of management and automated control systems.

12. As Armenia moves towards increasing renewable energy generation, the electricity network will need to be substantially upgraded to absorb additional variable energy resources. Moreover, the Project is expected to have numerous positive impacts on the environment and on the population of Armenia (refer to Table 2). In view of the above, the 'No Project' option is not a preferred alternative.

13. Alternative Regions. Project activities will be selected on a rolling basis by ENA, ADB, and EBRD for investment as part of a countrywide network modernization program. The types of activities to be undertaken under the Project are the same across the country and specific sites selected for investments will be determined by a number of factors, including potential environment and social impact. Accordingly, an assessment of alternative locations is not warranted or feasible.

1.5 Description of the Environment

14. The IEE report presents information about the physical, biological, and socio-economic characteristics of the environment. The purpose of this description is to establish an environmental baseline to identify potential direct, indirect, cumulative, and induced environmental impacts on and risks to these resources, and to suggest adequate response through measures that are appropriate to avoid, minimize, or mitigate potential adverse impacts. The environmental baseline conditions in the Project area include:

15. Meteorology and climate. Armenia's climate is influenced by the Caucasus mountains and ranges from dry sub-tropical to cold alpine. The average annual temperature (1960-2015) is 7.6°C, varying from -8°C in the high mountains to 12 to 14°C in low valleys. The highlands of the Lesser Caucasus mountains are marked by distinct temperature contrasts between summer and winter months. Average annual precipitation is 524 mm, 40% of which occurs between April and June. Precipitation increases from east to west and primarily occurs in higher-elevation locations.[4]

16. Air quality. The transport sector is the leading source of outdoor air pollution in Armenia contributing 51.5% of the total, with emissions from energy production, mining and quarrying providing much of the remaining 48.5%.[5] Other sources include industrial emissions from chemical, tire, and vehicle manufacturing, food processing, the microelectronics industry, and burning of waste.

17. Climate change. Armenia has already begun to experience changes in climate, and projections indicate more warming, dry periods, and heavy rain events are likely to occur. Between 1960 and 2015, mean annual temperature rose (+0.1°C per decade), the snow line rose, snow accumulation and glacial volume declined, and average annual rainfall experienced no significant trends. Looking to the future, river flows are projected to decline with rising temperatures and declining precipitation, reducing freshwater supply.[6] Forests, which cover approximately 11% of the country based on national estimates, are at risk due to increased aridity, which reduces growth rates and regeneration, making trees more susceptible to pests, diseases, and forest fires.[7] More frequent and longer heatwaves pose health risks, especially to vulnerable populations.[8]

[4] USAID. 2017. *Climate Risk Profile: Armenia.* June. Accessed May 5, 2021. https://www.climatelinks.org/resources/climate-change-risk-profile-armenia.
[5] Gad Bigio, A., R. Von Culin, and A. Karapetyan. 2019. "Armenia's Transformative Urban Future: National Urban Assessment." (Asian Development Bank).
[6] Westphal, M. et al. 2011. Regional Climate Change Impacts Study for the South Caucasus Region.
[7] UNDP. 2013. Climate Risk Management in Armenia.
[8] UNDP/Stockholm Environmental Institute. 2013. The Socio-Economic Impact of Climate Change in Armenia.

18. Geology, geomorphology, and soils. Armenia is a mountainous country with 77% of its territory between 1,000–2,500 meters above sea level, with an average altitude of 1,830 meters. A complex combination of depressions, plateaus, river valleys, uplands, and limited land, forests, and water is met with unfavorable geological engineering conditions in most areas (i.e., high seismicity and abundant geodynamic processes).[9] Fourteen major soil types, 27 semi types, and a total of 228 soil groups have been identified according to the natural-soil zones in the territory of Armenia.

19. Hydrology and hydrogeology. Despite the availability of water, resources are stressed, particularly in the densely populated Hrazdan River basin in the central part of the country.[10] There is also significant seasonal and annual variability in river runoff, including frequent droughts and risk of flooding in the spring, when about 55-70% of total annual runoff occurs during the peak snow melting period. The rivers in Armenia are largely tributaries of the Araks and the Kura – two of the dominant rivers in the southern Caucasus. Armenia has more than 100 small lakes, some of which regularly dry out in the dry season. The Sevan and Arpi lakes are the most important in terms of size and economic value.

20. Natural hazards. Armenia faces significant natural hazard risk from earthquakes, floods, and landslides, with additional risk from hail and drought. Historically, earthquakes of at least 5.5 magnitude have an average reoccurrence interval of 30 to 40 years.[11] Armenia's exposure to flooding risk is significant despite not having abundant flowing surface water due to snow melting, which contributes 55–70% of annual discharge. "The landslide hazard zone covers one-third of the country, primarily in foothill and mountain areas. Around 15% of the total population is exposed."[12]

21. Habitats, flora, and fauna. Armenia's landscape can be divided into six distinct ecosystem zones: forests; deserts and semi-deserts; steppes and meadow-steppes; sub-alpine and alpine meadows; and wetlands, rivers, and lakes. Due to favorable botanical and geographical distribution and diversity of floristic provinces and sub provinces, the vegetation in Armenia has become extremely rich and diverse. Armenia is located at the intersection of three biogeographical provinces, with active geological processes and a variety of climates that have created assorted ecosystems and abundant biodiversity. According to the World Wildlife Fund (WWF), the Caucasus region is among the planet's 25 most diverse and endangered hotspots, rich in species endemism.[13] Armenia's specially protected nature areas (SPNAs) are divided into four groups: national parks, state reserves, state wildlife sanctuaries, and natural monuments. Armenia also features 18 Important Bird Areas (IBAs)[14], 23 proposed Emerald

[9] *Modernizing Weather, Climate and Hydrological Services: A Road Map for Armenia (English).* Washington, D.C.: World Bank Group.
[10] Second National Communication on Climate Change, 2010. Report prepared for United Nations Framework Convention on Climate Change. Yerevan: Government of Armenia, Ministry of Nature Protection.
[11] World Bank. 2009. "Disaster Risk Reduction and Emergency Management in Armenia." October 2009.
[12] UNDP. Armenia. Disaster Risk Reduction. https://www.am.undp.org/content/armenia/en/home/projects/disaster-risk-reduction-.html
[13] Critical Ecosystem Partnership Fund. 2003. *Caucus Biodiversity Hotspot*. Critical Ecosystem Partnership Fund.
[14] BirdLife International. 2021. IBAs of Armenia. Accessed May 18, 2021. http://datazone.birdlife.org/site/results?thrlev1=&thrlev2=&kw=&reg=0&cty=11&snm=&fam=0&gen=0&spc=&cmn=.

Networks of Areas of Special Conservation Interest ("Emerald Network Sites")[15], 12 Prime Butterfly Areas[16], 3 Ramsar Wetlands of International Importance,[17] 28 IUCN Key Biodiversity Areas (including all the IBAs),[18] and 32 Important Plant Areas (IPAs)[19].

22. Historical and cultural heritage. Armenia hosts a rich cultural heritage which includes monuments, temples, and monasteries; music compositions; literary practices; dances; traditions; crafts; and food. Three cultural sites are included in the UNESCO World Heritage list (i) the Cathedral and Churches of Echmiatsin and the Archaeological Site of Zvartnots, (ii) the Monasteries of Haghpat and Sanahin, and (iii) the Monastery of Geghard and the Upper Azat Valley. There are another four sites on the tentative list which are being considered for nomination.[20]

23. Social environment. Armenia has a population of approximately 3 million people, 98% of whom are ethnically Armenian.[21] During recent years the country's demographic and urban profile has been characterized by an ageing population; a regular decline of the number of inhabitants due to external migration; and internal migration of rural population to the bigger cities, which fosters depopulation of villages and smaller towns. Pronounced and continued disparities and inequalities exist among Armenia's regions in demographic, economic, and social terms that worsened as the country moved from a centrally planned economy to a market economy after independence from the Soviet Union. Armenia has historically been an ethnically homogeneous country, a trend reinforced since the onset of Armenia's conflict with Azerbaijan and the economic hardship following independence in 1991. According to the 2011 Census, more than 98% of the total population is ethnically Armenian. Minority groups in the republic include Yezidis (35,308 or 1.2% of the total population), Russians (11,911, 0.4%), Assyrians (2,769, 0.1%), Kurds (2,162, 0.1%), Ukrainians (1,176), and Greeks (900). Armenia's minorities are scattered across the country, and do not form local majorities in any region or administrative unit.[22]

1.6 Anticipated Environmental Impacts and Mitigation Measures

24. The Project is expected to generate both positive and negative impacts throughout the project cycle. Potential impacts were screened, identified, and assigned significance based on the assessment method provided in Section 8.1. Impact Assessment Methodology. The assessments consider any embedded controls that already exist or are planned as part of the

[15] Rayvush, George, Alla Aleksanyan, Karen Aghababyan, Ashot Aslanyan, Marine Oganesyan, Samvel Nahapetyan, Marine Arakelyan, Astghik Ghazaryan, and Mark Kalashian. 2016. *The "Emerald" Network in the Republic of Armenia.* Yerevan: Ministry of Nature Protection of the Republic of Armenia.
[16] Aghababyan, K., and Khanamirian. 2020. "Butterfly Conservation Armenia."
[17] RAMSAR. 2011. "Annotated List of Wetlands of International Importance: Armenia." Armenia | RAMSAR. Accessed May 20, 2020. https://rsis.ramsar.org/sites/default/files/rsiswp_search/exports/Ramsar-Sites-annotated-summary-Armenia.pdf?1589973917.
[18] BirdLife International. 2015. *Important Bird Areas: Armenia.* Accessed May 20, 2020. http://datazone.birdlife.org/country/armenia/ibas.
[19] PlantLife. 2019. *Armenia.* http://www.plantlifeipa.org/criteria.
[20] United Nations Educational, Scientific and Cultural Organization. World Heritage List: Armenia. https://whc.unesco.org/en/statesparties/am.
[21] Central Intelligence Agency. 2021. *The World Factbook: Armenia.* February 1. Accessed May 22, 2021. https://www.cia.gov/the-world-factbook/countries/armenia/.
[22] UNHCR. 2008. *World Directory of Minorities and Indigenous Peoples - Armenia*: Yezidis & Kurds. Accessed June 9, 2021. https://www.refworld.org/docid/49749d60c.html.

Project (i.e., physical or procedural controls). Also factored into the analysis are any gaps identified in the embedded controls and their effectiveness to manage risks based on observations and findings.

25. Assessment of impact tables for the most significant potential impacts were developed to provide more in-depth analysis and are included in Section 8.2. Impacts and Mitigation Measures. Residual impacts after implementing mitigation measures were then identified.

26. A general description of primary environmental impacts and mitigation measures is provided below:

27. Management of hazardous materials and wastes. Without mitigation, considerable risks exist from the management of hazardous materials and wastes. Contamination of soil, water, and air can result from the inappropriate handling, storage, and disposal of the oils, petroleum products, lubricants, chemicals, and other hazardous materials that are needed for this Project and to operate the electrical network. The handling, transportation, storage, and disposal of hazardous wastes generated from Project activities (e.g., asbestos, mercury-containing bulbs, flooded-acid batteries) are another potential source of contamination that could impact health and the environment. These impacts may result from activities performed by ENA's personnel or its contractors.

28. Contamination may also originate from storage sites such as ENA's branch offices, the Abovyan Warehouse, and the Abovyan Oil Storage Facility. Control of materials, waste, and equipment will be of the utmost importance to prevent soil, water, and air contamination as well as impacts to health of workers and community members. These risks will be managed with implementation of good construction and operation practices and through careful monitoring of contractor's activities and ENA's facilitates and offices. It should be noted that these sites have been subject to site visits and safeguards audits by the Lender's Engineer (Tetra Tech) under Phases 1 and 2 of the Project.

29. Risks around the management of used oils which may contain PCBs are especially pronounced given that testing for the presence and concentration of PCBs is currently not feasible. PCBs can be released into the environment from hazardous waste sites, improper handling and management of materials and wastes, and leaks from electrical equipment (e.g., transformers) containing used oils with PCBs. Risks include exposure to PCBs through food consumption, dermal contact, and inhalation. The risk of impacts will be reduced substantially by taking a precautionary management approach and making certain that all used oils are treated as potentially hazardous until testing can verify PCB presence and concentration.

30. Critical to mitigating impacts from hazardous materials and wastes is a complete commitment to implementing the ESMS already established under Phase 1 of the Project (refer to 6.14. Environmental and Social Management System (ESMS)). The plans, procedures, and guidelines that are part of the ESMS specifically address the potential risks around handling, transportation, storage, and disposal processes and will be strictly followed by ENA.

31. Occupational health and safety. ENA personnel and its contractors are exposed to different hazards including noise and vibration, dust, handling heavy materials and equipment, falling objects, work on slippery surfaces, fire hazards, electrical hazards, and chemical hazards. There are a number of potential health and safety related impacts which may directly result from Project activities, including the presence of new electrical infrastructure and management of hazardous materials and waste. Potential risks will be eliminated or reduced

using good practice and known control and management solutions. Moreover, the implementation of ENA's incident investigation and tracking system will provide the company and its employers and contractors the opportunity to identify hazards in their operations and shortcomings in their safety and health programs. Most importantly, it enables ENA and its contractors to identify and implement the corrective actions necessary to prevent future incidents. As with the management of hazardous materials and wastes, implementation of the plans, procedures, and guidelines that are part of ENA's ESMS is critical to managing health and safety of not only workers, but the community as well.

32. Community health and safety. There was no land acquisition undertaken, no involuntary resettlement impacts, and no indigenous peoples (IPs) affected by subprojects under Phase 1. Phase 2 of the Project is expected to be the same as ENA is making a concerted effort to avoid any activities which would result in land acquisition and resettlement. If resettlement is required, however, ENA has an established Involuntary Resettlement Management Procedure which is part of its ESMS in order to manage potential impacts.

33. In addition to potential health impacts from the exposure to hazardous materials and wastes, noise and vibrations, and the presence of worksites, injuries and fatalities can also occur to community members as a result of coming into contact (or close proximity) with electricity overhead lines, underground cables, and other charged equipment. These incidents may be as a result of accidental contact with charges equipment, lines, and cables (e.g., contacting an electrified line with machinery) or as a result of direct manipulation of distribution system elements (e.g., altering power supply infrastructure without authority).

34. A grievance redress mechanism (GRM) has been integrated into the company's Stakeholder Engagement Plan (SEP) and is designed to record, track, and respond to concerns and complaints. Risks will be further managed through development and distribution of community risk awareness materials targeting those living nearest to substations and other higher-risk areas.

35. Impacts to birds from electrocution and collisions with infrastructure. The most significant impact of the Project, in terms of biodiversity, relates to potential bird electrocution on poles and wires as well as collisions with electrical infrastructure. The risk of impacts to birds is based on the combination of three factors: biological (e.g., age, body size), environmental (e.g., habitat type, seasonal variation), and engineering (e.g., pole design, pole equipment). ENA will reduce potential impacts to birds by identifying within its Rapid Environmental and Social Assessment (RESA) reports when planned subprojects are within 5 km of one of Armenia's 18 Important Bird Areas (IBAs). If the answer is positive, ENA will engage a national specialist to identify potential risks and determine the design specifications needed to mitigate any impacts to bird species.

36. Network rehabilitation, efficiency improvement, and augmentation. Significant positive impacts will be provided from the improved energy supply to ENA's customers following the rehabilitation, efficiency improvement, and augmentation of the network made possible with financing under this Project. Positive impacts include new employment opportunities connected to the need for skilled and unskilled labor to support Project activities. Important socio-economic benefits will also be provided to households and businesses from improved energy services.

37. There are also noteworthy environmental and health and safety benefits that will be realized as Phase 2 is implemented. These benefits result from the replacement of older transformers with newer ones which are more reliable, have more safety-critical parts and designs, and require less frequent maintenance which reduces risks and duration of failures.

Meanwhile, completing the installment of spill containment systems in all of ENA transformer's with oil capacity larger the 500 liters will greatly reduce risks from unplanned releases of used oils.

1.7 Implementation, Management, and Monitoring

38. Management plans. An Environmental Management Plan (EMP) developed as part of this IEE provides details on the implementation of mitigation measures, monitoring program, cost estimates, and institutional arrangements to ensure that no significant adverse impacts results from the investment. The Environmental Monitoring Plan (EMoP) which accompanies the EMP provides the procedures and actions that recognize and analyze environmental and social changes consequent to the pre-construction / construction and operation phases of the Project.

39. The EMP shall be reviewed periodically to evaluate environmental controls and procedures to make sure they are still applicable to the activities being carried out. Reviews will be undertaken by ENA's Environmental Expert as follows:

- The full EMP shall be reviewed at least annually;
- Relevant parts of the EMP shall be reviewed following a reportable incident;
- In case any issues of failure of mitigation measure to reduce the impact occurs;
- Relevant parts of the EMP shall be reviewed following the receipt of an updated site specific or topic specific plan; and
- At the request of stakeholders.

40. The review shall include analysis of data, monitoring reports, incident reports, complaints/grievances, and feedback from stakeholders.

41. Monitoring. Monitoring and verification will be reported and made available for inspection upon request. All incidents will be reported, and corrective actions will be taken as necessary according to management plan recommendations and ENA procedures. This will enable and facilitate a process of continuous improvement. Monitoring during construction and operation phases of the project, through the audit of impact predictions and mitigation measures, will assure:

- mitigation measures are implemented effectively;
- mitigation measures are appropriate and, if not, that they are amended, or additional measures are designed and implemented;
- compliance with Project standards, guidelines, and best practice as applicable;
- assessment of cumulative and residual impacts, so that appropriate measures can be designed if necessary; and
- continuation of the IEE as an iterative process through to the construction and operational environment and social management systems, which will be based on continual improvement.

42. Grievance redress. The GRM established under Phase 1 of the Project is incorporated into ENA's SEP and follows Armenian Regulations and ADB Policy requirements. All grievances received will be addressed and investigated as part of the established GRM.

43. Contractor requirements. Contractor requirements are specified in the Contractors Management Procedure which is part pf ENA's ESMS (refer to Section 11.4. Contractors

Management Procedure Requirements). Contractors' responsibilities in the management procedure are divided into the following phases: i) pre-execution; ii) during execution; and iii) post-execution. ENA will ensure that the relevant mitigation measures identified within this IEE are incorporated into the instructions and normative documents that are required for contractors to follow as part of their work.

44. Rapid Environmental and Social Assessment. Categorization is being undertaken under Phase 2 of the Project using Rapid Environmental and Social Assessments (REAs). The process requires completion of the environmental categorization form for subprojects. The RESA form being used by ENA includes sector-specific checklists (refer to Annex 6. Rapid Environmental and Social Assessment (RESA) Form), developed based on the ADB's past knowledge and experience. These checklists consist of questions relating to (i) the sensitivity and vulnerability of environmental resources in project area, and (ii) the potential for the project to cause significant adverse environmental impacts.

45. The process of determining the Project's environment category is initiated by ENA, which prepares REA screening checklists, taking into account the type, size, and location of the proposed project. Subproject are then classified as one of the environmental categories (A, B, or C).

1.8 Conclusions and Recommendations

46. Based on the analysis of information and feedback received from various stakeholders, this IEE concludes that potential significant physical, biological, or socio-economic environment impacts from Phase 2 of the Distribution Network Rehabilitation, Efficiency Improvement, and Augmentation Project can be addressed and it is unlikely that there will be any significant environmental impacts remaining after planned mitigation measures. The Project will have short term impacts during implementation which can be mitigated to an acceptable level through measures which seek to reduce the potential for harm to the environment and human health. In many cases impact risks identified in the pre-construction / construction phase will exist in the operation phase given the operational realities of managing ENA's electrical network. From the analysis provided in this IEE, the classification of the Project as Category B per ADB SPS is confirmed.

47. Residual impacts for the most significant potential impacts (see assessment of impact tables in Section 8.2. Impacts and Mitigation Measures) are identified below. Negative and positive residual impacts are qualified as Negligible, Minor, Moderate, and Major according to the assessment method described in Section 8.1. Impact Assessment Methodology.

Table 2. Summary of Residual Environmental Impacts

Environmental Factor	Project Phase	Potential Impacts	Pre-mitigation Impact Significance	Residual Impact Significance
PCB Release and Exposure*	Pre-Construction / Construction Phase	Health impacts from the release and exposure of PCBs due to: i) improper handling and management of used oils with PCBs and PCB wastes, including contaminated soils; ii) leaks from electrical transformers and switchgear containing PCBs; iii) the testing and regeneration of used oils; and iv) the rehabilitation and disposal of used transformers and other oil containing equipment.	**Major**	**Minor**
	Operation Phase**			
Soil and Geology	Pre-Construction / Construction Phase	Soil works, including vegetation clearance, grading, levelling, compaction, backfilling, and demand for aggregates, as well as the construction and installation of various structures may lead to sedimentation of waterways, loss of topsoil, reduction in soil fertility, conversion of land use.	**Minor**	**Negligible / Minor**
	Pre-Construction / Construction Phase	Contamination of soil from the inappropriate use, handling, storage, and disposal of oils, petroleum products, lubricants, chemicals, hazardous materials, liquids, and solid waste.	**Moderate**	**Minor**
	Operation Phase			
Surface and Groundwater	Pre-Construction / Construction Phase	Altered hydrology from construction works, including vegetation clearance, grading, levelling, compaction, backfilling, and demand for aggregates, as well as the construction and installation of various structures may lead to detrimental changes to	**Minor**	**Negligible / Minor**

		site hydrology (e.g., erosion, sedimentation, and creating conditions for vector and waterborne diseases).		
	Pre-Construction / Construction Phase	Potential for impacts to quality of surface and ground water due to contamination from accidental releases of hazardous substances.	**Moderate**	**Minor**
	Operation Phase			
PCB Release and Exposure	Operation Phase	Installment of oil spill containment systems and the replacement of older transformers with newer ones.	***Positive******	**Major**
Soil and Geology				
Surface and Groundwater				
Air Quality	Pre-Construction / Construction Phase	Air quality impacts from (i) Fugitive dust emissions associated with the materials handling and wind erosion of open areas; (ii) Emissions from concrete batching; and (iii) Air emissions including NO_2, SO_2, PM_{10} and $PM_{2.5}$ from construction equipment and truck circulation within the work areas.	**Minor**	**Negligible / Minor**
	Operation Phase	Fewer emissions from power plants due to reduction of power loses following network upgrading and rehabilitation.	***Positive***	**Minor / Moderate**
Sulfur Hexafluoride (SF_6) Gas Emissions and Byproducts	Pre-Construction / Construction Phase	Contribute to global warming from SF_6 emissions.	**Minor**	**Negligible / Minor**
	Operation Phase			
	Pre-Construction / Construction Phase	Potential health impacts to workers from toxic byproducts formed when electrical discharges	**Moderate**	**Negligible / Minor**

	Operation Phase	occur within SF_6-filled equipment.		
Noise and Vibration	Pre-Construction / Construction Phase	Noise and vibration emissions resulting from the use of machinery and equipment and vehicle circulation.	**Minor**	**Negligible / Minor**
	Operation Phase	Reduced noise and vibration emissions resulting from the installment of newer and more modern equipment.	***Positive***	**Moderate**
Occupational Health and Safety *(Socio-Economic)*	Pre-Construction / Construction Phase	Occupational health and safety impacts from workers' exposure to different hazards during construction.	**Major**	**Minor**
	Operation Phase			
Community Health and Safety *(Socio-Economic)*	Pre-Construction / Construction Phase	Impacts to community health, safety, and security due to i) accidents and fatalities associated with the distribution system; ii) presence of storage areas and warehouses near populated areas; iii) presence of worksites; and iv) exposure to hazardous materials and waste.	**Major**	**Minor**
	Operation Phase			
Community Infrastructure, Services, and Access *(Socio-Economic)*	Pre-Construction / Construction Phase	Impact on community infrastructure, services, and access including temporary loss or reduction in utility supply and temporary road closures.	**Minor**	**Negligible / Minor**
	Operation Phase			
Economy, Employment, and Livelihoods *(Socio-Economic)*	Pre-Construction / Construction Phase	Impact to employment provided by the need for skilled and unskilled labor.	***Positive***	**Minor**
	Operation Phase	Improved energy supply provided to local businesses and households.	***Positive***	**Major**
Physical Cultural Heritage *(Socio-Economic)*	Pre-Construction / Construction Phase	Impact to physical cultural heritage (PCH) from construction related activities.	**Moderate**	**Minor**

Ecology and biodiversity	Pre-Construction / Construction Phase	Impacts to habitat and flora from site clearance and construction activities.	**Moderate**	**Minor**
	Operation Phase	Impacts to birds from electrocution and collisions with transmission lines and equipment.	**Moderate**	**Minor**
Hazardous Waste Management	Pre-Construction / Construction Phase	Impacts to heath and the environment from improper management of mercury-containing lamps, acid batteries, and asbestos. *(does not include PCB oils or SF_6 gas)*	**Moderate**	**Negligible / Minor**
	Operation Phase			

*Note: *The potential impacts from the release of and exposure to PCBs has been examined as a separate topic and is not covered again in the soil and relief, surface and groundwater, air quality, and health and safety (socio-economic) sections.*
*** It is expected that testing capacity will increase allowing for the presence of PCBs and their concentrations in oil can be determined. This has the potential to significantly reduce risks and support proper management of used oils and oil containing equipment.*
****It is considered sufficient for the purpose of this IEE to indicate that the Project is expected to result in a potential positive impact prior to mitigation without characterizing the exact degree of positive change likely to occur.*

2 Introduction

2.1 Overview

48. Electric Networks of Armenia (ENA) is undertaking a five-year investment program with financing from the European Bank of Reconstruction and Development (EBRD) and the Asian Development bank (ADB) to improve distribution service quality; reduce electricity losses and operational expenses; improve technical maintenance and safety conditions; modernize the metering system; rehabilitate, reinforce, and augment the distribution network; connect new customers; and introduce international standards of management and an automated control system.

49. Access to electricity is a basic human need and all households and businesses across Armenia will benefit from the supply of uninterrupted electricity in all cities. Ensuring the supply of electricity will also enable economic activity across the country and enhance the resilience of Armenian cities to sustain and support an effective response to the COVID-19 pandemic and limit its negative externalities.

50. Financing is being sought to support a second phase of the Distribution Network Rehabilitation, Efficiency Improvement, and Augmentation Project (herein referred to as Phase 2 of the Project). ENA will be contributing its own resources to cover 20% of the investment under the Project

51. The Project will be financed by a combination of internal funding and secured loans from the ADB, EBRD, and Leading Asia's Private Infrastructure Fund (LEAP). Table 3 identifies the corresponding sources of funds. The LEAP funds will be administered by the ADB.

Table 3. Project Financing Plan

Source	Amount (AMD million)	Source ($ million)	Amount (%)
Loans			
Asian Development Bank	10,000	20.00	13%
LEAP	8,025	15.00	10%
European Bank for Reconstruction and Development	37,450	70.00	47%
Internally generated funds	22,120	45.34	30%
Total	78,295	150.34	100%

Note: LEAP = Leading Asia's Private Infrastructure Fund.

52. The Project is aligned with two operational priorities under ADB's Strategy 2030: Operational Plans: Operational priority 2 (accelerating progress in gender equality) and Operational priority 4 (making cities more livable).[23] The Project is also consistent with the ADB's Country Partnership Strategy (CPS), 2019-2023 for Armenia which identifies priority infrastructure investments in transport, energy, and urban development as a strategic objective and operational priority to foster diversified, inclusive, and sustainable economic growth.[24]

[23] Asian Development Bank. 2018. Strategy 2030: Operational Plans. July. Accessed April 22, 2021. https://www.adb.org/about/strategy-2030-operational-priorities.
[24] Asian Development Bank. 2019. Armenia: Country Partnership Strategy (2019-2023). October. Accessed April 22, 2021. https://www.adb.org/documents/armenia-country-partnership-strategy-2019-2023.

2.2 Purpose and Scope of the IEE Report

53. The ADB's Operational Manual (OM) (2013)[25] describing safeguards policies and mandatory procedures specifies that when additional financing is required to scale up or modify a project, the incremental activities that such financing will support must be screened and classified again to ensure social and environmental sustainability in accordance with the commitments elaborated in the Safeguard Policy Statement (SPS) (2009).

54. The original Project was identified as a Category B (see Section 2.3 – Category of the Project) following project screening. An Initial Environmental Examination (IEE) was prepared in April 2017 by the consulting firm Tetra Tech ES, Inc. ("Tetra Tech") for the ADB in accordance with its safeguards standards.[26] Since additional financing is being sought from the ADB for the Project (i.e., "Phase 2"), this IEE has been carried out in accordance with the requirements of the ADB's OM and SPS.

55. This IEE provides a road map to the environmental measures needed to prevent and/or mitigate negative environmental effects associated with the implementation of Phase 2 of the Project. The IEE also provides a detailed description of the direct and indirect environmental effects associated with the Project during key periods of work. More specifically, the IEE:

(i) Describes the extent, duration, and severity of the impacts;
(ii) Analyzes all significant impacts;
(iii) Formulates the mitigation actions and presents it all in the form of an environmental management plan (EMP).

2.3 Category of the Project

56. According to the ADB's SPS, projects are classified by significance of potential environmental impacts. A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. Each proposed project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. Projects are assigned to one of the four categories (Category A, B, C, or FI):

- **Category A** – A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.
- **Category B** – A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required.

[25] Asian Development Bank. 2021. Operations Manual. March. Accessed April 22, 2021. https://www.adb.org/documents/operations-manual.
[26] Tetra Tech ES, Inc. 2017. *Initial Environmental Examination, Distribution Network Rehabilitation, Efficiency Improvement, and Augmentation (Republic of Armenia)*. Manilla: Asian Development Bank.

- **Category C** – A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.
- **Category FI** – A proposed project is classified as category FI if it involves investment of ADB funds to or through a FI.

57. Screening and classification undertaken as part of this assessment for additional financing confirms that the Project still falls under the ADB's project Category B.

2.4 Methodology and Defined Spatial Unit of Analysis Adopted for the IEE

2.4.1 IEE Methodology

58. This IEE was developed by an international environmental specialist[27] (herein referred to as the "Environmental Consultant") through a review of existing Project documentation, including the IEE developed for the ADB by Tetra Tech, existing grey and published literature, and consultations with ENA. Monitoring reports of the initial Project were developed by the Lender's Engineer (Tetra Tech), on a bi-annual basis from 2017 through 2020. These documents, along with ENA's annual safeguards and social monitoring reports, were also reviewed by the Environmental Consultant and supported development of this IEE.

59. An environment, social, health, and safety performance review for Phase 1 of the Project was undertaken by the Environmental Specialist and included site visits over seven days between May 3rd and May 11th, 2021. The performance review had two primary purposes, the first of which was to support an extended annual review report (XARR) being prepared in connection with the ADB's loan to the ENA under Phase 1. The second purpose was to support the development of this IEE.

60. More than 25 subproject sites were visited during the performance review and a risk-based approach was adopted in the selection of sites in collaboration with ENA. The sites visited covered a variety of subproject investment types in different stages of implementation to determine environmental safeguard compliance and performance. Several sites were also visited that are planned for Phase 2 investments, but because the Project's annual investment plans (AIP) had yet to be finalized, the exact locations of the first year's activities under Phase 2 were still largely unknown. The sites visited included transformer substations (newly installed or planned replacements), two branch offices, oil spill management systems, new electrical lines, the HWSF, the Abovyan Warehouse, and the Abovyan Oil Storage Facility.

61. Discussions were held with stakeholders during the Mission (i.e., ENA staff, project lenders, and a limited number of community members) in order to determine their perceptions of the level of impact from the Project works. Data and information obtained have been incorporated where appropriate in the IEE Report.

62. This IEE follows the methodology outlined in the ADB guidelines; ADB SPS, and environmental Laws of the Government of Armenia (GoA). The IEE process consisted of the following six main activities:

[27] Mr. Raymond Von Culin, Environmental Specialist

(i) Collection of baseline data describing biophysical and social environment within the study area; desk studies and field surveys to address identified gaps in the existing data; and update of information on topics and areas where negative impacts are expected.
(ii) Identification of the expected positive and negative impacts of the proposed works; assessment of the likelihood and significance of the potential negative impacts; and development of mitigation measures.
(iii) Analysis of alternatives, including the "no-project" alternative.
(iv) Development of an Environmental Management Plan (EMP).
(v) Drafting of the IEE report.
(vi) Information disclosure and stakeholder consultation.

2.4.2 IEE Boundaries

63. The Project's geographical scope is the entire country and the study area has had to be defined widely enough to include all the territories likely to be affected by Project activities. That being said, a number of specific investment types have already been identified as part of the additional financing under this Project (investment types are described in Section 4. Description of Activities). In those cases, a narrower analysis has been conducted to identify potential environmental and social impacts and the necessary mitigation measures to avoid, mitigate, and manage those risks. There are also specific ENA facilities that are either directly or indirectly associated with the operations and investments being made under the refinancing for this Project that fall under the scope of this IEE (e.g., ENA branch offices and storage facilities).

2.5 Structure of the Report

64. This IEE report has been presented as per requirements of the ADB's SPS. The report is organized into the following sections:

- Section 2. Introduction – This section describes the background information about the project and IEE study.
- Section 3. Policy, Legal, and Administrative Framework – This section summarizes the national and local legal and institutional frameworks that guided the conduct of the assessment.
- Section 4. Project Description – This section presents the key features and components of the proposed project.
- Section 5. Analysis of Alternatives – This section examines alternatives to the proposed Project.
- Section 6. ENA Facilities and Operations – This section provides information overview of existing ENA facilities and the current practices within its operations.
- Section 7. Description of the Environment – This section discusses the relevant physical, biological, and socioeconomic features that may be affected by the proposed Project.
- Section 8. Impact Assessment and Mitigation – This section details the impact assessment methodology used for this IEE and presents the environmental assessment of likely positive and adverse impacts attributed to the proposed Project and concomitant mitigation measures.
- Section 9. Public Consultation and Information Disclosure – This section describes consultation procedures in line with the ADB's Public Communications Policy and related national laws.
- Section 10. Grievance Redress Mechanism – This section describes the procedures for registering, resolving, and reporting complaints.

- Section 11. Environmental Management and Institutional Requirements – This section describes the process through which impacts identified in previous sections are translated into mitigation and monitoring plans to avoid, reduce, mitigate, or compensate adverse impacts and reinforces beneficial impacts. This section also describes the institutional requirements and processes for ENA and their contractors.
- Section 12. Cost Estimate of Environmental Mitigation Measures – This section provides an approximate cost estimate for environmental mitigation measures.
- Section 13. Conclusions and Recommendations – This section highlights key findings and recommendations to be implemented by the borrower.

3 Policy, Legal, and Administrative Framework

3.1 Overview

65. The IEE will be carried out in compliance with Armenian labor and environmental laws and standards, the environmental and social safeguard policies of International Financial Institutions (IFI's), as well as Core Labour standards (CLS) outlined in the International Labor Organization (ILO) Declaration on Fundamental Principles and Rights at Work. [28]

66. During planning and development of the IEE, a range of documents were considered. The list, inter alia, includes:

- International Conventions and Directives (environment, social);
  - Environmental and social safeguards of International Financial Institutions, such as:
  - ADB Safeguard Policy Statement, 2009;
  - ADB Environmental Safeguards – A Good Practice Sourcebook (Draft Working Document), 2012;
  - World Bank Environmental and Social Safeguard Policies, 2013;
  - IFC Environmental and Social Performance Standards, 2012;
  - General EHS Guidelines document (IFC, WB group, April 30, 2007);

67. According to Armenian law, the Project is subject to environmental regulation and requires an environmental impact permit in order to begin planned development activities.

68. According to the ADB's SPS, projects with limited impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures are considered a Category B which require development of an IEE.

3.2 Environmental Legislation of Armenia

Table 4. Project Relevant National Laws and Strategies

Name	Type	Date	Description
Atmospheric Air Protection Law	Law	1994	Provides for the quality of the atmosphere, elimination, and prevention of air pollution, regulates public communications on these issues. Defines norms of permissible concentrations and negative impacts, as well as norms of permissible pollution from movable and unmovable sources.
Law on Compensation Tariffs for Damage Caused to Flora and Fauna as a Consequence of Violation of Environmental Protection Laws	Law	2017	Establishes compensation tariffs for caused damage due to hunting or destruction of Red Book plant and animal species. Envisages penalties for both vertebrate and invertebrate endangered species.

[28] International Labour Organization (ILO). 2021. Declaration on Fundamental Principles and Rights at Work. Accessed April 22, 2021. https://www.ilo.org/actrav/areas/WCMS_DOC_ATR_ARE_DECL_EN/lang--en/index.htm.

Name	Type	Date	Description
Environmental Impact Assessment and Expertise Law	Law	2014	Confirms legal basis for state environmental impact expertise of a proposed activity or concept document. Presents the standard steps of the Environmental Impact Assessment (EIA) process in Armenia. Establishes general legal and organizational principles for conducting mandatory EIA of various types of activities and concept documents of development. Classifies activities into three categories reflecting different levels of environmental impact assessment according to severity of possible impacts.
Environmental Oversight Law	Law	2005	Regulates organization and enforcement of oversight of the implementation of environmental legislation; defines the legal and economic bases underlying that oversight, including relevant procedures and conditions.
Flora Law	Law	1999	Defines maintenance, protection, usage, and regeneration of flora. Includes objectives of flora examination, state monitoring, state inventory, requirements and approaches of Red Book preparation on flora, conditions, irregularities, limitations on usage, basis of termination of the right to use, provisions on flora maintenance, economic encouragement of usage and supervision.
Fauna Law	Law	2000	Defines policies of maintenance, protection, usage, and regeneration of fauna. States objectives of surveys, state monitoring, state inventory; outlines requirements and approaches of Red Book categorizations of fauna, conditions, and irregularities. Limits the allocation of fauna objects for usage, defines the basis of termination for right to use. Provides provisions on fauna maintenance, and economic encouragement of usage and supervision.
Forest Code	Law	2005	Regulates sustainable forest management, including guarding, protecting, rehabilitation, afforestation and rational use of forest and forest lands. Includes regulation of forest data collection, monitoring, and control.
Land Code	Law	2001	Defines the main directives for management of state lands, included those allocated for agriculture, urban construction, industry and mining, and energy production, among others. Defines lands under specially protected areas and other reserved lands. Establishes measures aimed at land protection, and land rights of state bodies, local authorities, and citizens.

Name	Type	Date	Description
Law on Lake Sevan	Law	2001, amended 2020	Establishes legal and economic basis of state policy on natural development, recovery, reproduction of natural resources, preservation and use of Lake Sevan. Confirms the Lake as home to ecosystems of strategic purpose for the country, requiring natural protection, and of economic, social, scientific, historical, and cultural, esthetic, health, climatic, recreational and spiritual value.
Rates of Nature Protection Payments	Law	2006	Sets the rates for nature protection payments and the mechanism of their calculation. Specifies rates of payments for emissions to air and water; increased rates are set for Yerevan and protected areas.
Specially Protected Natural Areas Law	Law	2006	Defines legal basis and state policy for development, restoration, maintenance, reproduction and use of nature and ecosystems of SPNAs. Divides specially protected natural areas into four categories: State Sanctuaries, National Parks, State Reserves and Natural Monuments; and Other types (areas of international, national, and local significance.) Lacks regulation for Community Protected Landscapes, which can be important for biodiversity and are located where SPNAs cannot be developed.
Strategy and State Program of Conservation and Use of Specially Protected Nature Areas (SPNA)	Strategy	2014	Defines history and current state of SPNAs in Armenia and in light of conservation and sustainable use. Considers SPNAs as they relate to ecosystem services, climate change, desertification, international standards, cultural heritage, and other factors.
Law on the Protection and Use of Fixed Cultural and Historic Monuments and Historic Environment	Law	1998	Provides the legal and policy basis for the protection and use of such monuments in Armenia and regulates the relations among protection and use activities. Article 15 of the Law describes procedures for - amongst other things – the discovery and state registration of monuments, the assessment of protection zones around them and the creation of historic-cultural reserves. Article 22 requires the approval of the authorized body (Department of Historic and Cultural Monuments Preservation) before land can be allocated for construction, agricultural and other types of activities in areas containing monuments.
Tax Code of the Republic of Armenia	Law	2016	Section 8 of the law outlines the provision of the new Armenian Environmental Tax. A tax on air emissions, pollution of water resources, and certain defined types of wastes. Section 10 of the Tax Code outlines a natural resources utilization payment for

Name	Type	Date	Description
			activities such as water extraction, salt, and mineral mining, and other activities defined therein.
Law on Wastes	Law	2004	Provides the legal and economic basis for collection, transportation, disposal, treatment, re-use of wastes, as well as prevention of negative impacts of waste on natural resources, human life, and health. Defines objects of waste usage, principles and directions of state policy, principles of state standardization, inventory, and introduction of statistical data, implementation of requirements, principles of wastes processing, requirements for presenting wastes for the state monitoring, activities to decrease the amount of the wastes, including nature utilization payments. Also includes provisions for the compensation of damages caused to human health and environment by legal entities and individuals using wastes, and requirements for state monitoring and legal violations.
Water Code	Law	2002	Protects Armenia's water resources and ensures citizens and economic sectors water access through effective management of resources and protection. Regulates the responsibilities of state/local authorities and public; the development of national water policy and program; management of water resources register and monitoring system; public access to the relevant information; water use and permitting systems; transboundary water resources use; water quality standards; and the protection and state supervision of water resources.

3.2.1 Regulatory Summaries

69. Regulatory summaries are provided below for Project relevant topics.

70. Environmental Impact Assessment. To reduce the differences between Armenian legislation and International environmental policies, the law on Environmental Impact Assessment and Expertise Law was approved in 2014. The EIA Law defines the types and standards of activities subject to expertise. Types of activities are divided into three categories according to the degree of their impact:

- Category (A) includes large-scale interventions that have the potential for significant impact on the environment
- Category (B) includes many of the same types of activities, but with smaller scale or potential of environmental impacts
- Category (C) includes the types of activities that have no significant impact on the environment and do not require a full assessment of the impact

71. The law requires projects to be assessed according to a two stage process: (i) the preliminary stage, which including screening and categorization as category A, B, or C according activity type; and (ii) a main examination phase, where Category A and B projects are further examined. The law provides the list of proposed activities by categories subject to environmental impact expertise and also provides an outline for the EIA report which includes sections on analysis of the project impacts for both physical, biological and social environments, and cumulative impacts. The EIA Law specifies notification, documentation, public consultations, and appeal procedures and requirements.

72. ENA currently complies with the national environmental impact assessment law and for this investment program and according to the Law, the construction and reconstruction of overhead power lines of 110 kV and higher are considered Category B. The construction and reconstruction of overhead lines that are higher than 220 kV are considered to be Category A.

73. "Reconstruction" is not clearly defined in the Armenian law and therefore may result in confusion between the implementer and the Ministry of Environment (MoE) on the classification of an activity. This Project does not involve the full construction or reconstruction of 110 kV or higher lines and therefore does not anticipate requiring a full EIA for any works that are currently planned under Phase 2.

74. Hazardous waste. In addition to the Law on Wastes (2004), the following national legislations and international conventions on hazardous waste management are relevant to Project[29]:

- Law on Licensing HO-193 (2001)
    - Defines the types of activities subject to licensing and regulates the relations connected to issuing permits. In the environmental protection sector (article 13) the law sets licensing requirements to recycling, treatment, storage, transportation, and placement of hazardous wastes. The licensing procedure is regulated by the Norms on issuing a license for hazardous waste handling operations (N 121-N). The licenses issued currently may contain inserts on the corresponding types of activities.
- Decree № 430-N (2006)
    - Wastes in Armenia are classified according to their level of hazard: class 1, 2, 3, 4, and 5. The most hazardous wastes belong to category 1, while category 5 implies non-hazardous waste. The List of wastes classified by hazardousness is compatible with the corresponding lists of the Basel Convention and those of the OECD. In addition, Armenia has adopted the list of banned wastes for import and classifies waste according to 4 different levels of hazardous wastes and as non-hazardous wastes. For the purpose of an inventory, a corresponding sub-legislative act was adopted, according to which all organizations that generate waste must submit annual reports on the quantity of the waste, amount of waste sent to landfills, as well as the payments made according to the different risk levels of the wastes.
- Decree № 19-N (2006)
    - Defines the model form of the Waste Passport. Under the Decree, the entity generating waste must declare the following: "I have concluded through research that the given waste contains only the above-mentioned toxic components in the

[29] AUA Acopian Center for the Environment. (2020). *Waste Governance in Armenia.* American University of Armenia and Life Foundation.

given percentages, due to which I have classified this waste as a waste of Category __. I confirm that the information provided by me is accurate and true."

- Government decision № 546 (2015) on Approving the technical regulations for lubricants, oils, and special liquids.
    - In order to prevent risks to human life and health, property, environment, flora, and fauna and/or health care, as well as activities misleading consumers, and in order to save resources, the present technical regulation defines requirements for lubricants, oils and special liquids (henceforth products), used lubricants, oils and special liquids, as well as products obtained following the recycling of used products.

      Products are allowed to be imported and circulated in the market, if their compatibility with the requirements of the technical regulation has been approved. For the purpose of the application of the present technical regulation, lubricants, oils and special liquids are identified in accordance with documents, which may be the technical documents, and/or the quality profiles, and/or testing acts, and/or supply agreements, and/or specifications, and/or labels, and/or brief characteristics or other documents characterizing the product.

      This regulation prohibits the waste oils and lubricants to be:
        i. disposed into water reservoirs, on soil and into sewage system
        ii. transferred and disposed in dumpsites dedicated for industrial and household wastes
        iii. mixed with gasoline, gas, oil, and diesel fuels for creation of a fuel to be used as a source of energy (except for entities authorized by competent governmental bodies)
        iv. mixed with products containing halogen organic compounds
        v. used as non-stick liquids to fill in construction components
- The Stockholm Convention on Persistent Organic Pollutants
    - The Stockholm Convention, which aims to eliminate or restrict the production and use of persistent organic pollutants, was ratified by the Government of Armenia in 2003.[30] As a party to the Stockholm Convention, Armenia can no longer produce PCBs and is obliged to stop using this chemical. However, existing equipment that contains or is contaminated with PCBs may continue to be used until 2025.

75. Health and Safety. The primary national legislation covering health and safety includes the following:

- Labor Code (2004)
    - The Labor Code of the RA, adopted on 9 November 2004, protects the rights and interests of employees and employers in collective and individual employment relationships, establishes state guarantees for labor rights and freedoms, and promotes the creation of Favorable conditions of work. The labor relations between the employee and employer are originated on the basis of labor contract concluded in a procedure established by the Labor Code and other normative legal acts containing norms on labor Code.

[30] A constitutional court decision (SDO-451, 30.09.2003) regarding the obligations set out in the Convention On Stable Organic Pollutants Convention complies that it complies with the Constitution of the Republic of Armenia. Available at: https://www.arlis.am/DocumentView.aspx?DocID=4769

- Law on Provision of Medical Care and Services to the Population (1996)
    - ENA provides all field employees with regular medical examinations, the timing of which is determined by the field duties. The Armenian Law on Medical Care and Services to the population establishes the legal, economic, and financial guidelines for medical, care and service delivery.

76. Other health and safety legislation that is relevant to the operation of ENA includes:

- The RA PSRC Resolution No. 176-N, 2004, "Rules and procedures to ensure safety and reliability of the Power System of Armenia".
- The RA Government Decree N 1933-N dated November 23, 2006, Technical Regulations "Safety rules for operation of the electric installations".
- The RA Government Decree N 1922-N dated November 23, 2006, Technical Regulations "Safety Requirements to the electric devices converting voltage of
- 1000V and higher".
- The RA Government N510-N of 2011 on Approval of licensing procedure and form on development and expertise of the urban development documents (except for activities not requiring construction permits).

3.3 ADB Safeguards Policy

77. The ADB's SPS adopted in 2009 describes common objectives of ADB's safeguards, lays out policy principles, objectives, scope and triggers, and principles for three key safeguard areas: (i) environmental safeguards, (ii) involuntary resettlement safeguards, and (iii) indigenous peoples safeguards. It applies to all ADB-financed, ADB administered projects, and their components including investment projects funded by a loan, grant, or other means. Objectives of ADB's safeguards are to:

- avoid adverse impacts of projects on the environment and affected people, where possible;
- minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and
- help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

78. Safeguard Requirements 1: Environment. The objectives are to ensure the environmental soundness and sustainability of projects, and to support the integration of environmental considerations into the project decision-making process. Environmental safeguards are triggered if a project is likely to have potential environmental risks and impacts. Eleven 'Policy Principles' have been adopted as part of the SPS, including:

i. Use a screening process for each proposed project, as early as possible, to determine the appropriate extent and type of environmental assessment so that appropriate studies are undertaken commensurate with the significance of potential impacts and risks.
    - The Project is classified as a Category B.

ii. Conduct an environmental assessment for each proposed project to identify potential direct, indirect, cumulative, and induced impacts and risks to physical, biological, socioeconomic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues), and physical cultural resources in the context of the project's area of influence. Assess potential transboundary and global

impacts, including climate change. Use strategic environmental assessment where appropriate.

- The IEE herewith provides the environmental assessment for the Project, including an assessment of climate change. Transboundary impacts are not applicable.

iii. Examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts and document the rationale for selecting the particular alternative proposed. Also consider the no project alternative.

- Alternatives have been considered, including the 'no project' alternative in Section 5 - Analysis of Alternatives.

iv. Avoid, and where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts and enhance positive impacts by means of environmental planning and management. Prepare an environmental management plan (EMP) that includes the proposed mitigation measurs, environmental monitoring, and reporting requirements, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators. Key considerations for EMP preparation include mitigation of potential adverse impacts to the level of no significant harm to third parties, and the polluter pays principle.

- An EMP has been prepared for the Project and is outlined in detail in Annex 1 - Environmental Management and Monitoring Plans.

v. Carry out meaningful consultation with affected people and facilitate their informed participation. Ensure women's participation in consultation. Involve stakeholders, including affected people and concerned nongovernment organizations (NGOs), early in the project preparation process and ensure that their views and concerns are made known to and understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation as necessary to address issues related to environmental assessment. Establish a grievance redress mechanism to receive and facilitate resolution of the affected people's concerns and grievances regarding the project's environmental performance.

- Consultation and information disclosure processes and the established GRM are provided in Section 9. Public Consultation and Information Disclosure and Section 10. Grievance Redress Mechanism respectively.

vi. Disclose a draft environmental assessment (including the EMP) in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders. Disclose the final environmental assessment, and its updates if any, to affected people and other stakeholders.

- This IEE and its EMP will be disclosed on the ADB website.

vii. Implement the EMP and monitor its effectiveness. Document monitoring results, including the development and implementation of corrective actions, and disclose monitoring reports.

- The IEE and its EMP outline a plan to monitor the implementation of the EMP and the institutional responsibilities for monitoring and reporting throughout the Project lifecycle: See Annex 1 - Environmental Management and Monitoring Plans.

viii. Do not implement project activities in areas of critical habitats, unless (i) there are no measurable adverse impacts on the critical habitat that could impair its ability to function, (ii) there is no reduction in the population of any recognized endangered or critically endangered species, and (iii) any lesser impacts are mitigated. If a project is located within a legally protected area, implement additional programs to promote and enhance

the conservation aims of the protected area. In an area of natural habitats, there must be no significant conversion or degradation, unless (i) alternatives are not available, (ii) the overall benefits from the project substantially outweigh the environmental costs, and (iii) any conversion or degradation is appropriately mitigated. Use a precautionary approach to the use, development, and management of renewable natural resources.

- No critical habitats have been identified that would be significantly impacted by the Project.

ix. Apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines. Adopt cleaner production processes and good energy efficiency practices. Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or load of pollutant emissions and discharges, including direct and indirect greenhouse gases emissions, waste generation, and release of hazardous materials from their production, transportation, handling, and storage. Avoid the use of hazardous materials subject to international bans or phase-outs. Purchase, use, and manage pesticides based on integrated pest management approaches and reduce reliance on synthetic chemical pesticides. When host country regulations differ from these levels and measures, the borrower/client will achieve whichever is more stringent.

- The IEE and its EMP outline specific mitigation and management measures to prevent and control pollution: Annex 1 - Environmental Management and Monitoring Plans. Section 3. Policy, Legal, and Administrative Framework, identifies the most stringent regulations.

x. Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. Establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities.

- The requirements for specific health and safety measures are provided in Annex 1 - Environmental Management and Monitoring Plans.

xi. Conserve physical cultural resources and avoid destroying or damaging them by using field-based surveys that employ qualified and experienced experts during environmental assessment. Provide for the use of "chance find" procedures that include a pre-approved management and conservation approach for materials that may be discovered during project implementation.

- No physical and cultural resources have been identified that would be impacted by the Project. A sample chance finds procedure is provided in Annex 3. Sample Chance Find Procedure.

79. Safeguard Requirements 2: Involuntary Resettlement. The objectives are to avoid involuntary resettlement wherever possible; to minimize involuntary resettlement by exploring project and design alternatives; to enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor and other vulnerable groups. The safeguard requirements underscore the requirements for undertaking the social impact assessment and resettlement planning process, preparing social impact assessment reports and resettlement planning documents, exploring negotiated land acquisition, disclosing information, and engaging in consultations, establishing a grievance mechanism, and resettlement monitoring and reporting.

80. The involuntary resettlement requirements apply to full or partial, permanent or temporary physical displacement (relocation, loss of residential land, or loss of shelter) and

economic displacement (loss of land, assets, access to assets, income sources, or means of livelihoods) resulting from (i) involuntary acquisition of land; or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas. Resettlement is considered involuntary when displaced individuals or communities do not have the right to refuse land acquisition that results in displacement.

- No resettlement has been undertaken to date on the Project and it is not anticipated to be required for any investment under Phase 2.

81. Safeguard Requirements 3: Indigenous Peoples. The objective is to design and implement projects in a way that fosters full respect for Indigenous Peoples' identity, dignity, human rights, livelihood systems, and cultural uniqueness as defined by the Indigenous Peoples themselves so that they (i) receive culturally appropriate social and economic benefits; (ii) do not suffer adverse impacts as a result of projects; and (iii) can participate actively in projects that affect them.

- The Project does not involve impacts to Indigenous Peoples and therefore no further actions relating to this safeguard are required.

3.4 Environmental Regulations and Standards of Armenia

3.4.1 Air Quality Standards

82. National Standards. In Armenia, the Law "On Atmospheric Air Protection" (01.11.1994, HO-121), last amended in 2020, and the "Decision of The Government of The Republic Of Armenia in the Limit of Permittable Permissible Density (Concentrations) of Atmosphere" (19.03.2006, N 160-N), last amended in 2013, regulate atmospheric emissions. The regulations define the maximum permissible concentrations (MPC) of nearly four hundred substances for a single time and daily average exposure. The International Finance Corporation (IFC), part of the World Bank Group (WBG), have established ambient air quality standards based on WHO guidelines.

Table 5. Ambient Air Quality Standards

Parameter	Averaging Period	Limit (µg/m^3)	
		Maximum Permissible Concentration (MPC) for Air Quality	IFC Guideline Value
Nitrogen Dioxide (NO_2)	Single Time	200	-
	30 minutes	-	-
	1 Hour	-	200
	24 Hours	40	-
	1 Year	-	40
Sulphur Dioxide (SO_2)	Single Time	500	-
	10 minutes	-	500
	30 minutes	-	-
	1 Hour	-	-
	24 Hours	50	20
Carbon Monoxide (CO)	Single Time	5,000	
	30 minutes	-	-
	24 Hours	3,000	-
PM10	Single Time	30	-
	1 year	-	20
	24 hours	60	50

Parameter	Averaging Period	Limit (µg/m^3)	
		Maximum Permissible Concentration (MPC) for Air Quality	IFC Guideline Value
PM2.5	Single Time	16	-
	1 year	-	10
	24 hours	3.5	25
Ozone	Single Time	16	-
	8-hour daily maximum	-	100
	24 hours	3	-

Source: "Decision of The Government of The Republic of Armenia in the Limit of Permittable Permissible Density (Concentrations) of Atmosphere" (19.03.2006, N 160-N)[31]

83. Project Air Quality Standards. In the event that air quality monitoring is required as a result of complaints from members of the public, the Project will ensure compliance with either national legislated standards or IFC guideline values, whichever is more stringent. The most stringent standards are highlighted blue in the table above.

3.4.2 Water Quality Standards

84. National Standards. The Republic of Armenia (RA) Government Decree "On defining water quality provision norms for each basin management area, based on the area peculiarities" (June 27, 2011, N 75-N) establishes water chemical quality indicators for each of the 14 major river basins of Armenia. It differentiates five grades of status: excellent (1st grade), good (2nd grade), average (3rd grade), insufficient (4th grade) and poor (5th grade). The overall rating of the chemical water quality is formed by the grade of the worst quality indicator. Since the MPCs vary across the 14 major river basins, the correct basin indicators must be specifically identified from Government Decree.[32]

85. IFC EHS Guidelines. The IFC's indicative guideline values applicable to sanitary wastewater discharges are provided in the table below.

[31] Available from Armenian Legal Information System: https://www.arlis.am/DocumentView.aspx?docID=86441.
[32] Available from Armenian Legal Information System: https://www.arlis.am/documentview.aspx?docID=65705

Table 6. IFC Indicative Values for Treated Sanitary Sewage Discharges

Pollutants	Units	Guideline Value
pH	mg/l	6 – 9
BOD	mg/l	30
COD	mg/l	125
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Oil and grease	mg/l	10
Total suspended solids	mg/l	50
Total coliform bacteria	MPN / 100 ml	400

*Note: * MPN, most probable number*
*** Refers to indicative value for treated sanitary sewage discharges according to the IFC EHS Guidelines for Wastewater and Ambient Water Quality.[33] This standard is not applicable to centralized, municipal, wastewater treatment systems which are included in EHS Guidelines for Water and Sanitation.*

86. Project Water Quality Standards. The scope of work under Phase 2 does not suggest that there will be any significant wastewater discharge from Project work sites, or any significant impacts to water bodies. In the case that testing is required to be conducted under this Project (e.g., from accidental leaks or spills of chemicals or hazardous materials; improper discharge of wastewater; etc.) national legislated standards and IFC guideline values will be followed, whichever is more stringent.

3.4.3 Groundwater Quality Standards

87. Groundwater quality standards are not set under Armenian law. Drinking water quality standards are commonly used instead as assessment criteria for groundwater. Drinking water quality is regulated by the RA Health Minister's N876 order as of December 25, 2008 on approving Quality control sanitary rules and norms on "Hygiene requirements for the water quality of centralized water supply systems". The admissible level of pollutants in surface water is given in Table 7. All effluents shall comply with the Armenian national standards.

Table 7. Drinking Water Quality Criteria

Parameters	Units of Measurement	Parameter values or maximum allowable concentration (MAC), not more than:
General Indicators		
Hydrogen ion concentration	pH values	within the limits 6-9
Phenol index	mg/l	0.25
Permanganate oxidation	mg/l	5
Petroleum products	mg/l	0,1
Surface-active substances (SAS), anion-active	mg/l	0.5
Total mineralization (solid residue)	mg/l	1000 (1500) 2/
Total hardness	mmol/l	7,0 (10) 2/
Inorganic Materials		

[33] IFC Environmental, Health, and Safety Guidelines are available at: https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

Aluminum (Al $^{3+}$)	mg/l	0.5
Arsenic (As)	mg/l	0.05
Barium (Ba $^{2+}$)	mg/l	0.1
Beryllium (Be $^{2+}$)	mg/l	0.0002
Boron (B)	mg/l	0.5
Cadmium (Cd)	mg/l	0.001
Chlorides (Cl^-)	mg/l	350
Chromium (Cr $^{6+}$)	mg/l	0.05
Cyanides (CN-)	mg/l	0.035
Copper (Cu)	mg/l	1
Iron (Fe)	mg/l	0.3 (1.0) 2/
Lead (Pb)	mg/l	0.03
Manganese (Mn)	mg/l	0.1 (0.5) 2/
Mercury (Hg)	mg/l	0.0005
Molybdenum (Mo)	mg/l	0.25
Nickel (Ni)	mg/l	0.1
Nitrates (by NO-3)	mg/l	45
Organic substances	mg/l	Not Allowed
Selenium (Se)	mg/l	0.01
Strontium (Sr 2+/)	mg/l	7
Sulphates(SO4 2-)	mg/l	500
Zinc (Zn 2+)	mg/l	5
Organic Materials		
2, 4-D	mg/l	0.03 3/
DDT Total of isomers	mg/l	0.002 3/
Lindane	mg/l	0.002 3/
For Climatic Regions		
Fluorides(F^-) for climatic zones I and II	mg/l	1.5
Fluorides(F^-) for climatic zone III	mg/l	1.2
Organoleptic Parameter Values		
Odor	Points	2
Taste	*	2
Coloration	Degrees	20/35/l)
Turbidity	Turbidity unit (by formalin)	

** The value noted parenthetically can be determined by the decision of State Chief Sanitary Doctor of the region, for the given water-supply system, reasoning from the evaluation of sanitary anti-epidemical situation of the area, as well as from water processing technology.*
Source: The order of the ra minister of health "Drinking water. Hygiene requirements for central water supply water quality. Quality control n 2-iii-a2-1 on approval of sanitary norms and rules"[34]

[34] Available from Armenian Legal Information System: https://www.arlis.am/DocumentView.aspx?DocID=37855

3.4.4 Noise Standards

88. National Standards. The national standards for noise are set according to the Ministry of Health's (MoH) order on "Noise in workplaces, apartment and public buildings, territories of urban construction" (6 Order N138, March 2002) and provided in Table 8.

Table 8. Armenian Standards for Noise Levels

Purpose/use of area and premises	Allowable limits (A-Weighted Decibels (dBA))	
	Day 07:00 – 23:00	Night 23:00 – 07:00
Areas adjacent to residential buildings, polyclinics, dispensaries, dispensaries, rest homes, boarding houses, nursing homes for the disabled, kindergartens, schools, other educational institutions, libraries	55	45

Source: Ministry of Health, Republic of Armenia, Order N138, 6 March 2002, Order on adoption of N2-III-11.3 sanitary norms "Noise in workplaces, apartment and public buildings, territories of urban construction"[35]

89. IFC EHS Guidelines. For IFC noise limits, impacts should not exceed the levels presented in Table 9, or if already exceeded result in a maximum increase in background levels of 3 decibels (dB) at the nearest receptor location off site.

Table 9. IFC Noise Level Guidelines

Receptor	One-hour L_{eq} (dBA)	
	Daytime 07:00 - 22:00	Night-time 22:00 - 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

Source: IFC Performance Standards on Noise

90. Workplace Noise Standards. In order to protect the health of staff in the workplace, the MoH's order on "Noise in workplaces, apartment and public buildings, territories of urban construction" (6 Order N138, March 2002) also includes standards for permissible sound levels for the most typical types of workplaces and work activities. The most relevant categories are given Table 10 along with IFC EHS guidelines for workplace noise.

Table 10. Work Environment Noise limits

Type of Work, workplace	Armenian Order N138	IFC General EHS Guidelines
Agricultural machinery and equipment road construction, land, and equipment machinery	80 dBA	
Heavy Industry (no demand for oral communication)		85 Equivalent level Laeq, 8h
Light industry (decreasing demand for oral communication)		50-65 Equivalent level Laeq, 8h

Source: MoH's order on "Noise in workplaces, apartment and public buildings, territories of urban construction" (6 Order N138, March 2002)

[35] Available from Armenian Legal Information System: https://www.arlis.am/DocumentView.aspx?DocID=117610

91. Project Noise Level Standards. For any pre-construction / construction phase monitoring, IFC guideline limits will be followed as the nighttime period is slightly longer than Armenian standards. For workplace noise, national guidelines shall be followed.

3.4.5 Vibration Standards

92. National Standards. The impact of vibration in the territory of the RA is regulated by the RA Health Minister's N 138 order as of March 6, 2002 on approving HN N 2.2.4-009-06 "Hygiene norms on Vibration at Workplaces, Public and Residential Buildings, and Residential Construction Areas". The maximum permissible levels of the normalized vibration standards are determined in accordance with Table 11.

Table 11. Armenian Permissible Levels of Vibration in Workplaces

Average Geometric Frequencies of Octave Zones (Hz)	Allowable Values X_t, Y_t, Z_t			
	Vibro-acceleration		Vibro-speed	
	m/sec^2	dB	$m/sec\ 10^{-2}$	dB
8	1.4	123	2.8	115
10	1.4	123	1.4	109
31.5	2.8	129	1.4	109
63	5.6	135	1.4	109
125	11	141	1.4	109
250	22	147	1.4	109
500	45	153	1.4	109
1,000	89	159	1.4	109
Corrected and equivalent corrected values and their levels	2.0	126	2.0	112

Source: RA Health Minister's N 138 order as of March 6, 2002 on approving HN N 2.2.4-009-06 "Hygiene norms on Vibration at Workplaces, Public and Residential Buildings, and Residential Construction Areas".[36]

93. International Standards. Over the years, numerous vibration criteria and standards have been suggested by researchers, organizations, and governmental agencies. Because IFC does not have specific vibration impact guidance, the California Department of Transportation (Caltrans) Transportation and Construction-Induced Vibration Guidance Manual (Caltrans, 2013) was used as a good industry practice guideline. The manual provides practical guidance for addressing vibration issues associated with construction, operation, and maintenance of roadway projects.

[36] Available from Armenian Legal Information System: https://www.arlis.am/DocumentView.aspx?DocID=87517

Table 12. Human and Building Response to Transient Vibration

PPV (mm/sec)	Human Response	Effect on Buildings
10 - 15	Unpleasant	Architectural damage and possible minor structural damage
5	Annoying	Threshold at which there is a risk of architectural damage to normal dwelling houses (houses with plastered walls and ceilings)
2.5	Begins to annoy	Virtually no risk of architectural damage to normal buildings
2	Readily perceptible	Recommended upper limit of vibration to which ruins and ancient monuments should be subjected
0.15 – 0.5	Threshold of perception	Vibration unlikely to cause damage of any type

Source: California Department of Transportation. 2013. Transportation and Construction Vibration Guidance Manual. Sacramento: California Department of Transportation.

94. Project Vibration Standards. Vibration impacts are not anticipated to be significant. However, in the event that complaints are received and monitoring is required, the Project shall follow the Caltrans standards provided in Table 12 during the pre-construction / construction phase.

3.4.6 Electromagnetic Fields and Security Zones

95. International Electromagnetic Fields (EMF) Standards. IFC EHS guidelines for Electric Power Transmission and Distribution refer to the International Commission on Non-Ionizing Radiation Protection (ICNIRP), which establish reference levels for occupation and general public exposure.[37] In 2013 the European Commission published Directive 2013/35/EU on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields).[38] The directive requires different action plans at successive action levels and successive limit values for exposure. The limits defined by ICNIRP and Directive 2013/35/EU are provided in the table below.

Table 13. Electromagnetic Field Limits Defines by ICNIRP and European Commission Directive 2013/35/EU

Source	El. Field strength [V/m]	Magn. Flux density [µT]
ICNIRP recommends for 50/60 Hz: *Reference levels for exposure to time-varying electric and magnetic fields (unperturbed r.m.s. values)* Occupational exposure General public exposure	 10,000 5,000	 500 100
Limit values according to the European Directive 2013/35/EU Exposure of workers	 10,000	 500

Note: r.m.s. = root mean square (value)

[37] International Commission on Non-Ionizing Radiation Protection. 2010. *Fact Sheet: On the Guidelines for limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz - 100 kHz)*. ICNIRP.
[38] European Commission. 2015. *Non-binding guide to good practice for implementing Directive 2013/35/EU*. Luxembourg:: Publications Office of the European Union.

96. The typical level of magnetic field and electric fields under a power line are shown in the table below. The table shows that at voltages below 10kV EMF values are well below exposure limits.

Table 14. Typical Ground-level Field Levels from Overhead Power Lines

Description	Magnetic Field (microteslas)	Electric Field (kV/m)
The largest steel pylons (275 kV and 400 kV)	Maximum field (under line) Typical field (under line) Typical field (25 m to side)	100 5-10 1-2
Smaller steel pylons (132 kV)	Maximum field (under line) Typical field (under line) Typical field (25 m to side)	40 0.5 – 2 0.05-0.2
Wooden poles (11 kV and 33 kV)	Maximum field (under line) Typical field (under line) Typical field (25 m to side)	7 0.2-0.5 0.01-0.05

Source: Electric and Magnetic Fields – The Facts. Energy Networks Association. 2012.

Box 1: A Note on Electromagnetic Fields

Electric and magnetic fields, also known as electromagnetic fields (EMF), are invisible lines of force emitted by and surrounding any electrical device (e.g. power lines and electrical equipment). Electric fields are produced by voltage and increase in strength as the voltage increases. Electric field strength is measured in volts per meter (V/m). Magnetic fields result from the flow of electric current and increase in strength as the current increases. Magnetic fields pass through most materials and are difficult to shield. Both electric and magnetic fields decrease rapidly with distance. Although there is public and scientific concern over the potential health effects associated with exposure to EMF (not only high voltage power lines and substations, but also from everyday household uses of electricity), there is no empirical data demonstrating adverse health effects from exposure to typical EMF levels from power transmissions lines and equipment.[39] While the evidence of adverse health risks is weak, it is still sufficient to warrant limited concern.[40]

97. Project EMF Standards. Human exposure to EMF will be managed by respecting the limits established by the ICNIRP.

3.4.7 Soil Quality

98. National Standards. Soil pollution permissible level is regulated by the "The technical regulation of the general requirements of the protection of the lands form pollution, the list of the contaminating substances, polluting lands, and the assessment of the lands pollution level" (RA Government resolution N 1277-N of 24.08.2006) and "Sanitary rules and norms. Hygienic requirements for the soil quality N2.1.7.003-10" (order N01-N of 25.01.2010 of the RA Minister of Healthcare).

99. The threshold limit values (TLV) of the chemicals (including pesticides) in the soil are defined in Table 15 of the sanitary norms N2.1.7.003-10 (presented with abridgements).

[39] International Commission on Non-Ionizing Radiation Protection(ICNIRP) (2001); International Agency for Research on Cancer (2002); U.S. National Institute of Health (2002); Advisory Group to the Radiation Protection Board of the UK (2001), and U.S. National Institute of Environmental Health Sciences (1999)).
[40] National Institute of Environmental Health Sciences. 2002. *Electric and Magnetic Fields Associated with the Use of Electric Power*. Bethesda: National Institutes of Health.

Table 15. Armenian Threshold Limit Values of Chemicals in Soil

No.	Denomination of the substances	Threshold Limit Values (TLV) mg/kg, considering the background	Limiting Indexes
15.	Gasoline	0.1	Air migration
16.	Benzine	0.3	Air migration
19.	Vanadium	150	General sanitary
52.	Xylols	0.3	Translocation
61.	Nitrates	130	Water migration
74.	Mercury	2.1	Translocation
75.	Lead	32	General sanitary
79.	Sulfur compounds (S), elementary sulfur	160	General sanitary
80.	Hydrogen sulfide	0.4	Air migration
81.	Sulphuric acid	160	General sanitary
85.	Styrene	0.1	Air migration
87.	Antimony	4.5	Air migration
88.	Toluene	0.3	Air migration
96.	Potassium Chloride	360	
102.	Cobalt	5	General sanitary
103.	Manganese 1) turf-podzolic black soil, derived by a) 0.1N H_2SO_4 b) pH 4.0 c) pH 5.1 – 6.0 d) pH ≥ 6.0 2) pH 4.8 turf-podzolic black soil, derived by a) ammonium acetate buffer b) pH 4.0 c) pH 5.1 – 6.0 d) pH ≥ 6.0	 a) 700 b) 300 c) 400 d) 500 a) 140 b) 60 c) 80 d) 100	General sanitary
104.	Copper	3	General sanitary
105.	Nickel	4	General sanitary
107.	Zinc	23	Translocation
109.	Chrome	6	General sanitary

Source: RA Minister of Healthcare order N01-N "Sanitary rules and norms. Hygienic requirements for the soil quality" N2.1.7.003-10 (order N01-N of 25.01.2010)[41]

100. Project Soil Testing Standards. Contamination of soil during Project related activities may result from inappropriate waste management and the transfer, storage, use, and disposal of oil products and other hazardous materials including fuel, lubricants, paints, and chemicals. In the event that soil contamination is discovered, national TLVs of chemicals in the soil will be followed.

3.4.8 Sulfur Hexafluoride (SF_6)

[41] Available from Armenian Legal Information System: https://www.arlis.am/DocumentView.aspx?DocID=146741

International Standards. The Paris Convention agreed to reduce climate-damaging greenhouse gases under the United Nations Framework Convention on Climate Change (UNFCCC) as of 2020. 195 member states, including Armenia (signed 20 September 2016 and ratified 23 March 2017), negotiated and adopted this agreement on the twenty-first session of the Conference of the Parties under the framework convention on climate change in Paris on 12 December 2015. As a Non-Annex I Party to the agreement, Armenia is required to provide estimates of the anthropogenic emissions of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) by sources and removals by sinks (Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and SF_6 reporting for Non-Annex Parties is encouraged but not required). Armenia's Fourth National Communication to the UNFCCC (submitted 17 May 2020)[42] included summary reports on CO_2, CH_4), N_2O, HFCs, PFCs, and SF_6 (no SF_6 emissions were reported as part of their national inventory).

Environmental Protection Agency. In 1999 the SF_6 Emission Reduction Partnership for Electric Power Systems was established as a collaborative effort between the EPA and the electric power industry to identify, recommend, and implement cost-effective solutions to reduce SF_6 emissions. The partnership has worked to identify and develop several resources and best practices to highlight cost-effective methods of reducing SF_6 emissions. Among other mitigation strategies, these include upgrading equipment to SF_6-free circuit breakers to reduce SF_6 use and leaks, establishing a lifecycle approach for SF_6 management, ensuring good management of SF_6 acquisitions and gas inventory, training employees annually in SF_6 handling and in using the necessary equipment, recycling SF_6 gas at equipment servicing or disposal, implementing leak detection and repair strategies, and decommissioning equipment properly.[43]

European Standards. Regulation 517/2014 on fluorinated greenhouse gases[44] is binding and directly applicable in all EU Member States. It contains extended obligations which are relevant for switchgear manufacturers, maintenance companies, and facility operators alike. Some of the articles in the regulation most relevant for SF_6 gas handling in electrical switchgear include the following:

- Article 3: Detected leaks must be immediately repaired
- Article 4: Leakage testing
- Article 5: Leak detection systems are mandatory only for high-voltage switchgear
- Article 10: Training and certification for persons handling SF_6
- Article 19: Reporting obligation for manufacturers to the European Commission

International Electrotechnical Commission. The International Electrochemical Commission (IEC) is a leading organization for the preparation and publication of international standards for all electrical, electronic, and related technologies. The IEC has several SF_6 standards in place including:

- IEC 60376 - Defines SF_6 quality and detection techniques for use in electrical equipment and gives general information about the gas and its environmental effects.
- IEC 62271 – Provides information on how to handle SF_6 and its mixtures

[42] Republic of Armenia. 2020. *Armenia's 4th National Communication on Climate Change*. Yerevan: Republic of Armenia. https://unfccc.int/documents/227815.
[43] United States Environmental Protection Agency. 2021. Electric Power Systems Partnership. April 12. Accessed June 30, 2021. https://www.epa.gov/eps-partnership.
[44] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32014R0517&from=EN

- IEC 60480 - Describes effects on human health, handling, and disposal of SF_6 byproducts
- IEC 60068 - How to determine SF_6 leakages

Institute of Electrical and Electronics Engineers. The Institute of Electrical and Electronics Engineers (IEEE) is a professional association for electronic engineering and electrical engineering. IEEE is a leading developer of industry standards, guides, and recommended practices in a broad range of technologies. Their C37.122-2010 standard[45] establishes ratings and requirements for planning, design, testing, installation, and operation of gas-insulated substations for alternating-current applications above 52 kV. Their C37.20.9-2019 standard[46] covers the design, testing, and installation of metal-enclosed switchgear that incorporates gas (typically SF_6) at higher than ambient pressure as an insulation medium for alternating-current applications rated above 1 kV to 52 kV.

ASTM International. ASTM International is a leader in the development of voluntary consensus standards including specifications for SF_6 gas (standard D2472-15)[47] as well as testing methods for determining water vapor content (standard D2029-97)[48], acidity (standard D2284-11)[49], and for air and carbon tetrafluoride (standard D2685-11)[50].

Project Standards for SF_6. Standards established by the IEC and IEEE will be followed for the use and handling of SF_6 gas and gas equipment.

3.4.9 Hazardous Waste

101. International standards for polychlorinated biphenyls (PCBs) and PCB-contaminated equipment. Many countries require specific marking, handling, disposal methods for PCBs and PCB-contaminated equipment. The classification of PCB levels for the United States, Australia, and the EU are provided below.

- **United States:**
  - All wastes containing more than 50 ppm of PCBs (50 mg/kg) are considered to be PCBs
- **Australia:**
  - Definition of PCB: > 50 ppm
  - Concentrated PCB: > 10% PCBs (100 000 ppm)
  - Non-PCB: < 2 ppm
  - Removal and destruction of equipment in use
- **European Union:**
  - 1996: Directive 96/59/EC on the destruction of PCBs
  - All wastes containing more than 50 ppm of PCBs (0.5 mg/kg) are considered to be PCBs

[45] https://ieeexplore.ieee.org/document/5700076
[46] https://ieeexplore.ieee.org/document/8737022
[47] https://www.astm.org/Standards/D2472.htm
[48] https://www.astm.org/Standards/D2029.htm
[49] https://www.astm.org/Standards/D2284.htm
[50] https://www.astm.org/Standards/D2685.htm

102. The Basel Convention has defined PCBs as any substance or material with a PCB concentration of above 50 ppm (50 mg/kg). Unidentified appliances must be presumed to be PCB-containing pending their identification by screening or laboratory analysis.

103. Project Standards for PCBs. All wastes containing more than 50 ppm of PCBs (50 mg/kg) are considered to be PCBs under this project. As is regulated under the EU, appliances contaminated to a level between 50 and 500 ppm may be retained until the end of their service life, provided they are identified and labelled. Unidentified appliances will be presumed to be PCB-containing pending their identification by screening or laboratory analysis.

Box 2: A Note About Polychlorinated biphenyls (PCBs)

Polychlorinated biphenyls (PCBs) are synthetic organic chemical compounds produced by substituting chlorine atoms for the hydrogen atoms on a biphenyl molecule. PCBs have ideal properties for industrial applications and are one of the most stable synthetic compounds known (i.e., are inflammable, resistant to breakdown, and exhibit low electrical conductivity).

Accordingly, PCBs became widely used in electrical equipment because their properties made them ideal dielectric and heat transfer fluids. PCBs were commonly found in transformers, transformer bushings, capacitors, voltage regulators, hydraulic systems, small capacitors in fluorescent light ballasts, and heat transfer systems. In addition, PCBs were sometimes used in electrical cable, switches, breakers, vacuum pumps, gas turbines, natural gas pipelines, carbonless copy paper, paints, adhesives, caulking compounds, and investment casting wax.

Extensive research has shown a link between PCBs and various human health effects (acute and chronic), including the formation of malignant and benign tumors, fetal deaths, reproductive abnormalities, mutations, liver damage, and skin irritation (chloracne). In addition, experiments have shown that PCBs attack the immunological system and affect the production of enzymes.[51]

104. International Standards for Asbestos Management. The IFC's EHS Guidelines specify that the use of asbestos-containing materials (ACM) should be avoided in new buildings and construction or as a new material in remodeling or renovation activities. Existing facilities with ACM should develop an asbestos management plan that clearly identifies the locations where the ACM is present, its condition (e.g., whether it is in friable form or has the potential to release fibers), procedures for monitoring its condition, procedures to access the locations where ACM is present to avoid damage, and training of staff who can potentially come into contact with the material to avoid damage and prevent exposure. The plan should be made available to all persons involved in operations and maintenance activities. Repair or removal and disposal of existing ACM in buildings should be performed only by specially trained personnel following host country requirements or, if the country does not have its own requirements, internationally recognized procedures. Decommissioning sites may also pose a risk of exposure to asbestos that should be prevented by using specially trained personnel to identify and carefully remove asbestos insulation and structural building elements before dismantling or demolition.

105. The International Labor Organization (ILO) established an Asbestos Convention (C162) in 1986 to promote national laws and regulations for the "prevention and control of, and protection of workers against, health hazards due to occupational exposure to asbestos". The convention outlines aspects of best practice: Scope and Definitions, General Principles,

[51] United States Environmental Protection Agency. 2004. "Compliance." *Polychlorinated Biphenyls (PCB) Inspection Manual*. Accessed April 27, 2021. https://www.epa.gov/compliance/polychlorinated-biphenyls-pcb-inspection-manual.

Protective and Preventive Measures, Surveillance of the Working Environment, and Workers' Health. As of April 23, 2021, 35 countries had ratified the Convention.

106. Some of the ILO asbestos convention requirements include:

- work clothing to be provided by employers;
- double changing rooms and wash facilities to prevent dust from going home on street clothes;
- training of workers about the health hazards to themselves and their families;
- periodic medical examinations of workers,
- periodic air monitoring of the work environment, with records retained for 30 years;
- development of a work plan prior to demolition work, to protect workers and provide for proper waste disposal; and
- protection from "retaliatory and disciplinary measures" of workers who remove themselves from work that they are justified in believing presents a serious danger to health.

107. Project Standards for Asbestos Management. ACM are not specifically addressed in Armenian legislation and the project will following IFC's EHS Guidelines and best practices established in the ILO's Asbestos Convention (C162).

3.4.10 International Organization for Standardization (ISO) standards

108. ENA currently holds the following ISO certifications relevant to the project:

- ISO14001:2015 - Environmental management systems: This ISO specifies the requirements for an environmental management system that an organization can use to enhance its environmental performance. It is intended for use by an organization seeking to manage its environmental responsibilities in a systematic manner that contributes to the environmental pillar of sustainability.
- ISO 9001:2015 - Quality management systems: This ISO specifies requirements for a quality management system when an organization:
    a) needs to demonstrate its ability to consistently provide products and services that meet customer and applicable statutory and regulatory requirements, and
    b) aims to enhance customer satisfaction through the effective application of the system, including processes for improvement of the system and the assurance of conformity to customer and applicable statutory and regulatory requirements.
- ISO 45001:2018 - Occupational Safety & Health Management System: specifies requirements for an occupational health and safety management system, and gives guidance for its use, to enable organizations to provide safe and healthy workplaces by preventing work-related injury and ill health, as well as by proactively improving its OH&S performance.
- ISO 50001:2018 - Energy management systems: Specifies requirements for establishing, implementing, maintaining, and improving an energy management system (EnMS). The intended outcome is to enable an organization to follow a systematic approach in achieving continual improvement of energy performance and the EnMS.

109. The implementation of the ISO standards is being managed by ENA's Integrated Management System (IMS) and Audit department. Certifications audits were regularly performed under Phase 1 of the Project by an independent and accredited certification body.

3.5 International Conventions Relevant to the Project Ratified by Armenia

110. Armenia has ratified a number of international agreements and conventions relating to the protection of the environment and biodiversity, including:

- The Convention on the Conservation of European Wildlife and Natural Habitats (Bern)
- Convention on Wetlands of International Importance (Ramsar)
- Conservation of Migratory Species of Wild Animals (Bonn)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington)
- European Landscape Convention (Florence)
- Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris)
- Convention on Biological Diversity (Rio de Janeiro)
- Framework Convention on Climate Change (Rio de Janeiro)
- Kyoto Protocol (linked to the Convention on Climate Change)
- Paris Agreement (linked to the Convention on Climate Change).

111. With respect to handling of hazardous substances:

Armenia is a party to international multilateral environmental agreements on hazardous waste, and other chemicals, and meets its commitments and obligations in transmitting information as required by each relevant agreement. This includes:

- Stockholm Convention “On Persistent Organic Pollutants” (ratified in 2003)
- Basel Convention “On the Control of Transboundary Movements of Hazardous Wastes and their Disposal” (a party since 1999).
- Rotterdam Convention on Hazardous Chemicals and Pesticides in International Trade (ratified in 2003)
- Montreal Protocol on Substances that Deplete the Ozone Layer (ratified in 1999)

112. In addition, Armenia is a signatory to the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters.

3.6 Institutional Framework

3.6.1 Electric Networks of Armenia

113. ENA was founded in May of 2002 as merger of four state regional companies (“Yerevan Electric Networks”, “North Electric Networks”, “South Electric Networks” and “Central Electric Networks”) distributing and selling electric energy. In 2004 ENA was acquired by “Midland Resources Holding” and in 2006 it became a subsidiary of RAO UES INTERNATIONAL" CJSC. In September 2015 the "Tashir" Group of Companies acquired 100% of the shares of ENA.

114. As the sole and exclusive licensee for the distribution of electricity in Armenia, ENA is responsible for the maintenance and augmentation of the distribution network and is engaged in the purchase and regulated distribution of electricity. The company has an exclusive license for distribution of electric energy within Armenia. With approximately 6,700 employees, ENA is the largest employer in Armenia. ENA’s customers are the entire population of Armenia, serving

approximately 985,000 electric utility customers. ENA owns and operates the following infrastructure elements:

- 26 thousand kilometers of aerial electric lines, including:
  - 2.8 thousand kilometers of 110 kV aerial electric lines
  - 2.3 thousand kilometers of 35 kV aerial electric lines
  - 8.28 thousand kilometers of 6(10) kV aerial electric lines
  - 12.8 thousand kilometers of 380 V voltage aerial lines
- 5.8 thousand kilometers of (ground) cable lines of electric transmission, including:
  - 0.1 thousand kilometers of 35 kV (ground) cable lines
  - 2.4 thousand kilometers of (ground) cable lines with 380 voltage
  - 3.3 thousand kilometers of 6(10) kV (ground) cable lines
- 9,056 substations and transformation units, including:
  - 102 110 kV substations with total power preset as 4478 MWA
  - 8465 6(10) kV transformation units with total power preset as 3200 MWA
  - 226 35 kV substations with total power preset as 1736 MWA
  - 261 6(10) kV distribution units

115. According to the Law On Energy, the tariffs of sale and purchase of electricity by the Company in the domestic market, as well as the tariffs for services on transit and distribution provided to the Company, are established by the Public Services Regulatory Commission of Armenia.

3.6.2 Armenian Governmental Agencies

116. The primary RA Governmental agencies relevant to this Project with respect to environment, social, and health and safety issues, are described below.

117. The Ministry of Environment (MoE). The MoE is the principal national environmental administrative authority responsible for protection, sustainable use, and regeneration of natural resources as well as the improvement of the environment in Armenia. The MoE's authority includes overseeing national policy development, developing environmental standards and guidelines, and enforcement. The MoE implements those functions through the following structural departments:

- Department for licenses, permits, and compliances
- Climate policy department
- Atmospheric policy department
- Water policy department
- Forest policy department
- Department for specially protected areas of nature and biodiversity policy
- Strategic Policy Department
- Department of land and underground resources policy
- Legal Department
- Department of international cooperation
- Hazardous Substances and Waste Policy Department

118. The MoE also undertakes several functions through the following key detached divisions and agencies:

- Committee of Forest of Ministry of Environment
- State Non-Commercial Organizations (SNCOs)
    - “Hydrometeorology and Monitoring Center” SNCO
    - "Zangezur" Biosphere Complex" SNCO
    - "Sevan" National Park" SNCO
    - "Dilijan" National Park" SNCO
    - "Lake Arpi" National Park SNCO
    - "Reserve Park Complex" SNCO
    - "Khosrov Forest" State Reserve" SNCO
    - “State Museum of Nature of Armenia” SNCO
    - “Environmental Impact Expertise Center" SNCO
- “Environmental project implementation unit” State Institution
- "Zvartnots" Aviameteorological Centre" State Closed Joint Stock Company (CJSC)

119. The key department within the MoE that has administrative authority over EIA/IEE approval processes is the “Environmental Impact Expertise Center” (EIEC). The EIEC is responsible for reviewing and issuance of assessment conclusion reports and adding conditions when necessary to protect the environment.

120. To ensure that all PCB uses are ceased by 2025 as required to parties under the Stolkhom Convention on Persistent Organic Pollutants, the MoE is working with international partners to complete national inventories of all PCBs and related contaminated equipment; improve the capacity and increase the knowledge of PCB equipment owners on proper maintenance of equipment to avoid further contamination; to establish proper storage of discontinued equipment and to ensure disposal of all the PCB oils and contaminated equipment in an environmentally sound manner.

121. Ministry of Territorial Administration and Infrastructure (MTAI). The MTAI is a central body of executive authority that develops and implements the policy of the GoA in the field of territorial administration and infrastructure management. The Ministry of Territorial Administration and Infrastructure (MTAI) has overall responsibility for energy policy.

122. Ministry of Health (MoH). The MoH is a state body of executive authority, which elaborates and implements the policies of the RA Government in the healthcare sector. The MoH implements functions related to development and organization of implementation of the healthcare management policy and state projects (including those on noise and vibration), development and approval and sanitary norms and rules, drafting as well as oversight over implementation of laws and regulations related to healthcare sector.

123. Urban Development, Technical Standards and Fire Safety Inspectorate. The Urban Development, Technical and Fire Safety Inspectorate is a body subordinate to the government, which is responsible for supervision and other law-prescribed functions. The Inspectorate is supposed to ensure compliance with the safety and legislative regulations applicable in the areas of urban development, technical and fire safety, transport, energy, and local and national geodesic and mapping activities and land use.

124. Among its duties, the Inspectorate performs investigations in the energy sector to determine the causes and circumstances of accidents and violations of technical regulations and other legal acts that result in the damage to human life (health), property, and the environment. The main task of their investigations is to identify the preconditions and causes of

accidents and violations and the development of measures to prevent similar accidents in the future. The classification of accidents at power plants and the procedure for professional investigations of accidents at power plants is provided in Government Decision Classification of Accidents In the Power Plants Under the Application Of Them in the Republic Of Armenia (N 580-N, 21.05.2007).[52]

125. Ministry of Education, Science, Culture and Sport. The Ministry of Education, Science, Culture and Sport (MESCS) has jurisdiction over archaeological, historical, and cultural sites. The Law on the Protection and Use of Fixed Cultural and Historic Monuments and Historic Environment (adopted November 11, 1998).[53] Under the law the Project will have to comply with the provisions of the following chapters:

a) Article 19. Any construction activity in areas containing historical monuments or archaeological sites must be realized in agreement with the authorized body (Ministry of Education, Science, Culture and Sport).
b) Article 20. Newly discovered sites obtain immediately protected status by law until they are included in the State Lists.
c) Article 21-22. Destruction of historical monuments and its environment is forbidden. Before the realization of any kind of activity at the area of the site the authorized body must study it and give corresponding permits or solutions.

126. Ministry of Labor and Social Affairs. Among other things, the Ministry is responsible for development and implementation of the state policy, legislation and programs in the following areas: social security, labor and employment, social assistance, social assistance to disabled and aged people, social protection of families, women and children, etc.

127. State Committee of the Real Estate Cadastre. The State Committee of the Real Estate Cadastre is a subordinate body to the government and charged with developing and implementing government policy. The objectives of the Cadastre Committee include:

a) Managing the real estate state unified cadaster and ensuring of cadaster system activity in accordance with the legislation; and
b) Recognition, guarantee, and protection of rights to the property by the state.

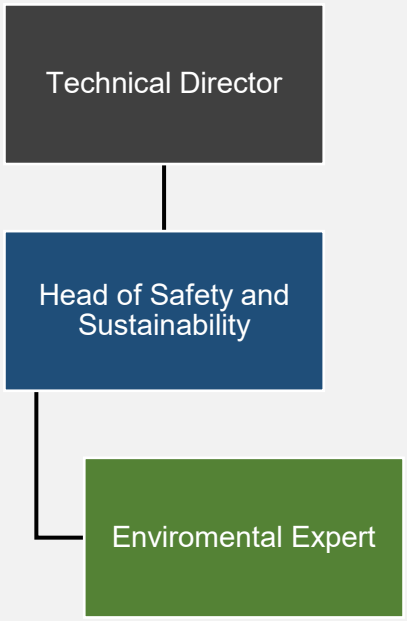
3.7 ENA Management and Organizational Structure

128. To comply with the Environmental and Social Action Plan (ESAP)[54] developed in Phase 1 of this Project, ENA established an Environmental and Social Management System (ESMS) (refer to Section 6.14. Environmental and Social Management System (ESMS)) aligned with ISO 14001- Environmental Management Systems. The organizational structure established by ENA to manage its ESMS is provided below.

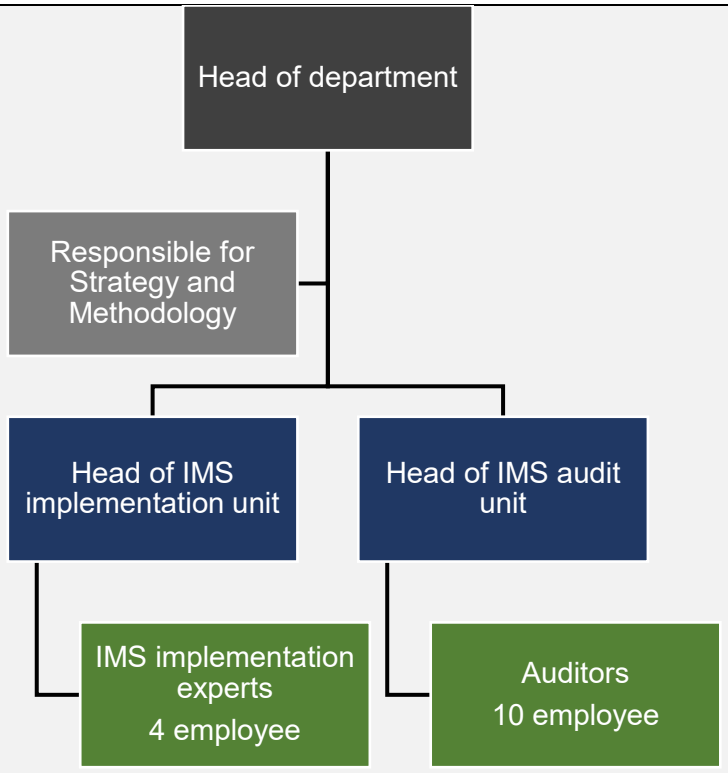
[52] Available from Armenian Legal Information System: https://www.arlis.am/documentview.aspx?docid=36013
[53] Government of Armenia. 1998. *Law on the Protection and Use of Fixed Cultural and Historic Monuments and Historic Environment.* November 11. Accessed April 27, 2021. http://www.parliament.am/legislation.php?sel=show&ID=1641&lang=arm.
[54] The Environmental and Social Action Plan (ESAP) is a tool used by lenders like the EBRD and ADB to ensure that any outstanding issues at the time of the operation approval are addressed in a timely and appropriate manner, and to ensure continued compliance with the lender's environmental and social compliance requirements, as well as local legal requirements.

Environmental Management

An Environmental Expert in ENA's Technical Department sits under the Technical Director and the Head of Safety and Sustainability. The Expert is a former employee of the MoE and has considerable experience in the environmental sector. This individual is a full-time employee of ENA and is responsible for preparing EIAs (e.g., hiring and coordinating consultants to prepare EIAs), public hearings, waste passports for hazardous materials, and makes reporting to state bodies about hazardous waste.

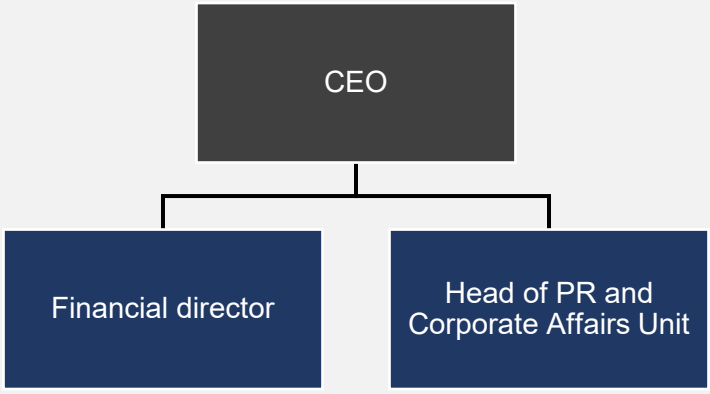


ENA has also established an Integrated Management System (IMS) and Audit department comprising a head of department (reporting directly to the ENA board), a head of IMS Implementation Unit (4 employees) and a head of IMS Audit Unit (9 employees). The audit team is required by ENA to review the performance of branch offices and sub-stations against the ISO standards (i.e., ISO14001:2015, ISO14001:2015, ISO 45001:2018, ISO 50001:2018). They are also responsible for undertaking routine monitoring of all ENA sites and report on their compliance with the ESMS. ENA's Environmental Specialist and audit team coordinate on environmental concerns.



Social Management

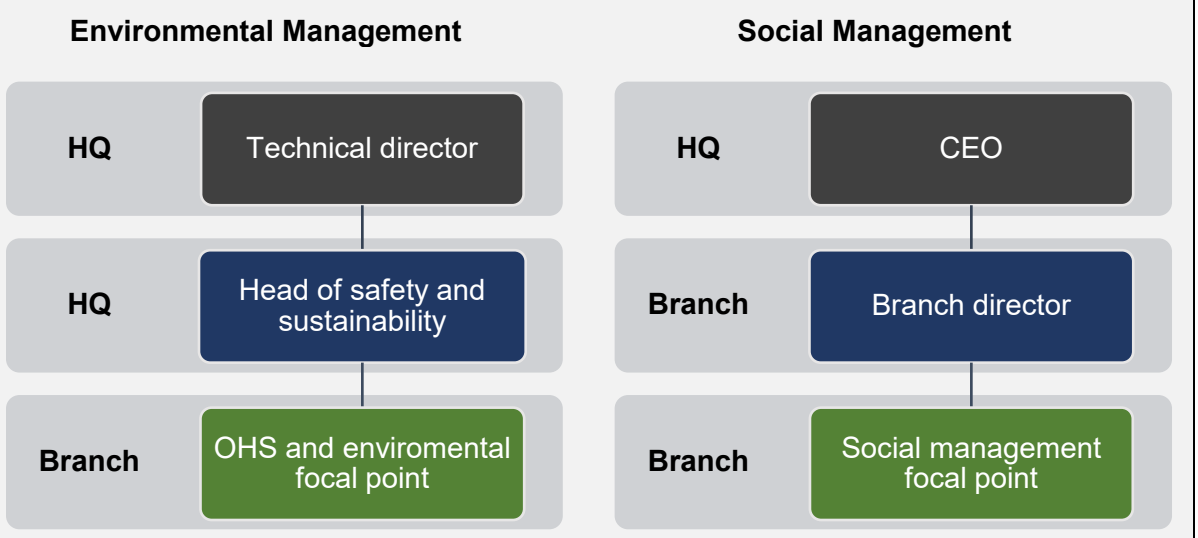
ENA's Public Relations and Corporate Affairs unit head is responsible for managing the company's Grievance Redress Mechanism (GRM) and any external communication with affected people (if any). ENA's Financial director has been appointed as coordinator to manage any potential social impacts related to resettlement and land acquisition (if required).



ENA Branch Offices

ENA branch offices have a focal point responsible for matters related to occupational health and safety and environmental management system. The focal point reports to the branch's Head of Safety and Sustainability who then reports to the ENA Technical Director. Branch's

also have a focal point responsible for the management social issues and which reports to the branch director, who then reports directly to the CEO.



4 Project Description

4.1 Project Introduction

4.1.1 Project Background

129. Additional financing provided to the Distribution Network Rehabilitation, Efficiency Improvement, and Augmentation Project will fund a continuation of the investments and interventions carried out under Phase 1. Project objectives include i) improving the quality of the distribution network and services of its multisite operations across the country; (ii) reducing electricity losses and operational expenses; (iii) improving technical maintenance and safety conditions; (iv) modernizing the metering system; (v) rehabilitating, reinforcing, and augmenting the distribution network; (vi) connecting new customers; and (vii) introducing international standards of management.

130. The main categories of Project investments are outlined below:

131. Category 1 - Investments to improve the status and working conditions of existing infrastructure and equipment (replacement, reconstruction, rehabilitation, and reinforcement projects) and the reduction of technical losses. This category includes the flowing sub-categories:

- Reconstruction of 0.4 kV distribution networks
- Reconstruction of 6/10 kV distribution networks
- Reconstruction of 35 /110 kV distribution networks
- Reconstruction of industrial buildings and transformer stations
- Electric network improvement in multi-apartment buildings

132. Category 2 - Includes projects focused on improvements in the quality of power supply (predominantly voltage level) and further reducing losses.

133. Category 3 - Projects are related to network expansion (new overhead lines, cables, transformers and customer connection projects) to meet increased demand and implement new customer connections. It includes the following sub-categories:

- Connecting new customers to the network
- Special projects
- Reconstruction of SS "Purak"35/6 kV
- Construction of DTSS and reconstruction of Yerevan HPP
- Construction of SS “Tsahkadzor” Avangard 35 kV
- Construction of DSS "Circus"
- Reconstruction of SS "Teryan" 35/6 kV
- Purchase of networks from other owners

134. Category 4 – Activities related to the implementation of automatic meter reading systems (procurement and installation of system and customer meters and software) and contains the following sub-categories:

- Installation of meter boxes
- Replacement of electricity meters
- Current Transformer test bench
- Reconstruction of the 6/10 kV transformer stations for the installation of AMR system
- Implementation of AMR at the 6/10/0.4 kV side of the transformer stations
- Implementation of AMR for the customers in Yerevan

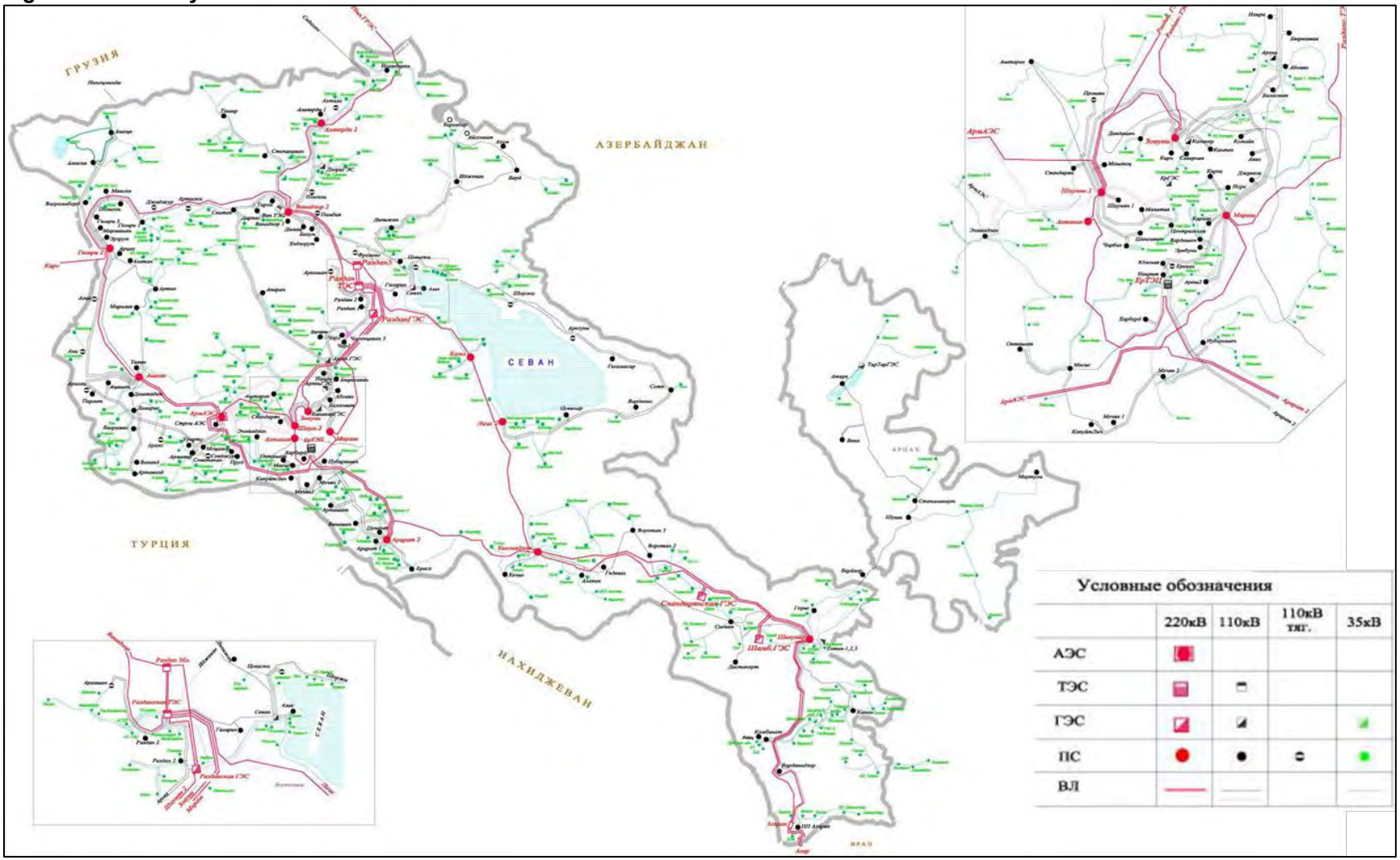
135. Category 5 – Includes the procurement of transportation and special vehicles to improve network maintenance and management.

136. Category 6 - Projects focused on improvements to ENA management systems (e.g., management information system software and implementation of ISOs), improvements in office environment (computers, accessories, desks) and improvements in safety (safety equipment, protection etc.) and other investments It includes the following sub-categories:

- Purchase of office equipment
- IT infrastructure
- Capital repair of vehicles
- Reconstruction of administrative buildings and structures
- Purchase of metering and safety devices
- Purchase of testing devices for relay protection
- Implementation of the ISO system
- Installation of natural gas reservoirs on vehicles
- Capital repair of equipment
- Investments related to environmental issues

137. A map of the electricity network of Armenia is provided in the figure below.

Figure 1. Electricity Network of Armenia



Source: Tetra Tech. 2019. Lenders' Engineer - Project Implementation Monitoring -Six-Month Project Status Report. Tetra Tech.
Note: The map is dated 01.01.2016.

4.1.2 Description of Activities

138. The Project under Phase 2 will continue the same investment program completed under Phase 1. Note that this is a rolling three-year Project and that although the total amount of investment and the types of works are known, the exact locations of the first year's Project activities are largely unknown. Annual investment plans (AIP) will be prepared at the start of each year of the Project by ENA and these plans will specify the locations where activities will be undertaken during that specific year. At the time of writing this IEE, the AIP for year one was still not finalized. In many cases the works being implemented under Phase 1 will roll into Phase 2 when additional financing is introduced.

139. Information available on the investment program for Phase 2 is included in the table below.

Table 16. Investment Program, 2021-2022

Item	Amount (AMD million)	Amount ($ million)	Share Total (%)
Substation modernization and reinforcement	23,726	45.56	30%
Network expansion and improvement	31,884	61.22	41%
Automatic metering systems	20,628	39.61	26%
Other investments	2,057	3.95	3%
Total	78,295	150.34	100%

Source: Financial model of Electric Networks of Armenia.

140. Sites visits conducted by the Environmental Consultant over seven days between May 3rd and May 11th, 2021 in support of both the ADB's extended XARR for Phase 1 and this IEE covered a variety of subproject investment types in different stages of implementation or planning. The pictures below have been provided to demonstrate the types of investment under Phase 1 that will continue under Phase 2 as well as the identified Phase 2 investments being planned.

Figure 2. Pictures of Phase 1 and Planned Phase 2 Investments

Interior of newly constructed substation in Shengavit District, Yerevan

New 10 kV – 0.4 kV kiosk transformer in Avan Village

New 10 kV line near the village of Lorut

Damaged substation housing to be removed and replaced in Vardenik

New walkways and oil containment system at Ararat Power Electric Power Substation – 1

Equipment to be replaced under Phase 2 at Charentsvan City substation (110 kV, 35 kV, 10 kV)

5 Analysis of Alternatives

5.1 Overview

141. One of the objectives of an IEE is to investigate alternatives to the Project. In relation to a proposed activity, "alternatives" means different ways of meeting the general purposes and requirements of the proposed activity. The following section also includes a 'No-Project' alternative as part of its analysis.

5.2 Energy Sector Context

142. Following the collapse of the Soviet Union, generation, transmission, and distribution infrastructure deteriorated from the effects of poor and irregular construction and maintenance work. In 2011, transmission assets were estimated to be on average more than 45 years old[55], and distribution assets in the two largest cities of Yerevan and Gyumri are almost fully depreciated.

143. Since the start of the 21st century, Armenia's energy sector has undergone a series of reforms that have significantly improved its performance. The reforms involved the unbundling of a vertically integrated electricity subsector and the privatization of power and gas distribution networks and of most generating companies.[56] Despite these positive reforms, Armenia's energy sector faces challenges, including the need to maintain energy supply reliability. Regular investments in various segments of the power network, including distribution, are vitally important otherwise, the gap between the supply and demand will continue to increase.

144. The GoA has given high priority to measures that address current challenges facing the energy sector, including the issues of increasing energy efficiency, reducing losses, and ensuring reliability and high quality of power supply.

5.3 No-Project Alternative

145. Without the Project, Armenia's electricity network would continue to deteriorate resulting in further electricity losses, unsafe conditions at existing facilities, and degraded quality of electricity for end users. The steadily declining state of the electricity network would severely hamper economic development throughout the country and widen the gap between the worst served and the average customer. The utility would also forego the opportunity of increasing its consumer base as well as revenue associated with the system expansion.

146. Phase 2 of this Project will help ENA improve private sector electricity distribution by reducing distribution losses; improving the quality of the distribution network and services; rehabilitating, reinforcing, and augmenting the distribution network; and introducing international standards of management and automated control systems.

147. As Armenia moves towards increasing renewable energy generation, the electricity network will need to be substantially upgraded to absorb additional variable energy resources. Moreover, the Project is expected to have numerous positive impacts on the environment and on the population of Armenia (refer to Sections 8.2. Impacts and Mitigation Measures and 13.2.

[55] World Bank. "Charged Decisions: Difficult Choices in Armenia's Energy Sector." October 2011.
[56] ADB. 2014. Country Partnership Strategy: Armenia, 2014–2018. Manila.

Conclusions and Recommendations). In view of the above, the 'No Project' option is not a preferred alternative.

5.4 Alternative Regions

Project activities will be selected on a rolling basis by ENA and reviewed by the ADB, and EBRD as part of a countrywide network modernization program. The types of activities to be undertaken under the Project are the same across the country and specific sites selected for investments will be determined by a number of factors, including potential environment and social impact. Accordingly, an assessment of alternative locations is not warranted or feasible.

6 ENA Facilities and Operations

6.1 General

148. This section of the IEE provides an overview of ENA's existing facilities and operations. Firstly, a review is given of the ENA's offices, warehouses, hazardous waste storage facility (HWSF), and Abovyan Oil Storage Facility. Secondly, an overview of current ENA practices regarding hazardous liquids, waste management, and PCBs is provided.

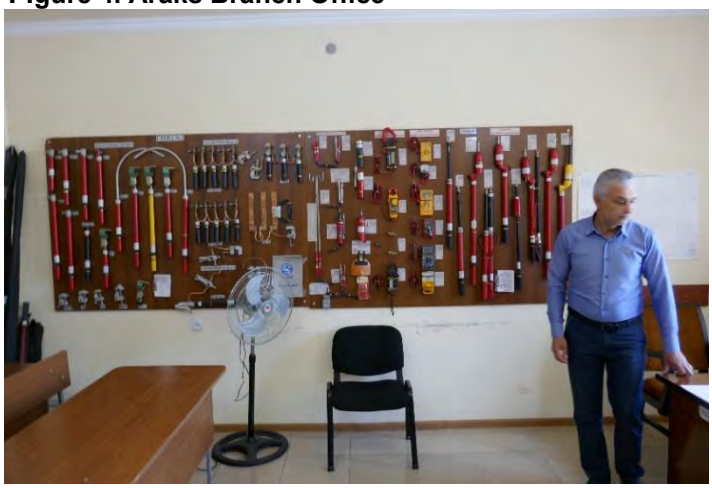
6.2 ENA Offices

149. In addition to ENA's head office in Yerevan there are eight regional branch offices which manage energy services for different parts of the country. Each branch consists of office space and storage facilities where equipment and supplies are kept for use by ENA staff as well as contractors. The Debet, Araks, Tatev, Musaler, Geghama, and Aghstev branch offices provide temporary hazardous waste storage for the regions prior to being sent to the HWSF. See Figure 3 below map to see how the county's regions are managed by the different ENA branch offices. The pictures provided below in Figure 4 and Figure 5 show the Araks and Debed branch offices visited during the Phase 1 environment, social, health, and safety performance review performed by the Environmental Consultant in May 2021.

Figure 3. ENA Branch Office Regions

Source: Electric Networks of Armenia. 2019. 2019 Annual Report. Yerevan: ENA.

Figure 4. Araks Branch Office



Training room in Araks Branch

Oil containing equipment on leak containment pallets

Tested safety equipment

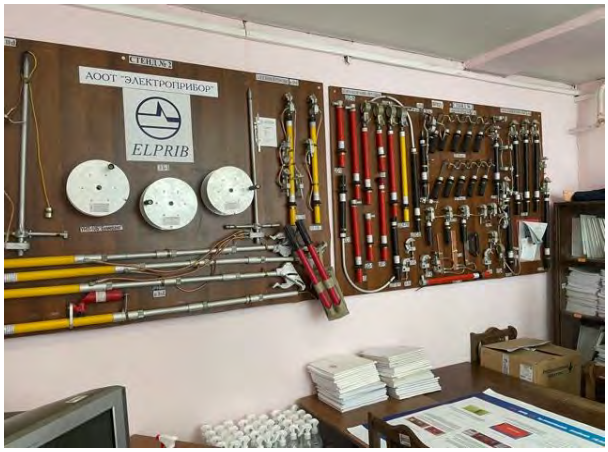
Oil spill kits

Figure 5. Debed Branch Office

Material and equipment staging area

Used battery storage area

Temporary hazardous waste storage area



Branch office training center

6.3 Abovyan Warehouse

150. ENA's Abovyan Warehouse is located approximately 15 km northeast of downtown Yerevan. The warehouse is ENA's primary collection and distribution center where supplies and equipment is inventoried, quality controlled, and distributed to the branch offices. Orders are typically done on a biannual or annual basis. The materials are then organized and stored in the open air or within one of several warehouse buildings. The warehouse area comprises of a large open space where various pieces of equipment and materials are stored outside. Small quantities of oil is stored there as well, but the vast majority of oil for ENA's operations is stored

at its Abovyan Oils Storage Facility. Oil filled transformers are also stored on site in an area designated for this purpose and designed to capture oil spills with a spill containment system.

Figure 6. Abovyan Warehouse

Oil spill containment area for transformers

Outdoor oil storage and spill kit

Mobile fire sighting equipment

Oil containment reservoir

6.4 Abovyan Oil Storage Facility

151. The Abovyan Oil Storage Facility is located approximately 15 km northeast of downtown Yerevan. It is adjacent to the Abovyan Warehouse but has a separate entrance. The oil storage area is within an operating electrical substation (110/35/10 kV) called “Abovyan 110”.

152. The facility includes four vertical tanks, each with 25-ton oil capacity. The tanks are above ground and in the corner of the substation approximately 10 meters from the nearest

substation equipment. The tanks are on a gravel bed and within a concrete oil spill containment structure designed to capture spilled oil and divert it into a reservoir tank. The reservoir has capacity to hold 110 tons oil. There is a security fence around the storage area and a tall wall around the entire substation.

153. A second entrance at the back of the substation near the storage tanks provides access for trucks.

Figure 7. Baghramyan Hazardous Waste Storage Facility

Oil storage tank and security fencing

Separate entrance to oil storage area and nearby substation equipment

6.5 Hazardous Waste Storage Facility (HWSF)

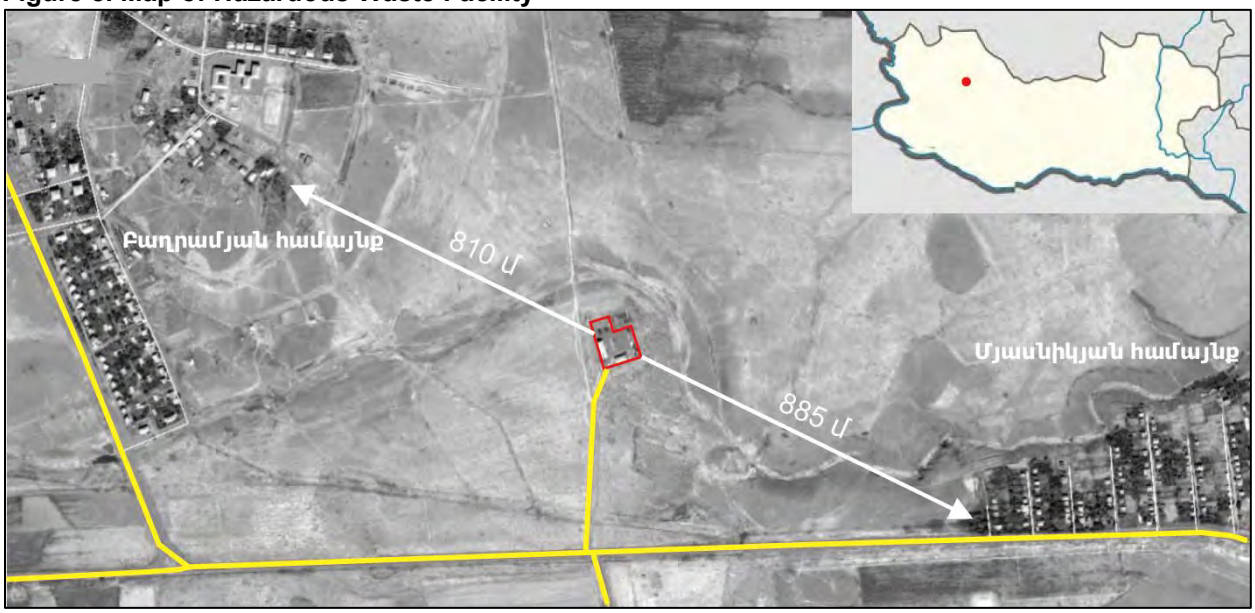
154. In consideration for the fact that Armenia has no hazardous waste facilities or disposal sites, a decision was made during Phase 1 of the project to build a specific area for storage of hazardous wastes. The purpose of the HWSF is to allow for suitable and cost-effective management of hazardous materials generated or collected as part of Project activities and during utility operations until a more permanent disposal solution can be realized.

155. An overview of the status of this facility is provided below.

156. Location – The HWSF is located within Armavir region approximately 1 km southeast from the village of Baghramyan and 55 km west of Yerevan. The site currently includes an office area and substation along with several storage buildings that are largely empty. The site is bounded by unoccupied land and large crops of volcanic tuff scatter the landscape making it unsuitable for agriculture. The nearest properties (residential) are approximately 800 m from the site. Access to the site is available only via a single lane track from the main road. There are no

sensitive habitats, or notable flora or fauna within the vicinity of the site. Although it is not visible from the site itself, a small ephemeral stream is located 100 m north and east of the site.[57]

Figure 8. Map of Hazardous Waste Facility



Source: *ATMS Solutions LLC. 2019. Baghramyan Hazardous Waste Storage Facility Environmental Impact Assessment. Yerevan: Electric Networks of Armenia.*

157. Permits - An EIA for the hazardous waste storage facility was completed in 2018 in accordance with the law on Environmental Impact Assessment and Expertise and submitted to the MoE for consideration. A positive decision was received from the MoE on April 19th, 2018 and a permit for construction was received. The EIA process included four rounds of public hearings (with regional state bodies and potentially affected people) on the following dates[58]:

- 1st public hearing: 15.09.2017
- 2nd public hearing: 19.12.2017
- 3rd public hearing: 23.01.2018
- 4th public hearing: 11.04.2018

158. There were some initial objections from the surrounding community about construction of the HWSF, but in the end the municipality worked with ENA to alleviate all their concerns. It helped that ENA took steps to ensure temporary employment opportunities for local community members related to the construction works.

159. Design - A local company (T-Construction) was hired to design the facility. The HWSF is comprised of three primary storage areas. The largest is the main warehouse which features a wall and chain link fenced permitter. There is an operating substation adjacent to it as well as an ENA staffed two-story office building. This storage area has been designed to primarily hold contaminated soils, PCB oils, paints, chemicals, solvents, asbestos, PCB tainted equipment,

[57] Tetra Tech. 2019. *Lenders' Engineer - Project Implementation Monitoring -Six-Month Project Status Report.* Tetra Tech.
[58] Ibid.

and insulators. A second separate storage area is designed to house ferrous and non-ferrous waste metals. The third area of the HWSF is connected to the office building with dedicated entrance. This area currently holds used lamps and batteries, PCB testing samples, and soiled PPE and rags. The main storage area has a water-based fire protection system installed which was required by local fire authorities. The HWSF was built to manage waste for an estimated 7-8 years until Armenia constructs a suitable hazardous waste dump and management system.

160. The storage areas for different types of hazardous wastes is provided in the table below and shown in Figure 9**Error! Reference source not found.**.

Table 17. Hazardous Wastes Stored in the HWSF and Area in m^2

#	Waste Type	Area, m^2
1	Mercury-containing lamps	15.7
2	Oil contaminated PPE, rags, and PCB testing samples	67.3
3	Lead Batteries	50.5
4	Asbestos-containing Materials	240
5	Chemicals, solvents, etc.	240
6	Oils, Oil Equipment, Containers, etc.	240
7	Soil, Gravel, Clothes, and Rags Contaminated with Transformer Oils	362
8	Glass and Ceramic Insulators	110
9	Contaminated metals	70.6
10	Scrap Non-ferrous Metal	74.3
11	Offices	-
12	Oil spill containment reservoir	-
13	Water tanks for fire fighting	-

Source: ATMS Solutions LLC. 2019. Baghramyan Hazardous Waste Storage Facility Environmental Impact Assessment. Yerevan: Electric Networks of Armenia.

Figure 9. Hazardous Waste Facility Site Plan

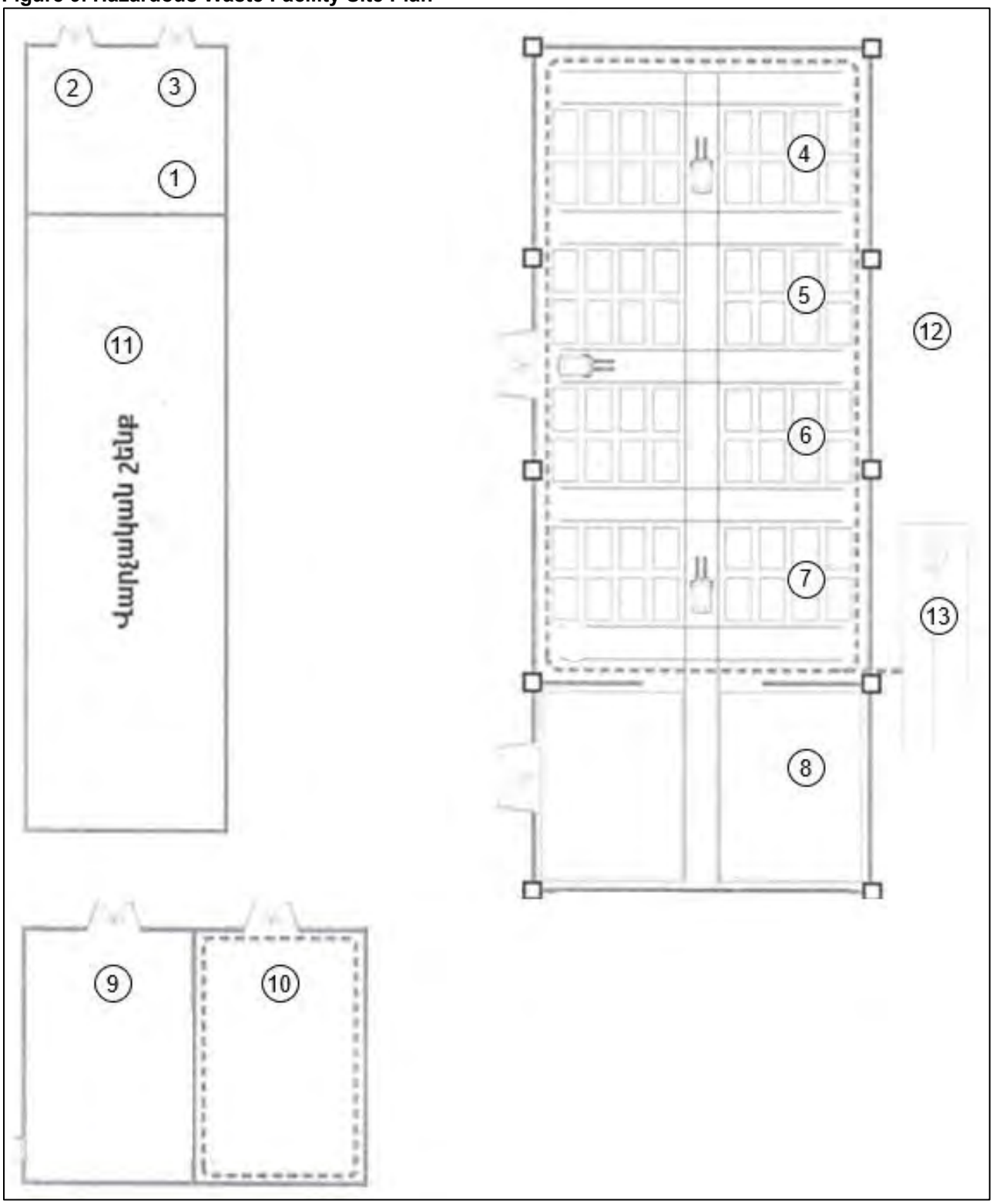


Figure 10. Baghramyan Hazardous Waste Storage Facility

Used battery storage area

Area for soils rags and other materials

Storage area for ferrous and non-ferrous metals

Interior of the main hazardous waste storage area

161. Construction and operating conditions were established by the EIA developed in January 2019 for the HWSF are summarized as follows[59]:

- Waste installation / storage should be carried out in precincts for this purpose in accordance with sanitary-epidemiological, hygienic, labour protection, and fire safety requirements and norms, including:
    - The hazardous waste storage area must be filled with fire prevention measures.
    - Depending on the composition and properties of the wastes, their storage facilities or platforms, personal protective equipment and cell container should be provided for first aid.
    - Dangerous waste disposal is not permitted in the immediate vicinity of the walls, columns, and equipment of the building.
    - The distance between the stored wastes and the wall (pile and so on) or the roof cover should not be less than 1 m, and between the waste and the lighting not less than 0.5 m.
    - It is forbidden to store materials with different properties of fire in one area.
    - Hazardous waste storage area should have proper access gates, crane mechanisms and vehicles. The dimensions of the passages and corridors shall be determined based on the size of the vehicles, the transported goods and the hoisting and unloading mechanism.
    - Buildings used for temporary storage of hazardous waste should have locked doors to prevent access to unauthorized persons.
    - Buildings used for temporary storage of hazardous waste must be dry, luminous, have natural or mechanical ventilation.
    - In case of industrial wastes with explosive, explosive and / or high reaction properties, window glass windows must be painted in yellow or white to prevent sunlight from penetrating.
    - Waste collection site should be located on the winding side of the dwelling structure / structures.
    - Waste storage area should be designed to be protected from surface water flooding.

162. The specific conditions for each waste set by the 2019 EIA are as follows:

- Mercury-containing lamps
    - Type of building: closed structure with natural and artificial ventilation.
    - The basis of the building / floor: Concrete / reinforced concrete, designed for mercury impact stable coverage.
    - Storage: the mercury lamps will be packaged with paper or soft cardboard and will be stored in boxes with the appropriate marking. In order to avoid possible injuries in the boxes between the lamps, a rainbow will be poured. After filling, the boxes will be properly closed and placed in a metal hermetic container and will be stored on racks.
    - Other terms: There should be special equipment and tools for rapid localization and collection of mercury leaks, such as the DEMERKIT SKM-50 collection.
- Glass and ceramic insulators
    - Type of building: closed / covered structure, natural ventilation.
    - The basis of the building / floor: there is no special requirement.

[59] ATMS Solutions LLC. 2019. *Baghramyan Hazardous Waste Storage Facility Environmental Impact Assessment*. Yerevan: Electric Networks of Armenia

  - Building walls: there is no special requirement.
  - Storage: stored in containers.
- Lead Batteries
  - Type of building: closed structure with natural and artificial, interconnected, and ventilated ventilation system.
  - The basis of the building / floor: concrete / reinforced concrete made of acid-resistant coating. For the removal of electrolyte drainage, the floor of the building will be equipped with an entire perimeter of the electrolyte collector, from which it will be filled in special capacity and will be neutralized.
  - Building walls: must be processed with acid-proof coating.
  - Storage: Used lead accumulators will be placed in closed containers (metal barrels or containers, wooden boxes, etc.), which will be placed on special supports (not less than 5 cm in length) to exclude electrolyte leakage. Can be stored on the racks.
  - Other terms: The building should have a special equipment and tools to rapidly localize and collect electrolyte leaks, such as PROFSORB sorbent.
- Oils
  - Type of building: closed structure with natural and artificial, interconnected, and ventilated ventilation system.
  - The basis of the building / floor: concrete / reinforced concrete, which is designed for oil-resistant coating. The building floor has an entire perimeter bund to collect emergency drainage. It will be equipped with a oil spout, from which they will be filled in metal containers and will be re-dispensed for oil storage tanks.
  - Building walls: must be processed with oil-resistant coating.
  - Storage: the oil will be stored in metal reservoirs / containers
  - Other terms: In the building should be fire extinguishers, special equipment and means for rapid localization and accumulation of oil leaks, such as PROFFOROR ECO sorbent.
- Oil equipment, containers, etc.
  - Type of building: closed structure with natural and artificial, interconnected, and ventilated ventilation system.
  - The basis of the building / floor: concrete / reinforced concrete, which is designed for oil-resistant coating. The building floor has an entire perimeter bund to collect emergency drainage. It will be equipped with a oil spout, from which they will be filled in metal containers and will be re-dispensed for oil storage tanks.
  - Building walls: must be processed with oil-resistant coating.
  - Storage: waste will be stored in metal containers.
  - Other terms: In the building should be fire extinguishers, special equipment and tools for rapid localization and collection of oil emissions, such as PROFSORB ECO sorbent.
- Contaminated metal scrap
  - Type of building: closed structure with natural ventilation system. The basis of the building / floor. asphalt or concrete / reinforced concrete. Building walls. there is no special requirement.
  - Storage: there is no special requirement.
  - Other terms: stored in containers, can also be dumped.
- Transformers
  - Type of building: closed structure with natural and artificial, interconnected, and ventilated ventilation system.
  - The basis of the building / floor: concrete / reinforced concrete, which is designed for oil-resistant coating. The building floor has an entire perimeter bund to collect

emergency drainage. It will be equipped with a oil spout, from which they will be filled in metal containers and will be re-dispensed for oil storage tanks.
    - Building walls: must be processed with oil-resistant coating.
    - Storage: waste will be stored on special stands.
    - Other terms. In the building should be fire extinguishers, special equipment and tools for rapid localization and collection of oil emissions, such as PROFSORB ECO sorbent.
- Asbestos-containing materials
    - Type of building: closed structure with natural ventilation system.
    - The basis of the building / floor: asphalt or concrete / reinforced concrete.
    - Building walls: there is no special requirement.
    - Storage: hold in sealed polyethylene bags or packaged polyethylene. Can also be stored in closed containers.

163. Licenses were provided by the MoE to operate the HWSF on November 8, 2019 and to transport hazardous waste to the facility on February 11, 2021.

6.6 Used Oil Testing and Regeneration and Transformer Refurbishment

164. Oil ages during the operating life of a transformer. Oil regeneration is a process whereby oil achieves a significant condition improvement, aimed at being as close to “as new” as possible, by removing the aging products. During maintenance of transformers, oil is routinely extracted from the transformers, tested in a laboratory, and regenerated. If the oils meet the required technical standards, they are reused in the same transformer or in different transformer. When possible, the processing is performed while a transformer is in service to achieve maximum effectiveness.

165. When the transformer needs to be refurbished, the oil is removed by a contractor at their place of business. It is typical for new oil to be added to top-up generators holding used oil as part of the regeneration process. Importantly, used oil is not added to new transformers or switch breakers.

166. Oil that is no longer suitable for reuse has in the past been sold to a hazardous waste recycling company called Am Eska[60] which is licensed by the GoA (based on decision N667-A) for processing, neutralization, storage, transportation, and installation of hazardous waste.[61, 62] Oil that is not sold for recycling would be sent to the HWSF, although no oil waste had been observed in storage during the Phase 1 environment, social, health, and safety performance review undertaken in May 2021.

167. ENA performs maintenance of transformers approximately every 6-7 years on average. The volumes of oils collected for regeneration are routinely reported and in 2019 contractors regenerated 20,000 kg while in 2020 they regenerated 35,000 kg of oil.[63]

6.7 Polychlorinated Biphenyls (PCBs)

168. On 22 October 2003 the GoA ratified the Stockholm Convention and proceeded to fulfil the country’s obligations/commitments under the convention. Armenia’s first National Implementation Plan (NIP) for the Stockholm Convention was endorsed by the GoA on 13 January 2005.

[60] Am Eska website: http://eska.am/
[61] Republic of Armenia Hazardous Waste Use Licenses, Ministry of Environment – http://www.mnp.am/shrjaka-mijavayr/vtangavor-taponneri-licenzianer
[62] At the time this IEE was written, ENA’s contract with Am Eska for processing oils was being renewed.
[63] As reported by Mr. Zhirayr Papazyan, Deputy of the Technical Director (Deputy CTO) in May 2021.

169. A preliminary PCB inventory was undertaken in 2002-2003 and concluded that in the energy sector there were approximately 17,000 tons of oils in power facilities of State Distribution Power Stations and HPPs (power transformers, rectifiers/converters, high voltage switches and breakers, compressors, etc.).[64] The inventory used visual inspections and field test kits for PCB identification and as such the results were determined unreliable.

170. In order to present a realistic inventory, the GoA requested financial support from the Global Environment Facility (GEF) and technical assistance from UNIDO to develop a more detailed inventory of PCBs. The project "Technical Assistance for Environmentally Sustainable Management of PCBs and other POPs Waste in the Republic of Armenia" was implemented in 2009 to develop the inventory. The GoA also requested assistance from NATO on"Inventory, Monitoring and Analysis of Obsolete Pesticides in Armenia for Environmentally Sound Disposal" (NATO Project ESP.EAP.SfPP 982812) which together with the assistance of the Brazilian Government established a POPs laboratory. This laboratory was used to provide analytical back-up of the PCB inventory exercise.[65]

171. The detailed PCB inventory included the following:

- Energy sector, including electricity production and distribution enterprises;
- Industrial sector, involving the companies, at the premises of which there are transformers of different capacity and volume, as well as capacitors and oil switches.

172. According to their inventory, the total number of transformers in Armenia at the time was 9,867 and the number of oil switches was 2,574.[66] Labels with identification numbers were attached to all the transformers, oil switches and other containers as part of their inventory. Refer to Table 18 for the inventory results.

Table 18. Scope of Oil Inventory

Companies	Transformers (pcs)	Oil switches (pcs)	Amounts of T-1500 type transformer oils (ton)
Energy generation and distribution (Power plants and High-Voltage Electric Network)	335	1,288	6,307
Electric Networks of Armenia CJSC	9,014	1,286	10,447
Other	518	0	0
Total	9,867	2,574	16,754

Source: Republic of Armenia, Updated National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (POPs). 2017.

173. During the inventory exercise, 442 oil samples were analyzed for PCBs with the following results: 299 samples were found to contain less than 50 ppm of PCBs; 133 samples had a PCB concentration 50-500 ppm; 6 samples had PCB concentration of 500-2,000 ppm; and in 4 samples the PCB concentration exceeded 2,000 ppm. After laboratory analysis, all sampled equipment were labeled to provide information on PCB content.

[64] United Nations Industrial Development Organization. 2008. *Technical assistance for environmentally sustainable management of PCBs and other POPs waste in the Republic of Armenia.* Project Document, Vienna: UNIDO.
[65] Republic of Armenia. 2017. *Updated National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (POPs)*. Yerevan: Republic of Armenia.
[66] United Nations Industrial Development Organization. 2012. Independent terminal evaluation, Technical assistance for environmentally sustainable management of PCBs and other POPs waste in the Republic of Armenia. Vienna: UNIDO.

Table 19. Analytical Results from Testing Transformers and Switch Gear

PCB contamination, ppm	<50	50-500	500-2,000	>2,000	Total
Number of equipment	299	133	6	4	442

Source: Republic of Armenia, Updated National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (POPs). 2017.

174. The results showed that 67% of samples were PCB negative. Among the PCB positive samples 133 samples (93%) were in the range of 50-500 ppm, while the remaining part was approximately evenly distributed between the range of 500-2000 ppm and > 2000 ppm.

175. Among the 313 transformer samples tested (of the 442 pieces of equipment tested overall), 179 turned out to be PCB negative <50 ppm; 126 were 50-500 ppm; and 4-6 samples were in the range of 500-2,000 ppm and >2000ppm (see

176. Table ***20***).

Table 20. Analytical Results of the Transformer Samples

PCB contamination	<50	50-500	500-2,000	>2,000	Total
Number of equipment	179	126	4	4	313
Equipment weight (kg)	636,650	227,311	5,380	6,685	876,026
Weight of oil (kg)	254,470	95,740	1,860	2,265	354,335
Total weight (kg)	891,120	323,051	7,240	8,950	1,230,361

Source: Republic of Armenia, Updated National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (POPs). 2017.

177. Based on the testing results, the number of transformers and the total weight of transformer oils in the electric sector was extrapolated for the entire energy sector as part of the GoA's 2017 updated NIP (see Table 21). According to their estimation, approximately 72% of transformers are free of PCBs, which represents 12,032 tons of transformer oils. Approximately 4,527 tons of transformer oil is contaminated with PCBs in the range of 50-500 ppm. Approximately 88 tons of transformer oil are contaminated with PCB between 500-2,000 ppm. Finally, approximately 107 tons of transformer oil is contaminated with PCBs above 2,000 ppm.

Table 21. Extrapolation of the Whole Energy Sector of RoA

PCB contamination	<50	50-500	500-2,000	>2,000	Total
Number of equipment	5,643	3,972	126	126	9,867
Equipment weight (kg)	30,103	10,748	254	316	41,421
Weight of oil (kg)	12,032	4,527	88	107	16,754
Total weight (kg)	42,135	15,275	342	423	58,175

Source: Republic of Armenia, Updated National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (POPs). 2017.

178. Capacity at the MoE to test oils for PCBs remains limited. Discussions with ENA suggest that the ministry was preparing to begin testing during Phase 1 of the Project. However, the recent conflict with Azerbaijan, the COVID-19 pandemic, and shortages of qualified staff has limited their ability to perform testing.

179. In 2018 and 2019, ENA sent 50 oil samples to Tbilisi, Georgia for testing. Results from those tests indicated that 20 samples were positive for PCBs above 50 ppm. The validity of their findings has been called into question by ENA however and the results can only be considered preliminary.[67] As a

[67] Mr. Zhirayr Papazyan, ENA Deputy of the Technical Director (Deputy CTO) reported on 5/14/21 that the firm used in Georgia was not properly licensed to perform the oil tests.

precautionary measure, ENA labeled the equipment tested in Georgia with Red and Green stickers (Green for PCBs below 50 ppm; Red for PCBs above 50 ppm) (see Figure 11). The 50 test samples ENA prepared are currently being stored at the HWSF and are clearly marked and recorded so that results can be verified later. ENA indicated that due to existing regulatory barriers around transporting potentially hazardous wastes out of the country, further testing outside Armenia is not possible at this time.

180. At the time this IEE was prepared, discussions between the MoE and ENA were continuing to determine when testing can begin for PCBs. Based on the information being provided to ENA, it is expected that testing will be able to commence at a lab operated by the MoE at some point during the life of Phase 2.

Figure 11. Labelling of Equipment with Potential PCBs

Figure 12. PCB Test Samples

6.8 Sulphur Hexafluoride (SF_6) Gas

181. Hexafluoride (SF_6) gas is used as an insulating and circuit breaking medium in approximately 17% of ENA's gas insulated equipment (GIE) (primarily switchgear), a vital component of the grid for isolating and protecting different sections. ENA's GIE is located in 35 kV (86 units) and 110 kV (55

units) substations. ENA estimates the total amount of gas being used in its switchgear to be approximately 1,550 kg.

182. Approximately 5 kg are purchased annually and stored at the substations where electric gas switchgear are being used. Storage and maintenance guidelines provided by the manufacturer and supplier of SF_6 gas are followed. SF_6 gas leak detectors are not used, however the volume of the gas in the substation switchgear is monitored regularly and any leaks would be identified.

183. ENA began transitioning to SF_6 GIE in 2011 and anticipates that future procurements of switchgear for 35 kV and 110 kV substations will be of this variety.

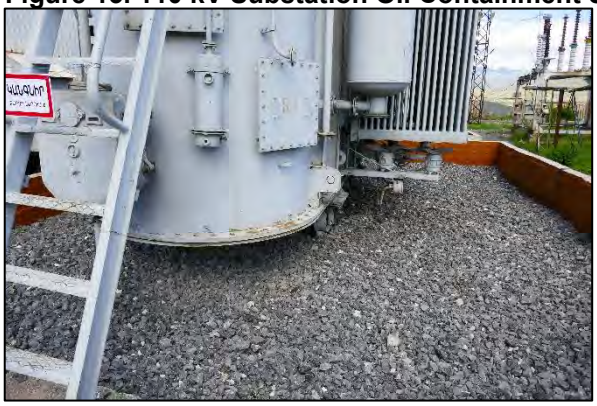
6.9 Oil Leak and Spill Management

184. With funding under Phase 1, ENA has invested in the construction of oil spill containment systems for transformers with an oil capacity greater than 500 liters at its 29 110 kV substations across the country. At the time this IEE was completed, 14 containment systems had been built with plans to construct the remaining 15 over the next two years.

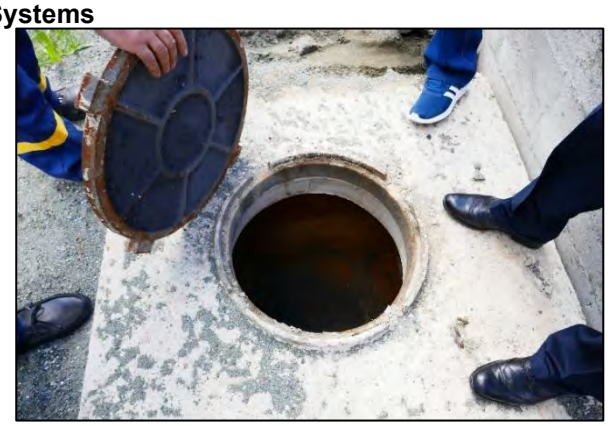
185. The oil containment systems being constructed at substations are designed to catch oil falling from the transformers. In the event of an oil leak, the oil passes through a course gravel floor and or through grates to the bottom where it is directed to several concrete reservoirs. These reservoirs allow for oil to pass from one reservoir to the next so that water and oil can be separated. The reservoirs can be accessed through manhole covers. Oil is ultimately collected in a well with sufficient capacity to handle all the oil within the transformers.

186. See Figure 13 for pictures of the oil containment systems at the Ararat Power Electric Power Substation – 1 and the Charentsvan Power Electric Power Substation – 2 visited during May 2021 site inspections. The four transformers examined were between 50-60 years old and contained between 25-38 tons of oil each.

Figure 13. 110 kV Substation Oil Containment Systems



Oil containment system for transformer



Access to oil spill reservoir

6.10 Solid Waste

187. Solid wastes generated at the maintenance yards are either reused by ENA (e.g., transformer parts) recycled where practical (e.g. transformer copper coils, aluminum cases) or collected for

disposal by licensed waste management companies. Used transformers that are not reused would be stored at the HWSF.

6.11 Asbestos-containing materials

188. Asbestos was used in the past as roofing material on its company buildings. ENA has been replacing roofs known to have asbestos in them, and since 2018 the following amounts of asbestos roofing waste have been removed: 4,494 m^2 in 2018; 1,275 m^2 in 2019; and 2,362 m^2 in 2020. ENA estimates that less than 20% of their buildings still have asbestos to be removed but could not provide an estimated quantity.

189. Asbestos is removed by third party contractors and collected for storage. A limited amount of asbestos waste was observed during the Environmental Consultant's site visit to the HWSF in May 2021.

6.12 Community Safety

190. A variety of community safety awareness programs have been planned by ENA during Phase 1 of the Project. Plans include school awareness programs to introduce safety literature to students as use that as an entry point to their families. There are also plans to increase community risk awareness by distributing literature on safety to those living in close proximity to substations. Discussion have also taken place to develop television and newspaper announcements to increase community risk awareness.

6.13 Occupational Health and Safety

191. A review of ENA accident statistics since Phase 1 of the Project began in 2017 has been undertaken as part of this IEE to determine if accidents are occurring in the company and, to the extent possible, why.

192. Number of Injured and fatalities. Between 2017 and April 2021 there have been 25 reported incidents with 21 fatalities (84% of all incidents). Of the total number of incidents, eight involved ENA employees (32%) while the remained was made up of ENA contractors and community members. ENA reports that the vast majority of incidents not involving ENA employees was from its contractors, although the number could not be verified with the information available.

193. To make a comparison, the Joint Stock Company (JSC) Regional Electric Networks (REN) and the regional distribution companies in Uzbekistan have 24,500 employees and registered an average of 9.5 fatalities per year.[68] This equates to one fatality for every 2,579 staff. Armenia has about 6,800 employees and registered an average of 1.75 fatalities among its staff per year between 2017 and 2020, an average of approximately one fatality for every 3,886 employees. Whilst this number is still considered unacceptable, it does suggest that Armenia's fatality rate among its staff does not compare negatively from regional levels.

194. Investigations and Reporting Incidents. The Urban Development, Technical and Fire Safety Inspectorate is a body subordinate to the Government of the Republic of Armenia, which is responsible for ensuring compliance with the safety and legislative regulations. Among its duties, the Inspectorate performs investigations in the energy sector to determine the causes and circumstances

[68] Vista Environment. 2020. *Uzbekistan: Distribution Network Modernization.* Tashkent: Joint Stock Company Regional Electric Power Networks.

of accidents and violations of technical regulations and other legal acts that result in the damage to human life (health), property, and the environment. When incidents occur on ENA electrical network, the Inspectorate undertakes its investigations which can take many months to complete in some cases.[69]

195. ENA also undertakes its own investigations, however during Phase 1 of the Project that only included ENA employees. In cases where there were incidents to ENA contractors and community members, investigations were left to The Urban Development, Technical and Fire Safety Inspectorate. In July 2021, ENA will roll out new procedures for investigating, monitoring, and evaluating incidents for its staff, contractors, and the community in order to properly manage health and safety risks.

6.14 Environmental and Social Management System

196. Under Phase 1 of the Project, ENA developed and formalized an Environmental and Social Management System (ESMS) (aligned with ISO14001:2015 - Environmental management systems) that outlines company and regulation requirements and tracks compliance/implementation measures. As part of the development of the system the following documents were developed and implemented:

- Integrated Management System (IMS) Policy – Defines the fundamentals and principles of ENA's the integrated quality, environmental, OHS, information security, energy, and social management systems.
- Integrated Management System Risk Assessment and Management Procedure – Provides procedures for identifying operational, OHS, social, environmental, and information security risks as well as the control measures to manage identified risks.
- Human Resources Policy – Defines the principles of ENA's human resource management system.
- Contractors Management Procedure – Describes the mechanism to manage contractors according to the IMS and ensures a safe working environment is maintained. The procedures outline requirements for both contractors (e.g., health and training certificates, and OHS procedures) and ENA (e.g., establishing additional required safety and environmental precautions, inspecting tools and equipment, and monitoring) (refer to Section 11.4. Contractors Management Procedure Requirements).
- Stakeholders' Engagement Plan (SEP) – Provides a plan for informing stakeholders and the public about project activities that may impact them and to provide a recourse mechanism for stakeholders and the public to voice their concerns over environmental and social impacts. The SEP includes the grievance redress mechanism (GRM) (refer to Section 9. Public Consolation and Information Disclosure).
- Involuntary Resettlement Management Procedure – Describes the procedures necessary to assess and manage potential impacts as they relate to involuntary resettlement for ENA's investment projects.
- Work Instruction of Collecting and Storing of Used Oils – Defines the procedures for the collection and storage of used oils generated resulting from ENA operations. The instructions lay out the necessary steps for mitigating risks when handling used oils.
- Hazardous Materials Safe Management Procedures – Describes control measures for the safe management of hazardous materials and covers procurement, reception, storage, handling, and use of hazardous materials on site.
- IMS Performance Monitoring and Measurement Procedure – Describes a system for the establishment, documentation, and review of IMS performance monitoring as well as IMS management programs necessary to address significant risks.

[69] As reported by Mr. Zhirayr Papazyan, ENA Deputy of the Technical Director (Deputy CTO) reported on 5/3/21.

- Work Instruction of Collecting and Storing of Used Lamps – Defines the procedures for acquiring, handling, and storage of used lamps, including mercury-containing lamps
- Work Instruction of Collecting and Storing of Used Batteries – Defines the procedures for collecting and storing used batteries and includes directions on the proper PPE needed by personnel handling batteries and instructions on how to handle battery leaks.
- Identification and Evaluation of Compliance of Legal and Other Requirements Procedure – Describes the procedures for identifying, communicating, and monitoring legal and other requirements (e.g., of the Project Lenders safeguards policies) that need to be adhered to.
- On-Site IMS Inspection Procedure – Defines the procedures for conducting on-site inspections to monitor performance of staff and contractors according to the established IMS.
- Waste Management Procedure – Provides procedures that ensure waste generated by ENA are categorized and managed in a way that reduces risks and in accordance with related Armenia legislation.
- Waste Transportation Work Instruction – Provides instruction on how to manage transportation of waste generated by ENA operations, including hazardous waste.

7 Description of the Environment

7.1 Physical Resources

7.1.1 Biophysical Setting

197. Armenia is bordered to the north and east by Georgia and Azerbaijan and to the southeast and west by Iran and Turkey, respectively. Armenia is a mountainous, landlocked country in the geopolitical Transcaucasia region, characterized by the Southern Caucasus mountains.

198. Armenia is divided into 906 administrative territorial units: 10 regions (marzes) – Aragatsotn, Ararat, Armavir, Gegharkunik, Kotayk, Lori, Shirak, Syunik, Tavush, Vayots Dzor – and 502 communities consolidated into 52 community areas. The city of Yerevan, as the capital of the country, has a special administrative status. Regions are governed by marzpets (governors) appointed by the GoA. Yerevan is governed by a mayor appointed by the Council of Elders.

Figure 14. Regions of Armenia

Source: https://www.worldatlas.com/maps/armenia

7.1.2 Meteorology and Climate

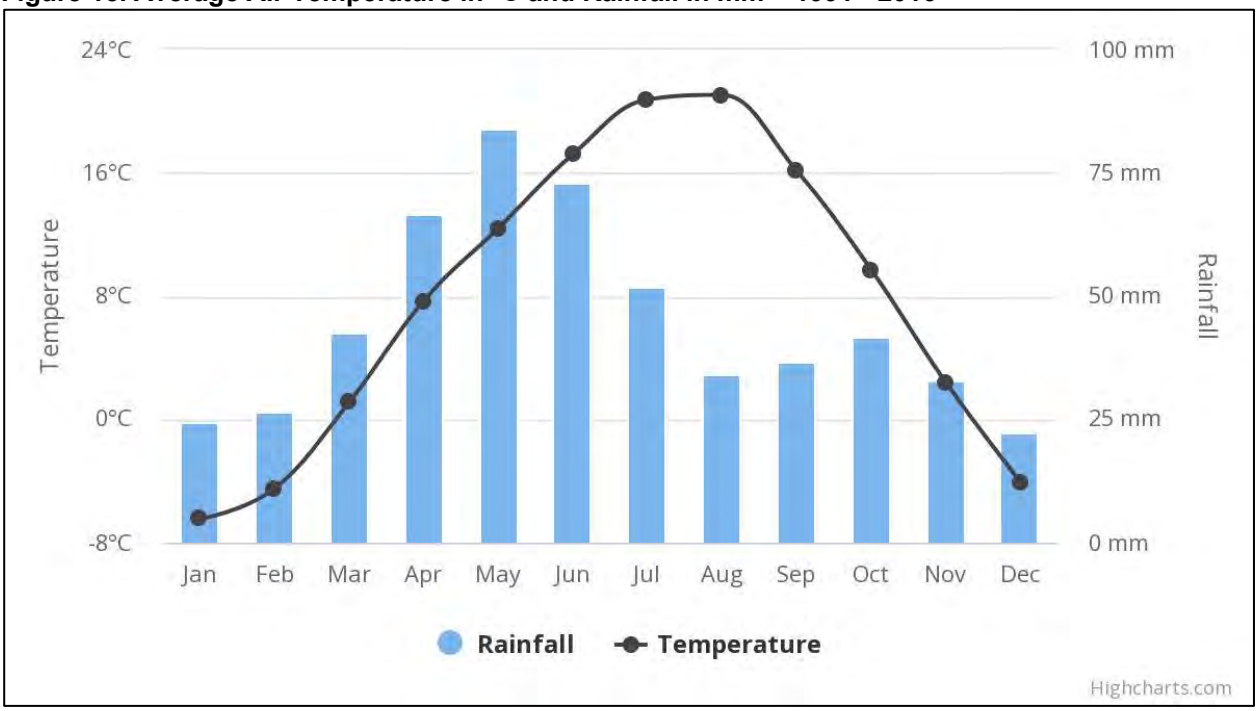
199. Armenia's climate is influenced by the Caucasus mountains and ranges from dry sub-tropical to cold alpine. The average annual temperature (1960-2015) is 7.6°C, varying from -8°C in the high mountains to 12 to 14°C in low valleys. The highlands of the Lesser Caucasus mountains are marked by distinct temperature contrasts between summer and winter months. Average annual precipitation is 524 mm, 40% of which occurs between April and June. Precipitation increases from east to west and primarily occurs in higher-elevation locations.[70]

Table 22. Average Air Temperature in ^{0}C and Rainfall in mm – 1991 - 2016

Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year Average
Average Air Temp.	-6.45	-4.46	1.14	7.71	12.42	17.21	20.76	21.06	16.15	9.73	2.41	-4.04	7.8
Average Rainfall	24.27	26.65	42.77	66.73	84.11	72.92	51.98	34.11	36.52	41.90	32.90	22.46	44.8

Source: The World Bank Group. 2021. Climate Change Knowledge Portal. Accessed April 29, 2021. https://climateknowledgeportal.worldbank.org/country/armenia/climate-data-historical.

Figure 15. Average Air Temperature in ^{0}C and Rainfall in mm – 1991 - 2016



Source: The World Bank Group. 2021. Climate Change Knowledge Portal. Accessed April 29, 2021. https://climateknowledgeportal.worldbank.org/country/armenia/climate-data-historical.

[70] USAID. 2017. *Climate Risk Profile: Armenia.* June. Accessed May 5, 2021. https://www.climatelinks.org/resources/climate-change-risk-profile-armenia.

7.1.3 Air Quality

200. Observations of atmospheric air pollution in Armenia are carried out through hybrid observation. It consists of 15 immobile, active sampling, and automatic observation stations where observations are performed daily, and from 214 portable, passive sampling points where weekly observations are made.[71] Atmospheric air quality monitoring is carried out in Abovyan, Alaverdi, Amberd, Ararat, Charentsavan, Gyumri, Hrazdan, Kajaran, Kapan, Martuni, Syunik, Tsaghkadzor, Vagharshapat, Vanadzor, and Yerevan

201. The transport sector is the leading source of outdoor air pollution in Armenia contributing 51.5% of the total, with emissions from energy production, mining and quarrying providing much of the remaining 48.5%.[72] Other sources include industrial emissions from chemical, tire and vehicle manufacturing, food processing, the microelectronics industry, and burning of waste.

202. Greenhouse gas emissions by sectors for from 1990 to 2014 is provided in the table below.

Table 23. Greenhouse Gas Emissions by Sectors from 1990– 2014, Greenhouse Gas Emissions (Gg CO_2-eq.)

Sector	1990	2000	2010	2012	2013	2014	2014 emission change (%) compared to		
							1990 levels	2000 levels	2012 levels
Energy	22,712.16	4,298.27	5,827.53	6,914.72	6,895.22	7,012.26	-69.13	63.14	1.41
Industrial Processes and Product Use	630.33	142.72	555.00	675.81	729.94	782.53	24.15	448.30	15.79
Agriculture	1989.21	1,326.67	1462.26	1,827.11	2,015.43	2044.73	2.79	54.12	11.91
Waste	438.99	532.94	582.61	598.55	603.49	611.19	39.23	14.68	2.11
Total Emissions	25,770.69	6,300.60	8,427.40	10,016.19	10,244.08	10,450.71	-59.45	65.87	4.34
Forestry and Other Land Use	-736	-454.33	-540.59	-512.68	-469.72	-477.14	-35.17	5.02	-6.93
Net Emissions	25,034.69	5,846.27	7,886.81	9,503.51	9,774.36	9,973.57	-60.16	70.60	4.95

Source: National Greenhouse Gas Inventory Report of the Republic of Armenia for 2014 Under the United Nations Framework Convention on Climate Change

7.1.4 Climate Change

203. Armenia has already begun to experience changes in climate and projections indicate more warming, dry periods, and heavy rain events are likely to occur. Between 1960 and 2015, the mean annual temperature rose (+0.1°C per decade), the snow line rose, snow accumulation and glacial volume declined, and average annual rainfall experienced no significant trends. By midcentury, mean annual temperature is projected to rise (+1.6°C to 2.2°C), monthly mean precipitation during summer

[71] Hydrometeorology and Monitoring Center SNCO. 2021. *Atmospheric Air.* May 24. Accessed May 24, 2021. http://www.armmonitoring.am/page/5.
[72] Gad Bigio, A., R. Von Culin, and A. Karapetyan. 2019. "Armenia's Transformative Urban Future: National Urban Assessment." (Asian Development Bank).

months is projected to decline (-7 to -10%), the number of consecutive dry days is projected to rise (+7 to +11%), and extreme rainfall days are projected to become more common (+22 to +32%). [73, 74]

204. Looking to the future, river flows are projected to decline with rising temperatures and declining precipitation, reducing freshwater supply.[75] Forests, which cover approximately 11% of the country based on national estimates, are at risk due to increased aridity, which reduces growth rates and regeneration, making trees more susceptible to pests, diseases, and forest fires.[76] More frequent and longer heatwaves pose health risks, especially to vulnerable populations.[77]

205. The energy sector is a key contributor to climate change, accounting for more than two-thirds of global greenhouse gas emissions. It is also directly impacted by climate change. Higher temperature values indicated by climate scenarios in Armenia will affect the amount of energy demand and reliability. With higher temperatures, people will seek forms of active cooling (e.g., air conditioning) which will affect energy use and supply. Warmer air also has a higher capacity to carry moisture in the form of water vapor, leading to a future climate with increased risks for extreme weather events. As a result, reliability of power production and distribution can be affected. Both power demand and production are also tied to water availability. This is most directly the case in hydropower systems, but the increased competition for water can lead to water and energy supply shortages and interruptions.

7.1.5 Geomorphology, Geology, and Soils

206. Armenia is a mountainous country with 77% of its territory between 1,000–2,500 meters above sea level, with an average altitude of 1,830 meters. A complex combination of depressions, plateaus, river valleys, uplands, and limited land, forests, and water is met with unfavorable geological engineering conditions in most areas (i.e., high seismicity and abundant geodynamic processes).[78] The considerable deviations in the altitude and surface characteristics, geomorphological conditions, and hydrothermal features have led not only to the development of a diverse climate and vegetation, but also to the formation of complex soils.

207. Fourteen major soil types, 27 semi types, and total of 228 soil groups have been identified according to the natural-soil zones in the territory of Armenia. “Nearly all zonal soil types that are developed not only in the region of Lesser Caucasus and the Armenian Volcanic Plateau but also in the mountain system of the Greater Caucasus, are available in Armenia’s territory”.[79] The general characteristics of natural-soil zones of Armenia are provided in Table 24. **Natural-soil zones and soil types in Armenia**.

[73] Minstry of Nature Protection of the Republic of Armenia. 2015. "Armenia's Third National Communication on Climate Change." Report, Yerevan.
[74] USAID. 2017. *Climate Risk Profile: Armenia.* June. Accessed May 5, 2021. https://www.climatelinks.org/resources/climate-change-risk-profile-armenia.
[75] Westphal, M. et al. 2011. Regional Climate Change Impacts Study for the South Caucasus Region.
[76] UNDP. 2013. Climate Risk Management in Armenia.
[77] UNDP/Stockholm Environmental Institute. 2013. The Socio-Economic Impact of Climate Change in Armenia.
[78] *Modernizing Weather, Climate and Hydrological Services: A Road Map for Armenia (English).* Washington, D.C.: World Bank Group.
[79] Proceeding the Economic Dimension of Land Degradation, Desertification and Increasing the Resilience of Affected Areas in the Region of Central and Eastern Europe (EDLDIR-2013). Mendel university in Brno press, Czech Republic 2013, ISBN 978-80-7375-715-1.

Table 24. Natural-soil zones and soil types in Armenia

Natural-soil zone	Soil types	Soil group	Territory		*Altitude (meters above sea level)*
			Thousand ha	**%**	
Semidesert	Semidesert brown	Calcisols	152	5.8	850 – 1,250
	Irrigated meadowbrown	Antrosols	53	2	
	Paleohydromorphic	Solonetz-Solonchaks	2	0.1	
	Saline-alkaline hydromorphic	Solonetz-Solonchaks	29	1.1	
Dry-prairie	Mountainous chestnut	Kastanozems	242	9.2	1,250 – 1,900
Prairie	Mountainous blacksoils	Chernozems	718	27.4	1,300 – 2,450
	Meadow blacksoils	Chernozems	13	0.5	
	Flood-plain – terraced	Antrosols	48	1.8	
	Groundsoils of Lake Sevan	Regosols and rock outcrops	18	0.7	
Forest	Mountainous-brown forest	Cambisols	133	5.2	500 – 2,400
	Mountainous sod – carbonate forest		15	0.6	
	Mountainous cinnamonic forest		564	21.6	
Mountainous - meadow	Mountainous - meadow	Leptosols	346	13.2	2,200 – 4,095
	Mountainous - meadow prairie	Phaeozems	283	10.8	
Total area			2,616	100	

Note: Does not include the 358,000 hectares of Armenia's land make the ledge rocks, sands, objects of infrastructure, and residential zones.
Source: Proceeding the Economic Dimension of Land Degradation, Desertification and Increasing the Resilience of Affected Areas in the Region of Central and Eastern Europe (EDLDIR-2013).

"The Caucuses mountains and the Armenian highlands represent the eastern part of the tectonically young, epigeosynclinal orogenic Alpine zone, lying between the Scythian platform (hercynian) and the Arabian platform (pre-cambrian)."[80] The Arabian plate moves northward at the rate of 17 mm/year and collides with the Eurasian plate.[81] Consequently, Armenia lies in one of the most seismically active regions of the world.

7.1.6 Hydrology

208. "The internal renewable surface water resources are estimated at 3.948 cubic kilometers (km^3)/year and the internal renewable groundwater resources at 4.311 km^3/year. The overlap between surface water and groundwater is estimated at 1.400 km^3/year. This gives a total of 6.859 km^3 of annual internal renewable water resources."[82]

[80] Embleton, Clifford. 2016. *Geomorphology of Europe*. London: Macmillan International Higher Education.
[81] 20th EGU General Assembly, EGU2018, Proceedings from the conference held 4-13 April, 2018 in Vienna, Austria, p.417
[82] FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO).

209. Despite the availability of water, resources are stressed, particularly in the densely populated Hrazdan River basin in the central part of the country.[83] There is also significant seasonal and annual variability in river runoff, including frequent droughts and risk of flooding in the spring, when about 55-70% of total annual runoff occurs during the peak snow melting period.[84]

210. The rivers in Armenia are largely tributaries of the Araks and the Kura – two of the dominant rivers in the southern Caucasus. About 76% of the total territory is part of the Araks basin and 24% of the Kura basin.[85] Approximately 9,500 rivers and streams, with a total length of 23,000 km, flow in Armenia.[86] The Akhuryan, Debet, Vorotan, Hrazdan, Aghstev, Arpa, and Metsamor-Kasakh rivers are each longer than 100 km.[87]

211. Armenia has more than 100 small lakes, some of which regularly dry out in the dry season. The Sevan and Arpi lakes are the most important in terms of size and economic value. Lake Sevan, which is in the center of the country and lies at 1,900 m above sea level, is the largest freshwater lake of the Caucasus, Asia Minor, and Middle Asia regions. Lake Sevan's location makes it a strategic source of energy (hydropower) and irrigation water that serves the densely populated Hrazdan river basin and the agricultural heartland of the Ararat Valley.[88] Lake Arpi is located to the north of the country at an altitude of 2,020 m above sea level, it is primarily used for irrigation and as an energy source. Other wetland types are present in Armenia in the form of sloping fens, bog meadows, river pools overgrown with vegetation, seasonal saline marshes, mires, and peatlands.

7.1.7 Natural Hazards

212. Armenia faces significant natural hazard risk from earthquakes, floods, and landslides, with additional risk from hail and drought. Over the last few decades, urbanization and changing climatic conditions have quadrupled economic losses in Armenia, putting the country's sustainable socioeconomic progress at risk. Such risks are already taking their toll on the country's hard-won development gains. From 1994–2014, Armenia lost well over $1.5 billion to natural hazards like floods, earthquakes, and drought.[89] Today more than 80% of Armenians are at risk of exposure to catastrophic events.[90]

213. Earthquakes. Historically, earthquakes of at least 5.5 magnitude have an average reoccurrence interval of 30 to 40 years.[91] These events have the potential to cause significant damage. "For example, an earthquake with a 0.4% annual probability of occurrence (a 250-year return period event) could cause nearly 10,000 fatalities and $6 billion in capital loss (about 60% of GDP)."[92] A seismic zonation map of Armenia is provided below:

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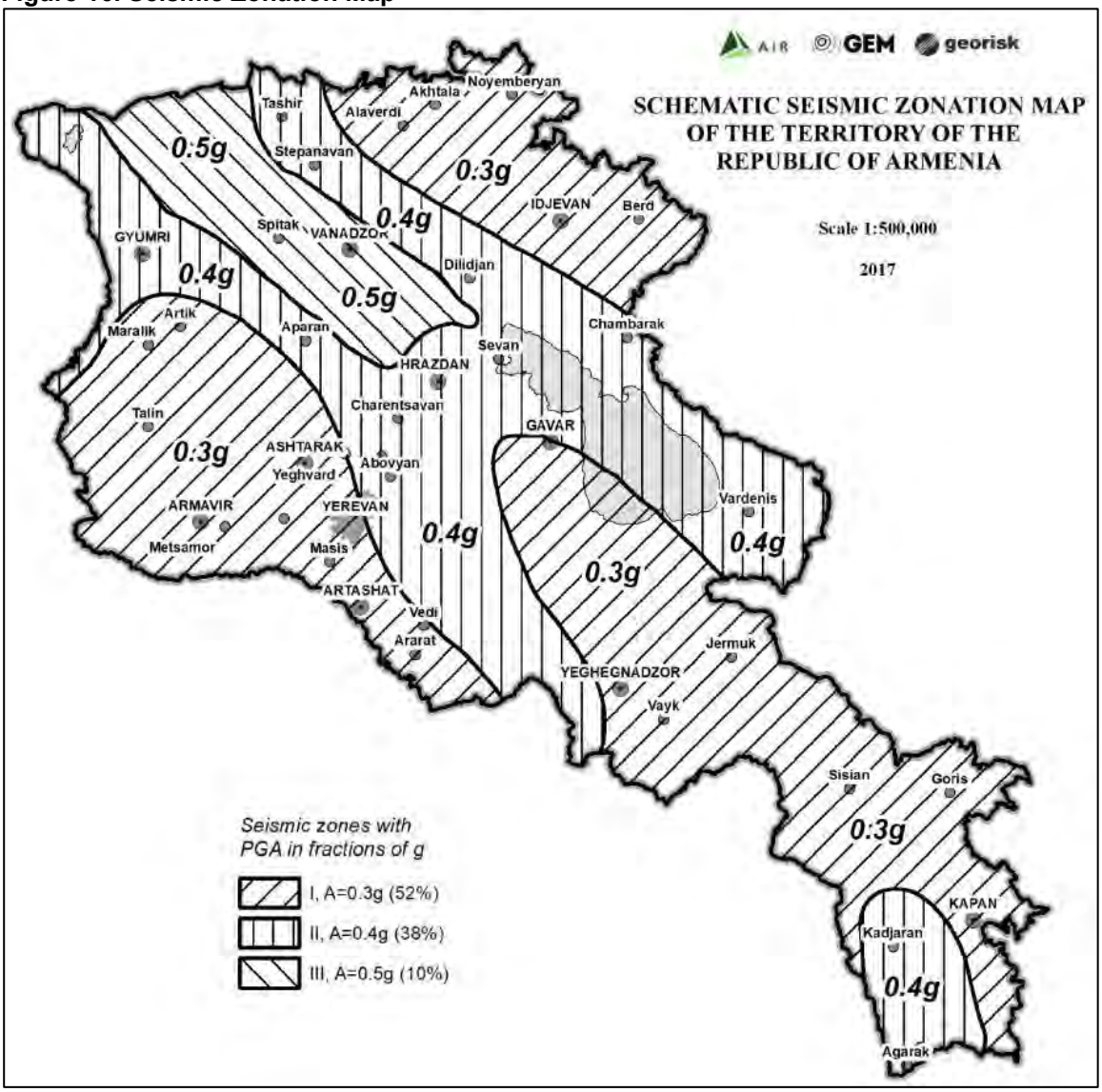
[83] Second National Communication on Climate Change, 2010. Report prepared for United Nations Framework Convention on Climate Change. Yerevan: Government of Armenia, Ministry of Nature Protection.
[84] Yu, Winston, Rita E. Cestti, and Ju Young Lee. 2015. *Toward Integrated Water Resources Management in Armenia.* Washington D.C.: World Bank Group.
[85] UNDP/GEF. 2006. Reducing transboundary degradation in Kura-Araks Basin
[86] Food and Agriculture Organization of the United Nations. 2016. *AQUASTAT Armenia.* Accessed May 22, 2020. http://www.fao.org/nr/water/aquastat/countries_regions/Profile_segments/ARM-WR_eng.stm.
[87] Ibid.
[88] Ibid.
[89] Disaster Risk Finance Country Note: Armenia (2017). Global Facility for Disaster Reduction and Recovery.
[90] 2019 Global Facility for Disaster Reduction and Recovery, https://www.gfdrr.org/en/armenia.
[91] World Bank. 2009. "Disaster Risk Reduction and Emergency Management in Armenia." October 2009.
[92] World Bank and Global Facility for Disaster Reduction and Recovery. Europe and Central Asia (ECA) Risk Profiles: Armenia. http://pubdocs.worldbank.org/en/473241483041826247/armenia.pdf.

Figure 16. Seismic Zonation Map



Source: Probabilistic Seismic Hazard Assessment for the Republic of Armenia, April 17, 2018

214. Water-related disasters. Armenia's exposure to flooding risk is significant despite not having abundant flowing surface water due to snow melting. "This can increase water volume in some river basins tenfold, and can also trigger seasonal flooding, particularly in the Araks, Hrazdan, and Aghstev river basins".[93] Regular seasonal flooding currently affects the northward-forested slopes of Armenia's mountain ranges. Other areas, such as the river basin of Meghri and Vedi and near Goris, experience flooding once every 2–3 years. Flash floods and mudslides occur in almost every region when snowmelt is accompanied by rainfall.[94] "Historically, April to June has been the most dangerous period

[93] World Bank. 2017. *Disaster Risk Finance Country Note: Armenia.* Washington, DC. http://documents.worldbank.org/curated/en/316831526641378244/pdf/Armenia-Disaster-Risk-Finance-Country-Note.pdf.

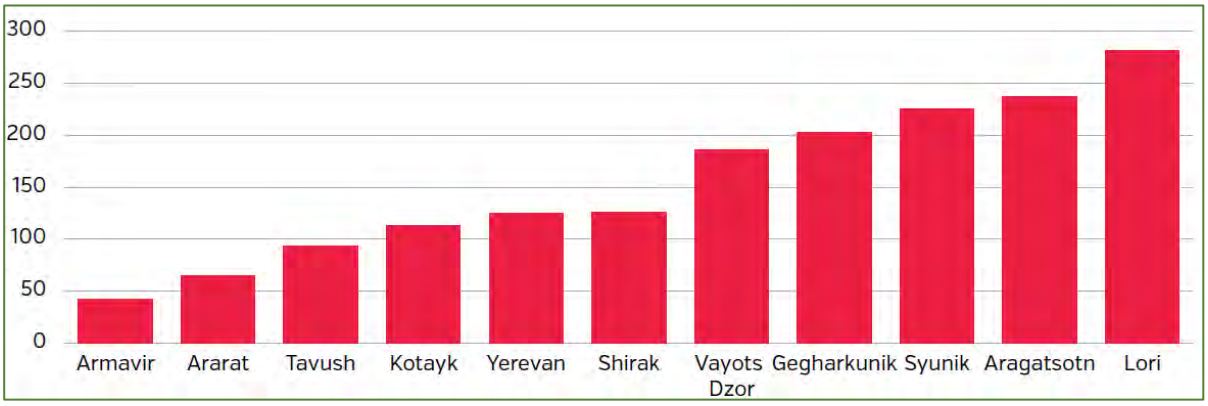
[94] World Bank. 2009. *Disaster Risk Reduction and Emergency Management in Armenia: Global Facility for Disaster Reduction and Recovery.* http://documents.worldbank.org/curated/en/987411468005434115/pdf/686590ESW0P1100Emergency0Management.pdf.

for floods. But flooding appears to have increased over the last several decades because of deforestation and urbanization."[95]

215. Landslides. Armenia is also prone to landslides that can be secondary effects of earthquakes or heavy precipitation. "The landslide hazard zone covers one-third of the country, primarily in foothill and mountain areas. Around 15% of the total population is exposed. Average annual damages from landslides amount are $10 million."[96]

216. Figure 17 shows the number of natural disasters recorded by region from 2010 through 2015. The numbers, which do not include earthquakes, suggest that Lori and Aragatsotn were the regions hit most frequently. In the capital city of Yerevan, natural disasters were recorded 125 times from 2010 to 2015.

Figure 17. Number of Recorded Natural Disasters by Region, 2010–2015 (excluding earthquakes)



Source: Disaster Risk Finance Country Note: Armenia (2017). Global Facility for Disaster Reduction and Recovery.

7.1.8 Waste

217. Since its independence, the Armenian government has taken incremental steps towards improving the laws governing waste management in the country. In 2004, it passed a Law on Waste to regulate waste collection, transportation, storage, processing, recycling, removal, and volume reduction. The MoE is the primary regulatory agency for solid waste management (SWM) and is mandated to develop policies, approve and monitor SWM sites and activities, perform waste inventories, record and control hazardous wastes, maintain a registry, and draft legal acts. The MTAI also plays a vital role as it is responsible for investment programs in the waste management sector.

218. Despite these legislative efforts, the legal framework for SWM is incomplete and Armenia still lacks a unified and coherent waste management strategy. The rights and obligations of waste producers, dump managers, haulers and agencies responsible for solid waste management are scattered throughout various laws and regulations. SWM is poorly organized with much of municipal waste being dumped into provisional landfills and dumpsites. Existing landfills are haphazardly created and lacking environmental assessments and technical oversight and guidance. Practically all types of waste are transported to and disposed at the same urban and rural landfills without any pre-treatment and/or sorting. Waste is frequently burned in open air, but at low temperatures, which results in

[95] H. Kootval et al. 2018. *Modernizing Weather, Climate and Hydrological Services: A Road Map for Armenia.* Washington, DC: World Bank.
[96] UNDP. Armenia. Disaster Risk Reduction. https://www.am.undp.org/content/armenia/en/home/projects/disaster-risk-reduction-.html

significant air pollution.[97] At present there are approximately 339 dumpsites which do not comply with existing sanitary norms.[98] While recycling efforts are primarily centered in Yerevan, where most for-profit recycling companies are based, there has been limited success in establishing centers in other areas of the country.

7.2 Biological Environment

7.2.1 Flora

219. Armenia's landscape can be divided into six distinct ecosystem zones: forests; deserts and semi-deserts; steppes and meadow-steppes; sub-alpine and alpine meadows; and wetlands, rivers, and lakes. Due to favorable botanical and geographical distribution and diversity of floristic provinces and sub provinces, as well as natural and historic conditions, the vegetation in Armenia has become extremely rich and diverse. Armenia harbors between 3,500[99] and 3,800 species of vascular plants. [100] This makes up around half of the entire Caucasian flora.[101] See Figure 18 for a map of ecosystems in Armenia.

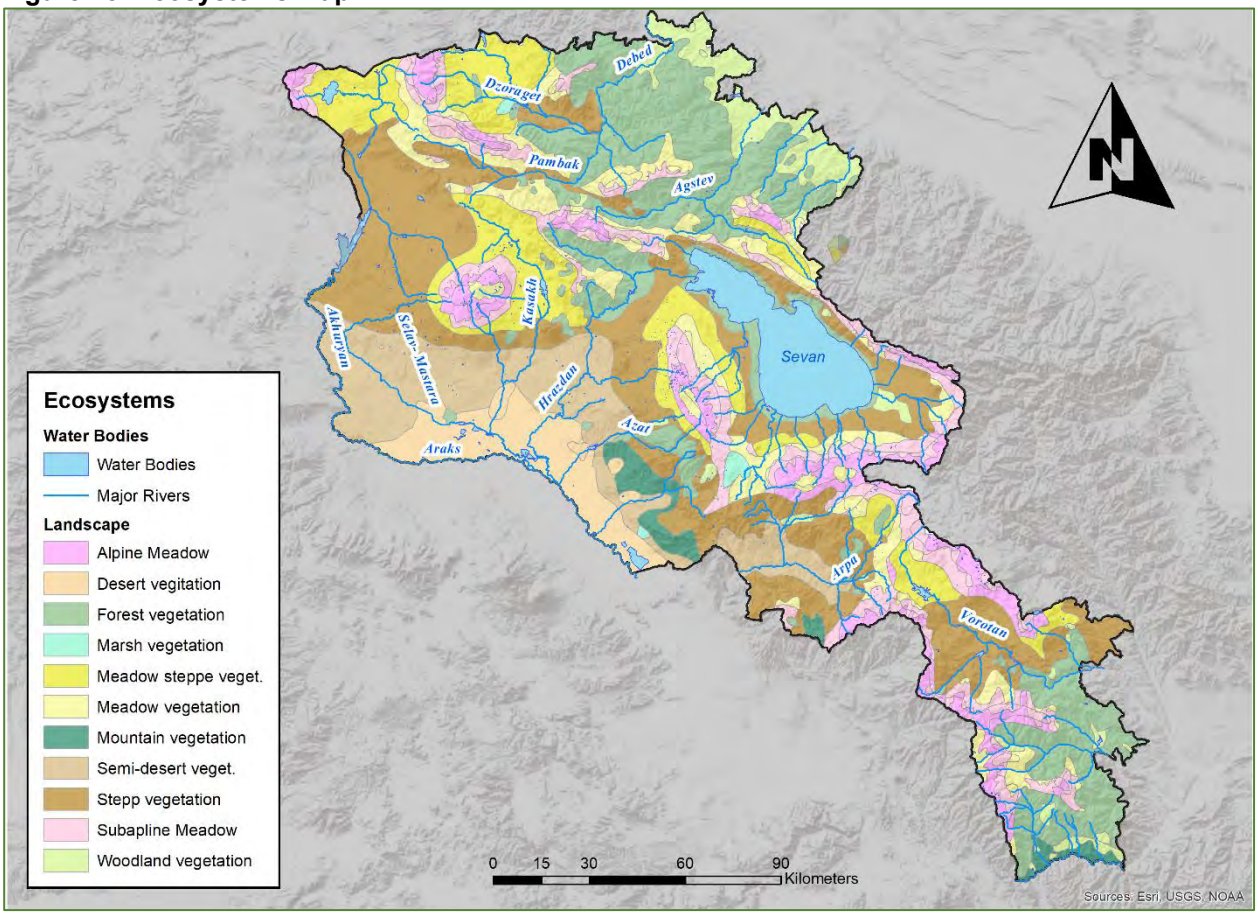
220. Armenia has experienced significant tree cover loss over the last 30 years, beginning at its independence from the Soviet Union. According to the most recent national forest inventory (1993), estimated forest cover in Armenia is 11.2% (334,100 ha) of its territory, although there is no consensus on current forest cover.[102] More recent estimates suggest that 70% of Armenia's existing forests are degraded.[103] Various natural and anthropogenic impacts on the natural seed regeneration have led to reductions of valuable forest species such as oak and beech. Today, Armenia's limited forest resources make them particularly vulnerable to over-harvesting. The distribution of forests in Armenia is uneven and fragmented. The primary forested areas are in the north, northeast and south, while the central part of the country no significant concentrations of trees. Virtually all forest resources are located in Tavush and Lori regions (northeast) and Syunik region (south), with just 2% located in central Armenia.[104]

221. The March 2020 update of the International Union for the Conservation of Nature (IUCN) Red List identified 76 species of globally threatened plants.[105] With assistance from the IUCN, Armenia has

[97] Ministry of Nature Protection, personal communication, Yerevan, April 2004. (cited in *Environmental Pollution and Product Charges in Armenia: Assessment of Reform Progress and Directions for Further Improvement*, OECD 2004)
[98] Gad Bigio, A., R. Von Culin, and A. Karapetyan. 2019. "Armenia's Transformative Urban Future: National Urban Assessment." (Asian Development Bank).
[99] Gabrielian, Eleonora; Zohary, Danial (2004): Wild relatives of food crops native Armenia and Nakhichevan. In: Flora Mediterranea 14, S. 1–76.
[100] CBD (2015): On approval of the Strategy and National Action Plan of the Republic of Armenia on Conservation, Protection, Reproduction and Use of Biological Diversity. Excerpt from the protocol of the session of the Government of the Republic of Armenia. CBD.
[101] Ibid.
[102] Other sources, including a 2007 study by the Organization for Security and Cooperation in Europe (OSCE), report that forest cover is below 10%.
[103] 2005. *RA Governmental Decision N1232Ա, National Forest Program of the Republic of Armenia.* Yerevan: Republic of Armenia.
[104] Mkrtchyan, Anahit, and Erik Grigoryan. 2014. Forest Dependency in Rural Armenia. Yerevan: European Union.
[105] International Union for the Conservation of Nature. 2020. "Table 8a: Total endemic and threatened endemic species in each country (totals by taxonomic group)." *IUCN Red List.* March 19. Accessed May 22, 2020. https://www.iucnredlist.org/resources/summary-statistics.

published their own Red Book of Plants and Animals, most recently in 2011, providing a national compendium of threatened species in Armenia; it assesses 452 species of plants.[106]

Figure 18. Ecosystems Map



Source: The Cadmus Group LLC and ICF. 2020. Armenia Foreign Assistance Act 119 Biodiversity Analysis. Washington: USAID.

7.2.2 Fauna

222. Armenia is located at the intersection of three biogeographical provinces, with active geological processes and a variety of climates that have created assorted ecosystems and abundant biodiversity. According to the World Wildlife Fund (WWF), the Caucasus region is among the planet's 25 most diverse and endangered hotspots, rich in species endemism.[107]

223. As of 2015, 17,703 species of animals have been recorded.[108] Of the over 17,700 species of animals, there are 17,154 invertebrates, 39 fish, 7 amphibians, 53 reptiles, 347 birds, and 93

[106] Ministry of Environment of the Republic of Armenia. 2021. "Red Book." *Ministry of Environment.* April 30. Accessed May 2, 2021. http://www.mnp.am/shrjaka-mijavayr/karmir-girq.
[107] Critical Ecosystem Partnership Fund. 2003. *Caucus Biodiversity Hotspot*. Critical Ecosystem Partnership Fund.
[108] Republic of Armenia. 2015. *Strategy of the Republic of Armenia on Conservation, Protection, Reproduction and Use of Biological Diversity*. Yerevan, Armenia: Republic of Armenia. https://www.cbd.int/doc/world/am/am-nbsap-v2-en.pdf.

mammals, two of which are endemic.[109, 110] The IUCN's March 2020 update of the Red List identified 43 species of globally threatened animals.[111]

224. Endangered species of note include the Armenian mouflon (Ovis orientalis, Endangered [EN]), an endemic species of wild sheep, the endemic Armenian birch mouse (Sicista armenica, EN), the Eurasian otter (Lutra, Near Threatened [NT]), the marbled polecat (Vormela peregusna, Vulnerable [VU]), and the Caucasian leopard (Panthera pardus saxicolor, EN).[112] The Caucasian leopard's range was once widespread throughout the Caucasus but is now restricted. Surveys conducted in 2013 and 2014 recorded 24 sightings of the leopards, 14 of these records were in the Zangezur mountains in Southern Armenia, which provide an important transboundary breeding range for the leopard in the Lesser Caucasus mountains.[113]

225. Among birds, endangered species include the following:

- White-headed duck (Oxyura leucocephala, EN)
- Lesser white-fronted goose (Anser erythropus, EN)
- Egyptian vulture (Neophron percnopterus, EN)
- Greater spotted eagle (Clanga clanga, EN)
- Lanner falcon (Falco biarmicus, EN)
- Red-tailed wheatear (Oenanthe chrysopygia, EN)
- Falco cherrug (Saker falcon, EN)
- Steppe eagle (Aquila nipalensis, EN)

226. Many of Armenia's reptilian species found in the highlands and mountains are also endangered, including the northern banded newt (Ommatotriton ophryticus, NT), steppe-runner (Eremias arguta, NT), and Darevsky's viper (Vipera darevskii, Critically Endangered [CR]).[114]

7.2.3 Protected Areas

227. Armenia's law on specially protected nature areas (SPNAs) defines protected areas as "natural objects of ground and surface waters, the entrails, land flora and fauna and appropriate air space, set apart under the statutory order under the law, which represent an environmental, scientific, health care, cultural, tourism, aesthetic values, which are fully or partially, temporarily or permanently exempted from economic exploitation and civil circulation and for which a special conservation regime is set forth".[115] SPNAs are divided into four groups: national parks, state reserves, state wildlife sanctuaries, and natural monuments. Refer to Figure 19 for a map of protected areas.

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[109] Ibid.
[110] International Union for the Conservation of Nature. 2020. "*Table 8a: Total endemic and threatened endemic species in each country (totals by taxonomic group).*" *IUCN Red List.* March 19. Accessed May 22, 2020. https://www.iucnredlist.org/resources/summary-statistics.
[111] Ibid.
[112] Biodiversity and Landscape Conservation Union. 2014. *Fifth National Report of the Republic of Armenia to the Convention of Biological Diversity*.
[113] Farhadin, Mohammad S., Mohsen Ahmadi, Elmira Sharbafi, Sadegh Khosravi, Hossein Alinezhad, and David W. Macdonald. 2015. "*Leveraging trans-boundary conservation partnerships: Persistence of Persian leopard (Panthera pardus saxicolor) in the Iranian Caucasus.*" Biological Conservation 191: 770 - 778. https://doi.org/10.1016/j.biocon.2015.08.027.
[114] Ministry of Nature Protection of the Republic of Armenia. 2010. *Second National Communication on Climate Change.* Yerevan, Armenia: Lusabats Publishing House.
[115] Food and Agriculture Organization of the United Nations. 2016. *AQUASTAT Armenia.* Accessed May 22, 2020. http://www.fao.org/nr/water/aquastat/countries_regions/Profile_segments/ARM-WR_eng.stm.

228. Armenian biodiversity conservation is mainly implemented through the designation of these SPNAs, where it believed that 60-70% of the species composition (flora and fauna), including the majority of rare, endangered, and endemic species, is concentrated.[116] As of 2014, the total territory covered by SPNAs in Armenia was 387,054 ha, or approximately 13.1% of the country.[117]

229. National Parks. Armenia's four national parks include Arevik, Dilijan, Lake Arpi, and Sevan. Together the parks cover an area of 236,802 ha, which is 7.9% of Armenia's territory.[118] State reserves are set aside as scientific research entities with strict conservation regimes.[119] Per the 1994 IUCN international classification, state reserves of Armenia fall under the 1a designation.

230. State Reserves. Armenia has three state reserves - Khosrov, Shikahogh, and Erebuni - covering approximately 35,500 ha or 1.2% of the country.[120] Per the 1994 IUCN international classification, state reserves of Armenia fall under the 1a designation.

231. Sanctuaries and Natural Monuments. Armenia's sanctuaries are designated to conserve specific species and their habitats and correspond to the 4th IUCN management category. Armenia has 27 designated sanctuaries, occupying approximately 114,800 ha or 3.9% of the country's territory. In addition. Armenia has designed 232 designated natural monuments (Biodiversity and Landscape Conservation Union 2014).

232. Armenia also features 18 Important Bird Areas (IBAs)[121], 23 proposed Emerald Networks of Areas of Special Conservation Interest ("Emerald Network Sites")[122], 12 Prime Butterfly Areas[123], 3 Ramsar Wetlands of International Importance,[124] 28 IUCN Key Biodiversity Areas (including all the IBAs),[125] and 32 Important Plant Areas (IPAs)[126].

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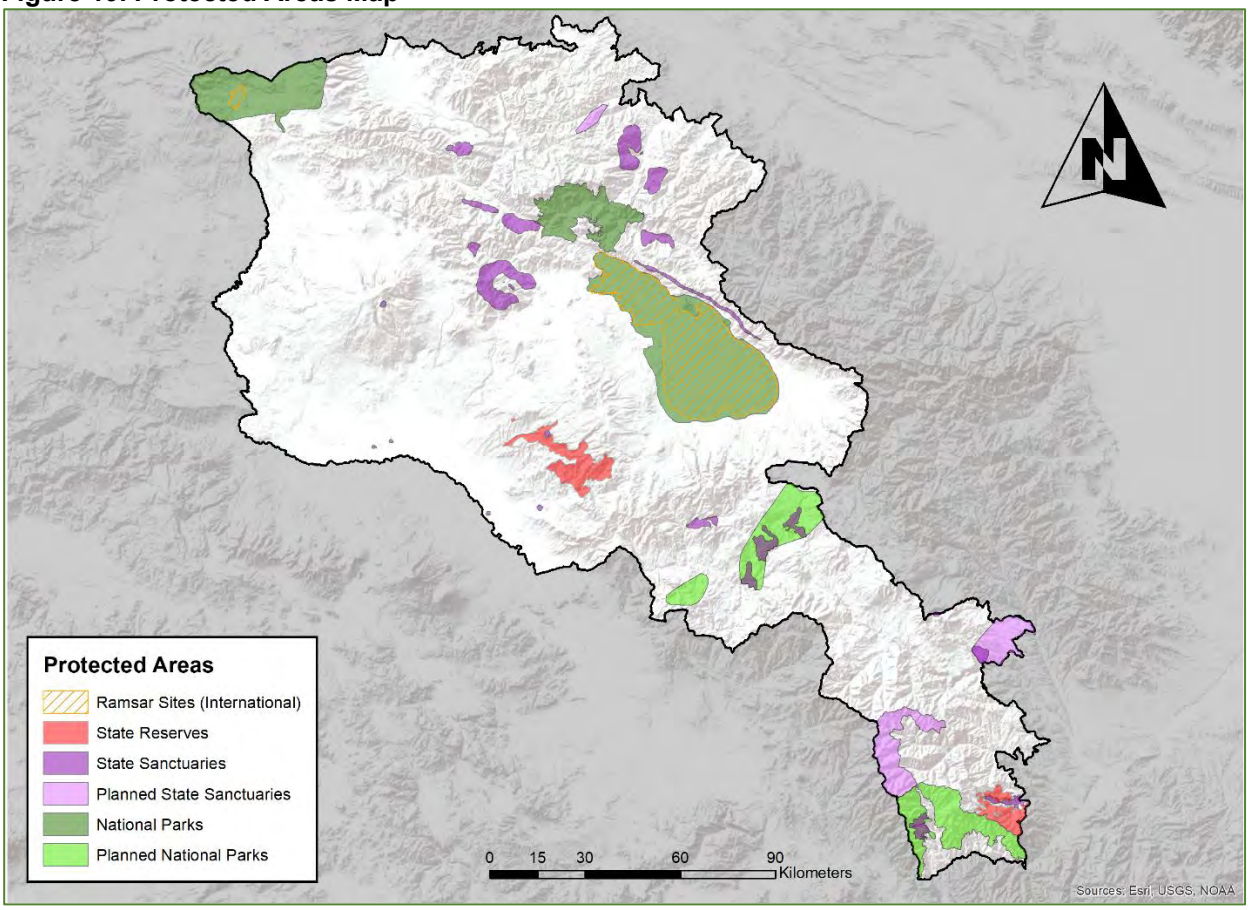
[116] The Cadmus Group LLC and ICF. 2020. *Armenia Foreign Assistance Act 119 Biodiversity Analysis*. Washington: USAID.
[117] Biodiversity and Landscape Conservation Union. 2014. *Fifth National Report of the Republic of Armenia to the Convention of Biological Diversity.* Yerevan, Armenia: Republic of Armenia Ministry of Nature Protection.
[118] Ibid.
[119] Khanjyan, Nazik. 2004. *Specially Protected Nature Areas of Armenia.* Yerevan: Ministry of Nature Protection of the Republic of Armenia .
[120] Biodiversity and Landscape Conservation Union. 2014. *Fifth National Report of the Republic of Armenia to the Convention of Biological Diversity.* Yerevan, Armenia: Republic of Armenia Ministry of Nature Protection.
[121] BirdLife International. 2021. IBAs of Armenia. Accessed May 18, 2021. http://datazone.birdlife.org/site/results?thrlev1=&thrlev2=&kw=&reg=0&cty=11&snm=&fam=0&gen=0&spc=&cmn=.
[122] Rayvush, George, Alla Aleksanyan, Karen Aghababyan, Ashot Aslanyan, Marine Oganesyan, Samvel Nahapetyan, Marine Arakelyan, Astghik Ghazaryan, and Mark Kalashian. 2016. *The "Emerald" Network in the Republic of Armenia.* Yerevan: Ministry of Nature Protection of the Republic of Armenia.
[123] Aghababyan, K., and Khanamirian. 2020. "Butterfly Conservation Armenia."
[124] RAMSAR. 2011. "Annotated List of Wetlands of International Importance: Armenia." Armenia | RAMSAR. Accessed May 20, 2020. https://rsis.ramsar.org/sites/default/files/rsiswp_search/exports/Ramsar-Sites-annotated-summary-Armenia.pdf?1589973917.
[125] BirdLife International. 2015. *Important Bird Areas: Armenia.* Accessed May 20, 2020. http://datazone.birdlife.org/country/armenia/ibas.
[126] PlantLife. 2019. *Armenia.* http://www.plantlifeipa.org/criteria.

Figure 19. Protected Areas Map



Source: The Cadmus Group LLC and ICF. 2020. Armenia Foreign Assistance Act 119 Biodiversity Analysis. Washington: USAID.

7.3 Social-Economic Information

7.3.1 General Profile

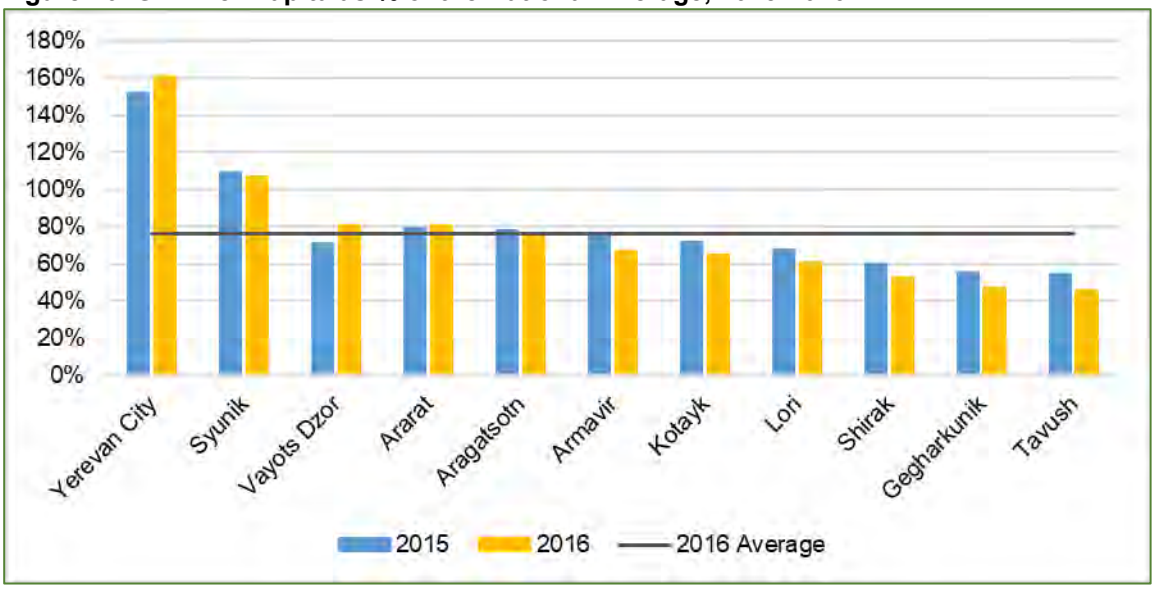
233. Armenia has a population of approximately 3 million people, 98% of whom are ethnically Armenian.[127] During recent years, the country's demographic and urban profile has been characterized by an ageing population; a regular decline of the number of inhabitants due to external migration; and internal migration of rural population to the bigger cities, which fosters depopulation of villages and smaller towns. Due primarily to low birthrates and emigration, the total population has declined by 500,000 people since 1990 and is projected to fall to 2.7 million by 2050.[128] Most of the population resides in the central and northern areas of the country and Yerevan, the capital, is the most populated city (4,832 persons per km^2 compared to Armenia average of 100 persons per km^2).[129]

234. Pronounced and continued disparities and inequalities exist among Armenia's regions in demographic, economic, and social terms that worsened as the country moved from a centrally

[127] Central Intelligence Agency. 2021. *The World Factbook: Armenia.* February 1. Accessed May 22, 2021. https://www.cia.gov/the-world-factbook/countries/armenia/.
[128] Gad Bigio, A., R. Von Culin, and A. Karapetyan. 2019. "Armenia's Transformative Urban Future: National Urban Assessment." (Asian Development Bank).
[129] Statistical Committee of the Republic of Armenia, 2018.

planned economy to a market economy after independence from the Soviet Union. In 2016, the distortion between per capita GDP in Yerevan compared to other regions ranges between 33% (in Syunik) and 3.5 times (in Tavush).[130]

Figure 20. GDP Per Capita as % of the National Average, 2015-2016



Source: Gad Bigio, A., R. Von Culin, and A. Karapetyan. 2019. "Armenia's Transformative Urban Future: National Urban Assessment." (Asian Development Bank).

235. Based on 2017 data from the Statistical Committee of Armenia, Agriculture still provides more than 30% of the total employment in Armenia, though its share has declined by 8% since 2011. Real estate activities contributed an 8% share of gross value added (although only employed 3,200 people, public administration and human health and social work activities contributed a combined 9% share of gross value added (employing nearly one-quarter of all workers).[131]

236. Pre COVID-19, Armenia had seen robust gross domestic product (GDP) growth in the past three years: 7.5% in 2017, 5.2% in 2018, and 7.6% in 2019. The COVID-19 pandemic and recent military hostilities have severely affected the Armenian economy. GDP dropped by 7.6% in 2020 reflecting the decline in services and trade. The fiscal deficit widened to around 5.5% of GDP in 2020. Annual inflation accelerated to 5.8% in March 2021 amid recent global food inflation and dram depreciation. While there is uncertainty about the pace of the recovery, the International Monetary Fund's conservative outlook expects growth of around 1% in 2021 and 3.5% in 2022. The 2021 growth projections are generally in line with the Central Bank of Armenia and Ministry of Finance's projections at around 1.5% in 2021.[132]

7.3.2 Historical and Cultural Heritage

237. Armenia hosts a rich cultural heritage which includes monuments, temples, and monasteries; music compositions; literary practices; dances; traditions; crafts; and food. Three cultural sites are

[130] Gad Bigio, A., R. Von Culin, and A. Karapetyan. 2019. "Armenia's Transformative Urban Future: National Urban Assessment." (Asian Development Bank).
[131] Ibid.
[132] International Monetary Fund. 2021. *IMF Staff Concludes Visit to Republic of Armenia.* April 2. Accessed April 28, 2021. https://www.imf.org/en/News/Articles/2021/04/21/pr21111-armenia-imf-staff-concludes-visit-to-republic-of-armenia.

included in the UNESCO World Heritage list (i) the Cathedral and Churches of Echmiatsin and the Archaeological Site of Zvartnots, (ii) the Monasteries of Haghpat and Sanahin, and (iii) the Monastery of Geghard and the Upper Azat Valley. There are another four sites on the tentative list which are being considered for nomination.[133] Only a few population centers are identified as historic centers, such as Gyumri, Goris, Yerevan, Meghri, Gavar, Dilijan, in addition to some other smaller towns and villages that have preserved historical parts and that are the subject of both protection and conversation.[134]

7.3.3 Minority Peoples

238. Armenia has historically been an ethnically homogeneous country, a trend reinforced since the onset of Armenia's conflict with Azerbaijan and the economic hardship following independence in 1991.

239. According to the 2011 Census, more than 98% of the total population of 3 million is ethnically Armenian. Minority groups in the republic include Yezidis (35,308 or 1.2% of the total population), Russians (11,911, 0.4%), Assyrians (2,769, 0.1%), Kurds (2,162, 0.1%), Ukrainians (1,176), and Greeks (900). Armenia's minorities are scattered across the country, and do not form local majorities in any region or administrative unit.[135]

240. Yezidis represent the largest minority group and generally lead nomadic lives, tending livestock and moving their animals through alpine pasture. A small number have settled in urban areas such as Yerevan.

241. "Prior to the conflict with Azerbaijan, Armenia's largest minority had been Azeris, accounting for some 186,000 people. This population was displaced to Azerbaijan virtually in its entirety as a result of the conflict. Similarly, Armenia received an influx of ethnic Armenian refugees from Azerbaijan."[136] As a result of the latest armed conflict with Azerbaijan in Nagorno Karabakh (27 September 2020 – 10 November 2020) a significant number of persons identifying mostly as ethnic Armenians were displaced on the territory of Armenia. An estimate by The International Organization for Migration indicated 90,640 spontaneous arrivals as of 9 December 2020.[137]

[133] United Nations Educational, Scientific and Cultural Organization. World Heritage List: Armenia. https://whc.unesco.org/en/statesparties/am.
[134] S. Petrosyan and G. Bădescu. 2016. Armenian Cultural Territorial Systems First Experience. In F. Rotondo, F. Selicato, V. Marin, and J. Lopez Galdeano, eds. *Cultural Territorial Systems: Landscape and Cultural Heritage as a Key to Sustainable and Local Development in Eastern Europe.* Springer International Publishing. pp. 191–214.
[135] UNHCR. 2008. *World Directory of Minorities and Indigenous Peoples - Armenia*: Yezidis & Kurds. Accessed June 9, 2021. https://www.refworld.org/docid/49749d60c.html.
[136] Minority Rights Group International. 2021. *Armenia*. Accessed June 9, 2021. https://minorityrights.org/country/armenia/.
[137] Source: The International Organization for Migration [11 December 2020]

8 Impact Assessment and Mitigation

8.1 Impact Assessment Methodology

8.1.1 Introduction

242. This IEE has been undertaken following a systematic process that (i) evaluates the potential impacts the Project could have on aspects of the physical, biological, social/ socio-economic, and cultural environment; (ii) identifies preliminary measures that the Project will take to avoid, minimize/reduce, mitigate, offset, or compensate for potential adverse impacts; and (iii) identifies measures to enhance potential positive impacts where practicable. This has been organized as per the various phases of the project lifecycle to provide a comprehensive assessment of the risks and impacts.

243. There are various techniques to identify and assess interactions of environmental project-factors; however, all environmental impact assessments should describe the action generating the impact, predict the nature and magnitude of environmental effects, interpret the results, and prevent negative effects on the environment. The impact assessment methodology used here provides a basis to characterize the potential impacts of the Project. It is based on models commonly employed in impact assessment and takes into account international best practices.

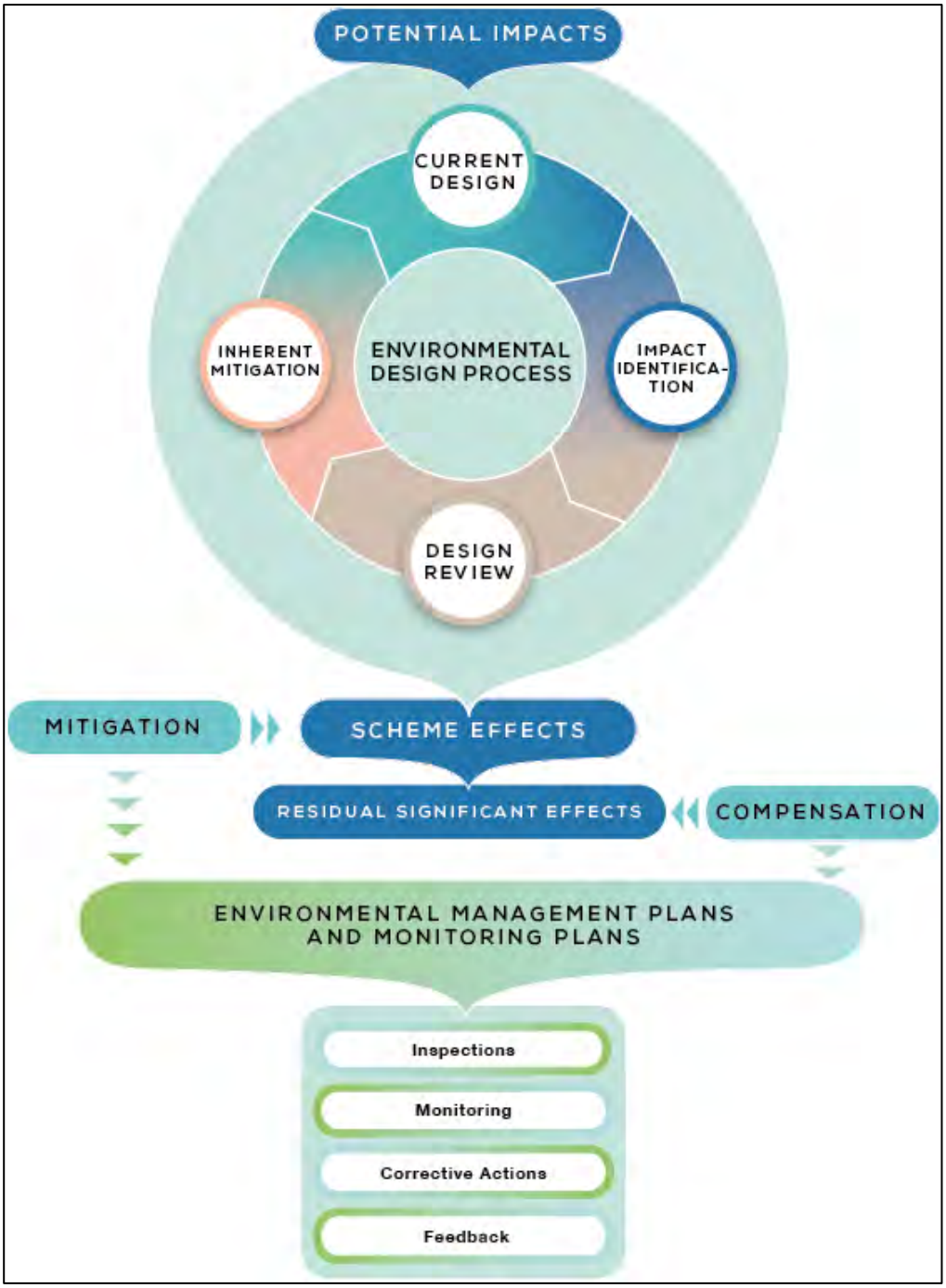
244. It should be noted that this is a rolling three-year Project and the exact locations of the first year's activities were still not identified at the time this IEE was prepared. That being said, the scope and scale of Project interventions is generally well understood since Phase 2 will largely continue the same investment program completed under Phase 1. Since the EMP in this IEE is considered a 'live document', any needed changes to manage potential Project related impacts can be addressed as additional information becomes available.

245. Impact identification and assessment starts with screening and categorization to determine if the project falls within ADB requirement for impact assessment (IA) and to determine the category of IA required. Once screened and categorized, the Environment Consultant proceeded with the following principal impact assessment steps:

- Impact scoping (i.e., prediction / identification): to determine what could potentially happen to resources/receptors because of the Project and its associated activities.
- Impact evaluation: to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor.
- Mitigation and enhancement: to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.
- Residual impact evaluation: to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

246. The IA is an iterative process with interaction between project designers/proponents and the impact assessor. This iterative design process is presented Figure 21 below. Through this iterative process, the project is continually improved in terms of its environmental acceptability.

Figure 21. Environmental Design Approach to IA



Source: IEE Good Practice Note - Impact Assessment Process for IEE. Central and West Asia Department (CWRD), ADB, June 2019.

8.1.2 Impact Scoping and Identification

247. The prediction and identification of environmental impacts were based on the following:

(i) input from interested and affected parties;

(ii) desktop research of information relevant to the Project;
(iii) site visit and professional assessment by environment specialist; and
(iv) the environment specialist's previous experience.

248. For actions to be carried out in the execution of the Project, we consider the Pre-Construction / Construction Phase together as one and the Operation Phase separately. It should be noted that because the activities will be implemented on a rolling basis within the life of the Project, the operation phase for some investments may begin prior to the end of the Project. For example, the potential impacts to birds from electrocution and collision with electrical infrastructure could begin as soon new equipment and infrastructure is installed and not necessarily when the Project is concluded.

8.1.3 Impact Evaluation

249. Once the prediction of potential impacts is complete, each potential impact is described in terms of its various relevant characteristics (e.g., type, timing, scale, duration, frequency, extent, probability). The terminology and designations used to describe impact characteristics are shown in Table 25. While the impact evaluations provided in Section 8.2. Impacts and Mitigation Measures are comprehensive, assessment of impact tables for only the most significant impacts have been developed to provide more in-depth analysis.

Table 25. Impact Evaluation Terminology and Designations

Characteristic	Definition	Designations
Phase of the Project	The phases of the Project life cycle.	• Pre-Construction / Construction Phase • Operation (including maintenance) Phase
Nature	A descriptor indicating the positive, negative, and neutral perceptions of the Project.	• **Positive or beneficial impact** – When impact is considered to represent improvement to baseline condition or introduce a new desirable factor; • **Negative impact** - When impact is considered to represent adverse change from the baseline or introduce a new undesirable factor. • **Neutral impact** - When impact is considered to represent neither beneficial nor adverse changes from the baseline or introduce no desirable/ undesirable factor.
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect).	• **Direct** - Impacts that result from a direct interaction between the Project and a resource/receptor. • **Indirect** - Impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment. • **Induced** - Impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project. • **Cumulative** - Impacts that arise as a result of an impact and effect from the Project interacting with those from another activity to create an additional impact and effect. • **Accidental -** impacts that result from accidental (unplanned) events within the project (e.g., fuel spillage during refueling) or in the external environment affecting the project. In these cases, the probability of the event occurring is considered.
Duration	The time period over which a resource / receptor is affected	• **Temporary** - Impact duration can range from relatively short (less than four years) to long (beyond the life of the Project). • **Short term** - Impacts that are predicted to last only for a limited period (e.g., during construction) but will cease on completion of the activity, or as a result of mitigation/reinstatement measures and natural recovery.

		• **Long term** - Impacts that will continue over an extended period but cease when the project stops operating. These will include impacts that may be intermittent or repeated rather than continuous if they occur over an extended time period. • **Permanent** - Impacts that occur during the development of the project and cause a permanent change in the affected receptor or resource that endures substantially beyond the project lifetime
Extent	The "reach" of the impact (e.g., confined to a small area around the Project Footprint, projected for several kilometers, etc.).	• **Local** - When impact due to the proposed Project related activities is restricted within Area of Influence which has been determined as 5 km for social resources and 10 km for environmental and ecological resources. Furthermore, the area of influence is defined with respect to project activities for each component in the impact scale depending upon resource/ receptor and its interaction with the environmental, ecological, and social attributes. • **Regional** - Impacts extend beyond the area of influence to affect regionally important environmental resources or are experienced at a regional scale as determined by administrative Boundaries. • **International** – Includes impacts that extend or occur across a national boundary.
Scale	The size of the potential impact (e.g., the size of the area with the potential to be damaged or impacted, the fraction of a resource that could potentially be lost or affected, etc.).	• No fixed designations. This is intended to be a numerical value or a qualitative description of "intensity".
Frequency	Frequency of impact when intermittent	• Refers to the return period for impacts which will recur over and over again. The impacts as one off or varying frequency.
Probability	The likelihood or chance an impact will occur.	• **Definite** - Impact will occur with high likelihood of probability. • **Possible** - Impact may occur but could be influenced by either natural or project related factors. • **Unlikely** - Impact unlikely unless specific natural or Project related circumstances occur.

8.1.4 Determining Magnitude of Impact Effect

250. Once impacts were characterized, they were assigned a 'magnitude'. Magnitude essentially describes the intensity of the change that is predicted to occur in the resource/receptor as a result of the impact. Magnitude designations themselves are universally consistent, but the descriptions for these designations vary on a resource/receptor-by-resource/receptor basis.

251. Magnitude is typically a function of some combination (depending on the resource/receptor in question) of the following impact characteristics:

- Duration
- Extent

- Scale
- Frequency
- Probability

252. Magnitude (from small to large) is a continuum. Evaluation along the continuum requires professional judgement and experience. Each impact on a case-by-case basis and the rationale for each determination is noted. The universal magnitude designations are:

- Positive;
- Negligible;
- Minor;
- Moderate; and
- Large.

253. Some impacts will result in changes to the environment that may be immeasurable, undetectable, or within the range of normal natural variation. Such changes are regarded as having no impact and characterized as having a negligible magnitude. In the case of impacts resulting from unplanned events, the same resource/ receptor-specific approach to concluding a magnitude designation is used. The likelihood factor is also considered, together with the other impact characteristics, when assigning a magnitude designation.

254. In the case of a potential ***positive*** impact, no magnitude designation (aside from 'positive') is assigned in the assessment of impact tables. It is considered sufficient for the purpose of this IEE to indicate that the Project is expected to result in a potential positive impact without characterizing the exact degree of positive change likely to occur.

255. In the case of potential impacts resulting from unplanned events, the same resource/receptor-specific approach to concluding a magnitude designation is utilized. However, the 'likelihood' factor is considered, together with the other impact characteristics, when assigning a magnitude designation.

8.1.5 Defining Sensitivity

256. In addition to characterizing the magnitude of impact, the other principal impact evaluation step taken was to define receptor sensitivity. Receptor sensitivity takes into consideration the receptor's resilience and value. Receptor resilience (or conversely, vulnerability) describes the ability of the receptor to withstand adverse impacts. It takes into consideration not only activity-impact-receptor pathways, but also environmental characteristics of the receptor that might make it more or less resilient to change. As such, a receptor can be considered as existing within a spectrum of 'vulnerable' to 'resilient', with the former more likely to experience significant impacts as a result of a given change. Receptor value takes into consideration its quality and its importance as represented, for example, by its conservation status, its cultural importance and / or its economic value. It recognizes that, for a given intensity impact, different receptors (either directly or indirectly) may be deemed to be of greater importance and as such the significance of the impact is greater than the impact intensity alone.

257. The sensitivity designations used herein for all resources/receptors are: **Low**, **Medium**, and **High**.

258. For ecological impacts, sensitivity is assigned as low, medium, or high based on the conservation importance of habitats and species. For socio-economic impacts, the degree of

sensitivity of a receptor is defined as the level of resilience (or capacity to cope) with sudden social and economic changes.

8.1.6 Impact Significance

259. Once magnitude of impact and sensitivity of resource/receptor have been characterized, the significance can be assigned for each impact (see Figure 22). Impact significance within assessment of impact tables is designated using the matrix shown in Table 26.

Figure 22. Impact Significance Determination

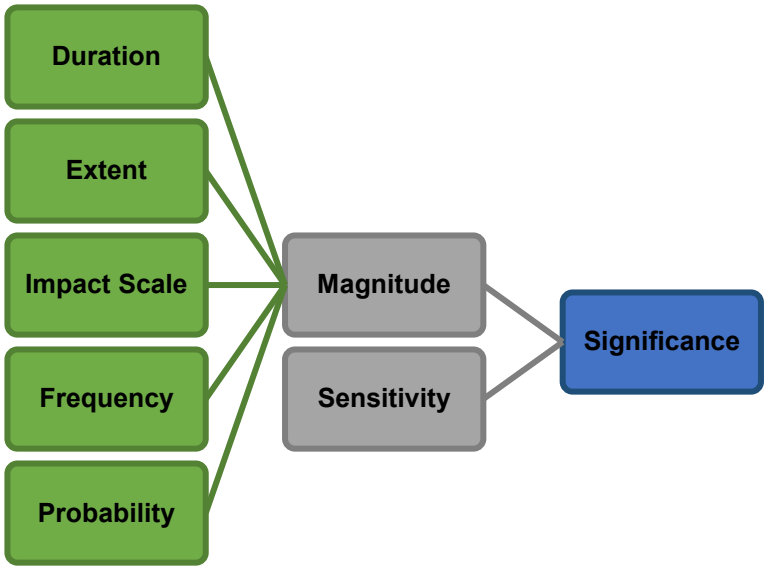


Table 26. Impact Significance Matrix

		Sensitivity of Resource/Receptor		
		Low	**Medium**	**High**
Magnitude of Impact	**Negligible**	Negligible	Negligible	Negligible
	Minor	Negligible	Minor	Moderate
	Moderate	Minor	Moderate	Major
	Large	Moderate	Major	Major

260. The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity designations that enter into the matrix.

261. It should be noted that impact prediction and evaluation take into account any embedded controls (i.e., physical or procedural controls that are already planned as part of the Project design). This avoids the situation where an impact is assigned a magnitude based on a hypothetical version of the Project that considers none of the embedded controls. For example, ENA has decided that it will not implement any activities within protected areas and will not undertake any activities requiring resettlement.

262. An impact of **negligible** significance is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.

263. An impact of **minor** significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity. In either case, the magnitude should be well within applicable standards.

264. An impact of **moderate** significance has an impact magnitude that is within applicable standards but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable. This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

265. An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of environmental impact assessment is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted. An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

266. The impact significance rating process serves two purposes: firstly, it helps to highlight the critical impacts requiring consideration in the approval process; secondly, it serves to show the primary impact characteristics, as defined above, used to evaluate impact significance.

8.1.7 Identification of Mitigation and Enhancement Measures

267. Once the significance of a potential impact was characterized, socially, environmentally, and technically, then acceptable, and cost-effective measures to manage and mitigate potential impacts were identified and defined. Mitigation measures are developed to avoid, reduce, remedy, or compensate for potential negative impacts, and to enhance potential environmental and social benefits.

268. The approach taken to defining mitigation measures is based on a typical mitigation hierarchy, as described in Table 27.

Table 27. Mitigation Hierarchy

Avoid at Source, Reduce at Source: avoiding or reducing at source through the design of the Project (e.g., avoiding by siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity);
Abate on Site: add something to the design to abate the impact (e.g., pollution control equipment, traffic controls, perimeter screening and landscaping);
Abate at Receptor: if an impact cannot be abated on-site then control measures can be implemented off-site (e.g., noise barriers to reduce noise impact at a nearby residence or fencing to prevent animals straying onto the site);
Repair or Remedy: some impacts involve unavoidable damage to a resource (e.g., agricultural land and forestry due to creating access, work camps or materials storage areas) and these impacts can be addressed through repair, restoration, or reinstatement measures; and **Compensate in Kind, Compensate Through Other Means:** where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, financial compensation for damaged crops or providing community facilities for loss of fisheries access, recreation, and amenity space).

8.1.8 Residual Impact Evaluation

269. The residual impact is what remains following the application of mitigation and management measures (if any are identified) and is thus the final level of impact associated with the development of a proposed project. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in the IEE report.

270. For activities with significant impacts, the environmental assessment process is required to identify suitable and practical mitigation measures that can be implemented. The implementation of the mitigations is ensured through compliance with the EMP. After first assigning significance in the absence of mitigation, each impact is re-evaluated assuming the appropriate mitigation measure(s) is/are effectively applied, and this results in a significance rating for the residual impact.

271. The significance of residual impacts, negative or positive, are qualified as **Negligible**, **Minor**, **Moderate**, and **Major**. Negative impacts deemed to be Moderate or Major after the application of the intended mitigation measures would receive ongoing management and monitoring during the various project phases. Additional mitigation measures will be suggested where applicable.

272. In some cases, it may only be possible to reduce the impact to a certain degree such as where an impact could not be completely avoided. All key residual significant impacts are described in this IEE with commentary on why further mitigation is not feasible.

8.1.9 Cumulative and Induced Impact Evaluation

273. Cumulative impacts are generally considered as those which are additive or interactive in nature that arise as a result of an impact from the Project interacting with an impact from another activity to create an intensified impact.

274. As identified within Section XVI of the ADB's Environmental Assessment Guidelines (the guideline document has since been updated by the Environmental Safeguards: A Good Practice

Sourcebook draft working document), as it applies to assessment of project impacts, they are specifically defined as those impacts which:

(i) are caused by the aggregate of past, present, and future actions;
(ii) are the total effect, including both direct and indirect effects, on a given resource, ecosystem, and human community of all actions taken, no matter who has taken the actions;
(iii) need to be analyzed in terms of the specific resource, ecosystem, and human community being affected;
(iv) cannot be practically analyzed beyond a reasonable boundary; the list of environmental effects must focus on those that are meaningful;
(v) rarely correspond to political or administrative boundaries;
(vi) may result from the accumulation of similar effects or the synergistic interaction of different effects;
(vii) may last for many years beyond the life of the project that caused the effects; and
(viii) should be assessed in terms of the capacity of the affected resource, ecosystem, and/or human community to accommodate additional effects.

275. Induced Impacts can be defined as adverse and/or beneficial impacts on areas and communities from unintended but predictable developments caused as a result of a project, which may occur later or at a different location.[138] A good example would be housing development and land clearance along the edge of a newly constructed road.

8.1.10 Management, Monitoring, and Audit

276. The final stage in the IA process is identifying the basic management and monitoring measures that are needed to determine whether: i) impacts or their associated project components remain in conformance with applicable standards; and ii) mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted.

277. Commitment is made to regular monitoring and verification of the implementation of the management plans and the undertaking of remedial actions where needed. Monitoring and verification will be reported and made available for inspection upon request. All incidents will be reported and corrective actions will be taken as necessary according to management plan recommendations and ENA procedures. This will enable and facilitate a process of continuous improvement. All grievances received will be addressed and investigated.

278. Monitoring during implementation will assure:

- mitigation measures are implemented effectively;
- mitigation measures are appropriate and, if not, that they are amended, or additional measures are designed and implemented;
- compliance with project standards, guidelines, and best practice as applicable;
- assessment of cumulative and residual impacts, so that appropriate measures can be designed if necessary; and
- continuation of the IEE as an iterative process through to the construction and operational environment and social management systems, which will be based on continual improvement.

8.2 Impacts and Mitigation Measures

[138] ADB - Environmental Safeguards: A Good Practice Sourcebook draft working document, December 2012.

8.2.1 General

279. An assessment of impact on the biophysical and socio-economic environment of Phase 2 of the Project has been prepared from the analysis of baseline information, existing grey and published literature, and consultations with government and non-government stakeholders within and outside Armenia. The assessment was also heavily informed by the Phase 1 environment, social, health, and safety performance review performed by the Environmental Consultant in May 2021.

280. As mentioned in the section covering impact assessment methodology, the assessments consider any embedded controls that already exist or are planned as part of the Project (i.e., physical or procedural controls). Also factored into the analysis are any gaps identified in the embedded controls and their effectiveness to manage risks based on observations and findings.

281. The assessment considers potential impacts on the following topics:

- PCB release and exposure
- Soil and relief
    - Potential impacts from natural hazards are also considered
- Surface and groundwater
- Air quality
- Sulfur hexafluoride (SF_6) gas emissions and byproducts
- Noise and vibration
- Socio-economic
    - Occupational health and safety
    - Community health and safety
    - Community infrastructure, services, and access
    - Economy, employment, and livelihoods
    - Physical cultural heritage
- Ecology and biodiversity
- Hazardous waste management

282. For each topic the assessment provides the following:

a) Scope of the assessment
b) Aspects of the Project that may cause impacts
c) Identification of sensitive receptors
d) Assessment of potential impacts for two phases: i) pre-construction / construction phase (together) and the ii) operation phase.
e) Tables assessing impact significance prior to implementation of mitigation measures for each phase
f) Mitigation measures
g) Residual impacts

283. Key sensitivities identified during the Phase 1 environment, social, health, and safety performance review are also identified and considered as part of the assessment of potential impacts prior to implementation of mitigation measures.

284. The potential impacts from the release of and exposure to PCBs has been examined as a separate topic and is not covered again in the soil and relief, surface and groundwater, air quality, and health and safety (socio-economic) sections.

285. Waste management has been treated as a cross-cutting issue and the analysis of potential impacts and their significance (before and after mitigation) has been incorporated into each section. A separate section is provided, however, on hazardous waste management which covers issues not already integrated into previous analyses.

286. To provide context to the risk assessment in connection to the activities planned under Phase 2, matrices are provided below which indicate whether potential impacts are anticipated against the Project investment categories (see Section 4.1. Project Description). Matrixes are provided for both the pre-construction / construction phase and the operation phase. On the left side of each matrix are the six planned Project investment categories and the at the top are the impact assessment topics covered in this assessment (described above).

Table 28. Matrix of Potential Impacts on Project Investment Categories - Pre-construction / Construction Phase

Project Investment Categories	PCB release & exposure	Soil & relief	Surface & groundwater	Air quality	Sulfur hexafluoride (SF_6) gas emissions & byproducts	Noise & vibration	Socio-economic					Ecology & biodiversity	Hazardous waste management
							Occupational Health & Safety	Community Health & safety	Community infrastructure, services, & access	Economy, employment, & livelihoods	Physical cultural heritage		
Category 1 - Improve the status and working conditions of existing infrastructure and equipment and the reduction of technical losses	X (-)	X (-)	X (-)	X (-)	X (-)	X (-)	X (-)	X (-)	X (-)	X (+)	X (-)	X (-)	X (-)
Category 2 - Improvements in the quality of power supply (predominantly voltage level) and further reducing losses	X (-)	X (-)	X (-)	X (-)	X (-)	X (-)	X (-)	X (-)	X (-)	X (+)	X (-)	X (-)	X (-)
Category 3 - Network expansion (new overhead lines, cables, transformers, and customer connection projects) to meet increased demand and implement new customer connections	X (-)	X (-)	X (-)	X (-)	X (-)	X (-)	X (-)	X (-)	X (-)	X (+)	X (-)	X (-)	X (-)
Category 4 – Implementation of automatic meter reading systems										X (+)			
Category 5 –Procurement of transportation and special vehicles to improve network maintenance and management													
Category 6 - Improved management systems (e.g., information software; ISO implementation), office improvements (e.g., computers; desks), and improvements in safety (safety equipment; protection)													

Note: "+" indicates anticipated positive impacts and "-" indicates anticipated negative impacts.

Table 29. Matrix of Potential Impacts on Project Investment Categories - Operation Phase

Project Investment Categories	PCB release & exposure	Soil & relief	Surface & groundwater	Air quality	Sulfur hexafluoride (SF_6) gas emissions & byproducts	Noise & vibration	Socio-economic					Ecology & biodiversity	Hazardous waste management
							Occupational Health & Safety	Community Health & safety	Community infrastructure, services, & access	Economy, employment, & livelihoods	Physical cultural heritage		
Category 1 - Improve the status and working conditions of existing infrastructure and equipment and the reduction of technical losses	X (+, -)	X (+, -)	X (+, -)	X (+)	X (-)	X (+)	X (-)	X (-)	X (-)	X (+)	X (-)	X (-)	X (-)
Category 2 - Improvements in the quality of power supply (predominantly voltage level) and further reducing losses	X (+, -)	X (+, -)	X (+, -)	X (+)	X (-)	X (+)	X (-)	X (-)	X (-)	X (+)	X (-)	X (-)	X (-)
Category 3 - Network expansion (new overhead lines, cables, transformers, and customer connection projects) to meet increased demand and implement new customer connections	X (+, -)	X (+, -)	X (+, -)	X (+)	X (-)	X (+)	X (-)	X (-)	X (-)	X (+)	X (-)	X (-)	X (-)
Category 4 – Implementation of automatic meter reading systems										X (+)			
Category 5 –Procurement of transportation and special vehicles to improve network maintenance and management				X (+, -)		X (-)	X (+, -)	X (+, -)	X (-)				
Category 6 - Improved management systems (e.g., information software; ISO implementation), office improvements (e.g., computers; desks), and improvements in safety (safety equipment; protection)	X (+)				X (+)		X (+)	X (+)				X (+)	X (+)

Note: "+" indicates anticipated positive impacts and "-" indicates anticipated negative impacts.

8.2.2 PCB Release and Exposure

287. **Scope of the Assessment**

288. This section looks at the potential impacts from the release and exposure of PCBs on the environment and human health.

289. **Aspects of The Project That Have the Potential to Impact Air, Land, Water, and Health**

290. The following planned Project activities could result in the release of PCBs:

- Routine maintenance of transformers and switchgear with used oils
- Handling and transport of used transformers and switchgear containing used oils
- Storage of used oils and oil containing equipment

291. **Sensitive Receptors Identified**

292. The most sensitive receptors with potential for exposure will be ENA personnel and contractors handling used oils, transformers and switchgear containing used oil, and oil contaminated soil. People living nearest to the areas where there have been leaks of used oil or where there is the potential for accidental releases of PCBs are also most at risk.

293. **Assessment of Potential Impact: *Pre-Construction / Construction Phase***

294. General. No chemicals included in Annex A, Part I of the Stockholm Convention are permitted for import into Armenia, including PCBs. Therefore, all the new oil procured by ENA for its operations are PCB free. However, PCBs were widely used around the world as additives in electrical equipment for many years and can be found in Armenia's older electrical transformers and switchgear. The GoA estimates that in Armenia approximately 4,527 tons of transformer oil is contaminated with PCBs in the range of 50-500 ppm; 88 tons of transformer oil are contaminated with PCB between 500-2,000 ppm; and 107 tons of transformer oil is contaminated with PCBs above 2,000 ppm.[139] As part of a 2017 inventory of all the transformers in Armenia, the GoA found that Electric Networks of Armenia CJSC operated more 9,014 of the 9,867 transformers in the country (approximately 90%) (see Section 6.7. Polychlorinated Biphenyls (PCBs)).

295. Testing oils for PCBs and PCB concentration is not being carried out and the challenges around testing will continue to limit ENA's ability to identify potentially hazardous oils in the immediate term. Barriers to testing include a lack of capacity at the MoE to establish a national testing facility, the need for independent analysis (as opposed to ENA testing itself), and the regulatory barriers of transporting potentially hazardous wastes out of the country (e.g., to Tbilisi, Georgia).

296. PCBs in the environment. PCBs do not readily break down once in the environment. They can remain for long periods cycling from one environmental compartment to another (e.g., soil to water, water to air, air to water, sediments to water). They can also be transported long distances far from where they were manufactured and used. They can have a range of toxicity in the environment due to

[139] Republic of Armenia. 2017. *Updated National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (POPs)*. Yerevan: Republic of Armenia.

the complex processes of partitioning, biotransformation, and bioaccumulation.[140] Risks include exposure to PCBs through food consumption, dermal contact, and inhalation.

297. PCBs can accumulate in the leaves and above-ground parts of plants and food crops. They are also taken up into the bodies of small organisms and fish. As a result, people who ingest fish, for example, may be exposed to PCBs that have bioaccumulated in the fish they are ingesting. Animal experiments have shown that PCB mixtures produce adverse health effects that include liver damage, skin irritations, reproductive and developmental effects, and cancer.[141] "In addition to the animal studies, a number of epidemiological studies of workers exposed to PCBs have been performed. Results of human studies raise concerns for the potential carcinogenicity of PCBs."[142]

298. PCBs can enter the atmosphere from volatilization from both soil and water surfaces.[143] Once in the atmosphere, PCBs are present both in the vapor phase and sorbed to particles. PCBs in the vapor phase appear to be more mobile and are transported further than particle-bound PCBs.[144] Higher chlorinated congeners[145] are more likely to sorb, while lower chlorinated congeners are more likely to volatilize.[146, 147] Oil with PCBs that are exposed to fire in an emergency event also have the potential to result in the uncontrolled release of PCBs, dioxins, and other products of combustion to the environment.

299. While there is only a limited number of studies on PCB inhalation toxicity published to date, existing studies conclude that inhalation of PCBs is not only an important route of exposure, but that it

[140] US Environmental Protection Agency. 2000. Polychlorinated biphenyls (PCBs) (Arochlors). January. Accessed May 27, 2021. https://nepis.epa.gov/Exe/ZyNET.exe/P100ZBED.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2016+Thru+2020&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=.
[141] IPEN. 2019. *Promoting PCB Non-Combustion Facility for Waste Destruction in the Philippines*. Manilla: International POPs Elimination Network (IPEN).
[142] US EPA. 2021. *Learn about Polychlorinated Biphenyls (PCBs)*. May 13. Accessed June 3, 2021. https://www.epa.gov/pcbs/learn-about-polychlorinated-biphenyls-pcbs.

[143] Hansen, B.G., Perez, A.B.P., Rahman, M., Larsen, B.R., 1999. QSARs for KOW and KOC of PCB congeners: a critical examination of data, assumptions and statistical approaches. Chemosphere 39, 2209e2228.
[144] Wania, F., Mackay, D. (1996): Tracking the distribution of persistent organic pollutants. Environ. Sci. Technol. 30, 390A-396A
[145] A PCB congener is any single, unique well-defined chemical compound in the PCB category. The name of a congener specifies the total number of chlorine substituents, and the position of each chlorine.
[146] Eisenreich, S. J., Looney, B. B., and Hollod, G. J. (1983a). PCBs in the Lake Superior atmosphere 1978-1980. In Physical Behavior of PCBs in the Great Lakes (D. Mackay, S. Paterson, S. Eisenreich, and M. Simmons, Eds.). Ann Arbor Science, Ann Arbor, MI.
[147] Pearson, Roger & Hornbuckle, Keri & Eisenreich, Steven & Swackhamer, Deborah. (1996). PCBs in Lake Michigan water revisited. Environmental Science & Technology - ENVIRON SCI TECHNOL. 30. 10.1021/es940626n.

can also result in serious disease and health impacts.[148, 149, 150, 151, 152] This includes cancer, cardiovascular disease, hypertension, diabetes, respiratory tract symptoms, gastrointestinal effects, mild liver effects, and effects on the skin and eyes such as chloracne, skin rashes, and eye irritation.

300. Leaks from electrical transformers and switchgear that are in operation. Risks exist from the use of older transformers and switchgear which contain used oils that may have PCBs in them. ENA has taken steps to construct containment systems for all its transformers with an oil capacity greater than 500 liters (see Section 6.9. Oil Leak and Spill Management). At the end of Phase 1, containment systems were constructed for 14 of the 29 transformers with capacity greater than 500 liters and ENA estimated that the remaining containment systems would be constructed during Phase 2. Smaller transformers, most of which are spread across the country and nearer to inhabited areas, are not being outfitted with oil containment systems.

301. Handling, transportation, and management of used oils. The handling and management of used oil during testing and regeneration and the rehabilitation of used transformers and switchgear presents a higher risk since it is a process conducted on a regular basis. The handling of oil and equipment during these processes takes place either outdoors when the equipment is in the field or in some cases within their facilities. With the introduction of new electrical equipment under this Project, ENA is undertaking these activities as part of its rehabilitation and augmentation of the network (see Section 6.6. Used Oil Testing and Regeneration and Transformer Refurbishment). The contractors that ENA hires to perform these maintenance activities may be exposed to PCBs through dermal contact and inhalation if appropriate procedures and safety protocol are not followed.

302. Newly procured transformer oils without PCBs are typically put into older equipment during the regeneration process. However, it is ENA's policy not to incorporate used oils into new equipment. This greatly reduces the likelihood that used oils which may contain high levels of PCBs are spread more widely in ENA's network.

303. Releases from storage locations. Old transformers, switchgear, and used oil taken out of operation for permanent storage and disposal may also lead to accidental releases. Used equipment may be stored temporarily at one of six branch offices (Debet, Araks, Tatev, Musaler, Geghama, and Aghstev offices) before being transported to the HWSF.

304. The HWSF was purpose built in 2019 for storage of hazardous waste including PCB oil and equipment that contained PCB oils (refer to Section 6.5. Hazardous Waste Storage Facility). The facility's largest storage area is where PCB contaminated oils and equipment would be stored. French drains running down the middle of the space were installed so that hazardous liquids that leak to the floor are collected in the drains and sent to a reservoir located outside the building.

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[148] Carpenter DO. Exposure to and health effects of volatile PCBs. Rev Environ Health. 2015;30(2):81-92. doi: 10.1515/reveh-2014-0074. PMID: 25822318.
[149] Lehmann, Geniece M et al. "Evaluating health risks from inhaled polychlorinated biphenyls: research needs for addressing uncertainty." *Environmental health perspectives* vol. 123,2 (2015): 109-13. doi:10.1289/ehp.1408564
[150] Ampleman, Matt D et al. "Inhalation and dietary exposure to PCBs in urban and rural cohorts via congener-specific measurements." *Environmental science & technology* vol. 49,2 (2015): 1156-64. doi:10.1021/es5048039
[151] US Environmental Protection Agency. 2000. Polychlorinated biphenyls (PCBs) (Arochlors). January. Accessed May 27, 2021. https://nepis.epa.gov/Exe/ZyNET.exe/P100ZBED.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2016+Thru+2020&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=.
[152] UNEP CHEMICALS. 2002. *PCB Transformers and Capacitors: From Management to Reclassification and Disposal.* Geneva: United Nations Environment Programme.

305. The risks of PCBs, among other hazardous waste, being release into the environment following an emergency such as a fire or explosion could threaten human health or the environment. The HWSF is well buffered from inhabited areas with the nearest properties (residential) approximately 800 m from the site. There are no sensitive habitats or notable flora or fauna within the vicinity of the site either.

306. Key Sensitivities Identified during Phase 1 Environment, Social, Health, and Safety Performance Review.

- Temporary storage areas and branch offices
    - The temporary storage areas at the two branch offices visited (Debed and Araks offices) appeared well organized and managed with oil and oil containing equipment/materials on leak containment pallets. It was noted during a site visit to the Araks Branch, however, that the flooring for the area where hazardous waste is temporarily stored was not sealed and accidental spills of any kind would not be prevented from passing into the ground.
- HWSF
    - It was observed that the main warehouse flooring had not been coated with a durable epoxy polymer sealant.[153]
- Emergency management and response
    - A Contingency and Emergency Response Plan had not yet been developed which sets out an organized, planned, and coordinated course of action to be followed in case of a fire, explosion, or release of hazardous waste or its hazardous constituents which could threaten human health or the environment.
    - ENA has plans to install an emergency alarm system at the HWSF to automatically alert authorities in cases of emergency.
    - Fire safety equipment, including appropriate fire suppressant systems, had yet to be fully installed across the HWSF.
- Contractors management procedures
    - During a review of the contract concluded with the firm hired to perform used oil regeneration it was discovered that the firm had not provide ENA with health certificates, qualifications of personnel, certifications of training, or OHS procedures as required under the Contractors Management Procedure before commencing activities under their contract (signed in 2019). These requirements are important elements of the tender and contract process as they allow ENA assess contractor health and safety policies and practices, inspect the tools and equipment to be used by the contractor, and define additional safety requirements.

[153] This was first identified as necessary by the Lender's Engineer (Tetra Tech) in 2019.

Table 30. Assessment of Potential Impacts from PCB Release and Exposure (prior to mitigation) – *Pre-Construction / Construction Phase*

Impact	Health impacts from the release and exposure of PCBs due to: i) improper handling and management of used oils with PCBs and PCB wastes, including contaminated soils; ii) leaks from electrical transformers and switchgear containing PCBs; iii) the testing and regeneration of used oils; and iv) the rehabilitation and disposal of used transformers and other oil containing equipment. *Note: This table takes in consideration the key sensitivities identified during Phase 1 environment, social, health, and safety performance review and the fact that the presence of PCBs in oil cannot currently be verified.*			
Impact Nature	**Negative**	**Positive**	**Neutral**	
	Impact on the environment is **negative**.			
Impact Type	**Direct**	**Indirect**	**Induced**	
	Impacts are considered a **direct** result of the Project that follow on from the direct investments of rehabilitating and augmenting the electrical network.			
Impact Duration	**Temporary**	**Short-term**	**Long-term**	**Permanent**
	The potential impacts from the release of PCBs into the environment is considered **long-term** given that PCBs do not readily break down once in the environment. The potential health impacts to people who are exposed to PCBs is considered **permanent**.			
Impact Extent	**Local**	**Regional**	**International**	
	Impacts are considered to be **regional** given that PCBs can be transported long distances from where they were used/released.			
Impact Scale	The scale of impacts and the intensity of exposure may be localized or unbounded and will vary based on a range of factors (e.g., mode of release and exposure; the amount of oil released; level of chlorinated congeners in the oil; etc.).			
Frequency	Older equipment containing used oils that have been or may begin to leak are distributed across ENA's network. Routine maintenance of transformers in the electrical network occurs throughout the year and includes testing and regeneration of used oils. Maintenance activities will continue through the life of the Project and the operation phase. At the same time, not all used oils will contain PCBs and regular monitoring of equipment will allow for identifying leaks quickly. Therefore, the potential for impacts should not be considered as frequent.			
Probability	**Unlikely**	**Possible**	**Definite**	
	The likelihood of the impact is **possible**.			
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Large**
	Considering the above, the magnitude is considered to be **large**.			
Receptor Sensitivity	**Low**	**Medium**	**High**	
	Sensitivity to potential impacts is considered **high**.			
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**
	Significance of impact is considered to be **major**.			

307. **Management and Mitigation Measures**: ***Pre-Construction / Construction Phase***

- General
  - Since it is currently not possible to test oils for PCBs and PCB concentration, unidentified appliances and all used oils must be presumed to be PCB-containing pending their identification by screening or laboratory analysis.

- ENA will ensure the plans, procedures, and guidelines developed as part of its ESMS are followed by its personnel and its contractors (see Section 6.14. Environmental and Social Management System (ESMS)). This includes:
  i. Hazardous Materials Safe Management Procedures
  ii. Work Instruction of Collecting and Storing of Used Oils
  iii. Waste Transportation Work Instruction
  iv. Waste Management Procedure
- ENA will ensure that its Contractors Management Procedures (which are part of its ESMS) are followed when hiring contractors, including those handling used oils. Procedures require contractors to provide ENA with health certificates, qualifications of personnel, certifications of training, and OHS procedures before commencing activities. The procedures also require ENA to:
  i. Define required safety and environmental precautions
  ii. Assess contractor controls and defining the need of additional controls
  iii. Inspect the certificates of tools and equipment to be used by the Contractor
  iv. Monitor IMS performance of contractors
- ENA will continue its active dialog with the MoE as it works to increase its testing capabilities to ensure PCB testing begins as soon as possible.
- According to the GoA's 2017 updated NIP for the Stockholm Convention on POPs[154], labels with identification numbers were attached to all the transformers as part of its inventory exercise (1,833 transformers were inventoried across the country). 442 oil samples were also taken to be analyzed for PCB content, of which 133 samples were found to have a PCB concentration between 50 – 500 ppm. Six samples showed concentration between 500- 2,000 ppm and four samples had PCB concentrations exceeding 2,000 ppm. Since the GoA's 2017 NIP did not provide more detailed inventory data on which transformers were among those with concentrations above 50 ppm, ENA should coordinate with the MoE to determine which of its transformers had high levels of PCBs so that additional precautions can be taken when managing the used oil and equipment.
- All of the construction and operating conditions established by the 2019 EIA developed for the HWSF will be followed (refer to Section 6.5 Hazardous Waste Storage Facility (HWSF)).[155]
- UNEP's 2002 guidelines on *PCB Transformers and Capacitors: From Management to Reclassification and Disposal* is a mandatory reference.[156]

- Release of PCBs into the environment
  - ENA will continue to outfit all of transformers with an oil capacity greater than 500 liters with leak containment systems.
  - ENA will continue to monitor its equipment in operation as part of its normal maintenance program and immediately fix or replace any equipment found to be leaking oil.
  - The flooring at each branch location where hazardous waste is temporarily stored will be made impervious to liquid spills.

[154] Republic of Armenia. 2017. *Updated National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (POPs)*. Yerevan: Republic of Armenia.
[155] ATMS Solutions LLC. 2019. *Baghramyan Hazardous Waste Storage Facility Environmental Impact Assessment*. Yerevan: Electric Networks of Armenia
[156] UNEP CHEMICALS. 2002. *PCB Transformers and Capacitors: From Management to Reclassification and Disposal.* Geneva: United Nations Environment Programme.

- In the event of a liquid spill from an older transformer or switchgear (i.e., not newly procured equipment as part of this Project which would not contain PCBs), the following steps are to be taken:[157]
  - A crew should respond immediately upon notification that a spill has occurred.
  - All clean-up personnel handling the leak and/or engaged in the actual clean-up are to wear personal protective clothing and equipment to prevent potential PCB contamination of clothing on skin.
  - All fluids will be prevented from reaching storm drains, sewers, drainage ditches, or any other place where water is flowing. The crew is to exercise every available option open to them to contain the spill, including temporary diversion or bunding (use of retaining walls). In addition, the crew should anticipate and prevent water from flowing into the contaminated area from sources such as nearby sprinkler systems and/or street gutter runoff. Every reasonable effort should be made to stop or slow the flow of oil potentially containing PCBs and contain that which has been discharged, using such manpower, equipment and material as is on site or immediately available.
  - If the spill does reach flowing water, storm sewers or any inaccessible area, the first employee arriving at the spill area should notify emergency authorities, and initiate measures to prevent any additional spill material from reaching water or lands.
  - Barricades should be placed around the contaminated areas to prevent pedestrians and vehicles from entering until the spill material is cleaned up and removed.
  - In most cases, oil absorptive material is a useful clean-up tool. If used, it should be spread on the contaminated area and should be left in place for at least one hour, or as long as necessary to ensure that all fluids have been absorbed.
  - After the spilled fluids have been absorbed, the absorptive material, along with any contaminated soils, should be placed in the steel containers provided for that specific disposal purpose. If conditions are such that PCB penetration cannot be determined, then at least 15 cm of soil depth should be removed.
  - All surfaces exposed to the spilled fluid should be decontaminated with swabs containing an efficient solvent, such as trichlorethane.
  - Any contaminated steel structures, wood racks, cable trays, etc., should also be washed down with solvent. All equipment on these structures that may be contaminated by a spill, but will not be removed, must also be similarly cleaned. Caution will be used with the solvent to prevent further contamination of equipment, vehicles etc. in the spill area.
  - All types of structures, buildings, private vehicles etc. that may be contaminated are to be washed down with solvent.
  - All contaminated items, including tools, clothing, boots, and other equipment, must either be thoroughly cleaned with solvent where practical, or disposed of in the steel containers provided specifically for disposal purposes.
  - All drums should be clearly identified and stored or loaded onto a vehicle. Drums must be carefully secured to avoid further spills.
  - The vehicle carrying the drums must also be labelled in accordance with ENA's transportation procedures.
  - The containers are to be taken directly to the HWSF storage area.

[157] Informed by the following source: UNEP CHEMICALS. 2002. *PCB Transformers and Capacitors*. Geneva: United Nations Environment Programme.

        - At large spills in densely populated areas, the spill area will be continuously manned until the spilled oil and all clean-up materials have been removed from the site, secured in drums, or otherwise neutralized.
        - If contact occurs between the skin and potential PCBs, a waterless hand cleaner should be used on the oil, the cleaner being disposed of in an appropriate container. If eye contact occurs, the eye should be thoroughly washed with water and specialized advice sought.
- Handling, transportation, and management of used oils
    - The main danger from PCBs is skin absorption and the following protective clothing will be used when handling used oils: overalls, boots or overshoes, gloves, and eye protection.
    - Chemical resistant fluorinated rubbers or elastomers and laminated materials offer the best protection against PCBs. Natural rubber are particularly permeable to PCBs and are thus unsuitable for use as protective garments.
    - If rubber boots are used, the boots need to be regularly discarded, and the foot protection reinforced by the use of disposable overshoes to be worn either inside or outside the boot.
    - Adequate ventilation will be maintained to ensure that levels of PCB vapor or aerosol do not build up.
    - Where mechanical ventilation is necessary it will be necessary to ensure that the air is extracted by air handling equipment with suitable filtration. To prevent environmental contamination, these filters may need to be of the two-stage variety: a fabric or electrostatic filter will remove aerosol and an activated carbon filter will remove vapor.
    - Respiratory protective equipment (RPE) must be required, in particular if:
        - work areas are poorly ventilated;
        - work involves the less chlorinated, more volatile PCB congeners; or
        - work is liable to lead to aerosol formation, and if temperatures are abnormally high.
    - The types of RPE must be selected to give adequate protection for workers.
    - If workers use non-disposable RPE regularly in a dirty area, they must be made aware that their RPE may become contaminated with PCBs that can be transferred to their face. This contamination can arise from absorption and passage of PCBs through the mask's material, or more likely, from contamination from the inside of the mask due to handling and poor storage during periods of non-use. Workers will minimize these risks through regular cleaning and maintenance of their RPE and training.
- Release of PCBs from storage locations
    - A comprehensive contingency and response plan will be developed for the HWSF which sets out an organized, planned, and coordinated course of action to be followed in case of a fire, explosion, or release of hazardous waste or its hazardous constituents which could threaten human health or the environment (refer to Annex 4. Contingency and Emergency Response Plan Template).
    - ENA will complete installation of an automated alarm system at the HWSF as part of its emergency management system.
    - Fire protection measures will be implemented throughout the facility, including the appropriate fire management devices and materials at the correct locations. This should be coordinated by ENA's technical safety and firefighting coordinators and the appropriate government emergency authority.
    - The floor of the main HWSF warehouse will be coated with a durable epoxy polymer sealant.

308. **Residual Impacts**: ***Pre-Construction / Construction Phase***

309. Without mitigation measures the significance of potential impacts from the release of and exposure to PCBs in used oil was determined to be major. However, the risks can be managed substantially by taking a precautionary management approach and treating all used oils as potentially hazardous; fully executing ENA's existing ESMS; and implementing the mitigation measures provided above. This remains true even though testing for the presence and concentration of PCBs in used oils is not currently feasible. Provided the mitigations measures above are followed, the residual impacts are considered **minor**.

310. **Assessment of Potential Impact: *Operation Phase***

311. Potential operation phase risks from PCB release and exposure will be the same as those identified in the pre-construction / construction phase (see Table 30). It is expected that testing capacity will increase at some point in time and that the presence of PCBs and their concentrations in oil can then be determined. This has the potential to further reduce risks and support safe management of used oils and oil containing equipment. For the sake of this analysis, the risk assessment of potential impacts from PCB release and exposure provided above for the pre-construction / construction phase also covers the operation phase.

312. Meanwhile, the replacement of older transformers with newer ones which are more reliable, have more safety-critical parts and designs, and require less frequent maintenance will greatly reduce risks that smaller transformers with used oils will leak. Completing the installment of spill containment systems in all of ENA transformer's with oil capacity larger the 500 liters will also greatly reduce risks from unplanned releases of used oils. This is considered a positive impact from the Project.

Table 31. Assessment of Potential Impacts from PCB Release and Exposure (prior to mitigation) – *Operation Phase*

Impact	Installment of spill containment systems in all of ENA transformer's with oil capacity larger the 500 liters and the replacement of older transformers with newer ones.				
Impact Nature	**Negative**		**Positive**		**Neutral**
	The installment of oil containment systems and the replacement of older transformers will reduce risks from unplanned releases of used oils and is therefore **positive**.				
Impact Type	**Direct**		**Indirect**		**Induced**
	Positive impacts are considered a **direct** result of the Project activities.				
Impact Duration	**Temporary**	**Short-term**		**Long-term**	**Permanent**
	The potential positive impacts from is considered **long-term** given the lifespan of the infrastructure and equipment being installed.				
Impact Extent	**Local**		**Regional**		**International**
	Positive impacts are considered to be **local** for non-PCB oil and **regional** for oil containing PCBs given that they can travel far distances.				
Impact Scale	The scale of positive impacts has the potential to be significant if PCBs are identified as being present in high concentrations within large capacity transformers.				
Frequency	Throughout the operation phase.				
Probability	**Unlikely**		**Possible**		**Definite**
	The installment of containment systems will **definitely** provide risk-reducing benefits.				
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Large**
	The impact is considered **positive**.				

Note: In the case of a potential positive impact, no magnitude designation (aside from 'positive') is assigned.

313. **Management and Mitigation Measures: *Operation Phase***

314. Risks of health impacts from the release and exposure of PCBs will persist into the foreseeable future. The management and mitigation measures identified in the pre-construction / construction phase above also apply to the operation phase.

315. **Residual Impacts: *Operation Phase***

316. Residual health impacts from the release and exposure of PCBs remains unchanged.

317. The significance of the positive impacts provided through the installation of spill containment systems and the replacement of older transformers with newer ones is considered **major** given the long-term benefits it provides at reducing significant risks from PCB release and exposure.

8.2.3 Soil and Geology

318. **Scope of the Assessment**

319. This section examines the potential impacts on soil and geology from Phase 2 activities.

320. Note that some of the conditions and effects described, particularly with regard to contamination and hydrogeology, may interact with other parameters such as ecology and surface water. Such interactions are described where appropriate. Also, the potential risks associated with the release of PCBs has already been assessed in the previous section is are not covered again.

321. Potential impacts from natural hazards are also considered in this section.

322. **Aspects of The Project That Have the Potential to Impact Soils and Geology**

323. The following planned project activities could affect soils:

- Soil disturbing activities and excavation associated with construction of substation structures and platforms, spill containment systems, excavation of trenches for burying electrical lines, and installation of poles leading to loss of soil structure, quantity, and quality
- Accidental events (spills, uncontrolled releases) associated with the storage, handling, and disposal of hazardous materials, including fuels and oils
- Storage and disposal of non-hazardous waste

324. **Sensitive Receptors Identified**

325. Activities under the Project will be implemented across the country and the identification of specific sensitive receptors was not possible. In general, however, residential areas where transformers will be placed should be considered as sensitive. Agricultural crops may also be negatively affected by Project activities.

326. None of the Phase 1 activities reviewed by the Environmental Consultant during his May 2021 audit appeared to have had any significant impacts to soil or geology.

327. **Assessment of Potential Impact: *Pre-Construction / Construction Phase***

328. Geological impacts. Soil works, including vegetation clearance, grading, levelling, compaction, and backfilling for construction and installation of various structures may be required. Changes to soil structure may be caused by mechanical disturbance from these activities. Exposure of soil to rain and wind may in turn cause erosion and loss of topsoil.

329. If compaction and erosion are not managed, associated potential impacts could include excessive sedimentation of local waterways, loss of topsoil and reduction in soil fertility, and detrimental changes to site hydrology. As a result of excavation and construction, the water regime of the soil on the adjacent sections of land may change.

330. Some Project activities may require construction aggregate. Aggregate is a broad category of coarse particulate material and includes sand, gravel, crushed stone, slag, and recycled concrete, among others. The extraction of these materials from quarries and borrow pits can result in significant environmental and social impacts. The most obvious environmental impact of aggregate mining is the conversion of land use, accompanied by potential loss of habitat, noise, dust, blasting effects, erosion, sedimentation, and changes to the visual scene. Aggregate is sometimes obtained from the banks and within rivers which can impacts water flow, sediment transport, and aquatic habitats. Unless properly controlled, borrow pits cause drainage and visual problems and present a potential for increased vector activity (e.g., mosquitoes or water contamination).

331. In general, the impacts to soil and geology are expected to be minimal considering the limited scale of construction and installation activities. The footprint of most transformer structures and platforms are between 3 m^2 and 9 m^2, with the majority being on the lower end of the scale. New transformers may be installed at the same location of the equipment it is replacing or may be placed at a new site nearby. The potential for impacts increases for construction and installation of transformers at new sites.

332. Construction of spill containment systems for transformers with oil capacity of 500 liters or more has the potential to result in greater soil impacts due to their size (refer to Section 6.9. Oil Leak and Spill Management). That being said, the systems are being constructed within existing substations where transformers and other electrical network infrastructure exists. The quality of soil in these locations is already impacted by network operations and any addental impacts from the construction of spill containment systems is expected to be minimal.

333. The vast majority of electrical lines being replaced and installed will be suspended on poles except in dense urban areas where they may be buried. The impacts from digging trenches for burying lines in these already heavily altered landscapes is expected to be minimal.

334. Finally, each electrical pole installed requires relatively superficial excavation in the soil. There may be more depth required depending on the soil type or condition. In most cases, new electrical poles are being installed at locations where no poles existed previously. Even in cases where suspension lines are being replaced, ENA will install the new poles and lines in a different location from the exiting lines to minimize outage time when commissioning a new line. In populated areas this often means installing poles on the other side of the street from the existing lines. In more rural areas, and depending on the terrain and land use, the replacement poles may be installed by as much as 50 m away from the existing line.

335. Soil contamination. Contamination of soil in the pre-construction / construction phase may result from the inappropriate handling, storage, and disposal of oils, petroleum products, lubricants, chemicals, hazardous materials, liquids, and solid waste. These impacts may result from activities performed by ENA personnel or its contractors under the Project. Risks to soil contamination may also

come from ENA's activities at substations, warehouses, and branch offices where most potentially contaminating materials are stored and used.

336. Soil contamination may also result from improper waste storage and disposal where leaks directly impact the soil. In other cases, soil and groundwater contamination from improper waste storage and disposal may be the result of contaminated surface water runoff being discharged from waste storage and disposal areas. This is covered more fully in Sections 8.2.2. PCB Release and Exposure; 8.2.4. Surface and Groundwater; and 8.2.10. Hazardous Waste Management.

337. A potentially significant source of soil and water contamination is the Abovyan Oil Storage Facility (refer to Section 6.4. Abovyan Oil Storage Facility). The facility includes four above ground vertical tanks, each with 25-ton oil capacity and is located within a functioning substation. The tanks are placed on a gravel bed and within a concrete oil spill containment structure designed to capture 110% of the storage capacity. A security fence has been installed around the storage area and a tall wall exists around the entire substation. While the oil here is free of PCBs, the amounts stored and its location near the city of Yerevan and within an operating substation increase the potential risks of major spills associated with the handling and transfer of oil. There are also potential risk associated with emergency situations resulting in the unplanned sudden or non-sudden release of oils (e.g., earthquake, fire, explosion).

338. Natural hazards. As described in the baseline section, Armenia faces significant natural hazard risk from earthquakes, floods, and landslides, with additional risk from hail and drought (see Section 7.1.7. Natural Hazards). It is possible that distribution lines and other electrical infrastructure could be located in areas that may be prone to landslides or mudslides in the Project activity sites. Such events could damage or destroy poles and distribution. Areas of higher risk could not be identified as part of this analysis given that investments are occurring across the country. Since in many cases the infrastructure and equipment being installed is replacing existing structures, it is likely that risks would already have been identified. With regards to seismicity, design features consider risks from seismic activity and the concrete poles installed under the Project are reinforced with steel to make them more resilient.

339. Key Sensitivities Identified during Phase 1 Environment, Social, Health, and Safety Performance Review.

- Standard Operating Procedures (SOPs) were not yet in place to specify the process for loading and unloading of oil at the Abovyan Oil Storage Facility.[158]
- The concrete base holding two of the oil storage tanks was in need of repair.
- The facility did not have established procedures to use in the event of fires, explosions, or any unplanned sudden or non-sudden release of oils.
- Despite that fact that the oil storage facility was cleared for operation by national authorities, it was concluded that firefighting equipment was not installed close enough to the oil storage area to respond to emergencies.

[158] This was identified as necessary in the CAP developed by the Lender's Engineer (Tetra Tech) in their seven-month project status report from October 2020.

Table 32. Assessment of Potential Impacts to Soil and Geology from Construction and Installation Activities (prior to mitigation) – *Pre-Construction / Construction Phase*

Impact	Soil works, including vegetation clearance, grading, levelling, compaction, backfilling, and demand for aggregates, as well as the construction and installation of various structures may lead to sedimentation of waterways, loss of topsoil, reduction in soil fertility, conversion of land use.				
Impact Nature	**Negative**	**Positive**	**Neutral**		
	Geology and soil impacts are **negative**.				
Impact Type	**Direct**	**Indirect**	**Induced**		
	The impacts on soil and geology from construction activities are **direct**. The potential impacts related to improper operation of quarry and burrow pits is considered **indirect**.				
Impact Duration	**Temporary**	**Short-term**	**Long-term**	**Permanent**	
	Impacts are considered **long-term** as a loss and alteration of topsoil may occur over a period longer than the pre-construction / construction phase.				
Impact Extent	**Local**	**Regional**	**International**		
	Impacts to soil and geology are expected to be largely focused around the Project area and considered **local.**				
Impact Scale	The scale of this impact is expected to be minimal given the scope of activities planned under the Project.				
Frequency	This impact will occur throughout the construction phase.				
Probability	**Unlikely**	**Possible**	**Definite**		
	Some impacts to soil are unavoidable and therefore **definite**.				
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Large**
	Potential impacts associated with topsoil loss are anticipated to be **minor** based upon the analysis above.				
Receptor Sensitivity	**Low**	**Medium**	**High**		
	The resource sensitivity (being the soil) is considered to be **medium** as it a valuable asset which can be easily lost or degraded due to inappropriate management practices.				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	The combination of a minor impact magnitude and medium resource sensitivity result in **minor** impact significance.				

Table 33. Assessment of Potential Impacts to Soil from Contaminants (prior to mitigation) – *Pre-Construction / Construction Phase*

Impact	Contamination of soil from the inappropriate use, handling, storage, and disposal of oils, petroleum products, lubricants, chemicals, hazardous materials, liquids, and solid waste. *This does not include potential risks from the release of PCBs which has been covered separately in the Section 8.2.2. PCB Release and Exposure.*			
Impact Nature	**Negative**	**Positive**	**Neutral**	
	Potential impacts from contamination of soil is considered **negative**.			
Impact Type	**Direct**	**Indirect**	**Induced**	
	Soil contamination may be a **direct** result of construction activities (e.g., inappropriate use) as well as an **indirect** result of those activities (e.g., inappropriate storage).			
Impact Duration	**Temporary**	**Short-term**	**Long-term**	**Permanent**
	Impacts are considered **long-term** as soil contamination has the potential to result in negative impacts over a long period of time.			
Impact Extent	**Local**	**Regional**	**International**	
	Impacts to soil from contamination would be **local** in nature.			
Impact Scale	The scale of this impact is considered moderate given the amounts of contaminants being managed by ENA at its branch offices, facilities, and warehouses.			
Frequency	Potential impacts could occur sporadically for the foreseeable future.			
Probability	**Unlikely**	**Possible**	**Definite**	
	Without considering soil contamination that may have occurred already, impacts moving forward are considered as **possible**.			
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Large**
	Potential impacts are anticipated to be **moderate** based upon the extent and scale.			
Receptor Sensitivity	**Low**	**Medium**	**High**	
	The resource sensitivity (being the soil) is considered to be **medium** as it a valuable asset which can be easily contaminated due to inappropriate management practices.			
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**
	The combination of a medium resource sensitivity and moderate impact magnitude will result in **moderate** impact significance.			

340. **Management and Mitigation Measures**: ***Pre-Construction / Construction Phase***

- General
  - ENA will ensure the plans, procedures, and guidelines developed as part of its ESMS are followed by its personnel and its contractors (see Section 6.14. Environmental and Social Management System (ESMS)). This includes:
    - ii. Hazardous Materials Safe Management Procedures
    - iii. Work Instruction of Collecting and Storing of Used Oils
    - iv. Waste Transportation Work Instruction
    - v. Waste Management Procedure
  - Rapid Environmental and Social Assessment (RESA) Checklists will identify potential impacts to soils, assess likely significance, and examine how negative impacts may be mitigated.
- Land degradation and modification of geological formations
  - Stockpiles of removed topsoil must be properly designed/shaped and managed.
  - Sand and aggregates will be stored in a hopper or bunker which shields the materials from winds. The bunker should enclose the stockpile on three sides. The walls should

extend one meter above the height of the maximum quantity of raw material kept on site and extend two meters beyond the front of the stockpile.
    - Temporary detention ponds or containment to control silt runoff will be provided as needed.
    - Intercepting ditches and drains will be created when appropriate to prevent runoff entering construction sites.
    - Transport of materials and personnel will be made on road boundaries to reduce soil compaction.
    - Disturbed vegetation should be replanted immediately after the construction / disturbance stops.
- Contamination of soil from the inappropriate use, handling, storage, and disposal of oils, petroleum products, lubricants, chemicals, hazardous materials, liquids, and solid waste.
    - The storage and handling of fuels, oils, and other hydrocarbons will be a controlled process, involving measures to prevent soil and water contamination.
    - Refueling of all vehicles and machinery will not be allowed within 50 m of any watercourse, drain, or channel leading to a water course.
    - Secondary containment devices (drop cloths, drain pans) shall be used to catch leaks or spills while removing or changing fluids from vehicles or equipment. Drip pans or absorbent materials shall be provided. On small spills, absorbent materials shall be used.
    - On-site vehicles and equipment shall be inspected regularly for leaks and all leaks shall be immediately repaired. Incoming vehicles and equipment shall be checked for leaks. Leaking vehicles/equipment shall not be allowed on-site.
    - The treatment of hazardous materials encountered in site clearance shall comply with any specific requirements given by the MoE, as well as relevant national legislation.
    - A no fly-tipping policy shall be followed.
    - Waste collection areas must be sited to avoid runoff draining directly to a water body.
    - Materials to be disposed of will be assessed and where required tested to confirm its chemical characteristics so that it can be categorized as inert, non-hazardous, or hazardous waste as appropriate.
    - Adequate training on environmental protection and safety shall be provided to ENA staff.
- Soil impacts from releases of hazardous materials from the Abovyan Oil Storage Facility
    - A Contingency and Emergency Response Plan will be developed to use in the event of fires, explosions, or any unplanned sudden or non-sudden release of oils (refer to Annex 4. Contingency and Emergency Response Plan Template).
    - SOPs will be developed to specify the process for loading and unloading of oil in the storage area.
    - Appropriate firefighting equipment in adequate quantities will be installed nearer to the oil storage area.
    - Structures within the oil storage facility will be monitored for deterioration and repaired immediately as needed.
- Quarries
    - Licensed borrow pits and quarry sites will be selected avoiding protected and sensitive areas, nearby settlements, water sources, forested areas, and fertile agriculture lands.

341. **Residual Impacts**: ***Pre-Construction / Construction Phase***

342. Impacts to soil from construction works was already assessed as minor and with implementation of the above management and mitigation measures, the residual impacts will be **negligible / minor**.

343. Residual impacts in the pre-construction / construction phase from the handling, transport, use, storage, and disposal and hazardous substances is expected to be **minor** provided that the following occurs: i) implementation of the above management and mitigation measures; and ii) ENA follows the policies, procedures, and guidance notes established under its ESMS, including newly developed plans and SOPs.

344. **Assessment of Potential Impact: *Operation Phase***

345. The impacts on soil as a result of construction related activities funded under this Project will be limited to the pre-construction / construction phase.

346. Risks to soil from the handling, transport, use, storage, and disposal and hazardous substances will continue as part of ENA's operations into the foreseeable future. The potential impacts identified in pre-construction / construction phase analysis are the same in the operation phase.

347. Significant positive impacts are expected from the installment of spill containment systems. Positive impacts will also result from the replacement of older transformers with newer ones which are more reliable, have more safety-critical parts and designs, and require less frequent maintenance which reduces risks and duration of failures. These positive impacts have been covered in Section 8.2.2. PCB Exposure and Release above (see Table 31) and are not reanalyzed.

348. **Management and Mitigation Measures: *Operation Phase***

349. The necessary management and mitigation measures needed to reduce potential impacts from soil contamination are the same as those identified in pre-construction / construction phase analysis.

350. **Residual Impacts: *Operation Phase***

351. Residual impacts from soil contamination identified in pre-construction / construction phase analysis (**minor**) remain the same.

352. The significance of the positive impacts provided through the installation of spill containment systems and the replacement of older transformers with newer ones is considered **major** given the long-term benefits it provides at reducing significant risks from PCB release and exposure.

8.2.4 Surface and Groundwater

353. **Scope of the Assessment**

354. The surface water and groundwater impact assessment has focused on potential impacts to hydrology and quality of the water environment from physical intervention and accidental discharges.

355. **Aspects of The Project That Have the Potential to Impact Surface and Groundwater**

356. The following Project aspects could affect surface water and groundwater resources in the Project area:

- Accidental leaks of oil from transformers and oil storage areas (including emergency situations)
- Accidental leaks of fuel/oil/ lubricants from cars and machinery

- Pollution caused by improper management of construction materials
- Improper handling, storage, and disposal of hazardous materials
- Increased water turbidity caused by earthworks and construction activities near water sources
- Contamination of groundwaters by infiltrated contaminated surface water

357. **Sensitive Receptors Identified**

358. The Project's activities will be implemented across the country and the identification of specific waterways that may be impacted was not possible. No major surface water courses or ground water resources were identified during the Phase 1 environment, social, health, and safety performance review undertaken in May 2021. It is possible that groundwater wells are located within the boundary of properties close to where transformers have been or will be constructed and replaced, however, it was not possible to confirm this during site visits.

359. **Assessment of Potential Impact: *Pre-Construction / Construction Phase***

360. General. During the pre-construction / construction phases, different activities have the potential to generate wastewater, accidental spills, and sedimentation which could lead to impacts on the hydrology and quality of surrounding freshwater bodies.

361. Altered hydrology. Soil may be compacted at the access roads and lay down areas to ensure soil stability. Movement of heavy vehicles in the construction area will also result in soil compaction and damage to the soil structure. This compaction of the soil may potentially result in changed hydrological characteristics, such as reduced permeability and water infiltration to the soil. This can create additional surface runoff as well as increase the runoff flow velocity. These issues have been covered in Section 8.2.3. Soil and Geology. The scale of impact on groundwater will depend in part on the 'depth' of the water horizon. The risk of impact on shallow aquifers which are more vulnerable may exist.

362. Without appropriate planning, construction activities may lead to the creation of artificial ponds and lakes (impoundments) from digging of shallow trenches for below ground cables (direct impact) and from the use quarries or "borrow pits" through an aggregate supplier (indirect impact). This can result in indirect impacts from erosion, sedimentation, and creating conditions for vector and waterborne diseases.

363. Contamination of Groundwater and Surface Water. Surface water contamination may occur due to accidental leaks or spills of chemicals or hazardous materials such as oils, lubricants, or fuel from heavy equipment; improper chemical/fuel storage; inappropriate disposal of domestic wastewater; washdown water from construction equipment; and from waste materials if not stored and disposed of properly. These issues have also been covered in Sections 8.2.2. PCB Release and Exposure, 8.2.3. Soil and Geology, and 8.2.10. Hazardous Waste Management.

364. Key Sensitivities Identified during Phase 1 Environment, Social, Health, and Safety Performance Review.

- Smaller water courses were observed in proximity to sites where transformers were constructed or are planned. While transformers with oil capacity of less than 500 liters do not automatically qualify for oil spill containment systems, the decision to include containment systems should be made on a case by basis depending on the circumstances of the equipment's location. At one observed site, there was an agricultural canal running within a

meter of a planned kiosk type transformer. The proximity to a water canal, or a similar sensitive receptor, means any accident spill could have far reaching implications downstream.

- Based on a review of the Rapid Environmental and Social Assessment (RESA) reports required by the ADB for subprojects, it was discovered that they do not always provide the correct initial screening results (i.e., Low, Medium, High). The environmental categorizations are also not correctly identified for some subprojects (i.e., Category A, B, and C). Identifying site specific risks is valuable to determine the correct mitigation measures (e.g., installing spill containment systems for smaller substations in areas with sensitive receptors).
- Outdoor oil spill containment pallets at the Abovyan Warehouse were filled with water from recent rains (see Section 6.3. Abovyan Warehouse).
- The spill containment systems being constructed for all transformers with oil capacity greater than 500 liters are susceptible to collection of rainwater in the reservoirs (see Section 6.9. Oil Leak and Spill Management). They are emptied of water as needed by ENA personnel.
- The containment system constructed during Phase 1 to collect leaking oil from new transformers at the Abovyan Warehouse also allows for rainwater to collect in its reservoir since it has no covering (see Section 6.3. Abovyan Warehouse). There is the potential that water collected in the system could over time reduce storage volume in the case of a significant oil spill.

Table 34. Assessment of Potential Impacts from Altered Hydrology (prior to mitigation) – *Pre-Construction / Construction Phase*

Impact	Altered hydrology from construction works, including vegetation clearance, grading, levelling, compaction, backfilling, and demand for aggregates, as well as the construction and installation of various structures may lead to detrimental changes to site hydrology (e.g., erosion, sedimentation, and creating conditions for vector and waterborne diseases).				
Impact Nature	**Negative**	**Positive**	**Neutral**		
	Potential impacts to surface and ground water are **negative**.				
Impact Type	**Direct**	**Indirect**	**Induced**		
	Impacts from Project activities to surface and groundwater resources can be **direct** (e.g., siltation cause by runoff at construction site) and **indirect** (e.g., the procurement of aggregate from suppliers who operate quarries or "borrow pits").				
Impact Duration	**Temporary**	**Short-term**	**Long-term**	**Permanent**	
	Most impacts will last for as long as the construction activity takes to be completed. In the case of this Project, the duration of construction activities is limited and therefore considered **short-term**.				
Impact Extent	**Local**	**Regional**	**International**		
	Potential impacts would be limited to the Project site footprint, as well as areas downstream of the Project site, and therefore are **local**.				
Impact Scale	The scale of this impact is expected to be minimal given the scale and scope of activities planned under Phase 2.				
Frequency	This impact will occur intermittently throughout the pre-construction / construction phase.				
Probability	**Unlikely**	**Possible**	**Definite**		
	Some impacts to hydrology are unavoidable and therefore **definite**.				
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Large**
	Potential impacts to hydrology are anticipated to be **minor** based upon the above analysis.				
Receptor Sensitivity	**Low**	**Medium**	**High**		
	Hydrologic alteration can be sensitive to land use changes and is therefore considered to be **medium**.				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	The combination of a minor impact magnitude and medium resource sensitivity result in **minor** impact significance.				

Table 35. Assessment of Potential Impacts to Surface and Groundwater from Contamination (prior to mitigation) – *Pre-Construction / Construction Phase*

Impact	Potential for impacts to quality of surface and ground water due to contamination from accidental releases of hazardous substances. *This does not include potential risks from the release of PCBs which has been covered separately in the Section 8.2.2. PCB Release and Exposure.*			
Impact Nature	**Negative**	**Positive**	**Neutral**	
	Potential impacts from contamination of soil is considered **negative**.			
Impact Type	**Direct**	**Indirect**	**Induced**	
	Potential water contamination will be primarily caused as a **direct** result of activities under the Project.			
Impact Duration	**Temporary**	**Short-term**	**Long-term**	**Permanent**
	Impacts are considered **long-term** as water contamination has the potential to result in negative impacts over a long period of time.			
Impact Extent	**Local**	**Regional**	**International**	
	Impacts to water from contamination are expected to be **local** in nature.			
Impact Scale	The scale of this impact is considered moderate given the amounts of contaminants being managed by ENA at its branch offices, facilities, and warehouses.			
Frequency	Potential impacts could occur sporadically throughout the pre-construction / construction phase or operation phase.			
Probability	**Unlikely**	**Possible**	**Definite**	
	Without considering water contamination that may have occurred in the past, impacts moving forward are considered as **possible**.			
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Large**
	Potential impacts are anticipated to be **minor**.				
Receptor Sensitivity	**Low**	**Medium**	**High**	
	The resource sensitivity (water) is considered to be **high** given its value and range of use which can be easily contaminated due to inappropriate management practices.			
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**
	The combination of a minor impact magnitude and high resource sensitivity result in **moderate** impact significance.			

365. **Management and Mitigation Measures**: ***Pre-Construction / Construction Phase***

- Pollution of nearby water bodies from poor land management and construction practices
  - ENA will ensure that all RESA reports accurately identify subproject specific risks, the correct initial screening results, and environmental and social risk categorization.
  - Outdoor oil spill containment reservoirs and containment pallets will be monitored regularly for rainwater collection and emptied as needed to maintain available storage volume.
  - Discharge of cement contaminated water will be prohibited.
  - All bare soil must be protected before it rains.
  - Vegetation must be preserved where feasible.
  - Concrete mixers must wash out leftover concrete without polluting the environment in designated areas.
- Impact to surface water contamination from inappropriate waste management
  - Materials and waste must be stockpiled to avoid erosion and washing off into surface water bodies. Drainage trenches must be established to divert surface runoff from the site when needed.

  - Proper storage of the construction materials will be implemented to minimize the potential damage or contamination of the materials.
  - Hazardous and non-hazardous waste will be segregated and provided appropriate containers for the type of waste type.
  - Waste will be stored systematically to allow inspection between containers to monitor leaks or spills.
  - Waste will be disposed of by licensed contractors.
- Impacts to surface water due to contamination
  - Alternative designs for smaller transformers should be developed so that they can be installed in areas with sensitive receptors.
  - Use of offsite fueling and maintenance facilities will be encouraged. Should any temporary fuel tank be available, it must be located at least 50 m away from any watercourse, drain, or channel leading to a water course.
  - Onsite repairs / maintenance and fueling activities will be limited.
  - Onsite vehicles and equipment shall be inspected regularly for leaks and all leaks shall be immediately repaired. Leaking vehicles/equipment shall not be allowed on-site.
  - Secondary containment devices (drop cloths, drain pans) shall be used to catch leaks or spills while removing or changing oils from vehicles or equipment. For small spills, absorbent materials must be used.
  - No washing of vehicles etc. in rivers or irrigation canals will be allowed.

366. **Residual Impacts**: ***Pre-Construction / Construction Phase***

367. Impacts to hydrology from construction works is expected to be short-term and localized in nature and can be controlled and minimized with the implementation of good construction practices and monitoring of contractors. If the recommended mitigation measures are implemented, residual impact significance would be **negligeable / minor**.

368. Residual impacts to surface and groundwater resources from contamination can be reduced to **minor** provided the recommended mitigation measures are implemented.

369. **Assessment of Potential Impact**: ***Operation Phase***

370. The impacts from construction that may result in altered hydrology are limited to the pre-construction / construction phase.

371. Risks to water quality will continue into the foreseeable future since ENA's normal operations require the handling, transport, use, storage, and disposal and hazardous substances. The potential impacts identified in pre-construction / construction phase analysis are the same in the operation phase.

372. Significant positive impacts are expected from the installment of spill containment systems replacement of older transformers with newer ones which are more reliable, have more safety-critical parts and designs, and require less frequent maintenance. These positive impacts have been covered in Section 8.2.2. PCB Exposure and Release above (see Table 31) and are not reanalyzed.

373. **Management and Mitigation Measures**: ***Operation Phase***

374. The necessary management and mitigation measures needed to reduce potential impacts to water quality are the same as those identified in pre-construction / construction phase analysis.

375. **Residual Impacts**: ***Operation Phase***

376. Residual impacts from water contamination identified in pre-construction / construction phase analysis (**minor**) remain the same.

377. The significance of the positive impacts provided through the installation of spill containment systems and the replacement of older transformers with newer ones is considered **major** given the long-term benefits it provides at reducing significant risks from PCB Release and Exposure.

8.2.5 Air Quality

378. **Scope of the Assessment**

379. This section discusses emissions of atmospheric pollutants and greenhouse gases during construction and operation of the Project and associated mitigation measures to be adopted.

380. **Aspects of The Project That Have the Potential to Impact Air Quality**

- Pre-Construction / Construction Phase activities with potential air quality impact:
    - Fugitive dust emissions from construction of the following:
        - (i) Above ground distribution lines which require minor excavation works where the pole is inserted into the ground.
        - (ii) New substations (e.g., kiosk transformers), substation buildings, and dismantling of old substation buildings
        - (iii) New oil spill management systems
    - Excavation of trenches for below ground distribution lines.
    - Vehicle emissions from construction vehicles (e.g., trucks, excavators, cherry pickers, etc.)

381. **Sensitive Receptors Identified**

382. The primary air sensitive receptors (ASR) in any subproject area will be residential properties close to where construction or rehabilitation activities will occur. Agricultural crops may also be impacted by dust if activities take place on or adjacent to agricultural land. Potential impacts from exposure to PCBs in the atmosphere are covered in Section 8.2.2. PCB Release and Exposure.

383. **Assessment of Potential Impact: *Pre-Construction / Construction Phase***

384. Dust. Dust is the major air quality problem from construction sites and caused primarily by excavation, loading, transportation, and unloading works. Dust is an issue for a variety of reasons, including:

a) *Health and safety problems* – Dust may irritate eyes and worsen the effects of asthma. Dust can reduce visibility for drivers on roads and be blown long distances by the wind.
b) *Impact on ecology* – Dust blowing onto watercourses may damage ecology by increasing sedimentation, reducing sunlight, and suffocating fish. It may also affect plant growth and change the species of plants growing in an area.
c) *Crop damage* – Dust can affect plant and fruit growth, especially dusts that are highly alkaline, for example limestone and cement dust. Dust deposited during light rainfall can cause the soil surface to form a crust increasing runoff.
d) *Inconvenience to local people* – Dust can coat outdoor laundry, homes, and vehicles.

e) *Damage to equipment* – Dust can increase abrasion of moving parts in equipment and clogging of air filters within the construction site.

385. Emissions. Vehicles and equipment exhaust emissions can lead to increases in levels of nitrogen oxides (NOx), sulfur dioxide (SO_2), particulate matter (PM_{10} and $PM_{2.5}$), volatile petroleum hydrocarbon constituents, and carbon monoxide (CO), which are key pollutants of concern with respect to human health. It is difficult to accurately quantify or predict dust or exhaust emissions arising from construction activities. Emissions from vehicles and building machinery will depend on the status of its technical maintenance, quality of fuel, and speed. Fuel use efficiency in old vehicles is generally low and exhaust emissions are higher. Impacts from vehicle emissions decrease rapidly with increasing distance from the source and are not likely to be significant at distances of more than 200 m from the source. Impacts are usually minor at a distance of more than 50 m.

386. The scale of the subprojects is generally small, and the impacts are expected to be minor. Moreover, the period of work on any one subproject is expected to be short. The replacement of transmission lines may take several months and cover long distances, so air quality impacts will not be stationary.

387. There is also the potential for emissions from the concrete production by ENA's contractors. Concrete used for supporting electrical poles in loose soils is likely to be mixed in smaller batches onsite and on a case by case basis. The emissions from concrete batch plants supplying larger amounts of concrete used for substation housing foundations and oils spill containment systems may result in the release of VOC, SO_2, and PM emissions. The locations of concrete plants are not known at this time and will be selected by the contractor. It should be noted that only a small percentage of the overall subprojects implemented under Phase 2 will require concrete.

Table 36. Assessment of Potential Impacts to Air Quality, Fugitive Emissions from Dust, Vehicles, and Stationary Sources (prior to mitigation) – *Pre-Construction / Construction Phase*

Impact	Air quality impacts from (i) Fugitive dust emissions associated with the materials handling and wind erosion of open areas; (ii) Emissions from concrete batching; and (iii) Air emissions including NO_2, SO_2, PM_{10} and $PM_{2.5}$ from construction equipment and truck circulation within the work areas.			
Impact Nature	**Negative**	**Positive**	**Neutral**	
	Impact on the environment is **negative**.			
Impact Type	**Direct**	**Indirect**	**Induced**	
	Impacts are considered both a **direct** result of activities under the Project (e.g., construction) and an **indirect** result that follows from the direct interactions between the Project and its environment (e.g., quarrying activity).			
Impact Duration	**Temporary**	**Short-term**	**Long-term**	**Permanent**
	Impacts will be **short-term** given the limited scope and scale of planned activities.			
Impact Extent	**Local**	**Regional**	**International**	
	Impacts are considered to be **local** in nature.			
Impact Scale	The fugitive dust impacts are expected to be limited, localized (within 50 m from the worksite boundary), and short-term (i.e., throughout the construction period). The air quality impacts are therefore expected to be small in scale.			
Frequency	Fugitive dust and air emissions related to construction and deconstruction activities and the placement of new electrical lines and equipment will last through the pre-construction / construction phase.			
Probability	**Unlikely**	**Possible**	**Definite**	
	Air quality impacts are **definite**.			
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Large**
	Impact magnitude is considered to be **minor** as there is a large separation distance between the Project site boundary and most ASRs.			
Receptor Sensitivity	**Low**	**Medium**	**High**	
	The receptor sensitivity is considered **medium** as the ASRs identified are largely residential areas.			
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**
	Significance of impact is considered to be **minor**.			

388. **Management and Mitigation Measures**: ***Pre-Construction / Construction Phase***

- Localized emissions of dust resulting from the use of machinery and equipment and circulation of vehicles.
    - Dust generating areas will be controlled by water spraying, particularly under dry weather conditions.
    - Stockpiles will be planned and sited to minimize the potential for dust generation by taking into account prevailing wind directions and the locations of sensitive receptors.
    - The drop height of potentially dust generating materials will be kept as low as possible.
    - Where practicable, stockpiles will be located away from sensitive receptors.
    - On-site speed limits will be applied and enforced for trucks travelling on unpaved surfaces (20 km/h).
    - Trucks transporting soil or other dusty materials off-site will be covered before leaving the sites.
    - Wherever possible, electrically powered equipment will be used rather than gas- or diesel-powered equipment.

- Localized and long-term emissions of combustion gas resulting from the use of machinery and equipment and circulation of vehicles.
    - Vehicles and machines will not be left running in periods between work or will be throttled down to a minimum.
    - The burning of waste or vegetation on site will be prohibited.
    - Special attention will be given in storage and handling of petrochemicals in order to avoid environmental hazards and risks.
    - Maintenance procedures will be implemented in order to keep equipment in good working condition to minimize exhaust emissions caused by poor performance.
    - Training will be provided for the operators of equipment and truck drivers regarding the air pollution potential of their activities.

389. **Residual Impacts: *Pre-Construction / Construction Phase***

390. It is considered unlikely that dust or exhaust emissions associated with construction and deconstruction activities and the placement of new electrical lines and equipment would be capable of having a significant effect on nearby sensitive receptors.

391. Assuming that the above management measures are implemented and monitored over time, the residual impact is assessed as **negligible / minor**.

392. **Assessment of Potential Impact: *Operation Phase***

393. The impacts on air quality from fugitive emissions from dust, vehicles, and stationary sources as a result of construction related activities funded under this Project will be limited to the pre-construction / construction phase.

394. One positive impact of note is the expected reduction in electricity losses from upgrading and rehabilitating ENA's network. By reducing system losses, the investments under this Project will lead to the reduction of total energy produced and lost by central power plants. Thus, it will also reduce pollutants (CO_2, NO_x, SO_2 and other particulate matter) from these plants. ENA calculates CO_2 emissions savings based on reduced losses in the system resulting from upgrades to the network. In 2018 and 2019 estimated CO_2 reduction was 69,654 and 30,921 respectively.[159] 2020 total annual CO_2 emissions have been calculated as approximately 203,000 tons. Anticipated emissions reductions for 2021 through 2025 are summarized in the table below.

Table 37. Anticipated CO_2 Emissions Avoided

Year	2020	2021	2022	2023	2024	2025
%	Actual	3%	3%	3%	3%	3%
Technical losses	190,005	184,304.57	178,775.44	173,412.17	168,209.81	163,163.51
Emissions annually avoided		-5,700.14	-5,529.14	-5363.26	-5,202.37	-5,046.29

Source: ENA

[159] Tetra Tech. 2021. *ENA - Modernization of Distribution Network Corporate Environmental and Social Compliance Audit Phase 2: Final Report*. London: EBRD.

Table 38. Assessment of Potential Impacts from Reduced Emissions (prior to mitigation) – *Operation Phase*

Impact	Fewer emissions from power plants due to reduction of power loses following network upgrading and rehabilitation.				
Impact Nature	**Negative**	**Positive**	**Neutral**		
	The reduction of emissions from power plants is **positive**.				
Impact Type	**Direct**	**Indirect**	**Induced**		
	Impacts are considered both an **indirect** result of activities under the Project.				
Impact Duration	**Temporary**	**Short-term**	**Long-term**	**Permanent**	
	Impacts will be **long-term** given the lifespan of the infrastructure being replaced and upgraded.				
Impact Extent	**Local**	**Regional**	**International**		
	Greenhouse gases can potentially affect the Earth's climate and therefore the benefits are **international**.				
Impact Scale	Impacts have the potential to affect the Earth's climate and therefore are considered global in nature. The overall relative contribution from emission reductions is considered minimal however.				
Frequency	Positive impacts will be continuous.				
Probability	**Unlikely**	**Possible**	**Definite**		
	Impacts are **definite**.				
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Large**
	Impact magnitude is **positive**.				

Note: In the case of a potential positive impact, no magnitude designation (aside from 'positive') is assigned.

395. **Management and Mitigation Measures: *Operation Phase***

396. None.

397. **Residual Impacts: *Operation Phase***

398. The significance of positive impacts from reduced emissions provided through upgrading and rehabilitation of ENA's network is considered **minor / moderate**.

8.2.6 Sulfur Hexafluoride (SF_6) Gas Emissions and Byproducts

399. **Scope of the Assessment**

400. This section discusses the greenhouse potential of SF_6 gas and the potential impacts from SF_6 emissions by ENA's gas insulated equipment (GIE) being utilized on its 35 kV and 110 kV substations. The section also discusses the health risks to workers who come into contact with toxic byproducts SF_6-filled equipment.

401. **Aspects of The Project That Have the Potential to Cause SF_6 Gas Emissions and Byproducts**

402. General. Sulfur hexafluoride (SF_6) is a relatively nontoxic gas used in a number of applications for its inert qualities. Approximately 17% of ENA's switchgear equipment (141 switchgear units) uses SF_6 gas. ENA has plans to continue procuring new SF_6 gas equipment and the number of total units is

expected to rise over time. For additional details on ENA's SF_6 GIE see Section 6.8. Sulfur Hexafluoride (SF_6) Gas.

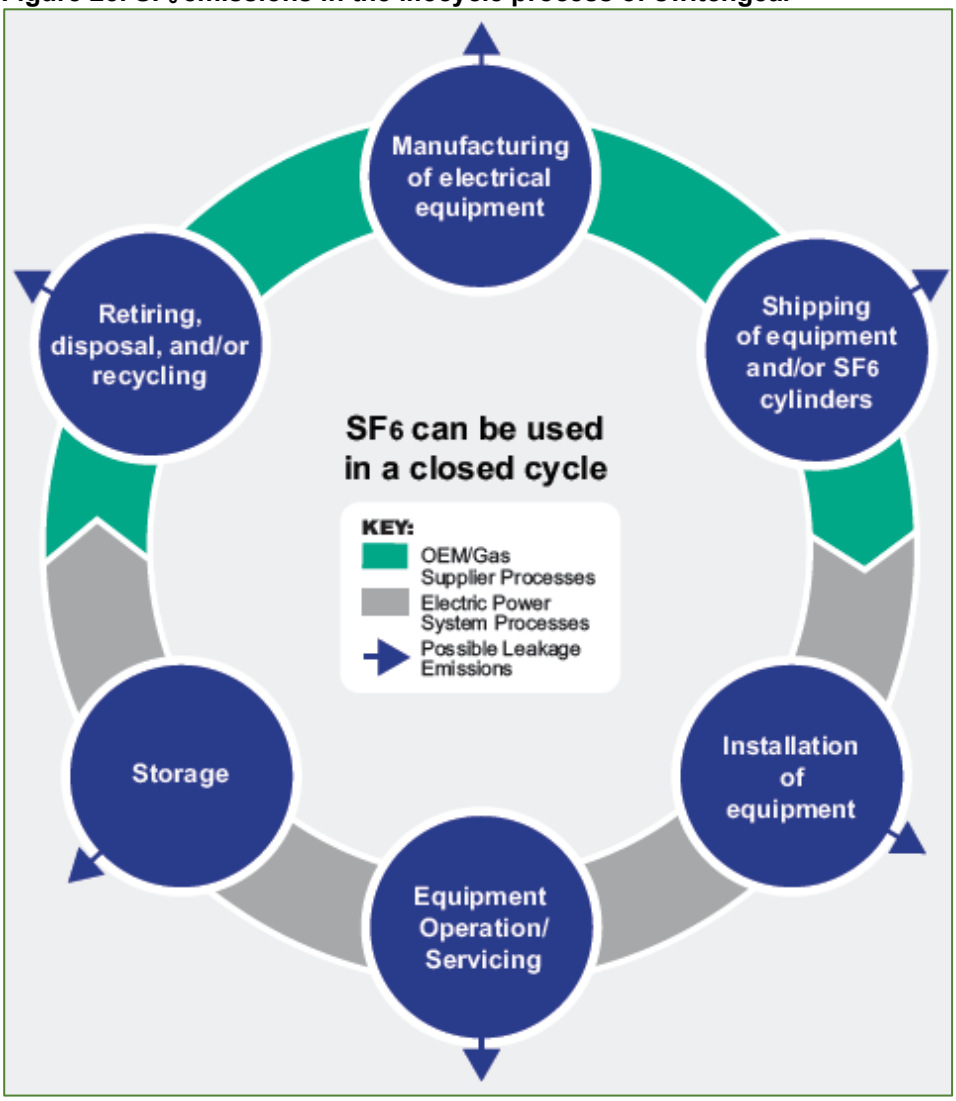
403. Global warming potential (GWP). SF_6 is described as the world's worst greenhouse gas. The IPCC reports on SF_6 gas indicate it has an atmospheric lifetime of 3,200 years and a GWP[160] value of 23,500 (100 years' time horizon) compared to CO_2, assuming photolysis by UV radiation as the main removal process.[161] More recent estimates however suggest the atmospheric lifetime of SF_6 is 850 years (uncertainty range from 850-1,400 years).[162] This reduced lifetime yields a GWP value of approximately 22,500.

404. The main sources of atmospheric SF_6 emissions are electricity distribution systems, magnesium production, and semi-conductor manufacturing. The use of SF_6 gas around the work has been increasing as evidenced by the observed changes in concentrations found within the atmosphere.[163] Moreover, its installed base is expected to grow by 75% by 2030.[164]

405. While more eco-friendly gas substitutes exist, SF_6 outperforms all alternative gases due to its combination of good dielectric, liquefaction, and heat transport properties. Therefore, no drop-in replacements for all SF_6-filled apparatus exist at this date, and it is possible none will be found in the foreseeable future.[165] In addition, drop-in replacements to replace SF_6 in presently installed equipment without any modifications appear unlikely due to compatibility issues.

[160] The Global Warming Potential (GWP) was developed to allow comparisons of the global warming impacts of different gases. Specifically, it is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide (CO_2).
[161] Stocker, T.; Qin, D.; Plattner, G.-K.; Tignor, M.; Allen, S.; Boschung, J.; Nauels, A.; Xia, Y.; Bex, V.; Midgley, P. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. 2013; https://www.ipcc.ch/report/ar5/wg1/.
[162] Ray, E. A.; Moore, F. L.; Elkins, J. W.; Rosenlof, K. H.; Laube, J. C.; Roeckmann, T.; Marsh, D. R.; Andrews, A. E. Quantification of the SF6 lifetime based on mesospheric loss measured in the stratospheric polar vortex. Journal of Geophysical Research: Atmospheres 2017, 122, 4626–4638, 2016JD026198.
[163] IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.
[164] McGrath, M. 2019. 'Climate change: Electrical industry's 'dirty secret' boosts warming'. *BBC*. Available at: https://www.bbc.com/news/science-environment-49567197
[165] Rabie M, Franck CM. Assessment of Eco-friendly Gases for Electrical Insulation to Replace the Most Potent Industrial Greenhouse Gas SF_6. Environ Sci Technol. 2018 Jan 16;52(2):369-380. doi: 10.1021/acs.est.7b03465. Epub 2018 Jan 3. PMID: 29236468.

Figure 23. SF_6 emissions in the lifecycle process of switchgear



Source: U. S. Environmental Protection Agency. 2018. Overview of SF_6 Emissions Sources and Reduction Options in Electric Power Systems.

406. Relevant descriptions of potential sources of SF_6 gas emissions is provided below[166]:

- *Installation of equipment* – While hermetically sealed-pressure switchgear is completely filled with SF_6 at the factory prior to shipping, closed-pressure switchgear is partially filled with SF_6 or N_2 at a pressure slightly above atmospheric for shipping. It is completely filled to the required pressure when installing equipment. During the installation process of closed-pressure systems, emissions of SF_6 can occur, especially if staff are not properly trained or are operating faulty refilling equipment.

[166] Information obtained from the following source: United States Environmental Protection Agency. 2018. *Overview of SF6 Emissions Sources and Reduction Options in Electric Power Systems*. Washington: US EPA.

- *Equipment operation* – As closed-pressure GIE seals wear out as a result of normal operation, gas leaks can occur in several locations, such as at the flanges, fittings, seals, or bushings, as well as from the casting.[167, 168] GIE can deteriorate and result in emissions of SF_6 if subject to:
    - high ambient temperatures and heat produced by the current passing through the circuit breaker;
    - chemical changes resulting from arcing due to current interruptions (e.g., SF_6 by-products reacting with the gasket material), if water is present to mix with by-products;
    - corrosion due to the external environment, such as pollution;[169] or
    - lightning, fires, storms, or other catastrophic events that can also cause sudden and severe damage to equipment.

  Additionally, poor maintenance, poor construction, and component failure can also cause SF_6 leaks in operating GIE.
- *Equipment servicing* – Servicing the equipment to repair leaks and refilling to operating pressure creates opportunity for potential emissions. For example, hoses on gas filling equipment can wear out and create leaks during top offs. Similarly, faulty recovery equipment can result in gas losses. Even when leaking equipment is prioritized for repair or replacement, delays due to extreme weather or inability to take equipment off-line may impede timely repair and replacement.
- *Storage* – It is common for companies to keep a stock of SF_6 cylinders; additionally, partially filled GIE that are recently purchased and not yet installed may be stored temporarily on-site. Storage cylinders or de-energized GIE present another potential SF_6 emissions source.
- *Decommissioning, disposal, or recycling* – All equipment, including hermetically sealed pressure, must be decommissioned properly to reduce emissions of SF_6. The gas must be either recycled or destroyed, either by the gas producer or a specialized service. When closed-pressure equipment is opened, SF_6 can be released to the atmosphere, especially if decommissioning staff are not properly trained to handle SF_6 and prevent its release. Emissions from sealed-pressure equipment can occur when staff decommissioning such equipment are not aware that it contains SF_6 or that the SF_6 should be recovered.

407. Health and safety concerns. While SF_6 is inert during normal use, when electrical discharges occur within SF_6-filled equipment, toxic byproducts can be produced (e.g., hydrogen fluoride) that pose a threat to health of workers who come into contact with them.

408. "According to information listed in the Hazardous Substances Databank (HSDB)[170], gaseous SF_6 byproducts such as SF_4, SiF_4, SO_2F_2, SO_2, and HF are extremely irritating to the eyes, nose, and throat. Other human health effects of these gases include pulmonary edema, skin and eye burns, nasal congestion, and bronchitis due to their corrosive characteristics. Solid byproducts such as AlF_3 and CuF_2 dusts are also irritating to exposed skin and eyes, and the nose, throat, and lungs when inhaled. If copper salts are inhaled in sufficient concentration so that it reaches the gastrointestinal

[167] Campbell, E. (2006). "SF6 Accounting Practices." DILO summary paper.
[168] Blackman, J., Averyt, M., and Taylor, Z. (2006). "SF6 Leak Rates from High Voltage Circuit Breakers – U.S. EPA Investigates Potential Greenhouse Gas Emissions Source." Proceedings of the 2006 IEEE Power Engineering Society General Meeting, June 2006. Montreal, Quebec, Canada.
[169] Bessede, J., Buescher, A., Marshall, R., Montillet, G., Stelter, A. (2006). "Limiting SF_6 Gas Emission by Optimization of Design and Handling over the Life Cycle of HV Switchgear." EPA Conference on SF_6 and the Environment. San Antonio, USA.
[170] National Library of Medicine (NLM). 2001. *Hazardous Substances Databank (HSDB)*. Internet site located at: https://www.nlm.nih.gov/databases/download/hsdb.html

tract (via cough and mucociliary mechanisms), they act as irritants producing salivation, nausea, vomiting, gastric pain, hemorrhagic gastritis, and diarrhea."[171]

409. Key Sensitivities Identified during Phase 1 Environment, Social, Health, and Safety Performance Review.

- While ENA is following the handling and storage of instructions for SF_6 gas provided by the supplier and regularly monitoring its GIE for leaks, SOPs and training have not been developed for successfully managing SF_6 emissions at all phases of the lifecycle.

Table 39. Assessment of Potential Impacts to Climate Change, Release of SF_6 Gas into the Atmosphere (prior to mitigation) – *Pre-Construction / Construction Phase*

Impact	Contribution to global warming from SF_6 emissions. *This assessment considers ENA's regular monitoring of SF_6 gas leaks as an embedded control (i.e., a physical control that is already established).*				
Impact Nature	**Negative**	**Positive**	**Neutral**		
	Impact on the environment is **negative.**				
Impact Type	**Direct**	**Indirect**	**Induced**		
	The potential impacts from the release of SF_6 gas into the atmosphere are considered **indirect**.				
Impact Duration	**Temporary**	**Short-term**	**Long-term**	**Permanent**	
	The atmospheric lifetime of SF_6 gas is estimated to be 850 – 3,200 years and is therefore considered **long-term**.				
Impact Extent	**Local**	**Regional**	**International**		
	Greenhouse gases can potentially affect the Earth's climate.				
Impact Scale	Impacts have the potential to affect the Earth's climate and therefore are considered global in nature. The overall relative contribution from emissions is considered minimal however.				
Frequency	The potential release of SF_6 gas would be infrequent considering the relatively few pieces of SF_6 compatible equipment that ENA uses (141 switchgear units representing approximately 17% of all switchgear units) and the fact that the equipment is relatively new.				
Probability	**Unlikely**	**Possible**	**Definite**		
	Negative impacts are **possible**.				
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Large**
	Considering duration, extent, scale, frequency, and probability, the overall magnitude is considered **minor**.				
Receptor Sensitivity	**Low**	**Medium**	**High**		
	The greenhouse effect is enhanced by anthropogenic releases of greenhouse gases. The concentration of greenhouse gas (GHG) in the atmosphere beyond the level of naturally occurring concentrations could result in more heat being held within the atmosphere. Receptor/resource sensitivity is rated as **medium**.				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	Overall, the impact significance, based on magnitude and sensitivity, will be **minor**.				

[171] ICF Consulting. 2002. *Byproducts of Sulfur Hexafluoride (SF_6) Use in the Electric Power Industry*. Washington: U.S. Environmental Protection Agency.

Table 40. Assessment of Potential Impacts from Toxic Byproducts of SF_6 Gas (prior to mitigation) – *Pre-Construction / Construction Phase*

Impact	Health impacts to workers from toxic byproducts formed when electrical discharges occur within SF_6-filled equipment.			
Impact Nature	**Negative**	**Positive**	**Neutral**	
	Impact on the environment is **negative.**			
Impact Type	**Direct**	**Indirect**	**Induced**	
	The potential health impacts from toxic byproducts is considered **indirect**.			
Impact Duration	**Temporary**	**Short-term**	**Long-term**	**Permanent**
	Health impacts vary based on several factors (e.g., exposure time, type of exposure, type of toxic byproduct, etc.) but in general are considered **long-term**.			
Impact Extent	**Local**	**Regional**	**International**	
	The impacts would be experienced by workers manipulating equipment or where SF_6 gas is stored and is therefore considered **local**.			
Impact Scale	The scale of impacts is likely to be limited to the areas immediately around GIE and stored gas.			
Frequency	These are considered as one-off impacts with little frequency given the monitoring for leaks taking place.			
Probability	**Unlikely**	**Possible**	**Definite**	
	Negative impacts are **possible**.			
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Large**
	Considering duration, extent, scale, frequency, and probability, the overall magnitude is considered **minor**.			
Receptor Sensitivity	**Low**	**Medium**	**High**	
	The sensitivity of workers to health impacts is considered as **high**.			
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**
	Overall, the impact significance, based on magnitude and sensitivity, will be **moderate**.			

410. **Management and Mitigation Measures**: ***Pre-Construction / Construction Phase***

- Contribution to global warming and health impacts from toxic by-products
  - ENA will closely follow the handling and storage instructions for SF_6 gas provided by the supplier and in accordance with best industry practice.
  - ENA will follow international standards on the handling of SF_6 gas and gas equipment established by the IEC and the IEEE (refer to Section 2.4.8. Sulfur Hexafluoride (SF_6)).
  - To ensure there are no leaks from its equipment, ENA will continue to carefully monitor all its GIE. If leaks are detected, they should be fixed immediately to ensure the least possible amount of gas is emitted.
  - All new SF_6 GIE procured should be of high quality with low rates of leakage.
  - Policies, protocols, and SOPs will be developed using a lifecycle approach to SF_6 management, which can help ensure that personnel track inventories of SF_6, detect and repair leaks, properly recover SF_6 from GIE, and dispose of equipment and gas, as well as take advantage of other options for reducing SF_6 emissions.
  - Personnel involved in handling gas should be trained in SF_6 handling and using equipment for performing this task on a routine basis (e.g., annual refresher trainings). Training should raise awareness of emissions, environmental and health impacts of SF_6 and by-products, and potential reduction options, but training also enables employees to follow procedures and protocols properly.

411. **Residual Impacts: *Pre-Construction / Construction Phase***

412. By continuing to monitor SF_6-filled equipment for leaks as part of its normal operating and through the implementation of SOPs and a training program, residual impacts from SF_6 emissions can be brought down to **negligible / minor**.

413. Based on implementation of the above management and mitigation measures, residual impacts to worker health from exposure to toxic byproducts from SF_6-filled equipment can also be managed effectively and are assessed as **negligible / minor**.

414. **Assessment of Potential Impact: *Operation Phase***

415. Potential impacts from emissions of SF_6 gas and from the potential exposure of workers to toxic byproducts formed when electrical discharges occur within SF_6-filled equipment will continue for the foreseeable future. The potential impacts, necessary management and mitigation measures, and likely residual impacts identified in pre-construction / construction phase analysis are the same in the operation phase.

8.2.7 Noise and Vibration

416. **Scope of the Assessment**

417. This section discusses the impacts of noise and vibration during construction and operation of the Project and associated mitigation measures to be adopted.

418. **Aspects of The Project That Have the Potential to Impact Noise and Vibration**

419. The following planned Project activities could generate noise and vibrations in the project area:

- Installations of above ground distribution lines which require minor excavation works where the pole is inserted into the ground.
- Minor construction of new substations (e.g., kiosk transformers), substation buildings, and dismantling of old substation buildings
- Construction of new oil spill management systems
- Excavation of trenches for below ground distribution lines.
- Vehicle movements around work sites.

420. **Sensitive Receptors Identified**

421. The Project's activities will be implemented across the country and the identification of specific sensitive receptors was not possible. In general, however, the main sensitive receptors are residential properties close to the areas where construction or rehabilitation of distribution lines (above and below ground) and installation / rehabilitation of transformers and transformer buildings will occur (e.g. within 15 m).

422. **Assessment of Potential Impact: *Pre-Construction / Construction Phase***

423. General. The limited scope and scale of construction related activities under Phase 2 are unlikely to result in significant noise and vibration related impacts. Moreover, the exact location of

Project activities where construction may be required is unknow at this time. Accordingly, a noise impact assessment was not considered to be necessary or feasible.

424. Noise and vibration from construction activity. Each construction phase has its unique noise and vibration characteristics due to use of different equipment items. The potential sources of noise and vibration during the preparation, construction, and worksite closure include equipment, machinery, and transportation used for the construction activities. Any heavy equipment used will be the major sources of noise and vibration. Construction noise and vibration levels at receptors will fluctuate depending on the type and number of equipment, their duration of use, and the distance from receptor.

425. Table 41 represents typical noise levels from various construction equipment items. It should be noted that the values indicated in the table may differ depending on the brand and age of machinery provided/used by construction company.

Table 41. Construction Equipment Noise Emission Levels

Equipment	Typical noise level (dBA) approximately 15 m from source
Crane	85
Drilling Machines	85
Angle dozers	85
Shovel loaders	85
Bulldozers	85
Tractor	84
Grader	83
Excavators	83
Concrete pump	81
Front loaders	80
Ditcher/Trencher	80
Concrete mixer truck	80
Dump/flatbed Truck	80
Compactor	78
Backhoe	77

426. It is expected that the use of heavy machinery will be limited given the scale and scope of work for construction activities being planned under Phase 2.

427. There is also the limited potential for increases in traffic and thereby in traffic noise impacts to receptors where construction may take place (e.g., construction and installation of transformers on the road reserve and the installation of new electrical poles). The relative isolation of most of the Project sites and the limited duration of construction activities will reduce the potential noise-related impacts. No nighttime construction activities are planned; therefore, there would be no nighttime impacts.

Table 42. Assessment of Potential Impacts from Noise and Vibration related to Construction and Installation Activities (prior to mitigation) – *Pre-Construction / Construction Phase*

Impact	Noise and vibration emissions resulting from the use of machinery and equipment and vehicle circulation.								
Impact Nature	**Negative**		**Positive**		**Neutral**				
	Noise impact from the construction activities is **negative**.								
Impact Type	**Direct**		**Indirect**		**Induced**				
	Noise impact from the construction activities is **direct**.								
Impact Duration	**Temporary**	**Short-term**		**Long-term**		**Permanent**			
	Noise impact from the construction activities will last through the construction period of each sub-project and is considered **short-term**.								
Impact Extent	**Local**		**Regional**		**International**				
	Noise impact from construction equipment and activities is **local**.								
Impact Scale	Impacts will be felt the immediate area around where sub-project construction activities take place around the country as well as any specific construction related sites outside of the subproject areas.								
Frequency	Intermittently throughout Phase 2 of the Project.								
Probability	**Unlikely**		**Possible**		**Definite**				
	Noise impacts are **definite**.								
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Large**				
	Noise emissions and construction related vibration are **minor** since they will be of short-term nature and largely limited to civil engineering works and site deliveries.								
Receptor Sensitivity	**Low**		**Medium**		**High**				
	Likely noise sensitive receptors are residential areas and the sensitivity of the receptor is considered as **medium**.								
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**					
	As the impact magnitude is minor and the receptor sensitivity is medium, the impact significance is considered as **minor**.								

428. **Management and Mitigation Measures**: ***Pre-Construction / Construction Phase***

- General
  - ENA will ensure that its Contractors Management Procedures (which are part of its ESMS) are followed when hiring contractors involved in construction (see Section 11.4. Contractors Management Procedure Requirements). The procedures also require ENA to:
    i. Define required safety and environmental precautions (those listed above)
    ii. Assess contractor controls and defining the need of additional controls
    iii. Inspect the certificates of tools and equipment to be used by the Contractor
    iv. Monitor IMS performance of contractors
  - Ensure that Rapid Environmental and Social Assessment (RESA) Checklists are used to identify impacts from noise and vibration, assess likely significance, and examine how negative impacts may be mitigated.
- Noise and vibration emissions resulting from the use of machinery and equipment and vehicle circulation
  - Restrict construction hours to between 07:00 to 20:00 hours within 500 m of the houses and other noise sensitive receptors.
  - Set optimum travel speed during offsite travel.

- Install temporary noise barriers made of plywood or acoustical blankets around noisy operation where deemed necessary or beneficial (e.g., near schools, hospitals, or residences).
- Regular maintenance of equipment such as lubricating moving parts, tightening loose parts, and replacing worn out components.
- Shut down or throttle down between work periods for machines and construction plant items (e.g., trucks) that may be in intermittent use.
- Reduce the number of equipment operating simultaneously as far as practicable.
- Orientate equipment known to emit noise strongly in one direction so that the noise is directed away from receptors as far as practicable.
- Avoid transportation of materials on- and off-site through existing community areas during nighttime hours.
- Use material stockpiles and other structures, where practicable, to screen noise sensitive receptors from on-site construction activities.
- Record and respond to complaints according to the established grievance redress mechanism (GRM).
- Keep nearby residences informed in advance about noisy activities during various construction phases.
- When there is a possibility of human annoyance from construction activities, conduct such activity only during weekday daytime hours when the ambient background noise and vibration is higher, and many residents are away from their homes at work.

429. **Residual Impacts: *Pre-Construction / Construction Phase***

430. Even where the mitigation measures set out here are followed, there will still be instances where construction works result in unanticipated elevated noise levels and vibration. However, these will only be short term, temporary and localized impacts. Good oversight and regular monitoring on contractors by ENA should limit noise impacts to the extent possible. Residual impacts are assessed as **negligible / minor**.

431. **Assessment of Potential Impact: *Operation Phase***

432. Noise and vibration impacts resulting from construction related activities funded under this Project will be limited to the pre-construction / construction phase.

433. As part of its network rehabilitation and improvement activities under this Project, ENA is replacing older equipment with newer and more modern ones. The installation of newer transformers, especially in residential areas, is reducing noise and vibration impacts. This is considered an important benefit in addition to the preperformance improvements of installing newer equipment.

Table 43. Assessment of Potential Impacts from Noise and Vibration from Installation of Newer Equipment (prior to mitigation) – *Operation Phase*

Impact	Reduced noise and vibration emissions resulting from the installment of newer and more modern equipment.				
Impact Nature	**Negative**		**Positive**		**Neutral**
	Reducing noise and vibration is a **positive** impact.				
Impact Type	**Direct**		**Indirect**		**Induced**
	Benefits from reduced noise and vibration are **direct**.				
Impact Duration	**Temporary**	**Short-term**		**Long-term**	**Permanent**
	Installment of new and more modern equipment is expected to provide **long-term** noise and vibration reduction benefits.				
Impact Extent	**Local**		**Regional**		**International**
	Noise and vibration benefits will be **local**.				
Impact Scale	Positive impacts will be experience in the immediate area around wherever new equipment is installed.				
Frequency	New installations will occur intermittently throughout Phase 2 of the Project.				
Probability	**Unlikely**		**Possible**		**Definite**
	Positive impacts are **definite**.				
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Major**
	The impact is identified as **positive**.				

Note: In the case of a potential positive impact, no magnitude designation (aside from 'positive') is assigned.

434. **Management and Mitigation Measures: Operation Phase**

435. None.

436. **Residual Impacts: *Operation Phase***

437. The significance of positive impacts provided through the installation of newer equipment and the retiring or older louder equipment is considered **moderate** given the long-term benefits it provides to sensitive receptors.

8.2.8 Socio-Economic

438. **Scope of the Assessment**

439. This assessment describes the potential socio-economic impacts associated with Project activities under Phase 2. The key objectives include the following:

- Identify and assess potential Project-related socio-economic impacts across the Project cycle.
- Determine whether Phase 2 activities will have positive or adverse effects on individuals, households, and institutions.
- Describe, where appropriate, the general mitigation measures that will be incorporated into the Project.

440. The section will cover the following areas:

- Occupational health and safety
- Community health and safety
- Utilities and infrastructure
- Economy, employment, and livelihoods
- Physical cultural heritage

441. **Aspects of The Project That Have the Potential to Result in Socio-Economic Impacts**

- Occupational Health and Safety
  - Accidents involving:
    - the use of heavy equipment
    - working at height
    - live power lines
    - construction vehicles
  - Accidents due to lack of, or poor application of, personal protective equipment (PPE)
  - Lack of first aid, medical facilities, and emergency equipment (e.g., signage, fire extinguishers)
- Community Health and Safety
  - Construction of network components, specifically electrical components
  - Exposure to live electrical equipment
- Utilities and Infrastructure
  - Service disruptions from removal and or replacement of existing overhead lines and transformers, i.e. existing power supply
  - Earth-moving/excavation works that may inadvertently damage existing infrastructure (e.g., gas, water, internet, and telephone lines).
- Employment and Livelihoods
  - Employment opportunities
  - Improved supply and quality of electricity
- Physical Cultural Heritage
  - Construction activities

442. **Sensitive Receptors Identified**

- Occupational Health and Safety
  - ENA staff and contractors working on Project specific activities (e.g., installation of new electrical lines) and as part of normal operations to maintain and operate the electrical network.
- Community Health and Safety
  - Local communities, and particularly those living adjacent to network equipment
- Utilities and Infrastructure
  - The local population are considered to be the key sensitive receptors that could be affected by the construction works in terms of supply of electricity and other services (e.g. water supply and gas as well as temporary access impacts).
- Employment and Livelihoods
  - Primarily local Armenian firms
- Physical Cultural Heritage
  - All types of cultural heritage is considered sensitive

443. **Assessment of Potential Impact**: ***Pre-Construction / Construction Phase***

444. General. There was no land acquisition undertaken, no involuntary resettlement impacts, and no indigenous peoples (IPs) affected by subprojects under Phase 1. Phase 2 of the Project is expected to be the same as ENA is making a concerted effort to avoid any activities which would result in land acquisition and resettlement. If resettlement is required, ENA has an established Involuntary Resettlement Management Procedure which is part of its ESMS in order to manage potential impacts.

445. Occupational health and safety. Project workers will be exposed to different hazards during construction including noise and vibration, dust, handling heavy materials and equipment, falling objects, work on slippery surfaces, fire hazards, and chemical hazards such as toxic fumes and vapors etc. Potential health impacts to workers from exposure to PCBs and from toxic byproducts of SF_6 gas have already been covered in Section 8.2.2. PCB Release and Exposure and Section 8.2.6. Sulfur Hexafluoride (SF_6) Gas Emissions and Byproducts. Potential impacts from air quality deterioration and noise and vibration are specifically covered in Section 8.2.5. Air Quality and Section 8.2.7. Noise and Vibration.

446. Detailed data on work related accidents and fatalities associated with the distribution system in Armenia were not available to analyze (see Section 6.13. Occupational Health and Safety for data that was available).

447. ENA has training facilities within its branch offices and at its headquarters to support regular training of its personnel.

448. Community health and safety. Potential health impacts to the community from exposure to PCBs have already been covered in Section 8.2.2. PCB Release and Exposure. Potential impacts from air quality deterioration and noise and vibration are specifically covered in Section 8.2.5. Air Quality and Section 8.2.7. Noise and Vibration. Data on community accidents and fatalities associated with the distribution system in Armenia were not available to analyze.

449. There are several potential health and safety related impacts which may result from construction activities, including:

- Accidents and fatalities associated with the distribution system
    - Injuries and fatalities can occur to community members as a result of coming into contact (or close proximity) with electricity overhead lines, underground cables, and other charged equipment. These incidents may be as a result of accidental contact with charges equipment, lines, and cables (e.g., contacting an electrified line with machinery) or as a result of direct manipulation of distribution system elements (e.g., altering power supply infrastructure without authority).
- Presence of storage areas and warehouses near populated areas
    - Storage areas where hazardous materials are held, including branch offices, the HSWF, and the Abovyan Oil Storage Facility, are often near populated areas. Emergency situations resulting in an unplanned release of hazardous materials into the air and water could lead to potentially serious impacts to the surrounding communities. These risks have been covered in previous sections.
- Presence of worksites
    - There can be safety issues with the establishment of new worksites – e.g., community members falling in unsecured trenches or interacting with unsecured equipment. This can lead to onsite accidents and injuries.
- Exposure to hazardous materials and waste

- It is particularly important that hazardous materials are managed appropriately so as not to contaminate the surrounding water sources or air quality. There are a number of activities that will generate hazardous waste (e.g., asbestos).

450. A GRM has been developed as part of ENA's ESMS and is integrated in company's Stakeholder Engagement Plan (SEP) (refer to Sections 6.14. Environmental and Social Management System (ESMS) and 9. Public Consultation and Information Disclosure, and Annex 2. ENA Grievance Redress Form).

451. Utilities and infrastructure. Construction works under the Project have the potential to result in temporary loss or reduction in utility supply to consumers including gas, internet, water, and telephone services. During the permitting process with municipalities for construction works on municipal lands, the utility companies sign off on the plan. Since much of the land utilized by ENA for its construction of transformers and electrical lines is on municipal land, the permitting process should mitigate any unplanned disruptions to utility services for communities.

452. The replacement of electrical lines as part of ENA's work to rehabilitate and improve network efficiency will result in the temporary loss of power to residences and businesses. Losses are expected to be of short duration however given ENA's efforts to build new electrical lines near the existing ones rather than at the same locations (e.g., installation of new poles and lines across the street from existing lines). This allows for only a brief disruption on services as the new line is commissioned.

453. Finally, temporary road closures and the loss of access to property and businesses is possible, especially in more densely populated areas. Again, such impacts will be short term considering the limited scope of work most construction activities have.

454. Employment and livelihoods. The works undertaken under the Project will be completed by ENA personnel or, in most cases, by ENA contractors many of which have existing contracts with the company. While there is expected to be some benefits in terms of employment opportunities provided by increased demand for work generated by Project activities, the benefits are likely to limited.

455. Physical cultural heritage. Project works mainly involve the rehabilitation and replacement of distribution lines and transformers. In some cases, such as the installation of transformers and transformer housing structures, this means like-for-like replacements which are unlikely to have significant impacts on physical cultural heritage (PCR). In other cases, the rehabilitation and replacement of transformers and distribution lines will take place near existing infrastructure and equipment but on previously undisturbed land. The footprint of these constructions is limited, and the chance of impacting PCR is minimal.

456. The largest construction activities in terms of scale include the construction of spill containment structures for transformers with an oil capacity larger than 500 liters. In these situations, construction will take place within existing substations that are already heavily modified and where PCR are unlikely to be discovered.

457. Meanwhile, there is a trend in urban areas to move pole-mounted distribution lines below ground, and examples of this were noted in Gyumri during the Phase 1 environment, social, health, and safety performance review. The scale of these investments and the fact that they take place in already modified urban environments suggest the potential for impacts to PCR is very low.

458. For these reasons, no impacts on such sites are in principle expected. Since encountering of change finds cannot be entirely excluded however, the potential for impacts remains.

459. Key Sensitivities Identified during Phase 1 Environment, Social, Health, and Safety Performance Review.

- The most common grievances received form people in the community are related to noise complaints. Review of the complaints captured by ENA's GRM indicated that these issues were logged and addressed appropriately and according to their GRM process. However, it was discovered during dialog with ENA staff that there have been occasions where grievances were raised by communities at the local level (i.e., with the municipality rather than with ENA directly through their online platform) which are not being captured by ENA's GRM tracking system. In some cases, the complaints raised to the level of ENA management. It was concluded that grievances and complaints from the community were found not being managed through one system.
- ENA's staff do not have arch flash PPE and an arc flash hazard assessment has not been conducted to determine what arc flash hazards risks exist and if additional protective measures are required.
- Fatal and non-fatal accidents for ENA staff, contractors, and community members were not being adequately investigated or tracked. ENA committed to establishing a procedure for investigating and tracking incidents and will roll it out by July 2021.
- Community risk awareness material for those living near substations and other higher-risk areas has not been developed or distributed.
- Established procedures to use in the event of fires, explosions, or any unplanned sudden or non-sudden release of hazardous materials were not developed for the HWSF and the Abovyan Oil Storage Faciality.
- SOPs were not yet in place to specify the process for loading and unloading of oil at the Abovyan Oil Storage Facility.
- No formal chance finds procedure has been developed for the Project which outlines what should happen if previously unknown heritage resources are encountered during project construction or operation.
- Due to concerns with the health and safety records of the contractors supporting work under this Project, ENA is considering providing training to contractors to reduce risks and improve performance.

Table 44. Assessment of Impacts to Impact on Occupational Health and Safety (prior to mitigation) – *Pre-Construction / Construction Phase*

Impact	The exposure of workers to various physical hazards that may result to minor, disabling, catastrophic, or fatal injuries. *This analysis does not account for potential impacts from exposure to PCBs and toxic byproducts of SF_6-filled equipment which are covered in Section 8.2.2. PCB Release and Exposure and 8.2.6. Sulfur Hexafluoride (SF_6) Gas Emissions and Byproducts.*			
Impact Nature	**Negative**	**Positive**	**Neutral**	
	Potential impacts to the local area are **negative**.			
Impact Type	**Direct**	**Indirect**	**Induced**	
	Potential impacts to workers related to the activities funded by the Project are **direct**.			
Impact Duration	**Temporary**	**Short-term**	**Long-term**	**Permanent**
	Impact has the potential to have a lasting **long-term** effect.			
Impact Extent	**Local**	**Regional**	**International**	
	The impact is considered to be **local**.			
Impact Scale	The impact scale is difficult to predict. While most activities planned under this Project will not involve any construction, where OHS risks are highest, the overall scale of potential impacts could be potentially large if not managed appropriately.			
Frequency	The impacts would likely occur with rare frequency, although the tracking of incidents is not in place to determine this effectively.			
Probability	**Unlikely**	**Possible**	**Definite**	
	The probability of OHS impacts is identified as **possible**.			
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Large**
	The impact magnitude is considered **large** given that mechanisms to investigate, monitor, and evaluate incidents for ENA's staff, contractors, and the community are not established.			
Receptor Sensitivity	**Low**	**Medium**	**High**	
	In consideration of the potential impact to human health, receptor vulnerability is identified as **high**.			
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**
	Without additional management and mitigation measures in place, the potential impact significance is **major**.			

Table 45. Assessment of Impacts to Impact on Community Health and Safety (prior to mitigation) – *Pre-Construction / Construction Phase*

Impact	Impact on community health, safety, and security due to i) accidents and fatalities associated with the distribution system; ii) presence of storage areas and warehouses near populated areas; iii) presence of worksites; and iv) exposure to hazardous materials and waste.			
Impact Nature	**Negative**	**Positive**	**Neutral**	
	Potential impacts to the local area are **negative**.			
Impact Type	**Direct**	**Indirect**	**Induced**	
	Potential impacts related to construction activities are **direct**. Potential impacts related to exposure from hazardous materials and waste are **indirect**.			
Impact Duration	**Temporary**	**Short-term**	**Long-term**	**Permanent**
	Impact has the potential to have **long-term** and lasting effect.			
Impact Extent	**Local**	**Regional**	**International**	
	The impact is considered to be **local**.			
Impact Scale	The impact scale is difficult to predict. In light of the substantial work anticipated for the Project, and the two-year construction period, the scale of potential impacts could be potentially large if not managed appropriately.			
Frequency	The impact likely occurs during the construction phase with the rare frequency.			
Probability	**Unlikely**	**Possible**	**Definite**	
	Health and safety impacts are **possible**.			
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Large**
	The impact magnitude is considered **moderate**.			
Receptor Sensitivity	**Low**	**Medium**	**High**	
	In consideration of the potential impact to human health, receptor vulnerability is identified as **high**.			
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**
	Without management and mitigation measure in place, the potential impact significance is **major**.			

Table 46. Assessment of Impacts to Community Infrastructure, Services, and Access (prior to mitigation) – *Pre-Construction / Construction Phase*

Impact	Impacts to community infrastructure, services, and access including temporary loss or reduction in utility supply and temporary road closures.			
Impact Nature	**Negative**	**Positive**	**Neutral**	
	The nature of these impacts would be **negative**.			
Impact Type	**Direct**	**Indirect**	**Induced**	
	The impact to community infrastructure, services, and access is **direct**.			
Impact Duration	**Temporary**	**Short-term**	**Long-term**	**Permanent**
	Impact are likely to be **short-term** and should only last as long as the construction period for each sub-project.			
Impact Extent	**Local**	**Regional**	**International**	
	The impact is **local** and limited to areas around the construction sites.			
Impact Scale	The impact scale is considered relatively minor due to the practices in place to mitigate unforeseen disruptions to services and access (i.e., the municipal level permitting process).			
Frequency	The impacts will occur intermittently during the pre-construction / construction phase.			
Probability	**Unlikely**	**Possible**	**Definite**	
	Impacts to community infrastructure, services, and access are **possible**. Brief disruptions to electricity supply when new lines are commissioned is **definite**.			
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Large**
	The impact magnitude is likely to be **minor** overall considering the above analysis.			
Receptor Sensitivity	**Low**	**Medium**	**High**	
	The sensitivity of receptors is considered to be **medium**.			
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**
	The overall significance is likely to be **minor**.			

Table 47. Assessment of Impacts to Employment and Livelihoods (prior to mitigation) – *Pre-Construction / Construction Phase*

Impact	Impacts on employment and economy provided by the need for skilled and unskilled labor and services.				
Impact Nature	**Negative**	**Positive**	**Neutral**		
	Increase in employment opportunities are **positive**.				
Impact Type	**Direct**	**Indirect**	**Induced**		
	Direct impacts to the workforce, and contracting firms in particular, are anticipated.				
Impact Duration	**Temporary**	**Short-term**	**Long-term**	**Permanent**	
	The impact is considered **short-term** since most benefits will be limited to the pre-construction / construction phase.				
Impact Extent	**Local**	**Regional**	**International**		
	The Project will primarily drive employment and business opportunities for Armenian firms and the impact extent is considered **local**.				
Impact Scale	The impact scale is difficult to predict since it will depend on the amount of work ENA needs to contract out for and the duration of those contracts. The extent to which local firms will benefit from employment opportunities created by the Project will also depend partially on the skill-level of the positions to be filled.				
Frequency	Throughout the pre-construction / construction phase of the Project.				
Probability	**Unlikely**	**Possible**	**Definite**		
	Employment related impacts are **definite**.				
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Major**
	The impact is **positive**.				

Note: In the case of a potential positive impact, no magnitude designation (aside from 'positive') is assigned.

Table 48. Assessment of Impacts to Physical Cultural Heritage (prior to mitigation) – *Pre-Construction / Construction Phase*

Impact	Impact to physical cultural heritage (PCH) from construction related activities.				
Impact Nature	**Negative**	**Positive**	**Neutral**		
	Impacts to PCH are **negative**.				
Impact Type	**Direct**	**Indirect**	**Induced**		
	Any impacts to PCH would be a **direct** result of Project activities.				
Impact Duration	**Temporary**	**Short-term**	**Long-term**	**Permanent**	
	Impacts on PCH would be considered **permanent** considering historical, spiritual, and or scientific significance.				
Impact Extent	**Local**	**Regional**	**International**		
	Physical impact to PCH would be site specific and **local**, but the extent of the loss or damage may be felt **internationally**.				
Impact Scale	The size of the potential impact is difficult to determine. Any damage to PCH would be significant, but the types of construction activities and the limited scope of work being undertaken under this Project make the overall impact scale small.				
Frequency	Impacts would occur very infrequently, if at all, during the construction phase.				
Probability	**Unlikely**	**Possible**	**Definite**		
	Impacts to PCH are **possible**.				
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Large**
	The impact magnitude is likely to be **minor** overall considering the above analysis.				
Receptor Sensitivity	**Low**	**Medium**	**High**		
	The sensitivity of receptors is considered to be **high**.				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	The overall significance is likely to be **moderate**.				

460. **Management and Mitigation Measures**: ***Pre-Construction / Construction Phase***

- Occupational Health and Safety
  - ENA will finalize development and implementation of a robust incident investigation and tracking system to record, track, manage, and report incidents to workers and the community involving ENA's electrical system.
  - All accidents and near misses will be reported and the statistics collected to be used to identify trends and requirements for further training or 'safety stand-downs' where incident numbers are growing.
  - ENA will ensure that its Contractors Management Procedures (which are part of its ESMS) are followed when hiring contractors, including those handling used oils (refer to Section 11.4. Contractors Management Procedure Requirements). Procedures require contractors to provide ENA with health certificates, qualifications of personnel, certifications of training, and OHS procedures before commencing activities. The procedures also require ENA to:
    i. Define required safety and environmental precautions (those listed above)
    ii. Assess contractor controls and defining the need of additional controls
    iii. Inspect the certificates of tools and equipment to be used by the Contractor
    iv. Monitor IMS performance of contractors
  - Contingency and Emergency Response Plans (refer to Annex 4. Contingency and Emergency Response Plan Template) will be developed for the HWSF and the

Abovyan Oil Storage Facility to use in the event of fires, explosions, or any unplanned sudden or non-sudden release of hazardous materials.
    - SOPs will be developed to specify the process for loading and unloading of oil at the Abovyan Oil Storage Facility.
    - ENA should complete arc flash hazard assessments for its substations through an incremental process to: i) identify arc flash hazards at its facilities; ii) estimate the likelihood of occurrence and the potential severity of injury or damage to health; and iii) determine if additional protective measures are required. Substations where incidents have been recorded or where equipment is of higher risk due to age and condition should be targeted first.
    - Contractors will be monitored to ensure that they have the correct PPE and are using it.
    - Fire-fighting equipment will be installed at work areas, as appropriate.
    - Proper collection and disposal of solid wastes will be ensured in line with local regulations and ENA's ESMS.
    - Fall prevention and protection measures will be implemented whenever a worker is exposed to the hazard of falling more than two meters, falling into operating machinery, or through an opening in a work surface.
    - Precautions will be taken to ensure that objects (e.g., equipment, tool, debris, pre-cast sections, etc.) do not fall onto or hit people, vehicle, and properties in adjoining areas.
- Community Health and Safety
    - ENA's GRM should be modified to establish a process which records grievances and complaints filed by community members through ENA's online system as well as those that are made at the local level. This includes information on the status of complaints and payments made for temporary damages or losses caused by ENA or its contractors.
    - Ensure the grievance mechanism is functional and understood by the community.
    - Community risk awareness materials for those living near substations and other higher-risk areas will be developed or distributed (refer to Annex 5. Sample Community Health and Safety Leaflet).
    - Signs advising road users that construction is in progress will be provided.
    - Barriers should be installed to keep pedestrians away from hazardous areas such as constructions sites and excavation sites.
    - Signage should be installed at the periphery of the construction site to warn and direct traffic and pedestrians.
    - Security personnel in hazardous areas will be maintained to restrict public access.
    - Speed limits should be strictly imposed on construction vehicles along residential areas and where other sensitive receptors such as schools, hospitals, and other populated areas are located.
    - Drivers will be educated on safe driving practices to minimize accidents and to prevent spills of hazardous substances and other construction materials during transport.
    - Flag persons will be employed to control traffic when construction equipment is entering or leaving the work area.
- Utilities and Infrastructure
    - Traffic advisory signs should be posed (to minimize traffic build-up) in coordination with local Authorities.
    - Accidentally damaged private property and/or infrastructure will be promptly restored and tracked as part of its GRM.
    - Community will be informed about the schedule of works which could cause temporary restriction of services and the potential duration of the 'impact' in advance.
- Physical Cultural Heritage

  - ENA will ensure that Rapid Environmental and Social Assessment (RESA) Checklists are used to correctly identify potential impacts from activities near known cultural sites, assess likely significance, and examine how potential negative impacts may be mitigated.
  - Develop and implement a chance finds procedures to appropriately manage unanticipated discoveries of cultural or historic artefacts (movable or immovable) in the course of the work. A sample chance finds procedure has been provided in Annex 3. Sample Chance Finds Procedure which can be modified as needed.

461. **Residual Impacts**: ***Pre-Construction / Construction Phase***

- Occupational Health and Safety
  - Due to the nature of construction activities and the activities required for maintaining and operating the electrical system, occupational health and safety measures can reduce but not eliminate exposure to workers from various physical hazards. Assuming that the above management measures will be implemented and monitored over time, the residual impact was assessed as **minor**. Ongoing monitoring should occur to track implementation and evaluate the management measures.
- Community Health and Safety
  - While risks to community health and safety cannot be eliminated altogether, following the management and mitigation measures provided above can reduce potential impacts considerably. The residual impact are assessed as **minor**.
- Community Infrastructure, Services, and Access
  - Residual impacts to community infrastructure, services, and access from Project related activities will be **negligeable / minor** if the management and mitigation measure are implemented.
- Employment and Livelihoods
  - The significance of positive employment impacts resulting from the need for skilled and unskilled labor is assessed as **minor**.
- Physical Cultural Heritage
  - By developing and implementing a chance finds procedure the potential for residual impacts can be lowered to **minor**.

462. **Assessment of Potential Impact**: ***Operation Phase***

- Occupational Health and Safety
  - The potential for occupational health and safety impacts is related to the inherent risks associated with managing and operating an electrical network. The potential impacts, necessary management and mitigation measures, and likely residual impacts identified in pre-construction / construction phase analysis are applicable to the operation phase. No further analysis is provided.
- Community Health and Safety
  - As with occupational health and safety, the potential for health and safety impacts to communities will continue to exist for the foreseeable future. The analysis of potential impacts, necessary management and mitigation measures, and likely residual impacts for pre-construction / construction phase analysis apply to the operation phase.
- Utilities and Infrastructure
  - The potential impacts on community infrastructure, services, and access from Project related activities will be limited to the pre-construction / construction phase.
- Economy, Employment, and Livelihoods

  - Positive impact to employment provided by the need for skilled and unskilled labor will be mostly felt during the pre-construction / construction phase.
  - A significant positive impact is anticipated from the improved energy supply provided to ENA's customers following the rehabilitation, efficiency improvement, and augmentation of the network made possible with financing under this Project. This will have benefits to local businesses and households which often experienced uneven power supply and power outages.
- Physical Cultural Heritage
  - Potential impacts to PCH from Project related activities will not continue into the operation phase.

Table 49. Assessment of Impacts to Employment and Livelihoods (prior to mitigation) – *Operation Phase*

Impact	Improved energy supply provided to local businesses and households.				
Impact Nature	**Negative**	**Positive**	**Neutral**		
	An improved electrical network will provide **positive** impacts to Armenians.				
Impact Type	**Direct**	**Indirect**	**Induced**		
	The impacts to Armenian businesses and residents following completion of the investments under this project are considered **direct**. Long-term economic development and business confidence made possible from the Project is considered **induced**.				
Impact Duration	**Temporary**	**Short-term**	**Long-term**	**Permanent**	
	The impact is considered **long-term** since benefits will continue into the foreseeable future.				
Impact Extent	**Local**	**Regional**	**International**		
	The beneficiaries of a more reliable and efficient electrical network are **local**.				
Impact Scale	Over time, the scale of positive impacts will be substantial and far-reaching.				
Frequency	Positive impacts will recur over and over again in different ways and with different outcomes.				
Probability	**Unlikely**	**Possible**	**Definite**		
	There will **definitely** be positive impacts from improved energy supply.				
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Major**
	The impact is **positive**.				

Note: In the case of a potential positive impact, no magnitude designation (aside from 'positive') is assigned.

463. **Management and Mitigation Measures: Operation Phase**

- None.

464. **Residual Impacts: *Operation Phase***

465. The significance of positive impacts from an improved energy supply is considered **major**.

8.2.9 Ecology and Biodiversity

466. **Scope of the Assessment**

467. This section provides an assessment of the potential effects on sensitive ecological and biodiversity receptors (i.e., flora, fauna, and habitat) from Phase 2 of the Project. It identifies and assesses the potential construction and operational impacts of the development and formulates an appropriate mitigation strategy. The scope of this assessment is to:

- examine and analyze general baseline data with regard to the proposed activities;
- identify the significance of any potential direct/indirect impact on the ecology and biodiversity; and
- identify appropriate and effective means of mitigating the identified potential adverse impacts.

468. Impacts have been evaluated and assessed through the use of information derived from desk-based studies and from key sensitivities identified during the Phase 1 environment, social, health, and safety performance review. General baseline ecological information is provided in Section 7.2. Biological Environment.

469. **Aspects of The Project That Have the Potential to Impact Ecology and Biodiversity**

470. The primary aspects of the Project that could impact upon flora, fauna, and habitat include:

- Vegetation clearance and topsoil removal activities within working corridors, however, many work sites will be located within residential areas and along roads where the presence of vegetation is low. Vegetation clearance associated with underground cables is less likely due to the fact that these locations will be in dense residential areas.
- Operation of electrified components.

471. No other aspects have been identified that may generate significant impacts to biodiversity due to the relatively small-scale nature of Project works and also due to the fact many activities will be undertaken in inhabited areas where ecosystems are altered or degraded.

472. **Sensitive Receptors Identified**

473. As noted previously, the exact location of subproject sites, including small-scale construction, are not known at this time and activities are expected to take place across the country.

474. Phase 2 investment activity sites are not currently being planned in any nationally or internationally designated conservation sites. The Phase 1 sites visited as part of the environment, social, health, and safety performance review did not indicate the presence of any notable habitat, flora, and fauna in proximity to completed or planned work sites. Meanwhile, the Environmental and Social Compliance Audit (ESCA) conducted by the Lender's Engineer (Tetra Tech ES, Inc.) for Phase 1 and Phase 2 provided an analysis on several potential activity locations in Tsaghkadzor, Vardenik, Nor Kharberd, and Vedi based on information provided by ENA.[172] The report concluded that the information showed sites near the Vedi, Vardenik, and Tsaghkadzor nationally designated key biodiversity areas, but that no Phase 2 works have been presented occurring within those site boundaries.

475. Notwithstanding the above, it is possible that activities in Phase 2 and in future years could be planned in ecologically sensitive areas (e.g., Sevan National Park, Dilijan National Park), or close to sensitive habitats, such as wetlands or forests.

[172] Tetra Tech. 2021. *ENA - Modernization of Distribution Network Corporate Environmental and Social Compliance Audit Phase 2: Final Report*. London: EBRD.

476. **Assessment of Potential Impact: *Pre-Construction / Construction Phase***

477. Site clearance. Some small areas of land may need to be cleared for below ground cables, new pole installations, new transformer structures and platforms, and new spill containment structures. This has the potential to result in loss of plants contributing to a decline in their numbers, as well as loss of habitat for species of mammals, birds, insects, and herpetofauna that they provide.

478. Since Project activities will not be planned within any protected area or known biological corridor, it is not expected to hinder any migratory routes of animal species, and the motility of most animals means that they are very likely to move away in response to related disturbances, thus avoiding accidental damage or death. Moreover, many of the planned construction activities will take place where existing structures exist and where habitat is already heavily modified.

479. The risk of negative impacts from the need to trim or remove trees is being partially mitigated by the use of insulated lines on ENA's 0.4 kV lines. In areas where trees are more densely planted or where trimming could impact fruit trees being grown by community members, the installation of insulated wires during Phase 1 of the Project has shown to be effective.

480. Indirect impacts. In addition to the direct impacts to vegetation resulting from the pre-construction / construction phase of the Project, there are also a number of potential indirect impacts on vegetation cover. For example, pollution of the surrounding areas with construction material waste; soil and water contamination from; soil compaction or, harmful aim emissions, etc. As a result of such impacts recovery of the natural functioning of the vegetation can take several years, which will have negative impact on the ecosystem. These potential impacts and the mitigation measures needed to address risks have been covered in previous sections (see Sections 8.2.3. Soil and Geology; 8.2.4. Surface and Groundwater; and 8.2.5. Air Quality).

Table 50. Assessment of Impacts to Habitat and Flora from Site Clearance and Construction Activities (prior to mitigation) – *Pre-Construction / Construction Phase*

Impact	Impacts to habitat and flora from site clearance and construction activities.			
Impact Nature	**Negative**	**Positive**	**Neutral**	
	The impact on habitat and vegetation in the Project area is **negative**.			
Impact Type	**Direct**	**Indirect**	**Induced**	
	Unavoidable **direct** impacts to vegetation will result from clearing and construction activities. There is also the potential for **indirect** impacts (e.g., soil and water contamination) due to poor construction practices.			
Impact Duration	**Temporary**	**Short-term**	**Long-term**	**Permanent**
	The loss / conversion of habitats could be **permanent**. Potential indirect impacts are considered **long-term**.			
Impact Extent	**Local**	**Regional**	**International**	
	The impacts are expected to be **local**.			
Impact Scale	The size of the potential impact is difficult to determine given the unknowns around project locations. In general, areas disturbed by Project activities will be less than 9 m^2. In many cases, like-for-like replacements will mean no newly disturbed areas.			
Frequency	Impacts will recur over and over again at different sites across the country.			
Probability	**Unlikely**	**Possible**	**Definite**	
	Some impacts to habitat and flora are **definite**.			
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Large**
	The impact magnitude is likely to be **minor** overall considering the above analysis.			
Receptor Sensitivity	**Low**	**Medium**	**High**	
	The sensitivity of receptors is considered to be **high**.			
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**
	The overall significance is likely to be **moderate**.			

481. **Management and Mitigation Measures**: ***Pre-Construction / Construction Phase***

- General
  - Ensure that Rapid Environmental and Social Assessment (RESA) Checklists are used to identify potential impacts to sensitive ecological areas, assess likely significance, and examine how negative impacts may be mitigated. The detailed screening process for Project activities with the potential to impact sensitive ecological areas outlined in the 2021 ESCA report developed by the Lender's Engineer will be referenced and followed.[173]
- Impacts to habitat and flora from site clearance and construction activities
  - ENA and its contractors shall identify during site surveys if any Armenia Red book plants species, and trees in particular, are located within five meters of a subproject boundary.[174] Where pre-construction walkover surveys reveal that protected tree species will be lost, ENA or the contractor will be responsible for replanting any trees cut on a 1:10 basis.

[173] Tetra Tech. 2021. *ENA - Modernization of Distribution Network Corporate Environmental and Social Compliance Audit Phase 2: Final Report*. London: EBRD.
[174] Ministry of Environment of the Republic of Armenia. 2021. "Red Book." Ministry of Environment. April 30. Accessed May 2, 2021. http://www.mnp.am/shrjaka-mijavayr/karmir-girq.

- Delimitation of areas to be cleared before the beginning of the construction activities will take place in order to limit as much as possible the surface of vegetation to be cleared.
- Disturbed sites will be recultivated after completion of works, as practicable.
- All efforts will be made to minimize removal of mature/significant trees and maintain connectivity between areas of forest habitats.
- Any reseeding or replanting of selected areas to be restored will use locally collected seed mixes and saplings.

482. **Residual Impacts: *Pre-Construction / Construction Phase***

483. Potential impacts to habitat and flora from site clearance and construction activities was assessed as moderate, but they can be reduced to **minor** by following management and mitigation measures provided.

484. **Assessment of Potential Impact: *Operation Phase***

485. Bird electrocutions. The most significant potential impact of the Project, in terms of biodiversity, relates to potential bird electrocution on poles and wires. As noted in Section 7.2.2. Fauna, Armenia has abundant biodiversity including an estimated 347 species of birds[175], more than 40 of which are listed as endangered, threatened, or vulnerable according to IUCN's Red List of Threatened Species.[176]

486. According to the US Fish and Wildlife Service (FWS) most cases of electrocution occurs when a bird simultaneously touches two energized parts or an energized part and a grounded conductor or equipment. A bird may touch energized parts when flying on or off a distribution pole, when defecating from the pole and causing a connection, or when a large number of birds roost on the lines at the same time, causing them to sway and make connections."

487. The risk of bird electrocutions on a distribution pole is based on the combination of three factors: biological, environmental, and engineering.[177]

- Biological Factors
  - A bird's vulnerability to an electrocution is based on the following characteristics:
    - *Body size* - Large birds are most at risk of touching two parts simultaneously as their wingspan and head-to-foot height is typically greater than the separation between energized components. However, small birds are also electrocuted as they can access smaller spaces where energized components are more closely aligned.
    - *Age* - Young birds are less agile and may be less able to avoid wires and equipment thus increasing risk of electrocution. In addition, juvenile birds are less experienced with hazards on the landscape and require time to adapt to these risks.

[175] Republic of Armenia. 2015. *Strategy of the Republic of Armenia on Conservation, Protection, Reproduction and Use of Biological Diversity*. Yerevan, Armenia: Republic of Armenia. https://www.cbd.int/doc/world/am/am-nbsap-v2-en.pdf.
[176] International Union for the Conservation of Nature. 2020. "*Table 8a: Total endemic and threatened endemic species in each country (totals by taxonomic group)*." IUCN Red List. March 19. Accessed May 22, 2020. https://www.iucnredlist.org/resources/summary-statistics.
[177] This information was taken from the following source: U.S. Fish & Wildlife Service. 2018. *Electrocutions*. November 16. Accessed June 10, 2021. https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds/electrocutions.php.

        - *Use of Perches* - Many birds, particularly raptors, seek out tall perches to hunt for food and some birds perch and roost on distribution poles. Frequent use of poles increases the exposure to energized parts while flying on and off a pole. Both large and small birds have been observed nesting on distribution poles. Nesting material may cause an electrical connection, or the nest material could catch on fire, killing the bird and damaging the power structure. Birds that roost on distribution lines in large flocks (e.g., swallows) can cause lines to sway and touch.
- Environmental Factors
    - In addition to biological factors, other environmental factors influence electrocution risk:
        - *Habitat Type* - Studies indicate that electrocutions are more likely to happen in habitats with low vegetation where the distribution pole is the (or one of the) tallest structures in the habitat. Given a bird's preference for elevated perches for protection from predators or to obtain a higher vantage point for hunting, distribution poles that are prominent features on the landscape will likely have greater use than poles in landscapes with other tall structures or trees. Urban or disturbed areas are generally characterized as low-quality habitats.
        - *Wet Weather* - In dry conditions, feathers are not good conductors of electricity. Electrocution typically requires skin or bone contact (e.g., wrist to wrist) with the energized parts. However, when feathers are wet, they have a higher conductivity and electrocutions occur with wingtip to wingtip connections.
        - *Seasonal Variation* - Birds are electrocuted year-round and studies vary on whether one season is of greater risk than others. During breeding season, more birds may attempt to nest on distribution poles, while in the fall there are more juveniles on the landscape, and finally in winter, some species congregate in large numbers, potentially increasing risk of pole use.
- Engineering Factors
    - The critical factor that increases the risk of bird electrocutions on distribution poles is the distance between energized parts. This distance can be between components horizontally (where a bird typically connects the circuit with its wings) or vertically where a bird might make a connection with its body (head to foot distance). Ultimately, the design of a pole influences risk through:
        - *Phase design* - The number of phases and phase separation distance directly influences electrocution risk.
        - *Pole type* - Metal poles commonly used in Europe and increasingly used in the U.S. are higher risk for electrocutions than other materials.
        - *Pole equipment* - Transformers, jumper wires, surge arresters, switch equipment, etc. increase the number of energized parts that can make connections when touched.

488. Bird types most commonly electrocuted include:

- *Raptors* - Eagles and buteos are of primary concern due to their large size, preference for nesting, roosting, and hunting from tall perches, especially in open habitats.
- *Waterbirds* - Herons and storks may use poles near wetlands to roost, dry feathers, and nest. This taxa may have increased risk due to large size and frequency of having wet feathers
- *Vultures and Condors* - Very large birds that are known to roost on power poles
- *Corvids* - Species of raven and crow frequently nest and roost on power poles and are of medium size that can make the connection between energized parts on many poles.
- *Songbirds* - Smaller birds such commonly try to nest on poles in small spaces created by pole equipment and wires.

489. Several factors will limit the risk of bird electrocutions occurring from the project including the use of underground cables in high density urban areas. In many of 0.4 kV distribution lines, ENA is installing insulated wires which will prevent bird electrocution on the insulated portions of these lines, but notably not the electrical components.

490. Bird strikes. Another significant potential impact of the Project to avian species is from collisions with the lines. As with risks from electrocution, bird collisions result from a complex mixture of biological, environmental, and engineering factors. Biological characteristics include body size, weight, maneuverability, flight behavior, vision, age, sex, health, time of day, season, habitat, and habitat use. Environmental conditions include land uses, weather, visibility, lighting, and sudden disturbances. Engineering aspects include size of lines, line placement, line orientation, line configuration, and structure type.[178]

491. The Avian Power Line Interaction Committee (APLIC), which is leader the electric utility industry in protecting avian resources, notes that it is difficult to extrapolate collision risk from one power line study and apply or compare it with other studies because of site-specific conditions and the lack of standard study methods. However, the species of birds reported to be most susceptible to collisions generally have a large body size, long wingspan, heavy body, and poor maneuverability. Examples include species of loons, storks, grebes, waterfowl, and some species of hawks and eagles. Flight behavior and other biological attributes contribute to species risk.

492. Studies suggest that most bird collisions occur with the shield wire, which is the smallest diameter and highest wire on a transmission line.[179] Many studies of lines with high collision rates indicate that collision risk can be lowered by 50-80% when these lines are marked, though other studies demonstrated only a 9.6% reduction.[180]

493. While individual losses from collision mortality are unlikely to affect large and robust populations, the loss of even one rare or endangered species may impact a local population or the overall population's viability.

494. Key Sensitivities Identified during Phase 1 Environment, Social, Health, and Safety Performance Review.

- No specific avian safe structures (e.g., perch guards) were seen implemented on ENA's network.
- In parts of the country visited, a significant number of stork nests on electrical poles were observed (see Figure 24). ENA indicated that bird nests on utility structures can reduce power reliability.
- No coordination among ENA, national biologists, NGOs, or the MoE on management of potential impacts to avian species is currently being undertaken.

[178] Avian Power Line Interaction Committee (APLIC). 2012. *Reducing Avian Collisions with Power Lines: The State of the Art in 2012.* Edison Electric Institute and APLIC. Washington, D.C.
[179] Ibid.
[180] Barrientos, R., C. Ponce, C. Palacín, C. A. Martín, B. Martín, and J. C. Alonso. 2012. Wire marking results in a small but significant reduction in avian mortality at power lines: A BACI designed study. PLoS ONE 7(3): e32569.

Figure 24. Stork Nesting on Electrical Pole

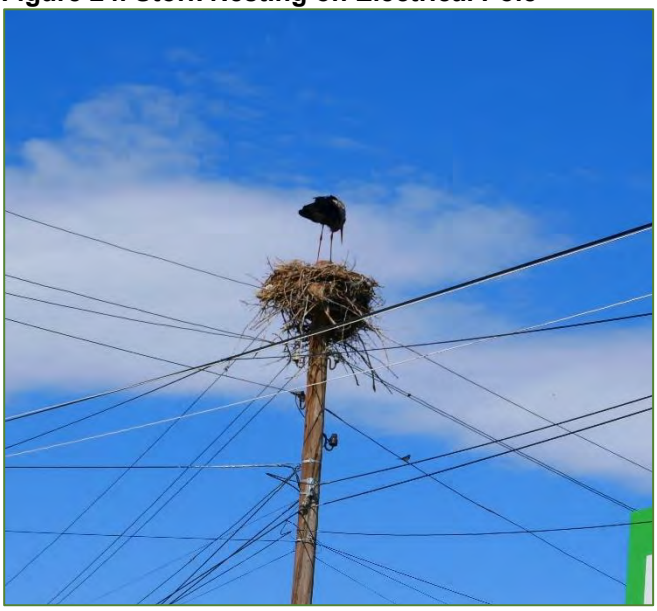


Table 51. Assessment of Impacts from Bird Strikes and Collisions (prior to mitigation) – *Operation Phase*

Impact	Impacts to birds from electrocution and collisions with transmission lines and equipment.				
Impact Nature	**Negative**	**Positive**	**Neutral**		
	The impact birds is **negative**.				
Impact Type	**Direct**	**Indirect**	**Induced**		
	Impacts to birds from the electrocution and collision with infrastructure is considered **indirect**.				
Impact Duration	**Temporary**	**Short-term**	**Long-term**	**Permanent**	
	Impacts to birds is considered **permanent** given the high likelihood of mortality.				
Impact Extent	**Local**	**Regional**	**International**		
	The impacts are **local** in nature				
Impact Scale	The size of the potential impact is difficult to determine given the little information that exists on bird mortality.				
Frequency	Impacts may recur over and over again at different sites across the country.				
Probability	**Unlikely**	**Possible**	**Definite**		
	At this time the probability is assessed as **possible**, but it is very likely impacts are occurring to bird populations.				
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Large**
	The impact magnitude is likely to be **moderate** overall considering the above analysis.				
Receptor Sensitivity	**Low**	**Medium**	**High**		
	The sensitivity of receptors is **medium** considering the biological, environmental, and engineering factors that exist for there to result in negative impacts.				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	The overall significance is likely to be **moderate**.				

495. **<u>Management and Mitigation Measures</u>: *Operation Phase***

- Bird Electrocutions
  - ENA should identify within its RESA reports and at the design phase whether planned subprojects are within 5 km of one of Armenia's 18 Important Bird Areas (IBAs).[181] If the answer is positive, ENA will engage a national specialist to visit the site and make an assessment of the types of birds that could potentially be affected and recommend design specifications to mitigate any impacts to these species. Design specifications should be based on those outlined by the Avian Power Line Interaction Committee (APLIC) in its *Suggested Practices for Avian Protection on Power Lines* document.[182]
  - ENA will be responsible for reviewing all of the design documents prior to their implementation to ensure that suitable mitigation measures recommended by the national bird specialist in line with those outlined above, have been included in the design to limit the potential for bird electrocution.
  - More broadly, ENA should coordinate and collaborate with biodiversity specialists, non-governmental organizations (e.g., World Wildlife Foundation, Armenian Society for the Protection of Birds), academic institutes (e.g., American University of Armenia, Department of Zoology at Yerevan State University), and the MoE to identify sensitive bird areas and the appropriate mitigation measures to minimize adverse effects to birds from electricity transmission facilities. The free online Integrated Biodiversity Assessment Tool (IBAT)[183] developed by the UN Environment World Conservation Monitoring Centre can provide valuable insights on high biodiversity areas when planning for subprojects.
  - ENA is to begin collecting data on bird related outages to quantify the impacts of birds on power systems, and to develop a range of measures for preventing bird mortalities and their associated outages.
  - ENA is to include bird carcass monitoring near Important Bird Areas (IBAs) as part of its regular monitoring activities and implement adaptive measures if results show risk to be significant.
  - Nest management
    - Nest management, including the design and installations of platforms on or near power structures, can enhance nesting while minimizing the risk of electrocution, equipment damage, and loss of service.
    - Where nests are present on poles the old poles shall be left in-situ if possible so that the nest can continue to be used.
    - Poles with nests shall not be removed during the nesting season.
    - Where the above is not possible consideration shall be given to the use of nesting platforms on new poles. Platforms provide for the needs of the birds, while preventing electrocutions and electrical outages. Mounting a nest platform above energized equipment is not encouraged because birds are likely to drop nest materials that could cause a fire or outage. Nest platforms are commercially available or can be constructed with materials on hand such as wooden pallets.

[181] BirdLife International. 2021. IBAs of Armenia. Accessed May 18, 2021. http://datazone.birdlife.org/site/results?thrlev1=&thrlev2=&kw=&reg=0&cty=11&snm=&fam=0&gen=0&spc=&cmn=.
[182] Avian Power Line Interaction Committee (APLIC). 2006. *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006*. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, D.C. and Sacramento, CA.
[183] Integrated Biodiversity Assessment Tool (IBAT): https://www.ibat-alliance.org/

    - There may be times when nesting should be discouraged to prevent avian electrocutions or risks to electrical equipment – this will be identified during pre-work surveys.
- Bird Collisions
    - In cases where planned subprojects are within 5 km of one of Armenia's 18 Important Bird Area (IBA), ENA will engage a national specialist to visit the site and make an assessment on risks to birds and recommend design specifications to mitigate any impacts to these species. Design specifications should be based on those outlined by the Avian Power Line Interaction Committee (APLIC) in its *Reducing Avian Collisions with Power Lines: The State of the Art in 2012* document.[184]
    - Risk reduction options may include line marking, managing surrounding lands, removing the shield wire, changing the size or configuration of wires, rerouting the line, and burying lines.

496. **Residual Impacts: *Operation Phase***

497. Despite the proposed mitigation measures it is still likely that some bird electrocutions will occur. However, the proposed mitigation measures should limit the number of birds affected. Residual impacts are expected to be **minor**.

8.2.10 Hazardous Waste Management

498. **Scope of the Assessment**

499. Waste and waste management is a cross-cutting issue and has been covered fully in the other sections within the IEE. This section will focus on specific issues not already analyzed including management of the following:

- Used mercury-containing lamps
- Used flooded-acid batteries
- Asbestos waste

500. **Sensitive Receptors Identified**

501. Sensitive receptors includes people who are handling hazardous wastes as well as those nearest to areas where these wastes are being stored.

502. **Aspects of The Project That Have the Potential to Impact Health and Environment**

503. The main aspects of the Project that could impact health and the environment include the handling, transportation, storage, and disposal of these wastes

504. **Assessment of Potential Impact: *Pre-Construction / Construction Phase***

505. General. Waste passports are generated by ENA every year which inventory hazardous materials. The passports include an environmental and health and safety aspects section which describes the status of substations with respect to wastes. The purpose of the passports is to

[184] Avian Power Line Interaction Committee (APLIC). 2012. *Reducing Avian Collisions with Power Lines: The State of the Art in 2012.* Edison Electric Institute and APLIC. Washington, D.C.

inventory hazardous wastes and identify any issues that need to be remedied to ensure compliance with ENA's ESMS.

506. Used mercury-containing lamps. ENA's electrical network still utilizes older mercury-containing lamps and the mercury within those lamps has the potential to result in health and environmental impacts if not collected, stored, transported, and disposed of correctly.

507. Mercury is a toxic chemical which is hazardous at any physical state. Symptoms of poisoning vary depending on the dose and time of exposure and ways of getting into the body. Mercury vapor cannot be felt even in high concentrations and contamination can only be detected with special equipment. Mercury exposure mostly affects the central nervous systems of the human body. It causes speech, hearing and vision disorder and impedes coordination of movements. These effects are irreversible, and only very lengthy treatment can slightly reduce its symptoms. Accumulating in the body throughout life, mercury can lead to infertility, fetal death, or abnormal births in pregnant women, decreased immunity, and cancer.[185]

508. Under Phase 1 of the Project ENA created guideline documents as part of its ESMS which indicate specific environmental issues associated with different types of works. Among those documents are work instructions that define the procedures for handling and storing use mercury-containing lamps. It also requires that all new lamps be LED type. Older lamps are used on the network until they fail and are then replaced with LED lamps.

509. Temporary storage of mercury-containing lamps, as well as other hazardous waste, is managed at the six designated branch offices (Debet, Araks, Tatev, Musaler, Geghama, and Aghstev offices) before being transported to the HWSF. Storage is managed by packing used lamps within purpose-built boxes which have padding and appropriate safety markings.

510. The disposal of mercury-containing lamps is a complex process, which is carried out in industrial conditions at specialized enterprises. There are currently no established enterprises in Armenia to dispose of these lamps, so they are stored at the HWSF until a sustainable solution can be found.

511. Waste batteries. Flooded-acid batteries are still being used in 35 of ENA's substations that store batteries to provide a permanent (continuous) source of direct current. ENA intends to replace its flooded-acid batteries with dry or gel-cell batteries which are less likely to leak.

512. Batteries that are not collected and recycled typically end up in the residual waste stream and a landfill. Disposal of batteries to landfills means the chemicals they contain may leak into the ground, potentially polluting the environment and harming human health.

513. While lead is ecotoxic, persistent, and bio-accumulative in the environment, it is primarily a health impact consideration. Long-term exposure to lead can result in a variety of adverse health effects, mainly involving the central nervous system, major organs, and can affect unborn babies. Health consequences from exposure are more significant in children aged 5 years or younger.

[185] World Health Organization. 2017. *Mercury and health*. March 31. Accessed June 10, 2021. https://www.who.int/news-room/fact-sheets/detail/mercury-and-health#:~:text=Elemental%20and%20methylmercury%20are%20toxic,kidneys%2C%20and%20may%20be%20fatal.

Unborn children can be exposed through their mothers and harmful effects may include premature birth, smaller babies, decreased mental ability, learning difficulties, and reduced growth.[186]

514. ENA has established as part of its ESMS a set of instructions and procedures to manage the collection, storage, and transport of lead batteries. Similar to mercury-containing lamps, used batteries are temporarily stored at one of six designated branches until transferred to the HWSF. The batteries are stored on recessed shelves designed to act a leak catchment and within well marked and managed storage rooms. They are stored there until they can be recycled which diverts batteries from landfills, helping recover thousands of tons of metals and saving on CO_2 emissions by reducing the need to mine new materials.

515. Asbestos. The removal of asbestos-cement roofing materials on some of ENA's existing buildings has been an ongoing activity under Phase 1 of the Project and which is expected to continue into Phase 2. To date, approximately 8,000 m^2 of asbestos waste have been removed and ENA estimates that less than 20% of their buildings still have asbestos to be removed.

516. When construction, demolition, mining, and manufacturing activities release asbestos into the environment, it contaminates the air (where it can be inhaled), water (where it can be ingested), and soil (where it can easily be disturbed and redistributed into the air). Asbestos can remain suspended in the air for long periods of time. It can be carried long distances by wind or water before settling, thus contaminating areas far away from its source. Because asbestos does not break down or biodegrade, it poses a significant health risk to humans.[187] Asbestos only poses a risk to health when asbestos fibers are breathed in. Inhaling asbestos fibers may cause asbestos-related disease and death. When asbestos fibers are breathed in, they can lodge in lung tissue and cause inflammation, scarring and some more serious asbestos- related diseases, which usually take many years, if not decades, to develop. The four major asbestos-related diseases, in increasing order of severity, are: pleural plaques, asbestosis, lung cancer, and mesothelioma.

517. Key Sensitivities Identified during Phase 1 Environment, Social, Health, and Safety Performance Review.

- The storage conditions for hazardous waste at the HWSF were not optimal in the areas storing used flooded-lead batteries and mercury-containing lamps. The following was observed[188]:
  - A fan is not installed in the used battery storage area
  - The fan in the used lamp area was connected to the light switch and therefore not running
  - The windows to the used battery and lamp area were not darkened
- Fire safety equipment, including appropriate fire suppressant systems, had yet to be fully installed across the HWSF.
- The HWSF did not have established procedures to use in the event of fires, explosions, or any unplanned sudden or non-sudden release of hazardous materials and waste.
- There are inconsistencies in the amount of asbestos waste that removal contractors are turning over to ENA compared to the quantities being estimated for removal and reported on its waste passports. The amount of asbestos waste removed to date was not observed at the branch offices visited or the HWSF and could not be fully accounted for.

[186] Ascend Waste and Environment Pty Ltd. 2015. *The Health and Environmental Impacts of Hazardous Wastes*. Sydney: The Australian Department of the Environment.
[187] Indiana Department of Health. 2021. *Health Risks and Environmental Impacts*. Accessed June 10, 2021. https://www.in.gov/idem/asbestos/health-risks-and-environmental-impacts/.
[188] It should be noted that these facility modifications were first identified as necessary by the Lender's Engineer (Tetra Tech) in 2019.

- Observed battery storage areas did not have acid spill kits to manage accidental spills/leaks.

Table 52. Assessment of Impacts from Management of Hazardous Wastes (Lamps, Acid batteries, and Asbestos) (prior to mitigation) – *Pre-Construction / Construction Phase*

Impact	Impacts to heath and the environment from improper management of mercury-containing lamps, acid batteries, and asbestos.			
Impact Nature	**Negative**	**Positive**	**Neutral**	
	The impact is **negative**.			
Impact Type	**Direct**	**Indirect**	**Induced**	
	Direct and **indirect** impacts will result from improper management of wastes connected to this Project.			
Impact Duration	**Temporary**	**Short-term**	**Long-term**	**Permanent**
	Any health impacts could be **permanent** while impacts to the environment are considered **long-term**.			
Impact Extent	**Local**	**Regional**	**International**	
	The impacts are expected to be **local**.			
Impact Scale	The size of the potential impact will depend on a number of factors, but overall is not expected to be large scale.			
Frequency	Impacts would be one-off events with little frequency.			
Probability	**Unlikely**	**Possible**	**Definite**	
	Impacts are **possible**.			
Impact Magnitude	**Positive**	**Negligible**	**Minor**	**Moderate**	**Large**
	The impact magnitude is likely to be **moderate** overall considering the above analysis.			
Receptor Sensitivity	**Low**	**Medium**	**High**	
	The sensitivity of receptors is considered to be **medium**.			
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**
	The overall significance is **moderate**.			

518. **Management and Mitigation Measures**: ***Pre-Construction / Construction Phase***

- General
  - ENA will ensure the plans, procedures, and guidelines developed as part of its ESMS are followed by its personnel and its contractors (see Section 6.14. Environmental and Social Management System (ESMS)). This includes:
    - Hazardous Materials Safe Management Procedures
    - Waste Transportation Work Instruction
    - Waste Management Procedure
    - Work Instruction of Collecting and Storing of Used Lamps
    - Work Instruction of Collecting and Storing of Used Batteries
  - A comprehensive contingency and response plan will be developed for the HWSF which sets out an organized, planned, and coordinated course of action to be followed in case of a fire, explosion, or release of hazardous waste or its hazardous constituents which could threaten human health or the environment (refer to Annex 4. Contingency and Emergency Response Plan Template).

  - All of the construction and operating conditions established by the 2019 EIA developed for the HWSF will be followed (refer to Section 6.5 Hazardous Waste Storage Facility (HWSF)).[189]
- Impacts to heath and the environment from improper management of mercury-containing lamps, acid batteries, and asbestos
  - All of the asbestos waste removed by ENA's contractors will be accounted for, tracked, handled, and stored appropriately at the HWSF.
  - ENA will complete installation of an automated alarm system at the HWSF as part of its emergency management system.
  - Fire protection measures will be implemented throughout the facility, including the appropriate fire management devices and materials at the correct locations. This should be coordinated by ENA's technical safety and firefighting coordinators and the appropriate government emergency authority.
  - The storage conditions for hazardous waste should be cool, dry, well-ventilated, and away from sunlight. As such, the following will be carried out:
    - A separate fan will be installed in the storage area for batteries.
    - The fan in the used lamps area will be separated from the light switch so that it can be on all the time
    - The windows will be darkened with paint or a stick-on film

519. **Residual Impacts: *Pre-Construction / Construction Phase***

520. ENA already has in place the needed procedural and instruction documents to manage hazardous wastes. Moreover, it has established the necessary storage infrastructure to manage mercury-containing lamps, used batteries, and asbestos as a result of the activities funded under Phase 1 of this Project. Provided the mitigations measures above are followed, the residual impacts can be reduced to **negligible / minor**.

521. **Assessment of Potential Impact: *Operation Phase***

522. Potential impacts will likely continue after the conclusion of this Project until all the mercury-containing lamps and used batteries are replaced and the asbestos is removed. After which, potential impacts will be limited to the management of collected wastes until they can be properly eliminated. Until that happens, the potential impacts identified in pre-construction / construction phase analysis are considered the same on the operation phase.

523. **Management and Mitigation Measures: *Operation Phase***

524. The necessary management and mitigation measures needed to reduce potential impacts are the same as those identified in pre-construction / construction phase analysis.

525. **Residual Impacts: *Operation Phase***

526. Residual impacts in the from the handling, transport, use, storage, and disposal of hazardous wastes are the same as those identified in the pre-construction / construction phase analysis.

8.2.11 Cumulative and Induced Impacts

[189] ATMS Solutions LLC. 2019. *Baghramyan Hazardous Waste Storage Facility Environmental Impact Assessment*. Yerevan: Electric Networks of Armenia

527. Cumulative impacts. Any cumulative impacts that arise from this Project will primarily result from the construction of the main Project components and associated facilities. For example, the replacement of existing transmission poles could be coupled with an extension of the line to provide more service to customers and the installation of a new transformer.

528. No other infrastructure projects have been identified near Phase 1 Project sites visited that may result in significant cumulative impacts. Given the nature of the works, it is also considered unlikely that any activities undertaken in future investment years would contribute to significant cumulative impacts.

529. Induced impacts. Upgrading of the distribution system, especially extending the coverage of the network, could lead to localized residential and light-industrial/commercial expansion in residential settlements. This is considered likely in both small villages and towns as well as in the areas surrounding city centers, such as Gyumri, Hrazdan, or Yerevan. Networks upgrades and expansion in these areas is not anticipated to lead to levels of development which would result in significant induced impacts, for example in the form of pressure on local health care systems, or other social infrastructure.

9 Public Consultation and Information Disclosure

9.1 General

530. The Law on Environmental Assessment and Expertise of 2014 sets out the public disclosure requirements for all projects that are required to carry out a full EIA. The MoE and the public are notified of the project through the disclosure of a non-technical summary (NTS), and the first round of public hearings is held. After that the EIA report is submitted to the MoE for review. For a Category A project, the Ministry has 60 days to review, and for a Category B project they have 40 days. Two public consultation meetings are required at this stage. The Ministry may extend the review deadline for up to 30 days after which it issues a positive or a negative conclusion of the expert review.

531. Legislation of the Republic of Armenia does not include specific provisions for stakeholder engagement for land acquisition and resettlement; thus, the Lender's requirements will be followed.

532. During Phase 1 of the Project, a stakeholder engagement plan (SEP) was developed. The SEP defines the methods, procedures, policies, and activities that will be implemented by ENA to inform stakeholders about the nature and potential impacts of their work.

533. The SEP outlines the following:

- Planned Project activities;
- Legal requirements for disclosure at both the national and international level;
- Process of identification and assessment of affected parties (including vulnerable and disadvantaged groups) and other interested stakeholders, as well as appropriate methods and tools to engage them;
- Identified stakeholders;
- Documents that will be disclosed and disclosure timelines;
- A GRM that allows stakeholders and the public to bring any project concerns to the attention of ENA and provide appropriate resolution processes; and
- A process for documenting the consultation and information disclosure activities, stakeholder tracking, and records management.

9.2 Stakeholders

534. To effectively implement the SEP, stakeholders have been identified in the table below. Stakeholders include local and national government, Project-affected communities, ENA employees, and sub-contractors working for ENA on Project activities. As the Project spans most of Armenia, a full list of Project-affected communities (and any vulnerable groups) is unavailable at this time; however, as the Project progresses, each community affected will be notified of the Project's plans and activities per the guidelines outlined in the SEP.

Table 53. Stakeholder Groups Identified

Stakeholder Group	Interest / Cause in Engagement
International Level	
Environmental and societal NGOs	Scientific understanding of the range of problems associated with the Project's activities.
National and Regional Level	
Government Ministries and Administration	Scientific understanding of the range of problems associated with the Project's activities.
NGOs	Scientific understanding of the range of problems associated with the Project's activities.
ENA Employees and Project Sub-Contractors	Technical understanding of the range of problems associated with the proposed Project including health and safety issues.
Local Level	
Local land users and other local population	Potential vulnerable groups, affected persons and communities, and other interested parties living in the close vicinity to Project works.

9.3 Objectives of Consultations

535. Stakeholder engagement (including consultation and the disclosure of information) is a key element of project planning, development, and implementation. Effective stakeholder engagement assists good design, builds strong relationships with local communities, and reduces the potential for delays through the early identification of issues to be addressed as a project progresses. The objectives of these consultations are:

- to inform and educate the common public, especially potentially impacted communities/ individuals and stakeholders about the proposed project activities;
- to familiarize the people with technical, environmental, social, and economic issues of the project for better understanding;
- to solicit the opinion of the affected communities/ individuals on environmental issues and assess the significance of impacts due to the proposed development;
- to foster cooperation among ENA, the communities, and the stakeholders to achieve a cordial working relationship for smooth implementation of the project;
- to identify environmental and social issues;
- to secure people's inputs in respect of project planning, selection of mitigation measures, and monitoring strategies; and
- to provide communities with a platform in the decision-making process.

9.4 Methodology Used for Consultations and Community Engagement

536. Projects requiring EIA. According to Armenian legislation, stakeholders and the public are required to be notified of public consultations 10 days before the consultation takes place. In order to give ample notice to all affected stakeholders, ENA plans to provide them 30 days in advance. After the consultation takes place, stakeholders and the public have two days to submit any additional comments or concerns to ENA through the established communication channels that are detailed in the public announcement. All documents will be disclosed on ENAs website (www.ena.am) and the MoE website (http://www.env.am/) and accessible by the general public at the time the consultation is announced. Documents will be produced in both English and Armenian.

537. All Public consultations will be coordinated through ENA's Public Relations (PR) Department with local authorities in any communities affected by Project activities. Affected populations will include end-users of electricity provided by ENA, people living on or near land that has transmission lines, distribution lines, substations, or branch offices. Announcements of the consultations will be published in the national newspaper "Republic of Armenia" and in local papers in affected communities.

538. Vulnerable groups will be identified through consultations with local authorities in affected communities carried out by the PR Department when they submit the NTS to the local authority representing the affected community. If any vulnerable populations are identified that may not have regular access to newspapers, circulars will be mailed to the local population and/or delivered to homes/settlements that do not receive regular mail service, and announcements will be posted in public places such as town halls, schools, and parks. Local authorities will be briefed on the consultation process so that they may communicate the details of the consultations directly to the affected communities. The announcements will include the date, location, project scope, location to access relevant documents, and contact information of ENA. State and national authorities will also be notified of the consultations.

539. ENA's PR Department consists of five employees in the public outreach department, two of whom are responsible for the consultation and grievance processes. The PR Department is responsible for ensuring that all consultations and disclosure activities follow this Stakeholder Engagement Plan. The PR Department is also be responsible for holding the public consultations and maintaining records of each meeting including meeting minutes and video recording of the public consultation. As it did under Phase 1 of the Project, the PR Department will compile annually the information from all consultations and report it to EBRD and ADB on all the consultations held during the year. In the case of tariff changes, the Public Services Regulatory Commission is responsible for disclosing all related documents, while ENA is still responsible for the public consultation process.

540. The steps in the consultation process for an EIA are:

1. PR Department and Environmental manager meet with local and national authorities to discuss project and identify any vulnerable populations
2. NTS of the project is submitted to the MoE and the head of the local authority in the affected community(ies)
3. Relevant documents are published on ENA's website (www.ena.am) and the MoE (http://www.env.am/)
4. Announcement of public consultation is published on community announcement boards in central places like community plazas, parks, schools, etc.
    - If vulnerable groups were previously identified, extra steps here may include mailing circulars announcing the consultation, radio/TV announcements of the consultation, etc.

541. The above outlined steps correspond to the four public hearings that are required during the EIA process as stated in the Armenian legislation:

- First Hearing – before submission of preliminary application (Category A, B, C)
- Second Hearing – during preliminary examination (Category A, B, C)
- Third Hearing – After the ESIA has been conducted by the Implementer but before it is submitted to the MNP (Category A, B)
- Fourth Hearing – The last phase of the examination procedure (Category A, B)

542. Projects requiring land acquisition and resettlement. If any land acquisition and resettlement (LAR) impacts are uncovered, and preparation and implementation of Resettlement Action Plan (RAP) is deemed necessary, the consultations shall be caried out from the earliest stages and through all resettlement activities. Affected men and women, including host communities shall be involved in consultation. This will facilitate their early and informed participation in decision-making processes related to resettlement. ENA will take into account any individuals or groups that may be disadvantaged or vulnerable. In particular, ENA will take necessary actions to ensure that vulnerable groups are not disadvantaged in the resettlement process, are fully informed and aware of their rights, and are able to benefit equally from the resettlement opportunities and benefits.

543. ENA shall consult with the affected persons in preparing the RAP and shall summarize the information contained in the RAP for public disclosure to ensure that affected people understand the compensation procedures and know what to expect at the various stages of the Project. In addition, where the Project involves the loss of public amenities, ENA shall undertake meaningful consultation with the locally affected community to identify and, where possible, agree upon suitable alternatives in accordance with the EBRD's Performance Requirement (PR) 10: Information Disclosure and Stakeholder Engagement.

544. Phase 2 Rehabilitation Works. Prior to the commencement of any activity under the Project involving sites bordering residential areas, ENA will provide notice to all neighboring properties of the works 24 hours in advance. The notice shall include a description of the activity and its location and the schedule of works. The notice will also include any safety-related information. The notice will also state if any disconnections will occur and for how long. The notice will also include the GRM form (see Annex 2. ENA Grievance Redress Form) and ENA contact details.

545. Operational activities. During the operation phase of the Project, ENA shall be responsible for routine community engagement relating to site safety. ENA are in the process of developing a community awareness campaign relating to electrical safety and this will be rolled out during Phase 2 through a range of media. In addition, during the operational phase the local community will be able to engage with ENA regarding any complaints, through the GRM (see Section 10.2. Grievance Redress Mechanism).

546. NGOs. Key NGOs pertaining to biodiversity conservation in Armenia (e.g., WWF Armenia) will be consulted regularly regarding bird safety mitigation measures. Further, IUCN regional species representatives will also be consulted on an-hoc basis as required depending on relevant bird species identified during RESA screening and through engagement with national bird specialists.

547. If any LAR impacts are uncovered and a RAP is prepared, NGOs may be involved during its implementation as mediators.

9.5 Stakeholder Engagement Activities

548. Table 54 presents the stakeholder engagement activities ENA will undertake. The activity types and their frequency are adapted to two Project stages: pre-construction / construction phase and operation phase.

Table 54. Summary of Planned Stakeholder Engagement

Target Stakeholders	Topics of Engagement	Methods Used	Location/Frequency	Responsibilities
International NGOs	Bird safety	Meetings with NGOs to discuss ENAs bird management strategy	Annually	ENA Environmental Expert
National NGOs	Bird safety	Meetings with NGOs to discuss ENAs bird management strategy	Ad-hoc as required, dependent on bird species identified	ENA Environmental Expert
Government Ministries and Administration	EIA	Per the requirements of the EIA regulations	Per the requirements of the EIA regulations	ENA Environmental Expert
	LAR (for state and community land)	Per the requirements of the LAR legislation and RF / RAP provisions	Per the requirements of the LAR legislation	ENA Social Expert
ENA Employees	Phase 2 works (details of works, training, employment and social policies, safety, grievance redress, etc.)	Meetings with staff and communication of the NTS (written, or verbally)	Annually	OHS Department ENA Environmental Expert
	Operational Activities (details of maintenance works, training, employment and social policies, safety, grievance redress, etc.)	Per the requirements of national legislation, IFI policies, ENA policies and procedures	Per the requirements of national legislation, IFI policies, ENA policies and procedures	HR Department PR Department OHS Department
ENA Sub-Contractors	Phase 2 Works (details of policy requirements applicable for contractors)	Distribution of NTS to all sub- contractors	Annually	Contracts Department
	Operational Activities (details of policy requirements applicable for contractors)	Per the requirements of national legislation, IFI policies, ENA policies and procedures	Per the requirements of national legislation, IFI policies, ENA policies and procedures	Contracts Department
Local Community	EIA (NTS, ENA's website, Community meetings & consultations)	Per the requirements of the EIA regulations	Per the requirements of the EIA regulations	ENA PR Department Environmental Expert Social Expert Safety Department
	Land acquisition and resettlement (Information brochure, census/SES questionnaires and process, entitlement matrix, RAP summary)	Per the requirements of the LAR legislation and RF / RAP provisions and IFI policies	Per the requirements of the LAR legislation and RF / RAP provisions and IFI policies	ENA Social Expert PR Department
	Phase 2 Works (land use, incidents during construction, construction traffic, engagement during works, environmental impacts, grievance redress, emergency preparedness, etc.)	Notices of works to all neighboring properties, leaflets, emails. Disclosure of ESCA, ESAP and NTS	Once, 24 hours prior to the start of a work activity Lenders and ENA website	ENA PR Department OHS Department Environmental Expert Social Expert

	Operational Activities (land use, incidents during operation, environmental impacts, grievance redress, emergency preparedness, etc.)	Mass Media, including web- based applications GRM	Periodic safety campaigns (at least every six months) at targeted locations.	ENA PR Department OHS Department Environmental Expert Social Expert

549. ENA has carried out public consultations for the following projects since 2016:

- EIA for “Armet” 35 / 0.4 kV substation’s feeder overhead line. Conclusion BP107, December 12, 2016 (Forestry area)
- EIA for Martuni – Nerqin Getashen 10 kV overhead line (“Sevan” National Park)
- EIA for 35/10 kV substation (Dilijan National Park)
- EIA (development is in process) for construction of Sotk 110/35/6 kV substation and 110 kV overhead line
- EIA (development is in process) for Vaghashen 6 kV overhead line (Forestry area)
- Agarak 110 kV overhead line (initial environmental examination phase)
- Hazardous waste temporary storage in Baghramyan region

10 Grievance Redress Mechanism

10.1 General

550. Grievance Redress Mechanisms (GRMs) are a locally based, formalized way to accept, assess, and resolve community feedback or complaints. They provide predictable, transparent, and credible processes to all parties, resulting in outcomes that are relatively low cost, fair, and effective. They build on trust as an integral component and facilitate corrective action and pre-emptive engagement. GRMs also set out a timeframe in the resolution of complaints.[190]

551. The Project GRM serves as a venue for receiving and addressing project-affected peoples' concerns and grievances about environment and social related impacts. It addresses concerns promptly through an understandable and transparent process that is accessible to all members of the community, gender responsive and culturally appropriate. The overall approach of the GRM is to deal with grievances at a local level first in an efficient manner and escalate to the next level or higher level of authority if grievance cannot be resolved.

552. The ADB Accountability Mechanism (AM) provides an independent forum and process for people to voice and seek solutions to their problem as well as alleged non-compliance by ADB with its operational policies and procedures. As ADB adheres to early problem prevention and problem-solving, Project complaints and concerns should first be addressed promptly and effectively at the Project, through the GRM, and operational levels. The AM is the "last resort" process for dealing with problems and compliance issues that were not prevented or solved at GRM and operational levels.

553. The ADB's 2009 Safeguards Policy Statement[191] requires the borrower/client to establish a mechanism that will receive and facilitate the resolution of affected persons' concerns and grievances about physical and economic displacement and other Project impacts, paying particular attention to vulnerable groups.

554. The GRM established under Phase 1 of the Project is incorporated into ENA's SEP and follows Armenian Regulations and ADB Policy requirements.

10.2 Grievance Redress Mechanism Structure

555. Overview. ENA's GRM serves to provide all stakeholders and the public with a tool to share their concerns with ENA and the relevant regulatory authorities. Grievance redress will be carried out in accordance with the provisions of the ENA's Grievance Mechanism Procedure outlined within its SEP.

556. ENA's GRM form is included in Annex 2. ENA Grievance Redress Form.

557. GRM structure and process. ENA tracks all comments or complaints received through its online system and reports quarterly to the Public Services Regulatory Commission on the nature of the grievances received, the Company's response, and the dates of the communications. Comments and complaints may be received at any time through several methods including the following:

[190] World Bank. 2014. Global Review of Grievance Redress Mechanisms in World Bank Projects. Washington, DC. World Bank.
[191] ADB. 2009. *Safeguards Policy Statement.* Manila.

- In Person:
  - To Public Relations Representative for external grievances.
  - To IMS Department for internal grievances.
  - To ENA CJSC General Manager during citizens reception, which is hold every Saturday from 11:00 to 14:00.
  - To state official bodies mainly Public Services Regulatory Committee (PSRC) and Ministry of Nature Protection.
  - To grievance box
- Electronic:
  - By website: http://ena.am/Contact.aspx?hid=45&lang=2 (External)
  - By social media: https://www.facebook.com/ZaoElektriceskieSetiArmenii and https://www.linkedin.com/company-beta/3025886/ (External)
  - By e-mail: ims@ena.am (Internal)
- By phone:
  - PR responsible 010-59-12-27
  - Helpline (+374 10) 59-13-12
  - Call-center 180 or 080000180.

558. The receiving department shall formally acknowledge grievances within five working days of the submission of the grievance. ENA shall communicate the outcome(s) with the submitter of the grievance within 20 calendar days.

559. The grievance is considered resolved upon the reception of an acceptance note by the complainant. Shall the complainant disagree with implemented actions; the receiving department shall organize a meeting with the complainant and other stakeholders (if necessary) for further discussion to reach an agreement.

560. Employee grievances are handled by the HR Department. Employees may submit grievances either in person, by email, by mail, or through the internal employee hotline. The ENA HR Department will follow up with resolution and inform the complainant on the outcome within 10 business days.

561. Anonymous complaints. In case of anonymous complaints, the complaining party can submit their complaint without personal details. Given that personal details are not provided, ENA will be unable to respond directly with the result of any complaint investigation. As such it will be the responsibility of the complaining party to follow up with ENA for further understand the progress and result of the investigation. ENA's website will be enhanced to include a page on anonymous grievances, which will include description of each anonymous grievance and the response provided.

11 Environmental Management and Institutional Requirements

11.1 Introduction

562. Through a systematic assessment, the IEE has identified a number of environmental and social impacts which may potentially result from the construction and operation of the Project. In order to manage and mitigate these impacts, a range of measures have been developed to reduce the overall residual impacts to acceptable levels and as low as reasonably practicable. Implementing and tracking the effect of these management and mitigation measures is an essential element to ensuring that the assessed residual impact levels are confirmed.

563. The Environmental Management Plan (EMP) provides details on the implementation of mitigation measures, monitoring program, cost estimates, and institutional arrangement to ensure that no significant adverse impacts results from the investment.

564. The basic objectives of the EMP are to:

- establish the roles and responsibilities of all parties involved in the Project's environmental management;
- ensure implementation of recommended actions aimed at environmental management and its enhancement; and
- ensure that the environment and its surrounding areas are protected and developed to meet the needs of the local communities including other stakeholders and safeguard the interests of the common people.

565. The environmental mitigation measures have been differentiated into the following stages: (i) pre-construction / construction Phase; and (iii) Operation Phase. The EMP is provided in Annex 1. Environmental Management and Monitoring Plans.

11.2 Environmental Monitoring Plan (EMoP)

566. A companion document of the EMP, the Environmental Monitoring Plan (EMoP) provides the procedures and actions that recognize and analyze environmental and social changes consequent to the pre-construction / construction and operation phases of the Project. The monitoring ensures that:

- legal standards for environmental parameters are not exceeded;
- mitigation measures are implemented in the manner described in the ESMP;
- changes to baseline environmental and social conditions during the project activities are continually monitored;
- early warning of environmental and social damage is recognized so that action may be taken, if possible, to prevent or reduce the seriousness of the unwanted impact; and
- corrective actions or new adaptive management programs are implemented, as required, if proposed mitigation measures are unable to reduce and/or eliminate potential project related impacts or meet the predetermined level of performance.

11.3 Review of the Environmental Management Plan (EMP)

567. The EMP shall be reviewed periodically to evaluate environmental controls and procedures to make sure they are still applicable to the activities being carried out. Reviews will be undertaken by ENA's Environmental Specialist as follows:

- The full EMP shall be reviewed at least annually;
- Relevant parts of the EMP shall be reviewed following a reportable incident;
- In case any issues of failure of mitigation measure to reduce the impact occurs;
- Relevant parts of the EMP shall be reviewed following the receipt of an updated site specific or topic specific plan; and
- At the request of stakeholders.

568. The review shall include analysis of data, monitoring reports, incident reports, complaints/grievances, and feedback from stakeholders.

11.4 Contractor and Project Management Requirements

569. Contractor requirements are specified in the Contractors Management Procedure which is part of ENA's ESMS. Contractors' responsibilities can be divided into the following phases: i) pre-execution; ii) during execution; and iii) post-execution.

570. Pre-execution. The management procedures specify that before assigning a contract and/or initiating contractors' activities, the Integrated Management System Department (IMSD) and the Technical safety and firefighting Department (TSFD) (refer to Section 3.7. ENA Management and Organizational Structure) shall receive for review a work plan from contractors which defines relevant safety and environmental precautions. The IMS Department also identifies any potential social impacts including land acquisition and resettlement at this stage.

571. The documents submitted to review by the contractor include:

- Health certificates of personnel involved (if applicable)
- Special qualification certificates (if applicable)
- Insurance of personnel involved (if applicable)
- Contact details of assigned work supervisor
- IMS procedures (if available)

572. The representatives from the IMSD and TSFD consult the contractors on the OHS hazards and environmental aspects involved in the activities to assess available control measure and define the need of additional controls. The IMSD and TSFD provide all valid ENA IMS procedures, instructions, and normative documents that are required for contractors to follow.

573. Contractors must demonstrate safety inductions, trainings, and knowledge assessment of its employees before commencing activities. Contractors also have to ensure that ADB Social protection requirements on Core Labor Standards are respected and child labor and forced labor will not be used during the contract.

574. The TSFD issues work permits as needed to contractors' personnel and introduces the reporting processes in the event of work-related injuries and incidents. ENA's TSFD engineer inspects the certificates of tools and equipment to be used by the contractor to ensure they are in good condition and do not present an additional hazard on-site.

575. During execution. The IMSD audit team monitors the IMS performance of contractors including compliance with legal requirements and conformance with applicable ENA IMS policies, procedures, and instructions. The audit team inspects each subproject twice a year. ENA personnel at branch offices where work is taking place perform more frequent monitoring of contractors and coordinate their findings with the IMSD.

576. An inspection report containing detected deviations (if found) are to be prepared and reported to ENA's head of TSFD and Head of Safety and Sustainability. If the inspection report reveals major nonconformities that may affect the safety of personnel – whether contractor's or ENA's personnel – and may have a significant impact on the environment, equipment, facilities, and community, the IMSD has the authority to stop a contractor's work.

577. If the contractor agrees to correct nonconformities, a follow-up inspection is to be conducted by the IMSD according to the "On-Site Inspection Procedure" (refer to Section 6.14. Environmental and Social Management System) to ensure that corrective actions are in line with the contracts terms, conditions, and requirements. If approved, the contractor's work can then be resumed.

578. In case corrective actions are deemed unsatisfactory, the contractor shall be given a chance to implement the actions required and agreed with the IMSD. If the contractor refuses to correct nonconformities or three consecutive deviations are registered, ENA's Head of Safety and Sustainability can take further actions including dismissal from the site and disqualification from future tenders.

579. Post-execution. Once planned works are completed, ENA personnel at the branch offices and IMSD inspect the work area to ensure there are no safety issues or impacts to the local community, environment, equipment, or facilities. A post-execution inspection report is prepared and submitted to the IMSD, TSFD, Head of Safety and Sustainability, and financial department to process final payments to contractors.

580. In case of new machinery or equipment installation project, trainings regarding safe operation of systems shall be delivered by the contractor to the concerned staff. Records of training content and participants shall be maintained by the HR Department with a copy to the IMS and related department(s).

581. ENA will ensure that the relevant mitigation measures identified within this EMMP are incorporated into the instructions and normative documents that are required for contractors to follow as part of their management requirements (see Section 11.4. Contractors and Project Management Requirements).

11.5 Rapid Environmental and Social Assessment (RESA)

582. All loans and investments are subject to categorization to determine environmental assessment requirements. Categorization is being undertaken under Phase 2 of the project using Rapid Environmental and Social Assessments (RESAs). The process requires completion of the environmental categorization form for subprojects. The RESA form being used by ENA includes sector-specific checklists (refer to Annex 6. Rapid Environmental and Social Assessment (RESA) Form), developed based on the ADB's past knowledge and experience. These checklists consist of questions relating to (i) the sensitivity and vulnerability of environmental resources in project area, and (ii) the potential for the project to cause significant adverse environmental impacts.

583. The process of determining the Project's environment category is initiated by ENA, which prepares RESA screening checklists, taking into account the type, size, and location of the proposed project. Subproject are then classified as one of the environmental categories (A, B, or C).

584. RESA forms are reported on by the Project's Phase 2 Lender's Engineer and provided to the Lenders for review on a monthly basis.

12 Cost Estimate of Environmental Mitigation Measures

585. Most costs associated with the environmental recommendations of the EMP are a normal part of the day to day operations of ENA and its contractors. General waste management, for example, is an environmental necessity, but not generally considered an "environmental cost".

586. Costs associated with implementation of mitigation measures identified within the EMP will become better defined as the plans for subprojects under Phase 2 are finalized. Table 55 lists the proposed mitigation measures and indicates where they would be "included in the project budget" and where additional costs are a likely "environmental cost" beyond what would normally be included in a project budget, or already part of the ENA's operational budget.

Table 55. Rough Cost Estimate for Mitigation Measures and Monitoring

Impact / Issue	Action	Number of Units / Unit cost /US$	Cost estimate / US$	Timing	Frequency and duration
Soil and water degradation	Construction of oil containment measures for smaller pad mounted transformers in proximity to sensitive receptors (e.g., rivers, canals, lakes)	Estimated additional $100 per transformer / Assume 25 per year	$2,500	Pre-construction / construction phase	As needed throughout Phase 2
	Flooring at each branch location where hazardous waste is temporarily stored will be made impervious to liquid spills.	Estimated $250 per temporary storage location	$250 (at least 1 location identified)	Pre-construction / construction phase	Once, as needed, for each location
	Transformer and switchgear maintenance	Included in general operation phase costs	NA	Pre-construction / construction phase and operation phase	Throughout Phase 2 and into the operation phase
	Transformer and switchgear replacement at end of life	Included in general operation phase costs	NA	Pre-construction / construction phase and operation phase	Throughout Phase 2 and into the operation phase
Biodiversity and Ecology	Hiring national bird specialist when planned activities are within 5 km of an IBA	If activities are in the proximity of an IBA, assume monthly cost of $1,500.	$1,500	Pre-construction / construction phase and operation phase	As needed throughout Phase 2
	Bird electrocution and collision prevention measures	If additional protection is required, assume a lump sum of $10,000 per ENA branch	$80,000	Pre-construction / construction phase	As needed throughout Phase 2

		office region (8 regions)			
	Implementation of nest management strategies, if required	Included in general construction costs	NA	Pre-construction / construction phase	As needed throughout Phase 2
	Bird carcass monitoring near Important Bird Areas (IBAs)	Assume $15,000 a year to monitor investment areas around Armenia's 18 IBAs	$15,000		Yearly
	Pre-work surveys	Included in contractor costs	NA	Pre-construction / construction phase	As needed throughout Phase 2
	Tree replanting	Assume 200 per year per ENA branch office region (8 regions) / $5 per seedling	$8,000	Pre-construction / construction phase	As needed throughout Phase 2
HWSF	Installation of a separate fan in the storage area for batteries.	$150 for equipment and installation	$150	Pre-construction / construction phase	Once
	Separate the fan in the used lamps area from the light switch	$100 for alteration	$100	Pre-construction / construction phase	Once
	Darkened windows in the used battery and lamp storage with paint or a stick-on film	$300 for all the windows combined	$300	Pre-construction / construction phase	Once
	Apply a durable epoxy polymer sealant on the floor in the main storage area	$500 for epoxy and application	$500	Pre-construction / construction phase	Once
Waste Management	Management of old poles and wires	Included in general construction costs for contractors	N/A	Pre-construction / construction phase	As needed throughout Phase 2
	Removal of old transformers	Included in general construction costs for contractors	N/A	Pre-construction / construction phase	As needed throughout Phase 2
	Spoil disposal	Included in general construction costs for contractors	N/A	Pre-construction / construction phase	As needed throughout Phase 2

PCB Testing	PPE for used oil management	Included in general construction costs for contractors	N/A	Pre-construction / construction phase	N/A
		5 sets of PPE per ENA branch office / $200	$8,000	Pre-construction / construction phase and operation phase	Once
	Testing for PCBs and PCB concentration	$50 per test (combined)	TBD*	Pre-construction / construction phase and operation phase	On a rolling basis as transformers are replaced or serviced
Training	SF_6 Gas management training	Once a year / $1,500	$1,500	Pre-construction / construction phase and operation phase	Yearly
	Training of ENA personnel on OHS	Included in general operation costs	NA	Pre-construction / construction phase and operation phase	Throughout Phase 2 and into the operation phase
	Training of contractors on OHS	$3,000 each session / twice a year	$6,000	Pre-construction / construction phase and operation phase	Yearly
General construction noise	General noise mitigation measures	Included in general construction costs for contractors	N/A	Pre-construction / construction phase	N/A
General impacts to utilities	General mitigation measures	Included in general construction costs	N/A	Pre-construction / construction phase	N/A
Occupational health and safety	Incident reporting	Included in ENA operations budget	N/A	Pre-construction / construction phase and operation phase	Throughout Phase 2 and into the operation phase
	General worksite measures, fencing, bunting, warning signs	Included in general construction costs	N/A	Pre-construction / construction phase	Throughout Phase 2
	Arc flash hazard assessments	$3,000 per station /	$75,000	Pre-construction /	Yearly

		incremental assessment process targeting 25 substations per year		construction phase and operation phase	
	Procurement of acid spill kits	$500 / for each of the 35 substations that store batteries	$17,500	Pre-construction / construction phase	Once
Community health and safety	Implementation of safety codes, and warning signs	Included in general construction costs	N/A	Pre-construction / construction phase	N/A
	Implementation of GRM	Included in ENA operations budget	N/A	Pre-construction / construction phase and operation phase	Throughout Phase 2 and into the operation phase
	Suitable locking mechanism for pad mounted transformers	Included in general construction costs	N/A	Pre-construction / construction phase	N/A
	Safety awareness program	Lump sum / $10,000	$10,000	Pre-construction / construction phase and operation phase	Throughout Phase 2 and into the operation phase
Grand Total		**$226,300**			

*Note: **The timing of testing will be determined by a when testing becomes available.*

13 Conclusions and Recommendations

13.1 Primary Environmental Impacts and Mitigation Measures

587. This IEE study has identified the potential for both positive and negative environmental and social impacts to occur as a result of the Project. A general description of primary environmental impacts and mitigation measures is provided below:

588. Management of hazardous materials and wastes. Without mitigation, considerable risks exist from the management of hazardous materials and wastes. Contamination of soil, water, and air can result from the inappropriate handling, storage, and disposal of the oils, petroleum products, lubricants, chemicals, and other hazardous materials that are needed for this Project and to operate the electrical network. The handling, transportation, storage, and disposal of hazardous wastes generated from Project activities (e.g., asbestos, mercury-containing bulbs, flooded-acid batteries) are another potential source of contamination that could impact health and the environment. These impacts may result from activities performed by ENA's personnel or its contractors.

589. Contamination may also originate from storage sites such as ENA's branch offices, the Abovyan Warehouse, and the Abovyan Oil Storage Facility. Control of materials, waste, and equipment will be of the utmost importance to prevent soil, water, and air contamination as well as impacts to health of workers and community members. These risks will be managed with implementation of good construction and operation practices and through careful monitoring of contractor's activities and ENA's facilitates and offices. It should be noted that these sites have been subject to site visits and safeguards audits by the Lender's Engineer (Tetra Tech) under Phases 1 and 2 of the Project.

590. Risks around the management of used oils which may contain PCBs are especially pronounced given that testing for the presence and concentration of PCBs is currently not feasible. PCBs can be released into the environment from hazardous waste sites, improper handling and management of materials and wastes, and leaks from electrical equipment (e.g., transformers) containing used oils with PCBs. Risks include exposure to PCBs through food consumption, dermal contact, and inhalation. The risk of impacts will be reduced substantially by taking a precautionary management approach and making certain that all used oils are treated as potentially hazardous until testing can verify PCB presence and concentration.

591. Critical to mitigating impacts from hazardous materials and wastes is a complete commitment to implementing the ESMS already established under Phase 1 of the Project (refer to Section 6.14. Environmental and Social Management System (ESMS)). The plans, procedures, and guidelines that are part of the ESMS specifically address the potential risks around handling, transportation, storage, and disposal processes and will be strictly followed by ENA.

592. Occupational health and safety. ENA personnel and its contractors are exposed to different hazards including noise and vibration, dust, handling heavy materials and equipment, falling objects, work on slippery surfaces, fire hazards, electrical hazards, and chemical hazards. There are a number of potential health and safety related impacts which may directly result from Project activities, including the presence of new electrical infrastructure and management of hazardous materials and waste. Potential risks will be eliminated or reduced using good practice and known control and management solutions. Moreover, the implementation of ENA's incident investigation and tracking system will provide the company and its employers and contractors the opportunity to identify hazards in their operations and shortcomings in their safety and health programs. Most

importantly, it enables ENA and its contractors to identify and implement the corrective actions necessary to prevent future incidents. As with the management of hazardous materials and wastes, implementation of the plans, procedures, and guidelines that are part of ENA's ESMS is critical to managing health and safety of not only workers, but the community as well.

593. Community health and safety. There was no land acquisition undertaken, no involuntary resettlement impacts, and no indigenous peoples (IPs) affected by subprojects under Phase 1. Phase 2 of the Project is expected to be the same as ENA is making a concerted effort to avoid any activities which would result in land acquisition and resettlement. If resettlement is required, ENA has an established Involuntary Resettlement Management Procedure which is part of its ESMS in order to manage potential impacts.

594. In addition to potential health impacts from the exposure to hazardous materials and wastes, noise and vibrations, and the presence of worksites, injuries and fatalities can also occur to community members as a result of coming into contact (or close proximity) with electricity overhead lines, underground cables, and other charged equipment. These incidents may be as a result of accidental contact with charges equipment, lines, and cables (e.g., contacting an electrified line with machinery) or as a result of direct manipulation of distribution system elements (e.g., altering power supply infrastructure without authority).

595. A grievance redress mechanism (GRM) has been integrated into the company's Stakeholder Engagement Plan (SEP) and is designed to record, track, and respond to concerns and complaints. Risks will be further managed through development and distribution of community risk awareness materials targeting those living nearest to substations and other higher-risk areas.

596. Impacts to birds from electrocution and collisions with infrastructure. The most significant impact of the Project, in terms of biodiversity, relates to potential bird electrocution on poles and wires as well as collisions with electrical infrastructure. The risk of impacts to birds is based on the combination of three factors: biological (e.g., age, body size), environmental (e.g., habitat type, seasonal variation), and engineering (e.g., pole design, pole equipment). ENA will reduce potential impacts to birds by identifying within its Rapid Environmental and Social Assessment (RESA) reports when planned subprojects are within 5 km of one of Armenia's 18 Important Bird Areas (IBAs). If the answer is positive, ENA will engage a national specialist to identify potential risks and determine the design specifications needed to mitigate any impacts to bird species.

597. Network rehabilitation, efficiency improvement, and augmentation. Significant positive impacts will be provided from the improved energy supply to ENA's customers following the rehabilitation, efficiency improvement, and augmentation of the network made possible with financing under this Project. Positive impacts include new employment opportunities connected to the need for skilled and unskilled labor to support Project activities. Important socio-economic benefits will also be provided to households and businesses from improved energy services.

598. There are also noteworthy environmental and health and safety benefits that will be realized as Phase 2 is implemented. These benefits result from the replacement of older transformers with newer ones which are more reliable, have more safety-critical parts and designs, and require less frequent maintenance which reduces risks and duration of failures. Meanwhile, completing the installment of spill containment systems in all of ENA transformer's with oil capacity larger the 500 liters will greatly reduce risks from unplanned releases of used oils.

13.2 Conclusions and Recommendations

599. Based on the analysis of information and feedback received from various stakeholders, this IEE concludes that potential significant physical, biological, or socio-economic environment impacts from Phase 2 of the Distribution Network Rehabilitation, Efficiency Improvement, and Augmentation Project can be addressed and it is unlikely that there will be any significant environmental impacts remaining after planned mitigation and offset measures. The Project will have short term impacts during implementation which can be mitigated to an acceptable level through measures which seek to reduce the potential for harm to the environment and human health. From the analysis provided in this IEE, the classification of the Project as Category B per ADB SPS is confirmed.

600. Residual impacts for the most significant potential impacts (see assessment of impact tables in Section 8.2. Impacts and Mitigation Measures) are identified below. Negative and positive residual impacts are qualified as Negligible, Minor, Moderate, and Major according to the assessment method described in Section 8.1. Impact Assessment Methodology.

Table 56. Summary of Residual Environmental Impacts

Environmental Factor	Project Phase	Potential Impacts	Pre-mitigation Impact Significance	Residual Impact Significance
PCB Release and Exposure*	Pre-Construction / Construction Phase	Health impacts from the release and exposure of PCBs due to: i) improper handling and management of used oils with PCBs and PCB wastes, including contaminated soils; ii) leaks from electrical transformers and switchgear containing PCBs; iii) the testing and regeneration of used oils; and iv) the rehabilitation and disposal of used transformers and other oil containing equipment.	**Major**	**Minor**
	Operation Phase**			
Soil and Geology	Pre-Construction / Construction Phase	Soil works, including vegetation clearance, grading, levelling, compaction, backfilling, and demand for aggregates, as well as the construction and installation of various structures may lead to sedimentation of waterways, loss of topsoil, reduction in soil fertility, conversion of land use.	**Minor**	**Negligible / Minor**
	Pre-Construction / Construction Phase	Contamination of soil from the inappropriate use, handling, storage, and disposal of oils, petroleum	**Moderate**	**Minor**

	Operation Phase	products, lubricants, chemicals, hazardous materials, liquids, and solid waste.		
Surface and Groundwater	Pre-Construction / Construction Phase	Altered hydrology from construction works, including vegetation clearance, grading, levelling, compaction, backfilling, and demand for aggregates, as well as the construction and installation of various structures may lead to detrimental changes to site hydrology (e.g., erosion, sedimentation, and creating conditions for vector and waterborne diseases).	**Minor**	**Negligible / Minor**
	Pre-Construction / Construction Phase	Potential for impacts to quality of surface and ground water due to contamination from accidental releases of hazardous substances.	**Moderate**	**Minor**
	Operation Phase			
PCB Release and Exposure Soil and Geology Surface and Groundwater	Operation Phase	Installment of oil spill containment systems and the replacement of older transformers with newer ones.	***Positive******	**Major**
Air Quality	Pre-Construction / Construction Phase	Air quality impacts from (i) Fugitive dust emissions associated with the materials handling and wind erosion of open areas; (ii) Emissions from concrete batching; and (iii) Air emissions including NO_2, SO_2, PM_{10} and $PM_{2.5}$ from construction equipment and truck circulation within the work areas.	**Minor**	**Negligible / Minor**
	Operation Phase	Fewer emissions from power plants due to reduction of power loses following network	***Positive***	**Minor / Moderate**

		upgrading and rehabilitation.		
Sulfur Hexafluoride (SF_6) Gas Emissions and Byproducts	Pre-Construction / Construction Phase	Contribute to global warming from SF_6 emissions.	**Minor**	**Negligible / Minor**
	Operation Phase			
	Pre-Construction / Construction Phase	Potential health impacts to workers from toxic byproducts formed when electrical discharges occur within SF_6-filled equipment.	**Moderate**	**Negligible / Minor**
	Operation Phase			
Noise and Vibration	Pre-Construction / Construction Phase	Noise and vibration emissions resulting from the use of machinery and equipment and vehicle circulation.	**Minor**	**Negligible / Minor**
	Operation Phase	Reduced noise and vibration emissions resulting from the installment of newer and more modern equipment.	***Positive***	**Moderate**
Occupational Health and Safety *(Socio-Economic)*	Pre-Construction / Construction Phase	Occupational health and safety impacts from workers' exposure to different hazards during construction.	**Major**	**Minor**
	Operation Phase			
Community Health and Safety *(Socio-Economic)*	Pre-Construction / Construction Phase	Impacts to community health, safety, and security due to i) accidents and fatalities associated with the distribution system; ii) presence of storage areas and warehouses near populated areas; iii) presence of worksites; and iv) exposure to hazardous materials and waste.	**Major**	**Minor**
	Operation Phase			
Community Infrastructure, Services, and Access *(Socio-Economic)*	Pre-Construction / Construction Phase	Impact on community infrastructure, services, and access including temporary loss or reduction in utility supply and temporary road closures.	**Minor**	**Negligible / Minor**
	Operation Phase			
Economy, Employment, and Livelihoods	Pre-Construction / Construction Phase	Impact to employment provided by the need for skilled and unskilled labor.	***Positive***	**Minor**

(Socio-Economic)	Operation Phase	Improved energy supply provided to local businesses and households.	***Positive***	**Major**
Physical Cultural Heritage *(Socio-Economic)*	Pre-Construction / Construction Phase	Impact to physical cultural heritage (PCH) from construction related activities.	**Moderate**	**Minor**
Ecology and biodiversity	Pre-Construction / Construction Phase	Impacts to habitat and flora from site clearance and construction activities.	**Moderate**	**Minor**
	Operation Phase	Impacts to birds from electrocution and collisions with transmission lines and equipment.	**Moderate**	**Minor**
Hazardous Waste Management	Pre-Construction / Construction Phase	Impacts to heath and the environment from improper management of mercury-containing lamps, acid batteries, and asbestos. *(does not include PCB oils or SF_6 gas)*	**Moderate**	**Negligible / Minor**
	Operation Phase			

*Note: *The potential impacts from the release of and exposure to PCBs has been examined as a separate topic and is not covered again in the soil and relief, surface and groundwater, air quality, and health and safety (socio-economic) sections.*
*** It is expected that testing capacity will increase allowing for the presence of PCBs and their concentrations in oil can be determined. This has the potential to significantly reduce risks and support proper management of used oils and oil containing equipment.*
****It is considered sufficient for the purpose of this IEE to indicate that the Project is expected to result in a potential positive impact prior to mitigation without characterizing the exact degree of positive change likely to occur.*

14 Annexes

Annex 1. Environmental Management and Monitoring Plans

1.a - Management Plan for Pre-Construction / Construction Phase

Table 57. Management Plan for Pre-Construction / Construction Phase

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development / Implementation	Control
Pre-Construction / Construction Phase					
General EMP obligations	Implementation of Environmental and Social Management System (ESMS)	• Ensure all the plans, procedures, and guidelines developed as part of its ESMS are followed by its personnel and its contractors (see Section 6.14. Environmental and Social Management System (ESMS)).	Project Cost	ENA	ADB and other Lenders
	2021 Environmental and Social Compliance Audit (ESCA)	• Revisions required under Phase 2 ESCA Corrective Action Plan (CAP) will be completed and followed.	Project Cost	ENA	ADB and other Lenders
	Implementation of Contractors Management Procedures	• ENA will ensure that its Contractors Management Procedures are followed when hiring contractors (see Section 11.4. Contractors Management Procedures Requirements). • For contracts that were concluded without having followed the Contractors Management Procedures, the necessary information will be provided by contractors, and conditions applied, to ensure Contractors Management Procedures are being followed consentingly. • ENA will ensure that the relevant mitigation measures identified within this EMMP are incorporated into the instructions and normative documents that are required for contractors to follow.	Project Cost	ENA	ADB and other Lenders
	Implementation of Rapid Environmental and Social Assessment	• ENA will ensure that all RESA reports accurately identify subproject specific risks, the correct initial screening results, and environmental and social risk categorization. Involuntary resettlement (IR) screening will identify subprojects which may lead to temporary damage to assets (e.g., crops, trees, or structures	Project Cost	ENA	ADB / EBRD

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development / Implementation	Control
	(RESA) Checklists	brought about by rerouting for transmission lines, or any changes in subproject location) and indicate if this will require land acquisition, or will likely lead to economic or physical displacement. RESA reports will also identify whether planned subprojects are within 5 km of one of Armenia's 18 Important Bird Areas (IBAs).			
	Incident investigation and tracking system	• Finalize development and implementation of a robust incident investigation and tracking system to record, track, manage, and report incidents to workers and the community.	Project Cost	ENA	ADB and other Lenders
	Development of plans, SOPs, and guidelines	• HWSF and Abovyan Oil Storage Facility o Separate contingency and response plans will be developed for the HWSF and the Abovyan Oils Storage Facility which set out an organized, planned, and coordinated course of action to be followed in case of a fire, explosion, or release of hazardous waste or its hazardous constituents which could threaten human health or the environment (refer to Annex 4. Contingency and Emergency Response Plan Template). • Abovyan Oil Storage Facility o SOPs will be developed to specify the process for loading and unloading of oil in the storage area. • SF_6 Gas o Policies, protocols, and SOPs will be developed using a lifecycle approach to SF_6 management, which can help ensure that personnel track inventories of SF_6, detect and repair leaks, properly recover SF_6 from GIE, and dispose of equipment and gas, as well as take advantage of other options for reducing SF_6 emissions. • Chance finds procedure o Chance finds procedures will be developed to appropriately manage unanticipated discoveries of cultural or historic artefacts (movable or immovable) in the course of the work. A sample chance finds procedure has been provided in	Project Cost	ENA	ADB and other Lenders

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development / Implementation	Control
		Annex 3. Sample Chance Finds Procedure which can be modified as needed. • Modified grievance redress mechanism (GRM) o A modified GRM will be established to process and record grievances and complaints filed by community members through ENA's online system as well as those that are made at the municipal level. This includes information on the status of complaints and payments made for temporary damages or losses caused by ENA or its contractors. Documents/proof of payment and basis of amount paid, or arrangement will also be collected as part of the GRM in case of temporary damage to structures.			
	Testing for the following: • Air quality • Water quality • Noise and vibrations • Electromagnetic Fields (EMF) • Soil quality • SF_6 • PCBs	• The following testing standards specified in this IEE will be followed: o Air quality (as needed) o Water quality (as needed) o Groundwater quality (as needed) o Noise (as needed) o Vibrations (as needed) o EMF (as needed) o Soil quality (as needed) o SF_6 (required) o PCBs (required)	Project / Contractor Cost	ENA and /or Contractors to Implement Mitigation	ENA: ADB and other Lenders Contractors: ENA
	HWSF conditions established under 2019 EIA	• All of the construction and operating conditions established by the 2019 EIA developed for the HWSF will be followed (refer to Section 6.5 Hazardous Waste Storage Facility (HWSF)).[192]	Project Cost	ENA	ADB and other Lenders
	EMP review and update	• The EMP shall be reviewed periodically to evaluate environmental controls and procedures to make sure they are still applicable to the activities being carried	Project Cost	ENA	ADB and other Lenders

[192] ATMS Solutions LLC. 2019. *Baghramyan Hazardous Waste Storage Facility Environmental Impact Assessment*. Yerevan: Electric Networks of Armenia

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development / Implementation	Control
		out. Reviews will be undertaken by ENA's Environmental Expert.			
PCB Release and Exposure	Release of PCBs into the environment	• Since it is currently not possible to test oils for PCBs and PCB concentration, unidentified appliances and used oils must be presumed to be PCB-containing pending their identification by screening or laboratory analysis. • ENA will continue its active dialog with the MoE as it works to increase its testing capabilities. • As soon as testing capacity allows, PCB testing will begin immediately and should be integrated into the regular maintenance schedules of transformers or when new equipment replaced old equipment. • ENA will coordinate with the MoE to identify which its transformers tested as part of the GoA's 2017 updated NIP for the Stockholm Convention on POPs had high levels of PCBs (refer to Section 6.7. Polychlorinated Biphenyls (PCBs)). • ENA will continue to outfit all of transformers with oil capacity greater than 500 liters with leak containment systems. • ENA will continue to monitor its equipment in operation as part of its normal maintenance program and immediately fix or replace any equipment found to be leaking oil. • The flooring at each branch location where hazardous waste is temporarily stored will be made impervious to liquid spills.	Project Cost	ENA	ADB and other Lenders
		• In the event of a liquid spill from an older transformer or switchgear (i.e., not newly procured equipment as part of this Project which would not contain PCBs), the following steps are to be taken: o A crew should respond immediately upon notification that a spill has occurred. o All clean-up personnel handling the leak and/or engaged in the actual clean-up are to wear personal protective clothing and equipment to	Project / Contractor Cost	ENA and /or Contractors to Implement Mitigation	ENA: ADB and other Lenders Contractors: ENA

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development / Implementation	Control
		prevent potential PCB contamination of clothing on skin. o All fluids will be prevented from reaching storm drains, sewers, drainage ditches, or any other place where water is flowing. The crew is to exercise every available option open to them to contain the spill, including temporary diversion or bunding (use of retaining walls). In addition, the crew should anticipate and prevent water from flowing into the contaminated area from sources such as nearby sprinkler systems and/or street gutter runoff. Every reasonable effort should be made to stop or slow the flow of PCBs and contain that which has been discharged, using such manpower, equipment and material as is on site or immediately available. o If the spill does reach flowing water, storm sewers or any inaccessible area, the first employee arriving at the spill area should notify emergency authorities, and also initiate measures to prevent any additional spill material from reaching water or lands. o Barricades should be placed around the contaminated areas to prevent pedestrians and vehicles from entering until the spill material is cleaned up and removed. o In most cases, oil absorptive material is a useful clean-up tool. If used, it should be spread on the contaminated area and should be left in place for at least one hour, or as long as necessary to ensure that all fluids have been absorbed. o After the spilled fluids have been absorbed, the absorptive material, along with any contaminated soils, should be placed in the steel containers provided for that specific disposal purpose. If conditions are such that PCB penetration cannot be determined, then at least 15 cm of soil depth should be removed.			

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development / Implementation	Control
		o All surfaces exposed to the spilled fluid should be decontaminated with swabs containing an efficient solvent, such as trichlorethane. o Any contaminated steel structures, wood racks, cable trays, etc., should also be washed down with solvent. All equipment on these structures that may be contaminated by a spill, but will not be removed, must also be similarly cleaned. Caution will be used with the solvent to prevent further contamination of equipment, vehicles etc. in the spill area. o All types of structures, buildings, private vehicles etc. that may be contaminated are to be washed down with solvent. o All contaminated items, including tools, clothing, boots, and other equipment, must either be thoroughly cleaned with solvent where practical, or disposed of in the steel containers provided specifically for disposal purposes. o All drums should be clearly identified and stored or loaded onto a vehicle. Drums must be carefully secured to avoid further spills. o The vehicle carrying the drums must also be labelled in accordance with ENA's transportation procedures. o The containers are to be taken directly to the HWSF storage area. o At large spills in densely populated areas, the spill area will be continuously manned until the spilled oil and all clean-up materials have been removed from the site, secured in drums, or otherwise neutralized. • If contact occurs between the skin and potential PCBs a waterless hand cleaner should be used on the oil, the cleaner being disposed of in an appropriate container. If eye contact occurs, the eye should be thoroughly washed with water and specialized advice sought.			

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development / Implementation	Control
		• UNEP's 2002 guidelines on *PCB Transformers and Capacitors: From Management to Reclassification and Disposal* is a mandatory reference.[193]			
	Improper handling, transportation, and management of used oils	• The following protective clothing will be used when handling used oils: overalls, boots, or overshoes, gloves, and eye protection. • Chemical resistant fluorinated rubbers or elastomers and laminated materials offer the best protection against PCBs. Natural rubber are particularly permeable to PCBs and are thus unsuitable for use as protective garments. • If rubber boots are used, the boots need to be regularly discarded, and the foot protection reinforced by the use of disposable overshoes to be worn either inside or outside the boot. • Adequate ventilation will be maintained to ensure that levels of PCB vapor or aerosol do not build up. • Where mechanical ventilation is necessary it will be necessary to ensure that the air is extracted by air handling equipment with suitable filtration. To prevent environmental contamination, these filters may need to be of the two-stage variety: a fabric or electrostatic filter will remove aerosol and an activated carbon filter will remove vapor. • Respiratory protective equipment (RPE) must be required, in particular if: o work areas are poorly ventilated; o work involves the less chlorinated, more volatile PCB congeners; or o work is liable to lead to aerosol formation, and if temperatures are abnormally high. • The types of RPE must be selected to give adequate protection for workers. • If workers use non-disposable RPE regularly in a dirty area, they must be made aware that their RPE may	Project / Contractor Cost	ENA and /or Contractors to Implement Mitigation	ENA: ADB and other Lenders Contractors: ENA

[193] UNEP CHEMICALS. 2002. *PCB Transformers and Capacitors: From Management to Reclassification and Disposal.* Geneva: United Nations Environment Programme.

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development / Implementation	Control
		become contaminated with PCBs that can be transferred to their face. This contamination can arise from absorption and passage of PCBs through the mask's material, or more likely, from contamination from the inside of the mask due to handling and poor storage during periods of non-use. Workers will minimize these risks through regular cleaning and maintenance of their RPE and training.			
	Release of PCBs from storage locations	• ENA will complete installation of an automated alarm system at the HWSF as part of its emergency management system. • Fire protection measures will be implemented throughout the facility, including the appropriate fire management devices and materials at the correct locations. This should be coordinated by ENA's technical safety and firefighting coordinators and the appropriate government emergency authority. • The floor of the main HWSF warehouse will be coated with a durable epoxy polymer sealant.	Project Cost	ENA	ADB and other Lenders
Soil and Geology	Land degradation and modification of geological formations	• Stockpiles of removed topsoil must be properly designed/shaped and managed. • Sand and aggregates will be stored in a hopper or bunker which shields the materials from winds. The bunker should enclose the stockpile on three sides. The walls should extend one meter above the height of the maximum quantity of raw material kept on site and extend two meters beyond the front of the stockpile. • Temporary detention ponds or containment to control silt runoff will be provided as needed. • Intercepting ditches and drains will be created to prevent runoff entering construction sites. • Transport of materials and personnel will be made on road boundaries to reduce soil compaction. • Disturbed vegetation should be replanted immediately after the construction / disturbance stops. • Licensed borrow pits and quarry sites will be selected avoiding protected and sensitive areas, nearby	Contractor Cost	Contractors to Implement Mitigation	ENA

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development / Implementation	Control
		settlements, water sources, forested areas, and fertile agriculture lands.			
	Contamination of soil from the inappropriate use, handling, storage, and disposal of oils, petroleum products, lubricants, chemicals, hazardous materials, liquids, and solid waste	• Adequate training on environmental protection and safety shall continue to be provided to ENA staff.	Project Cost	ENA	ADB and other Lenders
		• The storage and handling of fuels, oils, and other hydrocarbons will be a controlled process, involving measures to prevent soil and water contamination. • Refueling of all vehicles and machinery will not be allowed within 50 m of any watercourse, drain, or channel leading to a water course. • Secondary containment devices (drop cloths, drain pans) shall be used to catch leaks or spills while removing or changing fluids from vehicles or equipment. Drip pans or absorbent materials shall be provided. On small spills, absorbent materials shall be used. • On-site vehicles and equipment shall be inspected regularly for leaks and all leaks shall be immediately repaired. Incoming vehicles and equipment shall be checked for leaks. Leaking vehicles/equipment shall not be allowed on-site. • The treatment of hazardous materials encountered in site clearance shall comply with any specific requirements given by the MoE, as well as relevant national legislation. • A no fly-tipping policy shall be followed. • Waste collection areas must be sited to avoid runoff draining directly to a water body. • Materials to be disposed of will be assessed and where required tested to confirm its chemical characteristics so that it can be categorized as inert, non-hazardous, or hazardous waste as appropriate.	Project / Contractor Cost	ENA and /or Contractors to Implement Mitigation	ENA: ADB and other Lenders Contractors: ENA
	Soil impacts from releases of hazardous materials from the Abovyan Oil Storage Facility	• Appropriate firefighting equipment in adequate quantities will be installed nearer to the oil storage area. • Structures within the oil storage facility will be monitored for deterioration and repaired immediately as needed.	Project Cost	ENA	ADB and other Lenders

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development / Implementation	Control
Surface and Groundwater	Pollution of nearby water bodies from poor land management and construction practices	• Outdoor oil spill containment reservoirs and containment pallets will be monitored regularly for rainwater collection and emptied as needed to maintain available storage volume.	Project Cost	ENA	ADB and other Lenders
		• Discharge of cement contaminated water will be prohibited. • All bare soil must be protected before it rains. • Vegetation must be preserved where feasible. • Concrete mixers must wash out leftover concrete without polluting the environment in designated areas.	Contractor Cost	Contractors to Implement Mitigation	ENA
	Impact to surface water contamination from inappropriate waste management	• Waste will be disposed of by licensed contractors.	Project / Contractor Cost	ENA and /or Contractors to Implement Mitigation	ENA: ADB and other Lenders Contractors: ENA
		• Materials and waste must be stockpiled to avoid erosion and washing off into surface water bodies. Drainage trenches must be established to divert surface runoff from the site when needed. • Proper storage of the construction materials will be implemented to minimize the potential damage or contamination of the materials. • Hazardous and non-hazardous waste will be segregated and provided appropriate containers for the type of waste type. • Waste will be stored systematically to allow inspection between containers to monitor leaks or spills.	Contractor Cost	Contractors to Implement Mitigation	ENA
	Impacts to surface water due to contamination	• Alternative designs for smaller transformers should be developed so that they can be installed in areas with sensitive receptors.	Project Cost	ENA	ADB and other Lenders
		• Use of offsite fueling and maintenance facilities will be encouraged. Should any temporary fuel tank be available, it must be located at least 50 m away from any watercourse, drain, or channel leading to a water course. • Onsite repairs / maintenance and fueling activities will be limited. • Onsite vehicles and equipment shall be inspected regularly for leaks and all leaks shall be immediately	Project / Contractor Cost	ENA and /or Contractors to Implement Mitigation	ENA: ADB and other Lenders Contractors: ENA

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development / Implementation	Control
		repaired. Leaking vehicles/equipment shall not be allowed on-site. • Secondary containment devices (drop cloths, drain pans) shall be used to catch leaks or spills while removing or changing oils from vehicles or equipment. For small spills, absorbent materials must be used. • No washing of vehicles etc. in rivers or irrigation canals will be allowed.			
Air Quality	Localized emissions of dust resulting from the use of machinery and equipment and circulation of vehicles	• Dust generating areas will be controlled by water spraying, particularly under dry weather conditions. • Stockpiles will be planned and sited to minimize the potential for dust generation by taking into account prevailing wind directions and the locations of sensitive receptors. • The drop height of potentially dust generating materials will be kept as low as possible. • Where practicable, stockpiles will be located away from sensitive receptors. • On-site speed limits will be applied and enforced for trucks travelling on unpaved surfaces (20 km/h). • Trucks transporting soil or other dusty materials off-site will be covered before leaving the sites. • Wherever possible, electrically powered equipment will be used rather than gas- or diesel-powered equipment.	Contractor Cost	Contractors to Implement Mitigation	ENA
	Localized and long-term emissions of combustion gas resulting from the use of machinery and equipment and circulation of vehicles	• Vehicles and machines will not be left running in periods between work or will be throttled down to a minimum. • The burning of waste or vegetation on site will be prohibited. • Special attention will be given in storage and handling of petrochemicals in order to avoid environmental hazards and risks. • Maintenance procedures will be implemented in order to keep equipment in good working condition to minimize exhaust emissions caused by poor performance. • Training will be provided for the operators of equipment and truck drivers regarding the air pollution potential of their activities.	Project / Contractor Cost	ENA and /or Contractors to Implement Mitigation	ENA: ADB and other Lenders Contractors: ENA

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development / Implementation	Control
Sulfur Hexafluoride (SF_6) Gas Emissions and Byproducts	Contribution to global warming and health impacts from toxic by-products	• ENA will closely follow the handling and storage instructions for SF_6 gas provided by the supplier and in accordance with best industry practice. • ENA will follow international standards on the handling of SF_6 gas and gas equipment established by the IEC and the IEEE (refer to Section 2.4.8. Sulfur Hexafluoride (SF_6)). • To ensure there are no leaks from its equipment, ENA will continue to carefully monitor all its GIE. If leaks are detected, they should be fixed immediately to ensure the least possible amount of gas is emitted. • All new SF_6 GIE procured should be of high quality with low rates of leakage. • Implement policies, protocols, and SOPs developed using a lifecycle approach for SF_6 management. • Personnel involved in handling gas should be trained in SF_6 handling and using equipment for performing this task on a routine basis (e.g., annual refresher trainings). Training should raise awareness of emissions, environmental and health impacts of SF_6 and by-products, and potential reduction options, but training also enables employees to follow procedures and protocols properly.	Project Cost	ENA	ADB and other Lenders
Noise and Vibration	Noise and vibration emissions resulting from the use of machinery and equipment and vehicle circulation	• Restrict construction hours to between 07:00 to 20:00 hours within 500 m of the houses and other noise sensitive receptors. • Record and respond to complaints according to the established grievance redress mechanism (GRM).	Project Cost	ENA	ADB and other Lenders
		• Install temporary noise barriers made of plywood or acoustical blankets around noisy operation where deemed necessary or beneficial (e.g., near schools, hospitals, or residences). • Use material stockpiles and other structures, where practicable, to screen noise sensitive receptors from on-site construction activities.	Contractor Cost	Contractors to Implement Mitigation	ENA

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development / Implementation	Control
		• Set optimum travel speed during offsite travel. • Regular maintenance of equipment such as lubricating moving parts, tightening loose parts, and replacing worn out components. • Shut down or throttle down between work periods for machines and construction plant items (e.g., trucks) that may be in intermittent use. • Reduce the number of equipment operating simultaneously as far as practicable. • Orientate equipment known to emit noise strongly in one direction so that the noise is directed away from receptors as far as practicable. • Avoid transportation of materials on- and off-site through existing community areas during nighttime hours. • Keep nearby residences informed in advance about noisy activities during various construction phases. • When there is a possibility of human annoyance from construction activities, conduct such activity only during weekday daytime hours when the ambient background noise and vibration is higher, and many residents are away from their homes at work.	Project / Contractor Cost	ENA and /or Contractors to Implement Mitigation	ENA: ADB and other Lenders Contractors: ENA
Occupational Health and Safety *(Socio-Economic)*	The exposure of workers to various physical hazards that may result to minor, disabling, catastrophic, or fatal injuries	• All accidents and near misses will be reported and the statistics collected as part of its investigation and tracking procedure to be used to identify trends and requirements for further training or 'safety stand-downs' where incident numbers are growing. • ENA will ensure that its Contractors Management Procedures (which are part of its ESMS) are followed when hiring contractors, including those handling used oils. • ENA should complete arc flash hazard assessments for its substations through an incremental process to: i) identify arc flash hazards at its facilities; ii) estimate the likelihood of occurrence and the potential severity of injury or damage to health; and iii) determine if additional protective measures are required. Substations where incidents have been recorded or where equipment is of	Project Cost	ENA	ADB and other Lenders

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development / Implementation	Control
		higher risk due to age and condition should be targeted first. • Contractors will be monitored to ensure that they have the correct PPE and are using it. • Fire-fighting equipment will be installed at work areas, as appropriate.			
		• Proper collection and disposal of solid wastes will be ensured in line with local regulations and ENA's ESMS. • Fall prevention and protection measures will be implemented whenever a worker is exposed to the hazard of falling more than two meters, falling into operating machinery, or through an opening in a work surface. • Precautions will be taken to ensure that objects (e.g., equipment, tool, debris, pre-cast sections, etc.) do not fall onto or hit people, vehicle, and properties in adjoining areas.	Contractor Cost	Contractors to Implement Mitigation	ENA
Community Health and Safety *(Socio-Economic)*	Impacts to community health, safety, and security due to i) accidents and fatalities associated with the distribution system; ii) presence of storage areas and warehouses near populated areas; iii) presence of worksites; and iv) exposure to hazardous	• Implement a GRM that records grievances and complaints filed by community members through ENA's online system as well as those that are made at the local level. This includes information on the status of complaints and payments made for temporary damages or losses caused by ENA or its contractors. • Ensure the grievance mechanism is functional and understood by the community. • Community risk awareness material for those living near substations and other higher-risk areas will be developed or distributed (refer to Annex 5. Sample Community Health and Safety Leaflet). • Drivers will be educated on safe driving practices to minimize accidents and to prevent spill of hazardous substances and other construction materials during transport. • Security personnel in hazardous areas will be maintained to restrict public access.	Project Cost	ENA	ADB and other Lenders

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development / Implementation	Control
	materials and waste	• Signs advising road users that construction is in progress will be provided. • Barriers should be installed to keep pedestrians away from hazardous areas such as constructions sites and excavation sites. • Signage should be installed at the periphery of the construction site to warn and direct traffic and pedestrians. • Speed limits should be strictly imposed on construction vehicles along residential areas and where other sensitive receptors such as schools, hospitals, and other populated areas are located. • Flag persons will be employed to control traffic when construction equipment is entering or leaving the work area.	Project / Contractor Cost	ENA and /or Contractors to Implement Mitigation	ENA: ADB and other Lenders Contractors: ENA
Economy, Employment, and Livelihoods *(Socio-Economic)*	Impacts to community infrastructure, services, and access	• Traffic advisory signs should be posed (to minimize traffic build-up) in coordination with local Authorities. • Accidentally damaged private property and/or infrastructure will be promptly restored and tracked as part of its GRM. • Community will be informed about the schedule of works which could cause temporary restriction of services and the potential duration of the 'impact' in advance.	Project / Contractor Cost	ENA and /or Contractors to Implement Mitigation	ENA: ADB and other Lenders Contractors: ENA
Physical Cultural Heritage *(Socio-Economic)*	Impact to physical cultural heritage (PCH) from construction related activities	• Implement the chance finds procedures to appropriately manage unanticipated discoveries of cultural or historic artefacts (movable or immovable) in the course of the work.	Project Cost	ENA	ADB and other Lenders
Ecology and Biodiversity	Impacts to habitat and flora from site clearance and construction activities	• ENA and its contractors shall identify during site surveys if any Armenia Red book plants species, and trees in particular, are located within five meters of a subproject boundary.[194] Where pre-construction walkover surveys reveal that protected tree species will be lost, ENA or the	Project Cost	ENA	ADB and other Lenders

[194] Ministry of Environment of the Republic of Armenia. 2021. "Red Book." Ministry of Environment. April 30. Accessed May 2, 2021. http://www.mnp.am/shrjaka-mijavayr/karmir-girq.

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development / Implementation	Control
		contractor will be responsible for replanting any trees cut on a 1:10 basis.			
		• Delimitation of areas to be cleared before the beginning of the construction activities will take place in order to limit as much as possible the surface of vegetation to be cleared. • Disturbed sites will be recultivated after completion of works, as practicable. • All efforts will be made to minimize removal of mature/significant trees and maintain connectivity between areas of forest habitats. • Any reseeding or replanting of selected areas to be restored will use locally collected seed mixes and saplings.	Contractor Cost	Contractors to Implement Mitigation	ENA
Hazardous Waste Management	Impacts to heath and the environment from improper management of mercury-containing lamps, acid batteries, and asbestos	• All of the asbestos waste removed by ENA's contractors will be accounted for, tracked, handled, and stored appropriately at the HWSF. • ENA will complete installation of an automated alarm system at the HWSF as part of its emergency management system. • Fire protection measures will be implemented throughout the facility, including the appropriate fire management devices and materials at the correct locations. This should be coordinated by ENA's technical safety and firefighting coordinators and the appropriate government emergency authority. • The storage conditions for hazardous waste should be cool, dry, well-ventilated, and away from sunlight. The following will be carried out: o A separate fan will be installed in the storage area for batteries. o The fan in the used lamps area will be separated from the light switch so that it can be on all the time o The windows will be darkened with paint or a stick-on film	Project Cost	ENA	ADB and other Lenders

1.b - Management Plan for Operation Phase

Table 58. Management Plan for Operation Phase

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development/ Implementation	Control
Operation Phase					
Ecology and Biodiversity	Bird Electrocutions	• ENA should identify within its RESA reports and at the design phase whether planned subprojects are within 5 km of one of Armenia's 18 Important Bird Areas (IBAs).[195] If the answer is positive, ENA will engage a national specialist to visit the site and make an assessment of the types of birds that could potentially be affected and recommend design specifications to mitigate any impacts to these species. Design specifications should be based on those outlined by the Avian Power Line Interaction Committee (APLIC) in its Suggested Practices for Avian Protection on Power Lines document.[196] • ENA will be responsible for reviewing all of the design documents prior to their implementation to ensure that suitable mitigation measures recommended by the national bird specialist in line with those outlined above, have been included in the design to limit the potential for bird electrocution. • More broadly, ENA should coordinate and collaborate with biodiversity specialists, non-governmental organizations (e.g., World Wildlife Foundation, Armenian Society for the Protection of Birds), academic institutes (e.g., American University of Armenia, Department of Zoology at Yerevan State University), and the MoE to identify sensitive bird areas and the appropriate mitigation measures to minimize adverse effects to birds from electricity transmission facilities. The free online Integrated	Project Cost	ENA	ENA

[195] BirdLife International. 2021. IBAs of Armenia. Accessed May 18, 2021. http://datazone.birdlife.org/site/results?thrlev1=&thrlev2=&kw=&reg=0&cty=11&snm=&fam=0&gen=0&spc=&cmn=.
[196] Avian Power Line Interaction Committee (APLIC). 2006. *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006*. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, D.C. and Sacramento, CA.

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development/ Implementation	Control
		Biodiversity Assessment Tool (IBAT)[197] developed by the UN Environment World Conservation Monitoring Centre can provide valuable insights on high biodiversity areas when planning for subprojects. • ENA is to begin collecting data on bird related outages to quantify the impacts of birds on power systems, and to develop a range of measures for preventing bird mortalities and their associated outages. • ENA is to include bird carcass monitoring near Important Bird Areas (IBAs) as part of its regular monitoring activities and implement adaptive measures if results show risk to be significant. • Nest management o Nest management, including the design and installations of platforms on or near power structures, can enhance nesting while minimizing the risk of electrocution, equipment damage, and loss of service. o Where nests are present on poles the old poles shall be left in-situ if possible so that the nest can continue to be used. o Poles with nests shall not be removed during the nesting season. o Where the above is not possible consideration shall be given to the use of nesting platforms on new poles. Platforms provide for the needs of the birds, while preventing electrocutions and electrical outages. Mounting a nest platform above energized equipment is not encouraged because birds are likely to drop nest materials that could cause a fire or outage. Nest platforms are commercially available or can be constructed with materials on hand such as wooden pallets. o There may be times when nesting should be discouraged to prevent avian electrocutions or			

[197] Integrated Biodiversity Assessment Tool (IBAT): https://www.ibat-alliance.org/

Affected Aspect	Potential Impact / Issue	Mitigation/Enhancement Measures (all that apply)	Estimated Cost	Responsibility	
				Development/ Implementation	Control
		risks to electrical equipment – this will be identified during pre-work surveys.			
	Bird Collisions	• In cases where planned subprojects are within 5 km of one of Armenia's 18 Important Bird Area (IBA), ENA will engage a national specialist to visit the site and make an assessment on risks to birds and recommend design specifications to mitigate any impacts to these species. Design specifications should be based on those outlined by the Avian Power Line Interaction Committee (APLIC) in its Reducing Avian Collisions with Power Lines: The State of the Art in 2012 document.[198] • Risk reduction options may include line marking, managing surrounding lands, removing the shield wire, changing the size or configuration of wires, rerouting the line, and burying lines.	Project Cost	ENA	ENA

[198] Avian Power Line Interaction Committee (APLIC). 2012. *Reducing Avian Collisions with Power Lines: The State of the Art in 2012.* Edison Electric Institute and APLIC. Washington, D.C.

1.c - Environmental Monitoring Plan

Table 59. Environmental and Monitoring Plan

Issue	What parameter is to be monitored?	Where is the parameter to be monitored?	How Is the parameter to be monitored?	When is the parameter to be monitored? (Frequency)	Institutional responsibility
Pre-Construction / Construction Phase					
General EMP obligations	• Implementation of Environmental and Social Management System (ESMS)	N/A	• Project status reports • Monitoring site visits	• Information from each parameter should be included in regular reports to the ADB / EBRD / LEAP (biannually)	ENA
	• Implementation of Contractors Management Procedures and incorporation of relevant mitigation measures identified within this EMMP into the instructions and normative documents for contractors to follow.				
	• Implementation of Rapid Environmental and Social Assessment (RESA) Checklists				
	• Development of plans, SOPs, guidelines, and awareness materials o Incident investigation and tracking system o Contingency and response plans for the HWSF and Abovyan Oil Storage Facility o Loading and unloading SOPS for the Abovyan Oil Storage Facility o SF_6 Gas policies, protocols, and SOPs o Chance finds procedure o Modified grievance redress mechanism (GRM)		• ADB / EBRD / LEAP to review and clear	• Within thirty days of Phase 2 commencing • Information from the plans should be included in regular reports to the ADB / EBRD / LEAP	ENA

Issue	What parameter is to be monitored?	Where is the parameter to be monitored?	How Is the parameter to be monitored?	When is the parameter to be monitored? (Frequency)	Institutional responsibility
	o Community risk awareness material				
	• Use of the testing standards defined in this IEE for the following: o Air quality (as needed) o Water quality (as needed) o Groundwater quality (as needed) o Noise (as needed) o Vibrations (as needed) o EMF (as needed) o Soil quality (as needed) o SF_6 (required) o PCBs (required)		• Project status reports	• Testing information should be included in regular reports to the ADB / EBRD / LEAP (biannually)	ENA
	• EMP review and update		• The EMP shall be reviewed periodically to evaluate environmental controls and procedures to make sure they are still applicable to the activities being carried out.	• The full EMP shall be reviewed at least annually • Relevant parts of the EMP shall be reviewed following a reportable incident • In case any issues of failure of mitigation measure to reduce the impact occurs • Relevant parts of the EMP shall be reviewed following the receipt of an updated site specific or topic specific plan • At the request of stakeholders	ENA
HWSF	• Adherence to contingency and response plans • Installation of an automated alarm system at the HWSF as	HWSF	• Photos confirming completion • Monitoring site visits	• Prior to commencing Phase 2	ENA

Issue	What parameter is to be monitored?	Where is the parameter to be monitored?	How Is the parameter to be monitored?	When is the parameter to be monitored? (Frequency)	Institutional responsibility
	part of its emergency management system • A separate fan is installed in the storage area for batteries. • The fan in the used lamps area is separated from the light switch • The windows un the used battery and lamp storage area are darkened with paint or a stick-on film				
	• Adherence to the construction and operating conditions established by the 2019 EIA.[199]		• Inspections • Comparisons between operations at the HSWF and the conditions set within the 2019 EIA.	• Information from the plans should be included in regular reports to the ADB / EBRD / LEAP	ENA
Air quality – dust	• Fugitive dust emissions	At construction sites	• Visual monitoring	• During construction	ENA
Soil erosion	• Adequacy of soil erosion prevention measures.	All active construction sites	• Visual inspection	• During construction	ENA
Soil quality	• Adequacy of soil contamination prevention techniques	All active construction sites, warehouses, storage areas, substations, and around installed transformers.	• Visual inspection	• Daily	ENA
Quarry material	• Location of borrow pits	N/A	• Contractor's statement of works identifying origin of materials	• During contracting process and before construction	ENA
Surface water quality	• Adequacy of water contamination prevention techniques	All active construction sites, warehouses, storage	• Visual inspection	• Daily	ENA

[199] ATMS Solutions LLC. 2019. *Baghramyan Hazardous Waste Storage Facility Environmental Impact Assessment*. Yerevan: Electric Networks of Armenia

Issue	What parameter is to be monitored?	Where is the parameter to be monitored?	How Is the parameter to be monitored?	When is the parameter to be monitored? (Frequency)	Institutional responsibility
		areas, substations, and around installed transformers.			
Impact on planted areas and on trees in working areas	• Adequacy of clearance, revegetation, and restoration management processes	Planted vegetation areas	Visual inspection	• Prior to site preparation and construction phases • Unannounced inspections during construction and implementation	ENA
Possible loss or damage to cultural resources	• Presence of chance finds	Dependent on findings during construction	Visual inspection	Throughout construction works	ENA
Occupational health and safety	• Adherence to the Contractors Management Procedure • Adherence to the ESMS and all its guideline and policy documents. • Adherence to: o Incident investigation and tracking system o Contingency and response plans o Loading and unloading SOPS for the Abovyan Oil Storage Facility o SF_6 Gas policies, protocols, and SOPs • Worker complaints and concerns and recorded incidents • Use of personal protective equipment (PPE) relevant to the task • Trainings held	Worksites, ENA facilities	• Inspections • Interviews • Comparisons with the Contractors Management Procedure and other ESMS guideline and policy documents • Training records • Incident/accident records and investigation results	• Weekly • Unannounced inspections during construction • Upon complaint • Upon incident	ENA

Issue	What parameter is to be monitored?	Where is the parameter to be monitored?	How Is the parameter to be monitored?	When is the parameter to be monitored? (Frequency)	Institutional responsibility
Community health and safety	• Adherence to SEP and GRM • Adherence to Involuntary Resettlement Management Procedure • Community risk awareness material distributed • Availability of information on GRM • Adequacy of construction site signage and fencing (if needed) • Adequacy of temporary noise mitigation measures (if needed) • Accidents involving public and workers • Emergencies and responses • Public complaints	All active construction and operation sites	• Visual inspections • Informal interviews with community members • Review of complaints received and their processing status	• Monthly • Unannounced inspections • Interviews • Upon incident • GRM log	ENA
Waste management	• Adherence to ESMS guideline and policy documents o Contractors Management Procedure o Work Instruction of Collecting and Storing of Used Oils o Hazardous Materials Safe Management Procedures o Work Instruction of Collecting and Storing of Used Lamps o Work Instruction of Collecting and Storing of Used Batteries o Waste Management Procedure o Waste Transportation Work Instruction	ENA facilities and Contractor worksites	• Inspections • Observations • Review of waste passports	Weekly	ENA

Issue	What parameter is to be monitored?	Where is the parameter to be monitored?	How Is the parameter to be monitored?	When is the parameter to be monitored? (Frequency)	Institutional responsibility
	• Adherence to contingency and response plans at the HWSF and Abovyan Oil Storage Facility • Flooring at each branch location where hazardous waste is temporarily stored will be made impervious to liquid spills. • All asbestos waste removed by ENA's contractors is accounted for, tracked, handled, and stored appropriately at the HWSF.				
Adherence with EMP and loan covenants	• EMP /SEMP • Loan covenants	All active construction sites	• Visual inspection • Supervision	• Semi-Annually	ENA
Operation Phase					
Occupational health and safety	• Adherence to the Contractors Management Procedure • Adherence to the ESMS and all its guideline and policy documents. • Adherence to: o Incident investigation and tracking system o Contingency and response plans o Loading and unloading SOPS for the Abovyan Oil Storage Facility o SF_6 Gas policies, protocols, and SOPs • Worker complaints and concerns and recorded incidents	Worksites, ENA facilities	• Inspections • Interviews • Comparisons with the Contractors Management Procedure and other ESMS guideline and policy documents • Training records • Incident/Accident records and investigation results	• Weekly • Unannounced inspections during construction • Upon complaint • Upon incident	ENA

Issue	What parameter is to be monitored?	Where is the parameter to be monitored?	How Is the parameter to be monitored?	When is the parameter to be monitored? (Frequency)	Institutional responsibility
	• Use of personal protective equipment (PPE) relevant to the task • Trainings held				
Community health and safety	• Adherence to SEP and GRM • Adherence to Involuntary Resettlement Management Procedure • Community risk awareness material distributed • Availability of information on GRM • Adequacy of construction site signage and fencing (if needed) • Adequacy of temporary noise mitigation measures (if needed) • Accidents involving public and workers • Emergencies and responses • Public complaints	All operation sites and any construction sites that are active following conclusion of the Project.	• Visual inspections • Informal interviews with community members • Review of complaints received and their processing status	• Monthly • Unannounced inspections • Interviews • Upon incident • GRM log	ENA
Waste management	• Adherence to ESMS guideline and policy documents • Adherence to contingency and response plans at the HWSF and Abovyan Oil Storage Facility • All hazardous waste removed by ENA's contractors is accounted for, tracked, handled, and stored appropriately at the HWSF.	ENA facilities and Worksites where Contractors are active	• Inspections • Observations • Review of waste passports	• Weekly	ENA
Ecology and biodiversity	• Identification of planned activities within 5 km of one of	All active and planned sites for installation of new electrical lines or replacement of old lines	• Project status reports • Monitoring site visits	Information from each parameter should be included in regular reports to the ADB / EBRD / LEAP (biannually)	ENA

Issue	What parameter is to be monitored?	Where is the parameter to be monitored?	How Is the parameter to be monitored?	When is the parameter to be monitored? (Frequency)	Institutional responsibility
	Armenia's 18 Important Bird Areas (IBAs).[200] • Engagement with national bird specialists • Measures taken to prevent bird mortalities • Data collected on bird related outages • Data on bird carcass monitoring near IBAs • Implementation of nest management strategies				

[200] BirdLife International. 2021. IBAs of Armenia. Accessed May 18, 2021. http://datazone.birdlife.org/site/results?thrlev1=&thrlev2=&kw=&reg=0&cty=11&snm=&fam=0&gen=0&spc=&cmn=.

Annex 2. ENA Grievance Redress Form

Date / Թվական՝	__ / __ / ____	Code / Հ.Հ՝	
I. Personal & contact information / Բողոքարկողի անձնական և կապի տվյալները			
Full name / Անուն և Ազգանուն՝			
Community / Համայնք՝			
Organization / Կազմակերպություն՝			
Phone / Հեռախոս՝			
e-mail / Էլ-հասցե՝			
Address / Հասցե՝			
Communication language / Հաղորդակցման լեզուն՝	☐ Armenian / Հայերեն ☐ English / Անգլերեն ☐ Russian / Ռուսերեն		
II. Brief description of the incident or grievance / Միջադեպի կամ բողոքի ամփոփ նկարագրություն			
{Specify the type, location, date & time of the incident and people involved / Ամփոփ նկարագրել միջադեպի տեսակը, վայրը, թվականն ու ժամը, ինչպես նաև մասնակիցները (օրինակ՝ տուժած կողմեր և այլն)} _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____			
Frequency of the incident / Միջադեպի հաճախականությունը՝	☐ One-time occurrence / Մեկանգամյա միջադեպ ☐ Repetitive occurrences / Բազմիցս պատահել է (# occurrences / կրկնման քանակը՝ _____) ☐ Continuous / Շարունակական		
III. Your expectations on the resolution of the issue / Խնդրին ի՞նչ լուծում եք ակնկալում			
_____ _____ _____ _____ _____ _____ _____ _____			

_____

Signature / Ստորագրություն

Date / Ամսաթիվ

Please mail the form to The Public Relations Department of “ENA” CJSC at 0047, Armenak Armenakyan St., 127 Building, Yerevan – Armenia.
For further information e-mail to office@ena.am or contact us on +374 10 59-12-27 (ext 45-26).

Խնդրում ենք լրացված ձևաթուղթն ուղարկել «ՀԷՑ» ՓԲԸ հասարակայնության հետ կապերի և տեղեկատվության բաժին՝ ՀՀ, ք. Երևան, 0047, Արմենակ Արմենակյան փող., 127 շենք հասցեով: Լրացուցիչ տեղեկատվություն ստանալու համար կարող եք գրել office@ena.am էլ. հասցեով կամ զանգահարել +374 10 59-12-27, ներքին- 45-26 հեռախոսահամարով:

Annex 3. Sample Chance Find Procedure

I. Purpose of the chance find procedure

1. The chance find procedure is a project-specific procedure that outlines actions required if previously unknown heritage resources, particularly archaeological resources, are encountered during project construction or operation. A Chance Find Procedure, as described in IFC Performance Standard 8 and EBRD Performance Requirement 8, is a process that prevents chance finds from being disturbed until an assessment by a competent specialist is made and actions consistent with the requirements are implemented.

II. Scope of the chance find procedure

2. This procedure is applicable to all activities conducted by the personnel, including contractors, that have the potential to uncover a heritage item/site. The procedure details the actions to be taken when a previously unidentified and potential heritage item/site is found during construction activities. Procedure outlines the roles and responsibilities and the response times required from both project staff, and any relevant heritage authority.

III. Induction/Training

3. All personnel, especially those working on earth movements and excavations, are to be inducted on the identification of potential heritage items/sites and the relevant actions for them with regards to this procedure during the Project induction and regular toolbox talks.

IV. Chance find procedure

4. If any person discovers a physical cultural resource, such as (but not limited to) archaeological sites, historical sites, remains and objects, or a cemetery and/or individual graves during excavation or construction, the following steps shall be taken:

- Stop all works in the vicinity of the find, until a solution is found for the preservation of these artefacts, or advice from the relevant authorities is obtained;
- Immediately notify a foreman. The foreman will then notify the Construction Manager and the Environment Officer (EO)/Environmental Manager (EM);
- Record details in Incident Report and take photos of the find;
- Delineate the discovered site or area; secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities take over;
- Preliminary evaluation of the findings by archaeologists. The archaeologist must make a rapid assessment of the site or find to determine its importance. Based on this assessment the appropriate strategy can be implemented. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage such as aesthetic, historic, scientific or research, social and economic values of the find;
- Sites of minor significance (such as isolated or unclear features, and isolated finds) should be recorded immediately by the archaeologist, thus causing a minimum disruption to the work schedule of the Contractor. The results of all archaeological work must be reported to the Ministry/Agency, once completed.

- In case of significant find the Agency/Ministry (Agency for Protection of National Heritage or Archaeological Research Centre, hereinafter referred to as Heritage team) should be informed immediately and in writing within 7 days from the find (ref.law on heritage protection).
- The onsite archaeologist provides the Heritage team with photos, other information as relevant for identification and assessment of the significance of heritage items.
- The Ministry must investigate the fact within 2 weeks from the date of notification and provide response in writing.
- Decisions on how to handle the finding shall be taken by the responsible authorities. This could include changes in the layout (such as when finding an irremovable remain of cultural or archaeological importance) conservation, preservation, restoration and salvage;
- Construction works could resume only after permission is granted from the responsible authorities.
- In case no response received within the 2 weeks period mentioned above, this is considered as authorization to proceed with suspended construction works.

5. One of the main requirements of the procedure is record keeping. All finds must be registered. Photolog, copies of communication with decision making authorities, conclusions and recommendations/guidance, implementation reports – kept.

V. Additional information

6. Management options for archaeological site

- Site avoidance. If the boundaries of the site have been delineated attempt must be made to redesign the proposed development to avoid the site. (The fastest and most cost-effective management option)
- Mitigation. If it is not feasible to avoid the site through redesign, it will be necessary to sample it using data collection program prior to its loss. This could include surface collection and/or excavation. (The most expensive and time-consuming management option.)
- Site Protection. It may be possible to protect the site through the installation of barriers during the time of the development and/or possibly for a longer term. This could include the erection of high visibility fencing around the site or covering the site area with a geotextile and then capping it with fill. The exact prescription would be site- specific.

VI. Management of replicable and non-replicable heritage. Different approaches for the finds apply to replicable and non-replicable heritage.

a. Replicable heritage

7. Where tangible cultural heritage that is replicable[201] and not critical is encountered, mitigation measures will be applied.

[201] Replicable cultural heritage is defined as tangible forms of cultural heritage that can themselves be moved to another location or that can be replaced by a similar structure or natural features to which the cultural values can be transferred by appropriate measures. Archaeological or historical sites may be

The mitigation hierarchy is as follows:

- Avoidance;
- Minimization of adverse impacts and implementation of restoration measures, in situ;
- Restoration of the functionality of the cultural heritage, in a different location;
- Permanent removal of historical and archaeological artefacts and structures;
- Compensation of loss - where minimization of adverse impacts and restoration not feasible.

b. Non-replicable heritage. Most cultural heritage is best protected by in situ preservation, since removal is likely to result in irreparable damage or even destruction of the cultural heritage.

8. Nonreplicable cultural heritage[202] must not be removed unless all of the following conditions are met:

- There are no technically or financially feasible alternatives to removal;
- The overall benefits of the project conclusively outweigh the anticipated cultural heritage loss from removal; and

9. Any removal of cultural heritage must be conducted using the best available technique advised by relevant authority and supervised by archaeologist.

c. Human Remains Management Options. The handling of human remains believed to be archaeological in nature requires communication according to the same procedure described above.

10. There are two possible courses of action:

- Avoid. The development project is redesigned to completely avoid the found remains. An assessment should be made as to whether the remains may be affected by residual or accumulative impacts associated with the development, and properly addressed by a comprehensive management plan.
- Exhumate. Exhumation of the remains in a manner considered appropriate by decision makers. This will involve the predetermination of a site suitable for the reburial of the remains. Certain ceremonies or procedures may need to be followed before development activities can recommence in the area of the discovery.

considered replicable where the particular eras and cultural values they represent are well represented by other sites and/or structures.

[202] Nonreplicable cultural heritage may relate to the social, economic, cultural, environmental, and climatic conditions of past peoples, their evolving ecologies, adaptive strategies, and early forms of environmental management, where the (i) cultural heritage is unique or relatively unique for the period it represents, or (ii) cultural heritage is unique or relatively unique in linking several periods in the same site. Examples of non-replicable cultural heritage may include an ancient city or temple, or a site unique in the period that it represents.

VII. EMERGENCY CONTACTS

Electric Networks of Armenia" CJSC
Address:
Phone 1:
Phone 2:
E-Mail 1:
E-Mail 2:

Ministry of Education, Science, Culture and Sport
Address: RA, Yerevan 0010, Vazgen Sargsyan 3 Government House 2
Phone 1: (374 10) 59-96-68
Phone 2: (374 10) 59-96-00
E-Mail 1: info@escs.am
E-Mail 2: secretariat@escs.am

Annex 4. Contingency and Emergency Response Plan Template

Purpose of a Contingency and Emergency Response Plan

The purpose of this document is to provide the basic procedures to use in the event of fires, explosions, or any unplanned sudden or non-sudden release of oils, hazardous waste, or their constituents to air, soil, or surface water.

Note: It should be required that personnel training is provided for facility employees that will be involved in responding to emergencies so they are familiar with the types of materials and hazards that may be encountered onsite.

What Must a Contingency and Emergency Response Plan Include?

1. Background information

   - *This section sets the stage for users of the Contingency Plan. This information is necessary for an understanding of the actions to be taken in the event of Contingency Plan implementation. These actions will be described in Section 4. The applicant must also identify potential situations, based upon the facility's management practices that might result in the implementation of the plan.*

   1.1. Purpose of the Contingency Plan

   1.2. Facility Information
   - 1.2.1. Facility Name
   - 1.2.2. Address
   - 1.2.3. ENA emergency contact information
   - 1.2.4. ENA non-emergency contact information

2. Facility Description

   2.1. Description of Facility Operations

   - *Describe the general facility processes, routine operations, work areas, and management practices. Also identify the materials and waste types handled at the facility as well as the locations of all waste management areas.*

     - 2.1.1. General facility processes, routine operations, and work areas
     - 2.1.2. Waste and/or oil management practices (e.g., handling and transportation)
     - 2.1.3. Waste and/or oil types handled at the facility
     - 2.1.4. Storage area descriptions

   2.2. Identification of Potential Emergency Situations

   - *The Contingency Plan cannot realistically predict all situations that will arise. However, the plan should identify in this section potential situations that could arise (i.e., fires,*

leaks, explosions, earthquakes, storm events, etc.). Actions to be taken in response to these potential situations will be addressed in Section 5 below.

3. Emergency Response Coordinators

3.1. Identification of Primary and Alternate Emergency Coordinators

- *An up-to-date list of names, addresses, and phone numbers (office and home) of all persons qualified to act as emergency coordinator should be provided. When more than one person is listed, one must be designated as primary emergency coordinator and the others must be listed in the order in which they will assume responsibility as alternates.*

Table 1. Identification of Primary and Alternate Emergency Coordinators

Priority	Name	Address	Work Phone	Home Phone	Cell Phone
Primary Coordinator					
First Alternate Coordinator					
Second Alternate Coordinator					
Third Alternate Coordinator					

3.2. Qualifications of the Emergency Coordinators

- *You must demonstrate in this section that the emergency coordinators are fully qualified to serve as emergency coordinators. They must be knowledgeable of the facility's operations and activities and the Contingency Plan.*

4. Implementation of the Contingency Plan

The emergency coordinator must be contacted immediately in the occurrence of any situation that may result in potential or actual threats to human health or the environment. The emergency coordinator must implement this plan whenever there is a fire, explosion, or release of hazardous waste or hazardous waste constituents that could threaten human health or the environment.
The following situations are provided as guidance to facility personnel as the conditions or circumstances under which the plan must be implemented:

i. *Write the conditions or circumstances under which the plan must be implemented*
ii. …
iii. …

- *Identify the conditions or circumstances under which you believe that your facility might need to implement this Contingency Plan, based upon management practices. Include fires, explosions, and any sudden or non-sudden circumstances that may result in the release of oils, hazardous wastes, or hazardous waste constituents.*

5. Emergency Procedures

The following general procedures have been established for implementation by facility personnel and the emergency coordinator in order to efficiently respond to the release of oil, hazardous waste, or hazardous waste constituents that could threaten human health or the environment.

- *The Contingency Plan must describe the actions that the emergency coordinator and other facility personnel must take in response to fires, explosions, or any unplanned sudden, or non-sudden release of oils, hazardous waste, or hazardous waste constituents to air, soil, or surface water.*

- *The procedures that will be conducted to complete these actions must include the following elements:*

5.1. Immediate Notification Procedures for Facility Personnel and Local Emergency Authorities with Designated Response Roles

The list of emergency contacts in Table 2 identifies local and national emergency response authorities that must be notified in the event of an imminent or actual emergency situation requiring response.

The emergency coordinator will be responsible for ensuring that all appropriate authorities are notified as necessary.

- *You must complete Table 2.*

- *You must also outline how the emergency coordinator will notify facility personnel of an imminent or actual emergency situation.*

Table 2. Emergency Contacts

Authority	Name	Contact information
Local Emergency Response Authority		
National Emergency Response Authority		
Other Emergency Response Authority		

5.2. Procedures to Be Used for Identification of Releases

- *Identify the procedures that will be used by the emergency coordinator to identify the location, type, source, amount, and extent of releases.*

5.3. Procedures to Be Used to Assess Potential Hazards to Human Health and the Environment

The emergency coordinator will assess possible hazards, both direct and indirect, to human health or the environment that may result from the release, fire, or explosion.

- *You must describe how the emergency coordinator will conduct the hazards assessment. Also, modify the following hazards assessment as appropriate.*

The assessment will consider the effects of any gases that may be generated, surface runoff from water or chemical reagents used to control fires, and any chemical or physical reactions with equipment or structures.

5.4. Procedures to Determine if Evacuation Is Necessary

- *You must identify the procedures that the emergency coordinator will use to determine whether evacuation is necessary and how appropriate authorities will be notified.*

If the emergency coordinator's assessment indicates that evacuation of facility areas may be advisable, he/she will implement the evacuation plan for the facility. If the emergency coordinator's assessment indicates that evacuation of the surrounding local areas is also advisable, the appropriate local and national authorities will be immediately notified (see Table 2) and the following information will be provided:

1. Name and telephone number of the reporting individual
2. Name and address of the facility
3. Time and type of incident
4. Type and quantity of materials involved
5. Possible hazards to human health or the environment
6. Extent of injuries, if applicable

The facility's evacuation plan is included in this Contingency Plan as Attachment 1.

- *Include a written evacuation plan and evacuation map as Attachment 1.*

5.5. Procedures to Be Used to Ensure that Fires, Explosions, and Releases Do Not Occur, Reoccur, or Spread During the Emergency

Whenever there is an imminent or actual emergency situation where the potential or actual release of oil, hazardous waste, or hazardous waste constituents may threaten human health or the environment, the facility will implement the following procedures:

i. *Write Procedures Here*
ii. …
iii. …

- *Identify the control procedures that will be used for potential situations at the facility.*

During an emergency, the emergency coordinator must take all reasonable measures necessary to ensure that fires, explosions, or releases do not recur or spread to other areas of the facility, or off site. Actions that may be employed include:

i. *Describe action to be taken here*
ii. …
iii. …

- *Identify control procedures that may be taken to prevent recurrence or spread of fires, explosions, or releases. Where applicable, these procedures must include stopping processes and operations.*

  Attachment 2 is a detailed description of the type, amount, and location of all emergency equipment at the facility.

- *Include a detailed description of type, amount, and location of all emergency equipment as Attachment 2.*

5.6. Procedures to Provide Proper Treatment, Storage, and Disposal for Any Released Materials

- *Identify general procedures that the facility will use to ensure that any released materials will be properly managed in accordance with licensed activities at the facility.*

5.7. Procedures for Cleanup and Decontamination

- *Include general procedures to be used for post-emergency maintenance, cleanup, and decontamination of equipment used during the emergency. Procedures must address facility specific potential situations, along with generic situations.*

6. Record Keeping Requirements

6.1. Operating Record

In the event of an emergency situation that requires implementation of the Contingency Plan, the emergency coordinator will provide details of the event.

The report will contain the following information:

1. Date, time, and type of incident.
2. Type and quantity of materials involved.
3. Assessment of actual or potential hazards to human health and the environment.
4. Extent of injuries, if applicable.
5. Estimated quantity and disposition of recovered materials that resulted from the incident.

7. Attachments

Attachment 1: Evacuation Plan and Routes

Attachment 2: Emergency Equipment Description

Attachment 3: Schematic Drawing of the Facility and Locations of Emergency Equipment Within the Facility

Annex 5. Sample Community Health and Safety Leaflet

Source: UK Power Networks. n.d. Safety. Accessed June 9, 2021. https://www.ukpowernetworks.co.uk/internet/en/safety/.

Annex 6. Rapid Environmental and Social Assessment (RESA) Form

Rapid Environmental Assessment (REA) Checklist
TRANSMISSION & DISTRIBUTION

Instructions:
(i) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to checklists on involuntary resettlement and Indigenous Peoples;
(iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Project Title:	
Location	
Responsible Department:	

Screening Questions	Yes	No	Remarks
A. Project Siting Is the Project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site			
▪ Protected Area			
▪ Wetland			
▪ Mangrove			
▪ Estuarine			
▪ Buffer zone of protected area			
▪ Special area for protecting biodiversity			
B. Potential Environmental Impacts Will the Project cause…			
▪ encroachment on historical/cultural areas, disfiguration of landscape and increased waste generation?			
▪ encroachment on precious ecosystem (e.g. sensitive or protected areas)?			
▪ alteration of surface water hydrology of waterways crossed by roads and resulting in increased sediment in streams affected by increased soil erosion at the construction site?			
▪ damage to sensitive coastal/marine habitats by construction of submarine cables?			
▪ deterioration of surface water quality due to silt runoff, sanitary wastes from worker-based camps and chemicals used in construction?			
▪ increased local air pollution due to rock crushing, cutting and filling?			
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?			
▪ chemical pollution resulting from chemical clearing of vegetation for construction site?			
▪ noise and vibration due to blasting and other civil works?			
▪ dislocation or involuntary resettlement of people?			
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?			

Screening Questions	Yes	No	Remarks
▪ social conflicts relating to inconveniences in living conditions where construction interferes with pre-existing roads?			
▪ hazardous driving conditions where construction interferes with pre-existing roads?			
▪ creation of temporary breeding habitats for vectors of disease such as mosquitoes and rodents?			
▪ dislocation and compulsory resettlement of people living in right-of-way of the power transmission lines?			
▪ environmental disturbances associated with the maintenance of lines (e.g. routine control of vegetative height under the lines)?			
▪ facilitation of access to protected areas in case corridors traverse protected areas?			
▪ disturbances (e.g. noise and chemical pollutants) if herbicides are used to control vegetative height?			
▪ large population influx during project construction and operation that cause increased burden on social infrastructure and services (such as water supply and sanitation systems)?			
▪ social conflicts if workers from other regions or countries are hired?			
▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases from workers to local populations?			
▪ risks to community safety associated with maintenance of lines and related facilities?			
▪ community health hazards due to electromagnetic fields, land subsidence, lowered groundwater table, and salinization?			
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?			
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project (e.g., high voltage wires, and transmission towers and lines) are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?			

A Checklist for Preliminary Climate Risk Screening

Screening Questions		Score	Remarks
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather-related events such as floods, droughts, storms, landslides?	0	
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	0	
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s)?	0	
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design lifetime?	0	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high-risk project.

Result of Initial Screening (Low, Medium, High): _____

Other Comments:_____

Prepared by: _____

SOCIAL SAFEGUARDS SCREENING CHECKLISTS

Involuntary Resettlement Impact Checklist

Probable Involuntary Resettlement Effects (Please elaborate in the Remarks column)	**Yes**	**No**	**Not Known**	**Remarks**
Involuntary Acquisition of Land				
1. Will there be land acquisition?				
2. Is the site for land acquisition known?				
3. Is the ownership status and current usage of land to be acquired known?				
4. Will easement be utilized within an existing right of way (ROW)?				
5. Will there be loss of shelter and residential land due to land acquisition?				
6. Will there be loss of agricultural and other productive assets due to land acquisition?				
7. Will there be losses of crops, trees, and fixed assets due to land acquisition?				
8. Will there be loss of businesses or enterprises due to land acquisition?				
9. Will there be loss of income sources and means of livelihoods due to land acquisition?				
Involuntary Restrictions on Land Use or on Access to Legally Designated Parks and Protected Areas				
10. Will people lose access to natural resources, communal facilities and services?				
11. If land use is changed, will it have an adverse impact on social and economic activities?				
12. Will access to land and resources owned communally or by the state be restricted?				
Information on Displaced Persons:				
Any estimate of the likely number of persons that will be displaced by the Subproject? [ ] No [ ] Yes If yes, approximately how many? _____				
Are any of them poor, female-heads of households, or vulnerable to poverty risks? [ ] No [ ] Yes				
Are any displaced persons from indigenous or ethnic minority groups? [ ] No [ ] Yes				

Conclusion: Please categorize the investment project

category A - (with potential significant environmental and/or social impacts)	
category B - (with less significant environmental and/or social impacts)	
category C - (with minimal or no impacts)	

Is there need “Resettlement plan and Compensation package”?	[ ] No [ ] Yes
Is there need of complete environmental impact assessment?	[ ] No [ ] Yes

Filled by	Reviewed by	Approved by